MSRI
Mathematical Sciences Research Institute

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Annual Report on the Mathematical Sciences Research Institute 2021–2022 activities supported by NSF Grant DMS-1928930 June 1, 2021 to May 31, 2022

August 2022

Mathematical Sciences Research Institute
Annual Report, 2021-2022

WORKSHOP REPORTS (Chronological)

SUMMER GRADUATE SCHOOL REPORTS (Chronological)

1. Overview of Activities

This annual report covers MSRI's projects and activities supported by the NSF core grant, DMS-1928930, during the period **June 1, 2021 to May 31, 2022**.

1.1 New Developments

Aside from the usual scientific developments, there are two exceptional events to report for the year 2021-2022: the appointment of the next Director of MSRI and the success of MSRI's capital endowment campaign. On August 1, 2022, Tatiana Toro will take the helm of MSRI as David Eisenbud's successor. Transition plans have been in place for more than twelve months now, with Professor Toro having immersed herself in all aspects of MSRI's operations. MSRI has never experienced such an intense and productive collaboration between incoming and departing directors. The final stage of the transition (in the second half of July 2022) is underway, and there is every indication of a very smooth leadership transition with both MSRI's constituents and the broader scientific community looking forward to working with Tatiana Toro.

Three years ago, MSRI embarked on the silent portion of a fundraising campaign with the goal of raising its endowment from $30 million to $130 million. On May 18, 2022, the campaign was announced to the mathematical community, in particular to MSRI's 110 Academic Sponsors. So far, the Institute has obtained pledges on the order of $97 million, leaving only $3 million to reach the $100 million goal. Four remarkable philanthropists, Jim and Marilyn Simons, and Marsha and Henry Laufer, donated a combined total of $70 million. In return, the Institute will be renamed to The Simons Laufer Mathematical Sciences Institute (SLMath). The gifts are unrestricted, leaving MSRI's mission and governance structure unchanged. The pledges will be fulfilled over a period of 7 years ($10 million each year) and the disbursements for each period will be based on the average value of the endowment fund over the previous eight fiscal quarters' ending values. Disbursements are expected to be approximately 1.00% per quarter.

These exciting developments leave MSRI, soon to be SLMath, well poised to continue successfully executing its mission, which has benefited the mathematical community for the last 40 years.

Despite the continued challenges of the COVID-19 pandemic, 2021–22 proved to be a productive academic year. In fall 2021, MSRI hosted a jumbo program: *Universality and Integrability in Random Matrix Theory and Interacting Particle Systems (UIRM)* with lead organizer Ivan Corwin (Columbia University). In spring 2022, two programs were held concurrently: *Complex Dynamics: from special families to natural generalizations in one and several variables (COMD)* with lead organizer Sarah Koch (University of Michigan), and *The Analysis and Geometry of Random Spaces (AGRS)* with lead organizer Mario Bonk (University of California, Los Angeles). All three programs took place primarily in person, with ample precautions to protect the health of the MSRI community. Members in residence and staff were masked at all times, weekly COVID testing for members and staff, and no indoor eating except in private offices. Daily teas were served outside on the Strauch Lookout, where rolling blackboards were made available. Embraced by the members, this new indoor-outdoor setup will continue even after the end of the COVID-19 pandemic.

All programs also operated on a hybrid model: talks from seminars, colloquia, and workshops were available for synchronous participation by online and in person attendees, and a few hours later (pending permission from speakers) as part of MSRI's online video repository. This improvement has also been well-received by researchers, whether they attend programs in person or remotely. Members who visit MSRI for less than a semester (the duration of a program) are now able to participate in activities before and after their time in Berkeley, allowing for a richer experience. Additionally, members who feel unwell or test positive for COVID-19 during their visits can continue to follow the lectures while quarantining in their homes. Lastly, researchers who cannot participate in MSRI's programs due to space limitations are now able to participate remotely, allowing for broader outreach into the mathematical community. This hybrid model, supported by the hiring of additional IT staff, has unquestionably enriched MSRI's scientific offerings and will continue as a part of the Institute's regular operations.

For week-long workshops, the following approach has proven largely successful. To minimize the risk of COVID outbreaks, MSRI has limited in-person attendance to members in residence, workshop organizers, and speakers; other interested mathematicians participate online. This also minimizes MSRI's impact on climate change due to the reduction in short-term participant travel. While many mathematicians have endorsed this practice, others have expressed a desire to return to the status quo ante.

All programs in 2021-22 had stellar researchers, including four Clay Senior Scholars: Alice Guionnet and Herbert Spohn from the *Universality and Integrability in Random Matrix Theory and Interacting Particle Systems* program, Nikolai Makarov from the *Analysis and Geometry of Random Spaces* program, and Mikhail Lyubich from the *Complex Dynamics* program.

Professor Guionnet is an internationally renowned mathematician with stellar accomplishments. She earned her Ph.D. in 1995 and since then has received many awards and honors. Among those are the Rollo Davidson Prize (2003), Doisteau-Blutet Prize from the French Academy of Science (2006), Loève Prize (2009), Médaille d' Argent du CNRS (2010), Chevalière de la légion d'honneur (2012), elected to the Academia Europea (2017), and to the French Academy of Sciences (2018), and has received the Blaise Pascal Medal in Mathematics of the European Academy of Sciences (2018). Professor Guionnet is known for her research in probability theory. The *Universality and Integrability in Random Matrix Theory and Interacting Particle Systems* program organizers wrote, "Alice is universally recognized as one of the most important and accomplished probabilists" and in Professor Voiculescu's own voice, "Professor Guionnet is one of the world's most outstanding probabilists and mathematical physicists."

Professor Spohn is an internationally renowned mathematician and physicist with a prolific publication record. Over the years he has been awarded several prizes in recognition of his contributions to the field of interacting particle systems and more broadly to mathematics and physics. Some of the awards include: the Max-Planck Award '93, Eisenbud Prize '11, Heineman Prize '11, Georg-Cantor-Médaille '14, Henri Poincaré Prize '15, Max-Planck Medal '17, and Boltzmann Medal '19. As a mathematician and a physicist, Professor Spohn has worked with many researchers in both fields. Professor Stefano Olla writes, "Herbert is one of the most prominent mathematical-physicists, and his teaching has guided generations of scientists". The *Universality*

and Integrability in Random Matrix Theory and Interacting Particle Systems program organizers wrote, "Herbert is universality recognized as one of the most important and accomplished mathematical/statistical physicists worldwide."

Professor Makarov is a graduate of the Steklov Institute of Mathematics, having earned his Ph.D. in 1986. Since 1991, he has been a faculty at the California Institute of Technology (CalTech). Makarov was awarded the 1986 Salem Prize and was an invited speaker at the 1986 ICM (held in Berkeley). He was awarded the 2020 Schock Prize in Mathematics. In the *Analysis and Geometry of Random Spaces* program organizer's nomination statement and recommendation letters, Professor Makarov is described as a "highly regarded mathematician and a brilliant visionary." As described by Professor John Garnett, "[Makarov] is a serious teacher and mentor for research students and postdocs… His lectures in courses and seminars are sophisticated and stimulating." Among Makarov's eight Ph.D. students, Zhan and Smirnov have been awarded a Salem Prize and a Fields Medal. Professor Hakan Hedenmalm writes, "[Professor Makarov] has made lasting impressions on his students, postdocs, and colleagues."

Professor Lyubich is the current Director of the Institute for Mathematical Sciences (IMS) at Stony Brook where he is also a Distinguished Professor of Mathematics. Over the years he has received several prizes and awards such as the Alfred P. Sloan and Guggenheim Fellowships. More recently, he was awarded the 2010 Jeffery-Williams Prize from the Canadian Mathematical Society and a Fellowship of the Hagler Institute for Advanced Studies for 2019-2021. He gave an Invited Address at the ICM-94, and a Plenary lecture at the 2014 ICM conference in Seoul. Professor Lyubich is a leader in the field of dynamical systems, especially in holomorphic dynamics, and as the *Complex Dynamics* program organizers mention in their nomination letter (by Schleicher) "on essentially all topics of the program, he is one of the pioneers or profound contributors; […] This broad expertise is virtually unique in the field." Professor Minsky wrote that "Lyubich's work is characterized by a fearless assault on the deepest questions no matter how technically difficult, and by a powerful ability to exploit connections between geometry, combinatorics, and analysis." Professor Marcelo Viana was quick to point out that "Lyubich is a true leader in the field of dynamical systems, especially in low dimensions, where he has made a profound and lasting imprint. His contributions display [a] remarkable combination of mathematical intuition and technical skill." Over the last 25 years, Professor Lyubich has advised 12 PhD students mentored numerous postdocs and junior researchers. Especially as the Director of the IMS, Lyubich has been able to encourage many young researchers to work on projects and promote collaborations across expertise. As Professor Yair Minsky states, "his insights and enthusiasm have touched everyone working in this field over several decades".

Other luminaries, including organizers listed in the program reports, were Kari Astala (University of Helsinki), Pavel Bleher (Indiana University-Purdue University Indianapolis), Mario Bonk (University of California, Los Angeles), Ivan Corwin (Columbia University), Percy Deift (Courant Institute, New York University), Philippe DiFrancesco (University of Illinois), Núria Fagella (Universitat de Barcelona), Pablo Ferrari (Universidad de Buenos Aires), Alexander Its (Indiana University-Purdue University Indianapolis), Sarah Koch (University of Michigan), Gregory Lawler (University of Chicago), Curtis McMullen (Harvard University), Steffan Rohde (University of Washington), Eero Saksman (University of Helsinki), Nageswari Shanmugalingam

(University of Cincinatti), Mariya Shcherbina (Institute for Low Temperature Physics UNAS), Dylan Thurston (Indiana University), and Sebastian van Strien (Imperial College London).

In all, MSRI awarded distinguished Chern, Eisenbud, and Simons Professorships to 18 researchers.

A description of the research areas investigated during the 2021-22 academic year programs, together with a summary of the salient discoveries, can be found in the Appendix as part of the program organizers' reports. Below is a small sample that gives a glimpse into the lively research activities that took place throughout the year.

Universality and Integrability in Random matrix Theory and Interacting Particle Systems: Random matrix theory has many roots, perhaps explaining why it has so successfully thrived as a research area bridging mathematics and many other disciplines (such as statistics, physics, computer science, data science, numerical analysis, biology, ecology, engineering, operations research). The organizers list 20 areas of research that were actively pursued by members of their program. While it is hard to fully appreciate the impact of a program until years later, it is clear that new research directions were defined and new collaborations were established, providing this community with fuel for a new decade of breakthroughs. Here is one area noted in the organizers' report that merits particular attention.

A profound conceptual outcome of the semester has been the understanding that the fusion of integrability and randomness is a primordial focus of the theory of integrable systems. Some recent developments within this general umbrella which were featured during the semester include the exciting discovery of the classical integrable structures in KPZ models and their use in the study of the tail asymptotics of the models. These are the works of Amir, Corwin and Quastel, the works of Borodin and Gorin, the works of Corwin and Ghosal, the works of Cafasso and Claeys, the works of Krajenbrink and Doussal, and the works of Quastel and Remenik. The second fundamental conceptual development is the realization of the importance of studying the deterministic integrable PDEs and ODEs for random initial data, i.e., the importance of studying the stationary measures generated by the classical integrable Hamiltonians. Spohn, Grava, McLaughlin and Kriecherbauer led discussions in this area throughout the program.

Through the postdoc seminars, Desiraju, Ghosal, and Prokhorov initiated a collaboration on the ambitious problem of bringing together the integrable and probabilistic interpretations of the conformal block. They obtained preliminary results that are now being formalized in a manuscript. This project will continue for several years as there are many deep and lingering problems to solve.

Complex Dynamics: From Special Families to Natural Generalizations in One and Several Variables: One substantial breakthrough that the organizers were particularly proud of concerns one of the deepest and most prominent conjectures in all of dynamical systems: "Is the Mandelbrot set locally connected?" (also known as the MLC conjecture). This conjecture has challenged the field since the seminal work by Douady and Hubbard in the 1980s, and has inspired work by prominent mathematicians such as Jean-Christophe Yoccoz, Curt McMullen, and, in later years, Mikhail Lyubich and coauthors. Despite 40 years of intense work and progress, the conjecture remains open. While in residence at MSRI**,** three members of the program, Dzmitry Dudko, Jeremy Kahn, and Mikhail Lyubich, made tremendous progress toward solving this conjecture. They

proved that the Mandelbrot set is locally connected everywhere except possibly at certain endpoints. More precisely, every fiber of the Mandelbrot set is trivial except possibly for certain fibers that are associated to only a single external angle (and are infinitely renormalizable). This represents significant progress on one of the most important topics in complex dynamics.

Another interesting development has been in transcendental dynamics and concerns the extension of a fundamental theorem of Thurston on rational maps (his "characterization theorem") to the world of transcendental maps. Graduate student member Nikolai Prochorov took the lead, based on earlier work by Schleicher and Shishikura (started during the 1995 program at MSRI), later developed further with Hubbard and, much later, Shemyakov. This project has led to interesting discussions during respective visits with Shishikura, Hubbard, Lyubich, Dudko, Rempe, and others. Another graduate student, Caroline Davis, was at the center of a very active collaboration focused on the curves Per_n. Curt McMullen pointed the group to Milnor's original paper on quadratic rational maps, which contains the key statement that every connected component of Per_n contains quadratic polynomials. This sparked a creative approach to the question of connectivity that Davis and collaborators are pursuing. She is working to build a combinatorial model of Per_n using the notion of "shared matings." In particular, if she can show that any pair of polynomials in Per_n is connected by shared matings in her model, then Per_n is connected. She worked with Laurent Bartholdi on a daily basis to explore the Per_n curves and manufacture these models. Together, they made extensive progress on $n=6$ and $n=7$, establishing the connectivity of these curves.

The Analysis and Geometry of Random Spaces: This program brought together mathematicians from different research communities, in particular analysis and probability. One research area that was central to the program was the Gaussian Free Field (GFF) and the theory of random surfaces appearing in Liouville Quantum Gravity (LQG). Without a doubt, the most striking development is the work by Kupiainen, Rhodes, and Vargas in Liouville Quantum Gravity. They developed the first mathematically rigorous Conformal Field Theory that satisfies the so-called Segal axioms. A weekly seminar was devoted to study the foundations of the subject up to the most recent advances. Compared to this monumental achievement, results that are a direct outcome of the program are necessarily more modest. One notable highlight was inspired by a talk of Yilin Wang (recent recipient of the Mirzakhani New Frontiers Prize and Strauch Postdoctoral Fellow of the program) in one of the workshops. She presented her joint work with Don Marshall and Steffen Rohde on certain types of piecewise-geodesic Jordan curves obtained as minimizers of a Moebius invariant energy (the Loewner energy). She mentioned that the uniqueness of these minimizers (passing through a given number of points in a given homotopy class) is an open and difficult problem. The question caught the attention of quite a few participants, including Kari Astala, Mario Bonk, Janne Junnila, Peter Lin, Curt McMullen, and Steffen Rohde. This led to many fruitful discussions where new ideas were explored and connections to other fields were suggested. New collaborations arose and it now seems likely that Yilin Wang's problem will be solved in the very near future.

Aside from the semester-long programs described above, and their associated workshops, MSRI hosted several additional short-term activities.

Hot Topics Workshops. The first of the two was on *Foundations of Stable, Generalizable and Transferable Statistical Learning* led by Peter Bühlmann (ETH Zurich), John Duchi (Stanford University), Elizabeth Tipton (Northwestern University), and Bin Yu (University of California, Berkeley). This workshop's focus was on foundational aspects related to the goal of making automated statistical and machine learning algorithms more reliable, robust, interpretable, and trustworthy. The workshop linked areas at the interface between statistics, optimization, machine learning and computer science, such as distributional robustness and stability, adversarial and transfer learning, generalizability and meta-analysis, and causality.

The second Hot Topics workshop was on *Regularity Theory for Minimal Surfaces and Mean Curvature Flow* led by Christine Breiner (Brown University), Otis Chodosh (Stanford University), Luca Spolaor (University of California, San Diego), and Lu Wang (Yale University). This workshop explored connections between the regularity theory of minimal surfaces and of mean curvature flow. Experts from both areas presented their research and there was ample free time to establish connections between the topics.

The talks from all MSRI's workshops are recorded and may be viewed on the Institute's website: msri.org/web/msri/online-videos.

Summer Graduate Schools: In 2020, the pandemic forced the postponement of most of MSRI's summer graduate schools, except for two that were held online. In summer 2021, the pandemic was still impacting in-person meetings and of the 12 planned summer schools, 7 were held on-line. The others were either postponed or cancelled, as the lecturers were no longer available. Despite being on-line, the summer schools were quite successful with strong engagement from students, lecturers, and TAs. Given the international nature of MSRI's summer schools, the most difficult organizational aspect was establishing schedules that could accommodate multiple time zones. In some cases, students had to re-organize their lives around summer schools occurring (for their time zone) in the middle of the night. Fortunately however, MSRI was able to minimize time zone differences for most of its 2021 summer schools. Reports for each of the summer schools may be found in the Appendix.

The African Diaspora Joint Mathematics Workshop (ADJOINT) is a yearlong program that provides opportunities for U.S. mathematicians – especially those from the African Diaspora – to form collaborations with distinguished African-American research leaders on topics at the forefront of mathematical and statistical research.

ADJOINT begins with an intensive two-week summer session which, in 2021, took place both in-person and virtually. The 24 participants (including 4 research leaders) were divided in 4 groups; three of the groups met in the hometowns of their research leader, while the fourth group met online. All groups reported high satisfaction with ADJOINT, and many highlighted that, for the first time in their careers, they felt a strong sense of belonging in a mathematical community. The virtual group was among the most productive of the groups and met in-person at MSRI in summer 2022. A description of the ADJOINT program can be found in section 7.1.

The Mathematical Sciences Research Institute Undergraduate Program (MSRI-UP) is a comprehensive program for undergraduates that aims to increase the number of students from underrepresented groups in mathematics graduate programs, ran from June 12 through July 24 with students researching problems in Parking Functions. Due to the COVID-19 pandemic, all activities took place via Zoom. The students were provided iPads with keyboards and pencils together with a 3-month internet subscription and all the software necessary for mathematical collaboration. Summer 2021 marked the 15th year of the MSRI-UP program. Details of the program can be found in section 5.1

Summer Research in Mathematics (SRiM): The COVID-19 pandemic prevented SRiM's 2020 cohorts – primarily women and gender-expansive mathematicians – from convening on-site in Berkeley. Summer 2021 was slightly different. While MSRI could not accept in-person groups, many of the research teams met in the hometowns of one of the collaborators, or at convenient hubs. The groups that were able to meet were glad to have been given this opportunity and reported strong progress on their research problems. A few groups chose to postpone once more to the summer of 2022. Additional details can be found in section 6.1.

Funding: In 2021-22, approximately 51% of support for program members came from the NSF, 4% from the NSA, 16% from endowments, and 29% from private sources. These numbers demonstrate MSRI's ability to leverage the support that the NSF provides and thereby amplify its benefits; we feel that this is possible because the core NSF support provides such a strong foundation for, and endorsement of, MSRI's scientific quality.

Postdoctoral Program: Twenty-nine (29) Postdoctoral Fellows participated in MSRI's three scientific programs and in the complementary program. Of those, thirteen (13) received stipends from this NSF grant.

MSRI also hosted a number of distinguished early career researchers as "named" postdocs: Mikhail Hlushchanka was the Berlekamp Postdoctoral Fellow; Milind Hegde the Gamelin Fellow; Yan Mary He the Huneke Fellow; Alexandre Krajenbrink the McDuff Fellow; Yilin Wang the Strauch Fellow; Chiara Franceschini the Uhlenbeck Fellow; Emma Bailey and Janne Junnila the Viterbi Fellows; and Peter Lin and Leticia Pardo Simon the Della Pietra Fellows. For details, please see Section 3.

Mathematical Sciences Institutes Diversity Initiative: This diversity initiative, known as MSIDI, consists of a series of workshops for members of groups that have been historically underrepresented in the mathematical sciences. These workshops are sponsored by a collaborative grant involving NSF-funded US mathematical sciences institutes (IAS, ICERM, IMSI, IPAM, MSRI, and SAMSI). During the 2021-22 academic year, the Modern Math Workshop (MMW) that normally precedes the SACNAS conference was canceled. As SACNAS was held online, the MSIDI leadership team believed that a virtual MMW would not be successful. The next Modern Math Workshop will be held in San Juan, Puerto Rico in October 2022, immediately before the SACNAS conference.

The Blackwell-Tapia Conference, organized by MSRI was held November 18-20, 2021 and celebrated the 2020 prize recipient Tatiana Toro (University of Washington), who had recently

been announced as the next Director of MSRI effective August 1, 2022. The conference was held simultaneously at four locations nationwide, as well as online. MSRI served as the primary hub, with the Institute for Advanced Studies (IAS, Princeton), the Institute for Mathematical and Statistical Innovation (IMSI, Chicago), and the Institute for Pure and Applied Mathematics (IPAM, Los Angeles) serving as satellite sites. Researchers had the choice to attend the conference in person at any of the satellite locations or virtually. Each institute had in-person speakers as well as a representative of the MSIDI team present to facilitate networking activities.

The conference drew more than 140 participants, 38 of whom were online. 43% of participants were women, 21% were Hispanic/Latinx, and 22% were Black. The two-day workshop kicked off with a spectacular lecture/performance given by Stephon Alexander (Brown University) on the *Jazz of Spheres.* Alexander is a distinguished physicist and jazz saxophonist who wrote the 2016 book *The Jazz of Physics.* The first talk of the next day was given by Richard Tapia on the remarkable "journey of the isoperimetric problem," while the last day concluded with a conversation between Tatiana Toro (at MSRI) and Carlos Kenig (at IMSI), who had just delivered a talk on the significance of Toro's work. The final discussion was followed by various activities across the satellite institutes. MSRI hosted a banquet for attendees at the nearby David Brower Center. As MSRI sits on the territory of xučyun (Huichin), the ancestral and unceded land of the Chochenyo-speaking Ohlone people, the 10-course feast was prepared and presented by two notable Ohlone chefs using indigenous ingredients and methods.

Critical Issues in Mathematics Education: The Critical Issues in Mathematics Education (CIME) series of workshops addresses key problems in education today. They are designed to engage professional mathematicians in discussions with education researchers, teachers, and policy makers to improve mathematics education. This year's topic was on *Initiating, Sustaining, and Researching Mathematics Department Transformation of Introductory Courses for STEM Majors*. Participants examined and discussed topics surrounding equity, pedagogy, organizational structure, and implementation in their exploration of this theme. This workshop was held in a hybrid format to accommodate for the ongoing impact of the COVID-19 pandemic. 224 attendees participated in total. 56 people attended in-person and 168 joined us virtually.

Public Understanding of Mathematics: MSRI runs activities and programming each year that aim to help the public understand the power, beauty, and fun of mathematics:

Mathical Book Prize: (www.mathicalbooks.org)
The Mathical Book Prize is awarded by MSRI in cooperation with the Institute for Advanced Study. The award is presented in partnership with the National Council of Teachers of English, the National Council of Teachers of Mathematics, and in coordination with the Children's Book Council. Now in its 9th year, the prize aims to cultivate a love of mathematics by elevating outstanding children's books that explore the many ways that mathematics can be experienced in the world around us. MSRI partners with many organizations including First Book, Bring Me a Book, *School Library Journal*, the Books for Kids Foundation, and the DREME Network at Stanford University to distribute Mathical titles nationally to children in need. The 2022 prize was supported by the Firedoll Foundation and Joan and Irwin Jacobs. Founding support for the Mathical Prize was provided by the Simons Foundation.

In conjunction with the Mathical Book Prize, MSRI presented 25 school libraries with Mathical Book Prize Collection Development Awards in partnership with the *School Library Journal*. This award provides the recipient Title I schools with $700 to be used to purchase Mathical titles with the intention of inspiring a love and appreciation of math in the everyday world.

MSRI also collaborated with the National Council of Teachers of English (NCTE) and the National Council of Teachers of Mathematics (NCTM) to present a total of 20 Title I school classrooms nationwide with Mathical titles. Language arts and math teachers received $750 to purchase Mathical List titles for classroom integration.

The 2022 Mathical Prize winners are: **Pre-K**, *1 Smile, 10 Toes* by Nelleke Verhoeff (Barefoot Books); **Grades K-2**, *Uma Wimple Charts Her House* by Reif Larsen and Ben Gibson (Random House Children's Books); **Grades 3-5**, *Maryam's Magic: The Story Of Mathematician Maryam Mirzakhani* by Megan Reid, with illustrations by Aaliya Jaleel (HarperCollins Children's Books); **Grades 6-8**, *AfterMath* by Emily Barth Isler (Lerner Publishing Group).

Films for Public Television: The field of Mathematics is full of figures who have overcome odds, solved unusual problems, and inspired new generations of mathematicians. As part of our commitment to making these stories accessible, MSRI has produced several films aimed at a general audience. Many of these have been directed by George Csicsery of Zala Films, whose first film about a mathematician, *N is a Number*, brought the story of legendary mathematician Paul Erdős to the screen.

Secrets of the Surface: The Mathematical Vision of Maryam Mirzakhani (zalafilms.com/secrets), MSRI's 2020 feature-length documentary film, continued to be screened periodically in film festivals, at universities, and on PBS and APT stations and streaming services in 2022. Many of the physical screenings were accompanied by Q&A sessions which included panelists such as Drs. Hussein Banai of MIT; Laura DeMarco of Harvard University; and Shahyar Daneshgar, Shabnam Kavousian and Julia Plavnik, all of Indiana University. The film was also cited as a personal inspiration by high school student Milena Harned who recently published her first theorem in the *International Journal of Geometry*. She was introduced to the film through the Girls' Angle Math Club in Cambridge. In March, an interview with the filmmaker George Csicsery about his work on *Secrets of the Surface* was published in *Kayhan Life*—an English-language magazine dedicated to the global Iranian community.

MSRI is in production on another joint project with Zala Films under the working title *Journeys of Black Mathematicians*. This film aims to share the largely untold history of African-Americans in science and mathematics. It will feature interviews with prominent contemporary Black mathematicians and showcase innovative educational programs in math for Black students from grade school through postsecondary and postdoctoral levels. The project hopes to inspire young people, particularly African-Americans, to pursue careers in the mathematical sciences by highlighting the importance of their contributions as researchers and educators in the field. The film's release date is tentatively scheduled for 2024.

Numberphile: (youtube.com/numberphile). MSRI continues to provide financial and intellectual support to Brady Haran's Numberphile, a popular YouTube channel and podcast started in 2014.

Numberphile remains one of the most popular resources for public mathematical education on YouTube boasting 4.13 million subscribers on their channel. Popular uploads this year included *Gambling with the Martingale Strategy* with Dr. Tom Crawford, *Tunneling through a Mountain* with Prof. Hannah Fry, and *The Lightning Algorithm* with Dr. Matt Henderson.

In 2022, Numberphile uploaded 51 new videos, bringing the total to 655. It has accumulated an additional 2 million video views, bringing the total to 644 million. A further nine supplemental videos and nine podcast episodes were uploaded to the "extras channel" called Numberphile2, comprising a total of 212 bonus videos.

The CME Group-MSRI Prize in Innovative Quantitative Applications: (msri.org/web/msri/activities/cme-prize) recognizes originality and innovation in the use of mathematical, statistical or computational methods for the study of the behavior of markets, and more broadly of economics. The 16th annual Prize was awarded to Nancy L. Stokey, Frederick Henry Prince Distinguished Service Professor of Economics, University of Chicago. Stokey is a member of the National Academy of Sciences and of the American Academy of Arts and Sciences, a Fellow of the Econometric Society, a Distinguished Fellow of the American Economic Association, and the 2021 President of the Society for the Advancement of Economic Theory. She has served as co-editor of *Econometrica* and of *The Journal of Political Economy*, and as vice-President of the American Economic Association. Stokey is co-author of the influential monograph *Recursive Methods in Economic Dynamics* (1989), which has provided the mathematical basis for much of modern macroeconomics. She is also co-developer of a model of dynamic taxation and debt policy that has served as the foundation for much subsequent work in that area, and she is author of *The Economics of Inaction* (2009), which treats models that involve fixed costs of adjustment. Stokey has also contributed to various areas of microeconomics, with the first rigorous proof of the famous Coase conjecture, and as co-developer of the No-Trade theorem, a result that presents a fundamental puzzle about information, stock market prices, and the volume of trading. Stokey's recent work has focused on economic growth and development, especially on the role of trade and technology transfers in accelerating growth in middle-income countries. An award ceremony and seminar were held on May 16, 2022 at the CME Group in Chicago, IL.

Congressional Briefings: (www.msri.org/congress) In cooperation with the American Mathematical Society, MSRI hosts bi-annual congressional briefings in Washington, D.C. to inform members of Congress about scientific advances made possible through federally supported research. This event was the first in-person briefing since December 2019 due to the COVID-19 pandemic.

In December 2021, Field's Medalist Cédric Villani of the University of Lyon and Member of the French Parliament, presented a briefing on Capitol Hill entitled "Mitigating Climate Change: Science and Policy." MSRI Director David Eisenbud and AMS Executive Director Catherine Roberts joined U.S. Senator Sheldon Whitehouse (Rhode Island) and U.S. Representative Jerry McNerney (California) at the event.

National Math Festival: (www.nationalmathfestival.org) The National Math Festival is organized by MSRI in cooperation with the Institute for Advanced Studies and the National Museum of Mathematics. The first festival was held in 2015 with the aim of cultivating a sense of

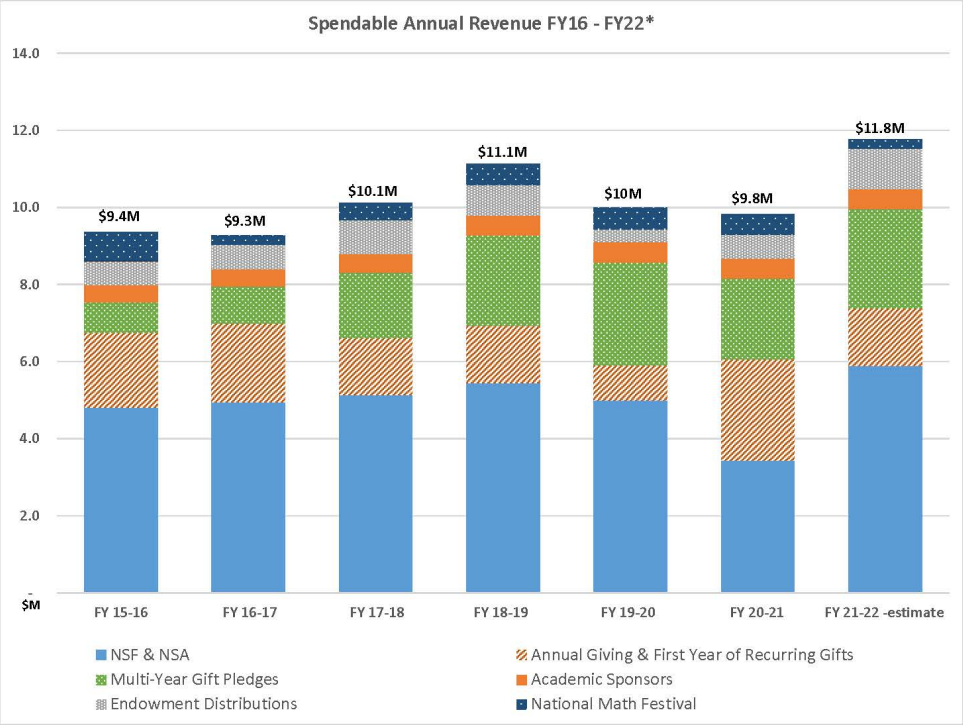
belonging in the math world. The 2021-2022 National Math Festival included live online interactive events in Fall and Spring, culminating in a day-long collaboration with North Carolina Central University (a local HBCU) as part of the North Carolina Science Festival (NCSciFest). The event explored the integration of mathematics-focused programming into an already robust statewide science month.

NMF programs in 2021-2022 included several new elements, including the launch of Dr. Kristopher Childs' podcast for teachers, Inspiring Voices from the Classroom; and the first high school Datathon4Justice with QSIDE (Institute for the Quantitative Study of Inclusion, Diversity, and Equity).

Art at MSRI: Despite Shiing-Shen Chern Hall being closed to the public for much of the year, MSRI continued to host art exhibitions of mathematical significance or local Bay Area interest as part of our enrichment for members and visitors, with one public reception to celebrate the year's exhibits held in June 2022. This year's mathematical art exhibit featured the works of Kevin Walker, a mathematician who currently works at Microsoft's quantum computing group. Learn more at kevinwalker.info.

Private Fundraising: The private fundraising for MSRI continues to be a robust operation that leverages NSF support to enhance and grow both our scientific and public outreach programming. We have hired a new fundraiser to focus on increasing the number of donors through annual fund drive efforts, as well as through targeted communication and networking.

As shown by the Spendable Annual Revenue Chart below, the total percentage of spendable funds from private donors (individuals, private foundations, and corporations) continues to increase due to additional multi-year pledges. These funds provide us with an increased ability to plan for the future. Overall private funding remains about half of the total revenue, which fits the trend pre-2020. In addition to what is shown on the chart for FY 21-22, we have raised over $60M in pledges and gifts from private sources this year to benefit our endowment campaign. This campaign as a whole will greatly increase our ability to expand existing programs and launch new initiatives.



($M)	FY 15-16	FY 16-17	FY 17-18	FY 18-19	FY 19-20	FY 20-21	FY 21-22 - estimate
NSF & NSA	4.81	4.96	5.14	5.44	5.00	3.43	5.89
Academic Sponsors	0.43	0.46	0.49	0.52	0.52	0.51	0.52
Endowment Distributions	0.63	0.63	0.87	0.79	0.34	0.62	1.04
Annual Giving & First Year of Recurring Gifts	1.94	2.04	1.47	1.50	0.90	2.63	1.49
National Math Festival	0.75	0.24	0.45	0.55	0.55	0.54	0.24
Multi-Year Gift Pledges	0.80	0.95	1.69	2.33	2.67	2.10	2.57
Total Spendable Revenue	**9.36**	**9.27**	**10.12**	**11.13**	**9.99**	**9.83**	**11.76**

1.2 Summary of Demographic Data for 2021-22 Activities

During the academic year 2021–22, 204 in-person members participated in MSRI's programs (29 of whom were Postdoctoral Fellows), with hundreds more participating online in the programmatic seminars. Including both online and in-person participants, MSRI's workshops had 2,369 attendees (distinct for each workshop, but some individuals attended multiple workshops).

The Postdoctoral program was particularly successful and is described in detail in Section 3. Of the Fellows, 41% were women, 21% were U.S. Citizens or Permanent Residents, and 66% listed a U.S. university as their home institution. Of those institutions, 42.1% are located in the Northeast, 42.1% in the West, 10.5% in the Midwest, and the remaining 5.3% (one postdoc) in the South.

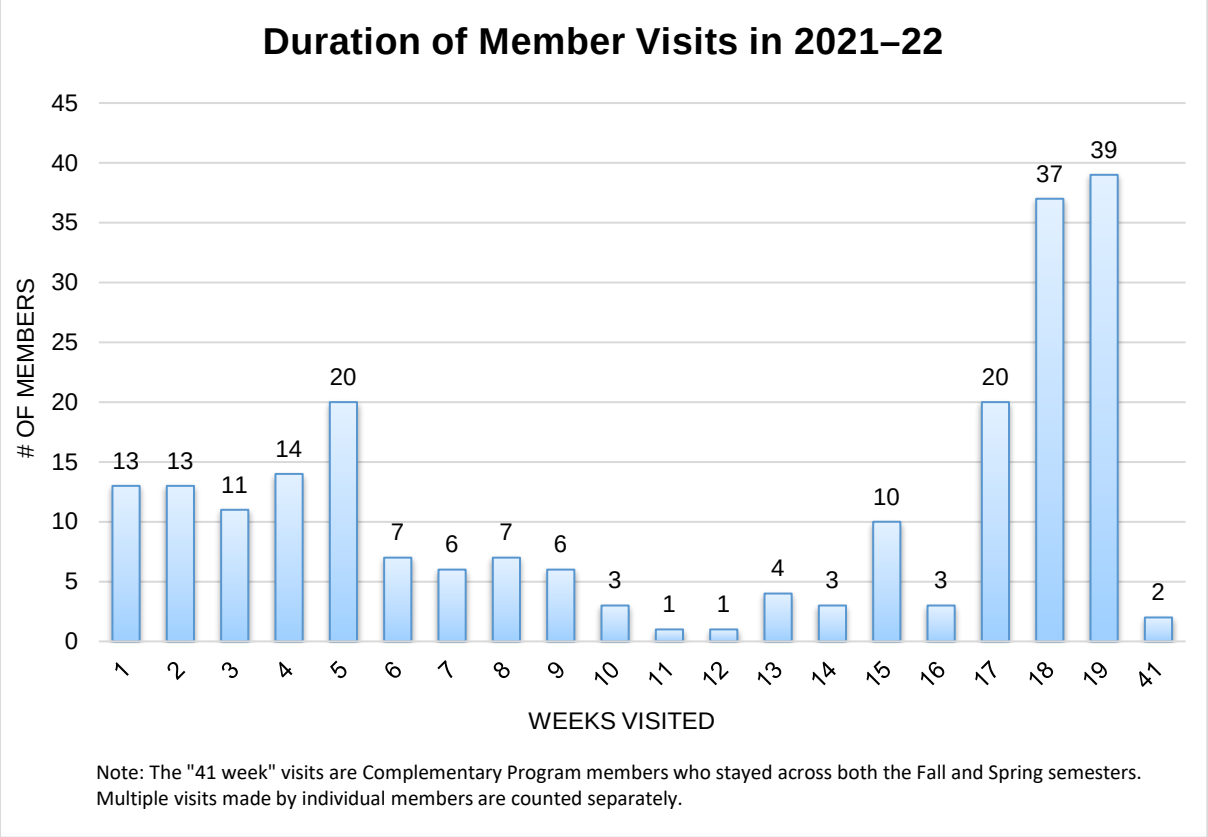
MSRI had a total of 204 members who spent time physically onsite at MSRI in a masked and socially-distanced capacity, with weekly PCR testing. Those members spent an average of 79 days at MSRI per visit, or 2.6 months out of a possible 4 months, representing roughly 65% of possible visit days. Peak attendance was in September 2021 for the fall semester and April 2022 for the spring semester. Of the members, 29% were female, 49% reported being U.S. Citizens or Permanent Residents, and 57% listed a U.S. university as their home institution. Of those institutions, 34% in the Northeast, 31% are located in the West, 25% in the Midwest, and 10% in the South. Of the members, 28% received their Ph.D. during the year 2015 or later, 31% received their Ph.D. between 2000 and 2014, 26% received their Ph.D. in 1999 or earlier, and the remaining 15% were graduate students. Detailed demographic data can be found in Section 2.

MSRI's 2021–22 workshops were held in a hybrid format with options for both in-person and virtual attendance. There were a total of 2,369 participants (some individuals attended multiple workshops and are counted more than once). Registration was encouraged, but not required for virtual attendees or speakers; therefore demographic information is not available for 177 unregistered participants. Of the 2,192 workshop participants for whom information is available, 40% were female and 55% were U.S. Citizens or Permanent Residents, of whom 19% reported being a member of an under-represented minority. In addition, 71% came from a U.S. institution. Demographic data on workshop participants can be found in Sections 2 and 4.

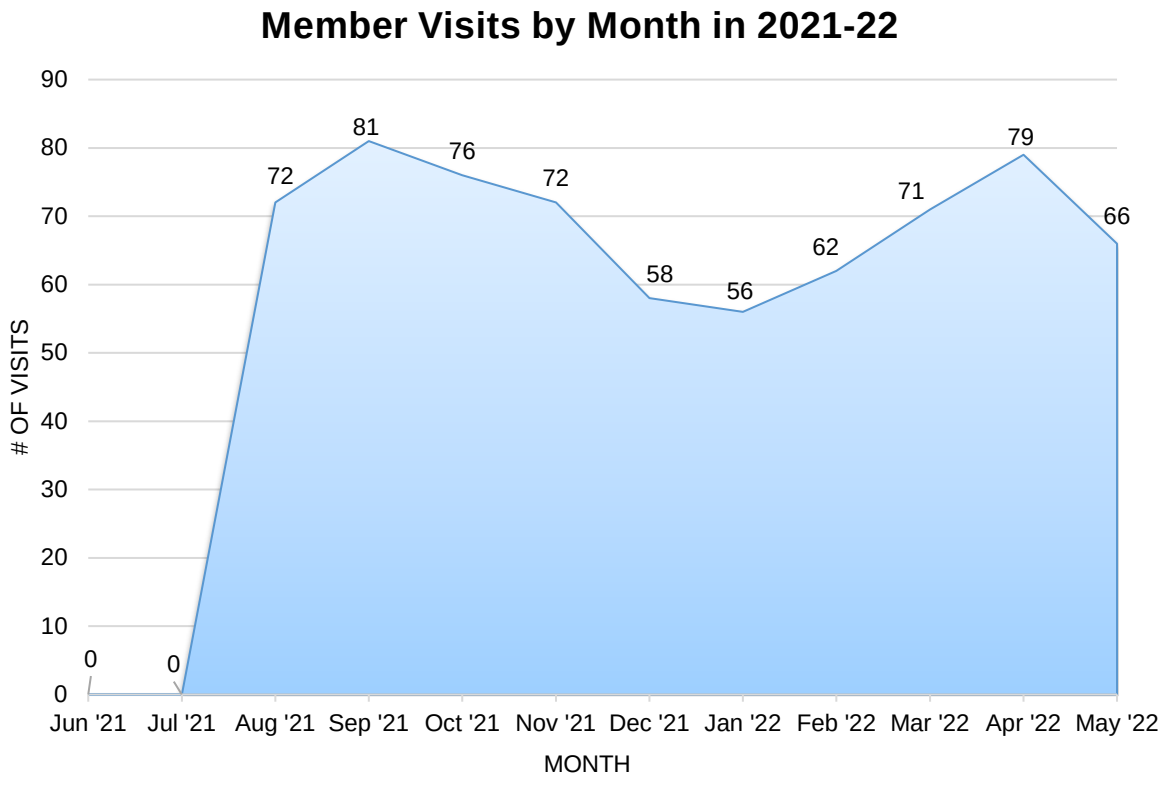
Member Visits Summary*

All program members	Summer 2021	Fall 2021	Spring 2022	2021-22	2004–22
Total Member Days	0	7,841	9,829	17,670	307,300
Total # of Member Visits	0	107	117	224	4,248
Average # of Days per Member Visit	0.00	73.28	84.01	78.88	72.34
Average # of Months per Member Visit	0.00	2.44	2.80	2.63	2.41
All female program members	**Summer 2021**	**Fall 2021**	**Spring 2022**	**2021-22**	**2009–22**
Total Member Days	0	2,092	3,567	5,659	56,870
Total # of Member Visits	0	26	36	62	751
Average # of Days per Member Visit	0.00	80.46	99.08	91.27	75.73
Average # of Months per Member Visit	0.00	2.68	3.30	3.04	2.52

**Please note that this table calculates members' visits, which can be multiple.*



Note: The "41 week" visits are Complementary Program members who stayed across both the Fall and Spring semesters. Multiple visits made by individual members are counted separately.



1.3 Scientific Programs and their Associated Workshops

There were three major, one complementary, and two summer research programs that took place during the 2021-22 year, as well as 9 programmatic workshops.

Note: Full descriptions of each activity can be found the Appendix (Section 13) of this Annual Report. In the lists of organizers of each activity below, the name of the lead organizer(s) appears in blue.

Program 1: Universality and Integrability in Random Matrix Theory and Interacting Particle Systems
August 16, 2021 – December 17, 2021
*Organizers: **Ivan Corwin** (Columbia University), Percy Deift (New York University, Courant Institute), Ioana Dumitriu (University of California, San Diego), Alice Guionnet (École Normale Supérieure de Lyon), Alexander Its (Indiana University--Purdue University), Herbert Spohn (Technische Universität München), Horng-Tzer Yau (Harvard University)*

Workshop 1: Connections and Introductory Workshop: Universality and Integrability in Random Matrix Theory and Interacting Particle Systems, Part 1 [Hybrid Workshop]
August 23, 2021 – August 27, 2021
Organizers: Gérard Ben Arous (New York University, Courant Institute), Ivan Corwin (Columbia University), Ioana Dumitriu (University of California, San Diego), Alice Guionnet (École Normale Supérieure de Lyon), Alisa Knizel (The University of Chicago), Sylvia Serfaty (New York University, Courant Institute), Horng-Tzer Yau (Harvard University)

Workshop 2: Connections and Introductory Workshop: Universality and Integrability in Random Matrix Theory and Interacting Particle Systems, Part 2 [Hybrid Workshop]
September 20, 2021 – September 24, 2021
Organizers: Gérard Ben Arous (New York University, Courant Institute), Ioana Dumitriu (University of California, San Diego), Alice Guionnet (École Normale Supérieure de Lyon), Alisa Knizel (The University of Chicago), Sylvia Serfaty (New York University, Courant Institute), Horng-Tzer Yau (Harvard University)

Workshop 3: Integrable Structures in Random Matrix Theory and Beyond [Hybrid Workshop]
October 18, 2021 – October 22, 2021
*Organizers: **Jinho Baik** (University of Michigan), Alexei Borodin (Massachusetts Institute of Technology), Tamara Grava (University of Bristol; International School for Advanced Studies (SISSA/ISAS)), Alexander Its (Indiana University--Purdue University), Sandrine Peche (Université de Paris VII (Denis Diderot))*

Program 2: The Analysis and Geometry of Random Spaces
January 18, 2022 - May 27, 2022
*Organizers: **Mario Bonk** (University of California, Los Angeles), Joan Lind (University of Tennessee), Steffen Rohde (University of Washington), Eero Saksman (University of Helsinki), Fredrik Viklund (Royal Institute of Technology), Jang-Mei Wu (University of Illinois at Urbana-Champaign)*

Workshop 1: Connections Workshop: The Analysis and Geometry of Random Spaces [Hybrid Workshop]
January 19, 2022 – January 21, 2022
*Organizers: Mario Bonk (University of California, Los Angeles), **Joan Lind** (University of Tennessee), Eero Saksman (University of Helsinki), Jang-Mei Wu (University of Illinois at Urbana-Champaign)*

Workshop 2: Introductory Workshop: The Analysis and Geometry of Random Spaces [Hybrid Workshop]
January 24, 2022 – January 28, 2022
*Organizers: **Mario Bonk** (University of California, Los Angeles), Joan Lind (University of Tennessee), Steffen Rohde (University of Washington), Fredrik Viklund (Royal Institute of Technology)*

Workshop 3: The Analysis and Geometry of Random Spaces [Hybrid Workshop]
March 28, 2022 – April 01, 2022
*Organizers: Nikolai Makarov (California Institute of Technology), **Steffen Rohde** (University of Washington), Eero Saksman (University of Helsinki), Amanda Turner (University of Lancaster), Fredrik Viklund (Royal Institute of Technology), Jang-Mei Wu (University of Illinois at Urbana-Champaign)*

Program 3: Complex Dynamics: from special families to natural generalizations in one and several variables
January 18, 2022 - May 27, 2022
*Organizers: **Sarah Koch** (University of Michigan), Jasmin Raissy (Institut de Mathématiques de Bordeaux), Dierk Schleicher (Université d'Aix-Marseille (AMU)), Mitsuhiro Shishikura (Kyoto University), Dylan Thurston (Indiana University)*

Workshop 1: Connections Workshop: Complex Dynamics - from special families to natural generalizations in one and several variables [Hybrid Workshop]
February 02, 2022 - February 04, 2022
*Organizers: Núria Fagella (University of Barcelona), **Tanya Firsova** (Kansas State University), Thomas Gauthier (Université Paris-Saclay), Sarah Koch (University of Michigan)*

Workshop 2: Introductory Workshop: Complex Dynamics - from special families to natural generalizations in one and several variables [Hybrid Workshop]
February 08, 2022 - February 17, 2022
*Organizers: Anna Miriam Benini (Università di Parma), Fabrizio Bianchi (Université de Lille), Mikhail Hlushchanka (Universiteit Utrecht), **Dylan Thurston** (Indiana University)*

Workshop 3: Adventurous Berkeley Complex Dynamics [Hybrid Workshop]
May 02, 2022 - May 06, 2022
*Organizers: Mikhail Lyubich (State University of New York, Stony Brook), **Jasmin Raissy** (Institut de Mathématiques de Bordeaux), **Roland Roeder** (Indiana University--Purdue University), Dierk Schleicher (Université d'Aix-Marseille (AMU))*

Program 4: Complementary Program (2021-22)
August 16, 2021 - May 27, 2022

MSRI had a small Complementary Program comprised of one postdoctoral fellow, Benjamin Briggs (University of Utah), and the following 18 researchers: David Anderson (Ohio State University), Bulent Can Özgür Esentepe (University of Connecticut), Hailong Dao (University of Kansas), Joseph Harris (Harvard University), Wade Hindes (Texas State University), Milivoje Lukić (Rice University), Mikhail Mazin (Kansas State University), Andrés R. Vindas Meléndez (University of California, Berkeley), Kent Morrison (American Institute of Mathematics), Bernd Ulrich (Perdue University), Pierre Nolin (City University of Hong Kong), Siamak Yassemi (University of Tehran), Ohad Noy Feldheim (The Hebrew University of Jerusalem), Jerzy Weyman (Jagiellonian University), Swati Patel (University of Warwick), Sylvain Ervedoza (Bordeaux Institute of Mathematics), Palina Salanevich (Utrecht University), and Robert Silversmith (University of Warwick).

Summer Research in Mathematics 2021
June 07, 2021 - August 9, 2021

African Diaspora Joint Mathematics Workshops (ADJOINT) 2021
June 21, 2021 - July 02, 2021

1.4 Scientific Activities Directed at Underrepresented Groups in Mathematics

Connections Workshops
During the 2021-22 academic year, MSRI hosted three Connections workshops, one for each scientific program. These workshops have three overarching goals: (1) to give accessible introductions to the main themes of the program and exciting new directions in related research; (2) to provide participants the opportunity to become acquainted with the work of women in the field; and (3) to connect early-career researchers, especially women, gender-expansive individuals, and minorities, to potential senior mentors. A typical workshop consists of introductory lectures, presentations by post-doctoral researchers and graduate students, and a panel discussion addressing the challenges faced by all young researchers, but especially by women, in establishing a career in mathematics. Throughout the workshops, special effort is made to foster mentoring relationships between established and early-career researchers at the lunches, dinners, and coffee breaks. Participants of the Connections Workshop are encouraged to stay for the following week for the Introductory Workshop to the semester's program. The workshop organizers are also encouraged to propose week-end activities for small groups of women with similar research interests to discuss problems and perhaps to begin work on a joint research project (e.g. forming small research or study groups that would work on predetermined problems, read a paper, or learn new techniques). As is the case for all MSRI workshops, registration to attend Connections workshop lectures is open to all interested persons. For more information regarding each workshop, please refer to Section 1.3 above as well as the Appendix (Section 13).

Celebration of Women in Mathematics 2022
May 12, 2022

The MSRI *Celebration of Women in Mathematics 2022* event was aimed at graduate students, with a focus on "How to Build a Career in Math." It was a hybrid workshop, with online and in-person activities at satellite institutions including MSRI, Rice University, UCLA, University of California, Riverside, and University of Connecticut. In 2014, Maryam Mirzakhani was awarded the Fields Medal for her outstanding contributions to the dynamics and geometry of Riemann surfaces and their moduli spaces, becoming the first woman, and the first Iranian, to be recognized for her mathematical achievements by this top mathematical prize. May 12th, her birthday, has been chosen to celebrate Women in Mathematics in her memory. The celebration takes place every year, all around the world. The goal of the day is to inspire women everywhere to celebrate their achievements in mathematics, and to encourage an open, welcoming and inclusive work environment for everybody.

The organizing committee was composed of 22 women from around the world, including Africa, the Americas, Europe, Asia, and the Middle East. There were 5 plenary speakers from 5 continents who delivered their talks online, followed by breakout sessions on various topics related building a career in mathematics.

Summer Research in Mathematics
June 07, 2021 – August 9, 2021

During the summer of 2021 MSRI hosted the Summer Research in Mathematics program, which provides space, funding, and the opportunity for in-person collaboration to small groups of mathematicians, especially women and gender-expansive individuals, whose ongoing research may have been disproportionately affected by various obstacles including family obligations, professional isolation, or access to funding. Through this effort, MSRI aims to mitigate the obstacles faced by these groups, improve the odds of research project completion, and deepen their research experience. The ultimate goal of this program is to enhance the mathematical sciences as a whole by positively affecting the research and careers of all of its participants and assisting their efforts to maintain involvement in the research community.

Groups of two to six mathematicians with partial results on an established research agenda met to advance their projects. Each member of the group must have a Ph.D. in mathematics or advanced graduate standing. Because MSRI was closed due to the pandemic, each group met in a different off-site location elected by the group members. Group meetings lasted a minimum of five working days, though the majority extended for two weeks or more. For more information regarding this program, please refer to Section 6 of this annual report.

2021 African Diaspora Joint Mathematics Workshops (ADJOINT)
June 21, 2021 – July 02, 2021
*Program Directors: Edray Goins (Pomona College), Caleb Ashley (University of Michigan), Naiomi Cameron (Spelman College), **Jacqueline Hughes-Oliver** (North Carolina State University), Anisah Nu'Man (Spelman College)*

The main objective of ADJOINT is to provide opportunities for in-person research collaboration to U.S. mathematicians, especially those from the African American mathematics community, who work in small groups with research leaders on various research projects. Through this effort, MSRI aims to establish and promote research communities that will foster and strengthen research productivity and career development among its participants. The ADJOINT workshops are designed to catalyze research collaborations, provide support for conferences to increase the visibility of the researchers, and to develop a sense of community among the mathematicians who attend. This program will enhance the mathematical sciences and its community by positively affecting the research and careers of African-American mathematicians and supporting their efforts to achieve full access and engagement in the broader research community.

The ADJOINT 2021 program supported a total of 24 researchers divided into four groups, including four renowned African American scientists acting as Research Leaders. All teams were predominantly comprised of African American mathematicians and statisticians at various stages in their careers. Their research projects were pursued further during the academic year via periodic virtual meetings. For more information regarding this program, please refer to Section 7 of this annual report.

Undergraduate Program: MSRI-UP 2021: Parking Functions: Choose Your Own Adventure
June 12, 2021 – July 24, 2021
*Organizers: Federico Ardila (San Francisco State University), Duane Cooper (Morehouse College), Maria Franco (Queensborough Community College (CUNY)), **Rebecca Garcia** (Sam Houston State University), Pamela Harris (Williams College), Candice Price (Smith College)*

The MSRI Undergraduate Program (MSRI-UP) is a comprehensive summer program designed for undergraduate students who have completed two years of university-level mathematics courses and would like to conduct research in the mathematical sciences. The main objective of the MSRI-UP is to identify talented students, especially those from underrepresented groups, who are interested in mathematics and make available to them meaningful research opportunities, the necessary skills and knowledge to participate in successful collaborations, and a community of academic peers and mentors who can advise, encourage and support them through a successful graduate program.

NSF Mathematics Institutes' Blackwell-Tapia Conference
Hybrid Conference with Satellite Locations at MSRI, IPAM, IMSI, and IAS
November 18, 2021 – November 20, 2021
Organized by MSRI

Held biennially, the Blackwell-Tapia Conference honors David Blackwell, the first African-American member of the National Academy of Science, and Richard Tapia, 2010 recipient of the National Medal of Science. These two seminal figures inspired a generation of African-American, Native American, and Latinx students to pursue careers in mathematics. The Blackwell-Tapia Prize recognizes a mathematician who has contributed significantly to research in his or her area of expertise, served as a role model for mathematical scientists from underrepresented minority groups, and contributed in other significant ways to addressing the problem of underrepresentation of minorities in mathematics.

Due to the COVID-19 pandemic, the 2020 Blackwell-Tapia Conference honoring prize-winner Tatiana Toro was rescheduled to take place in 2021. The conference included scientific talks, poster presentations, panel discussions, ample opportunities for networking, and the awarding of the Blackwell-Tapia Prize. For more information, see the report in Section 13, Appendix.

1.5 Summer Graduate Schools (Summer 2021)

SGS 1: Séminaire de Mathématiques Supérieures 2021: Microlocal Analysis: Theory and Applications (Virtual School)
May 03, 2021 – August 13, 2021
Location: University of Alberta, Canada
Organizers: Suresh Eswarathasan (Dalhousie University), Dmitry Jakobson (McGill University), Katya Krupchyk (University of California, Irvine), Stephane Nonnenmacher (Université de Paris XI)

SGS 2: 2021 CRM-PIMS Summer School in Probability (Virtual School)
May 24, 2021 – June 18, 2021
*Organizers: **Louigi Addario-Berry** (McGill University), Omer Angel (University of British Columbia), Alexander Fribergh (University of Montreal), Mathav Murugan (University of British Columbia), Edwin Perkins (University of British Columbia)*

SGS 3: Sparsity of Algebraic Points (Virtual School)
June 07, 2021 – June 18, 2021
*Organizers: Philipp Habegger (University of Basel), **Hector Pasten** (Pontificia Universidad Católica de Chile)*

SGS 4: Mathematics of Big Data: Sketching and (Multi-) Linear Algebra (Virtual School)
June 21, 2021 – July 02, 2021
*Organizers: **Kenneth Clarkson** (IBM Research Division), Lior Horesh (IBM Thomas J. Watson Research Center), Misha Kilmer (Tufts University), Tamara Kolda (Sandia National Laboratories; MathSci.ai), Shashanka Ubaru (IBM Thomas J. Watson Research Center)*

SGS 5: Gauge Theory in Geometry and Topology (Virtual School)
July 05, 2021 – July 16, 2021
*Organizers: Lynn Heller (Universität Hannover), Francesco Lin (Columbia University), **Laura Starkston** (University of California, Davis), Boyu Zhang (Princeton University)*

SGS 6: Random Conformal Geometry (Virtual School)
July 19, 2021 – July 30, 2021
*Organizers: Mario Bonk (University of California, Los Angeles), Steffen Rohde (University of Washington), **Fredrik Viklund** (Royal Institute of Technology)*

SGS 7: Foundations and Frontiers of Probabilistic Proofs (Virtual School)
July 26, 2021 – August 06, 2021
Organizers: Alessandro Chiesa (University of California, Berkeley), Tom Gur (University of Warwick)

1.6 Other Scientific Workshops

Workshop 1: Mathematics and Racial Justice [Virtual Workshop]
June 09, 2021 - June 18, 2021
*Organizers: Caleb Ashley (Boston College), Ron Buckmire (Occidental College), Duane Cooper (Morehouse College), Monica Jackson (American University), **Omayra Ortega** (Sonoma State University), **Robin Wilson** (California State Polytechnic University, Pomona)*

Workshop 2: Chern-Simons and Other Topological Field Theories
November 16, 2021 - November 18, 2021
Organizers: Stephon Alexander (Brown University), Fiona Burnell (University of Minnesota), David Eisenbud (MSRI - Mathematical Sciences Research Institute), Dan Freed (University of Texas, Austin), Joel Moore (University of California, Berkeley), John Morgan (Columbia University)

Workshop 3: Hot Topics: Foundations of Stable, Generalizable and Transferable Statistical Learning [Virtual Workshop]
March 7, 2022 - March 10, 2022
*Organizers: **Peter Bühlmann** (ETH Zurich), John Duchi (Stanford University), Elizabeth Tipton (Northwestern University), Bin Yu (University of California, Berkeley)*

Workshop 4: Hot Topics: Regularity Theory for Minimal Surfaces and Mean Curvature Flow [Virtual Workshop]
March 7, 2022 - March 10, 2022
*Organizers: **Peter Bühlmann** (ETH Zurich), John Duchi (Stanford University), Elizabeth Tipton (Northwestern University), Bin Yu (University of California, Berkeley)*

1.7 Education & Outreach Activities

Critical Issues in Mathematics Education 2022: Initiating, Sustaining, and Researching Mathematics Department Transformation of Introductory Courses for STEM Majors [Hybrid Workshop]
March 16, 2022 - March 18, 2022
*Organizers: Naneh Apkarian (Arizona State University), David Bressoud (Macalester College), Pamela Burdman (Just Equations), Jamylle Carter (Diablo Valley college), Ted Coe (Northwest Evaluation Association), Courtney Ginsberg (Math for America), Estrella Johnson (Virginia Polytechnic Institute and State University), W. Gary Martin (Auburn University), Michael O'Sullivan (San Diego State University), **Chris Rasmussen** (San Diego State University), Daniel Reinholz (San Diego State University), Wendy Smith (University of Nebraska), David Webb (University of Colorado at Boulder)*

May 12, a Celebration for Women in Mathematics, year 2022

May 12, 2022

Organizers: Ini Adinya (University of Ibadan), Maria-Grazia ASCENZI (University of California Los Angeles), Hajer Bahouri (Laboratoire Jacques-Louis Lions; Centre National de la Recherche Scientifique (CNRS)), Hélène Barcelo (MSRI - Mathematical Sciences Research Institute), Lenore Blum (Carnegie Mellon University), Donatella Danielli (Arizona State University), Shanna Dobson (University of California, Riverside), Malena Espanol (Arizona State University), Vasiliki Evdoridou (The Open University), Olubunmi Fadipe-Joseph (University of Ilorin), Anna Fino (Università di Torino), Adi Glucksam (Northwestern University), Eriko Hironaka (Florida State University), M.E. Hogan (Texas Tech University), Kyounghee Kim (Florida State University), Kuei-Nuan Lin (Pennsylvania State University), Liangbing Luo (University of Connecticut), ***Ornella Mattei*** *(San Francisco State University), Betul Orcan-Ekmekci (Rice University), Leticia Pardo Simon (University of Manchester), Julia Plavnik (Indiana University), Palina Salanevich (Universiteit Utrecht), Awais Shaukat (Government College University Lahore), Tara Taylor (St. Francis Xavier University)*

1.8 Program Consultants List

First Name	Last Name	Specialty	Employer	Consulting Provided
Pramod	Achar	Representation theory	Louisiana State University	Simons Foundation Postdoctoral Fellowship Selection Committee
Ini	Adinya	Computational mathematics	University of Ibadan	Celebration of Women in Math
Stephon	Alexander	Theoretical physics	Brown University	Chern-Simons Workshop
Maria-Grazia	Ascenzi	Bone micro-mechanics	UC Los Angeles	May 12th Celebration of Women in Math
Caleb	Ashley	Geometry	Boston College	EDI Issues
Hajer	Bahouri	Partial differential equations	Centre National de la Recherche Scientifique	May 12th Celebration of Women in Math
Vitaly	Bergelson	Combinatorics	Ohio State University	Simons Foundation Postdoctoral Fellowship Selection Committee
Christine	Berkesch	Geometry	University of Minnesota	Simons Foundation Postdoctoral Fellowship Selection Committee
Derek	Bingham	Applied statistics	Simon Fraser University	SRIM Selection Committee
Lenore	Blum	Complexity Theory	Carnegie Mellon University	May 12th Celebration of Women in Math
Theodora	Bourni	Geometric analysis	University of Tennessee, Knoxville	SRIM Selection Committee
Ron	Buckmire	Applied mathematics	Occidental College	EDI Issues
Fiona	Burnell	Theoretical physics	University of Minnesota	Chern-Simons Workshop
Naiomi	Cameron	Combinatorics	Spelman College	EDI Issues
Duane	Cooper	Mathematics of voting	Morehouse College	EDI Issues
Donatella	Danielli	Partial differential equations	Arizona State University	May 12th Celebration of Women in Math
Douglas	Diamond	Economics	University of Chicago	MSRI-CME Group Prize
Jian	Ding	Probability theory	University of Pennsylvania	Simons Foundation Postdoctoral Fellowship Selection Committee
Shanna	Dobson	Geometric Langlands	UC Riverside	May 12th Celebration of Women in Math
Darrell	Duffie	Ecomonics	Stanford University	MSRI-CME Group Prize
Malena	Espanol	Applied mathematics	Arizona State University	May 12th Celebration of Women in Math
Vasiliki	Evdoridou	Holomorphic dynamics	The Open University	May 12th Celebration of Women in Math
John	Ewing	Math, Education	Math for America	Criticial Issues in Mathematics Education
Olubunmi	Fadipe-Joseph	Complex Analysis	University of Ilorin	May 12th Celebration of Women in Math
Anna	Fino	Differential geometry	Università di Torino	May 12th Celebration of Women in Math
Johanna	Franklin	Computability theory	Hofstra University	SRIM Selection Committee
Dan	Freed	Geometry & global analysis	University of Texas, Austin	Chern-Simons Workshop
Dario	Gil	Quantum computing	VP, IBM Research	Hudson Forum
Adi	Glucksam	Complex Analysis	Northwestern University	May 12th Celebration of Women in Math
Edray	Goins	Algebraic geometry	Pomona College	EDI Issues
Maria	Gordina	Probability	University of Connecticut	Simons Foundation Postdoctoral Fellowship Selection Committee
Jack	Gould	Economics	University of Chicago	MSRI-CME Group Prize
Lars	Hansen	Economics	University of Chicago	MSRI-CME Group Prize
Eriko	Hironaka	Low-dimensional topology	Florida State University	May 12th Celebration of Women in Math
M.E.	Hogan	Quantum cosmology	Texas Tech University	May 12th Celebration of Women in Math
Jacqueline	Hughes-Oliver	Statistics, chemometrics	North Carolina State University	EDI Issues
Monica	Jackson	Statistics	American University	EDI Issues
Nicholas	Jewell	Biostatistics	UC Berkeley; London School of Hygiene & Tropical Medicine	Consulting Epidemiologist
Kiran	Kedlaya	number theory	UC San Diego	Simons Foundation Postdoctoral Fellowship Selection Committee
Kyounghee	Kim	Complex dynamics	Florida State University	May 12th Celebration of Women in Math
Albert S. (Pete)	Kyle	Finance	University of Maryland	MSRI-CME Group Prize

Max	Lieblich	Algebraic Geometry	University of Washington	Simons Foundation Postdoctoral Fellowship Selection Committee
Kuei-Nuan	Lin	Commutative algebra	Pennsylvania State University	May 12th Celebration of Women in Math
Robert	Lipshitz	low-dimensional topology	University of Oregon	Simons Foundation Postdoctoral Fellowship Selection Committee
Ivan	Loseu	Representation theory	Yale University	Simons Foundation Postdoctoral Fellowship Selection Committee
Liangbing	Luo	Probability and analysis	University of Connecticut	May 12th Celebration of Women in Math
Ornella	Mattei	Math. of materials science	San Francisco State University	May 12th Celebration of Women in Math
Leo	Melamed	Economics	CME Group	MSRI-CME Group Prize
Paul	Milgrom	Economics	Stanford University	MSRI-CME Group Prize
Marni	Mishna	Enumerative combinatorics	Simon Fraser University	SRIM Selection Committee
Joel	Moore	Theoretical physics	UC Berkeley	Chern-Simons Workshop
John	Morgan	Geometry & topology	Columbia University	Chern-Simons Workshop
Roger	Myerson	Economics	University of Chicago	MSRI-CME Group Prize
Anisah	Nu'Man	Geometric group theory	Spelman College	EDI Issues
Betul	Orcan-Ekmekci	Free boundary problems	Rice University	May 12th Celebration of Women in Math
Omayra	Ortega	Computational biology	Sonoma State University	EDI Issues
Leticia	Pardo Simon	Complex analysis	University of Manchester	May 12th Celebration of Women in Math
Julia	Plavnik	Noncommutative algebra	Indiana University	May 12th Celebration of Women in Math
Doug	Ravenel	Topology (algebraic)	University of Rochester	Simons Foundation Postdoctoral Fellowship Selection Committee
Julius	Ross	Complex Analysis	University of Illinois, Chicago	SRIM Selection Committee
Palina	Salanevich	Harmonic analysis	Universiteit Utrecht	May 12th Celebration of Women in Math
Myron	Scholes	Economics	Stanford University	MSRI-CME Group Prize
Awais	Shaukat		Government College University Lahore	May 12th Celebration of Women in Math
Tatiana	Shubin	Number theory	San Jose State University	Navajo Math Circles and Alliance for Indigenous Math Circles
Michael	Singer	Algebra	North Carolina State University	EDI Issues
Matthew	Stover	Geometry, topology	Temple University	SRIM Selection Committee
Weiran	Sun	Numerical analysis	Simon Fraser University	Simons Foundation Postdoctoral Fellowship Selection Committee
Maja	Taskovic	Nonlinear kinetic equations	Emory University	Simons Foundation Postdoctoral Fellowship Selection Committee
Tara	Taylor	Fractal analysis	St. Francis Xavier University	May 12th Celebration of Women in Math
Jean	Tirole	Economics	Toulouse School of Economics	MSRI-CME Group Prize
Tatiana	Toro	Geometric measure theory	University of Washington	Incoming Director consulted throughout the year
Stephanie	van Willigenburg	Algebraic combinatorics	University of British Columbia	Simons Foundation Postdoctoral Fellowship Selection Committee
Dario	Villani	Machine learning	Duality Group	Hudson Forum
Bianca	Viray	Algebra, number theory	University of Washington	SRIM Selection Committee
Guofang	Wei	Differential geometry	UC Santa Barbara	Simons Foundation Postdoctoral Fellowship Selection Committee
Robin	Wilson	Low-dimensional topology	California State Polytechnic University	EDI Issues
Board of Trustees (BOT)		See Section 12: Committee Membership		Scientific Programs & Summer Graduate Schools
Broadening Participation Advisory Committee (BPAC)		See Section 12: Committee Membership		Scientific Programs & EDI
Educational Advisory Committee (EAC)		See Section 12: Committee Membership		Criticial Issues in Mathematics Education
Scientific Advisory Committee (SAC)		See Section 12: Committee Membership		Scientific Programs & Summer Graduate Schools

2. Program and Workshop Data

2.1 Program Member List

(See email attachment)

2.2 Program Members Summary

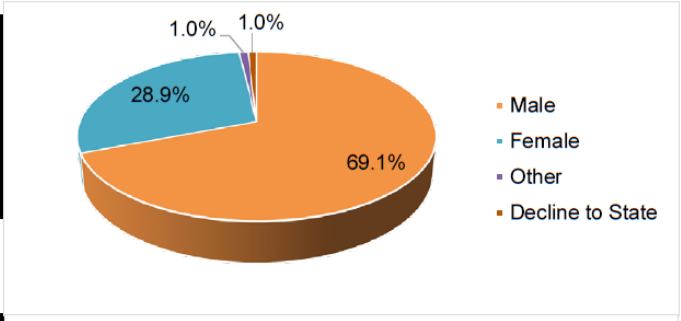
Programs	Distinct Members	Women	%	Minorities*	%	US Home Inst.	%	US Citizens & Perm. Res.
Universality and Integrability in Random Matrix Theory and Interacting Particle Systems	90	23	*25.6%*	2	*4.3%*	55	61.1%	46
Complex Dynamics: from special families to natural generalizations in one and several variables	43	18	*41.9%*	2	*9.5%*	24	55.8%	21
The Analysis and Geometry of Random Spaces	52	16	*30.8%*	1	*5.0%*	27	51.9%	20
Complementary Program 2021-22	19	2	*10.5%*	1	*7.7%*	11	57.9%	13
Total # of Distinct Members	**204**	**59**	***28.9%***	**6**	***6.0%***	**117**	***57.4%***	**100**

**Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.*

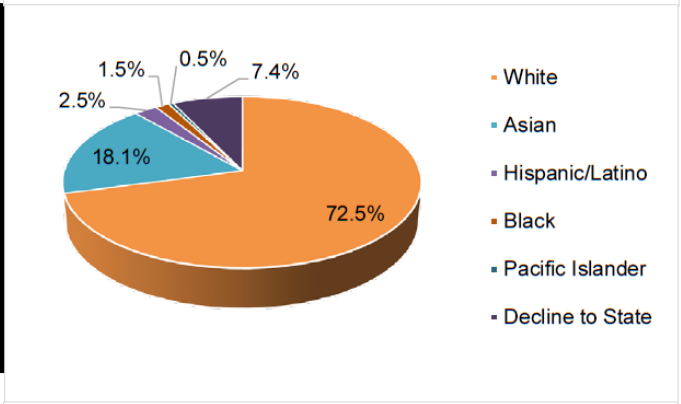
2.3 Program Members Demographic Summary

2021-22 Program Members Demographic Summary

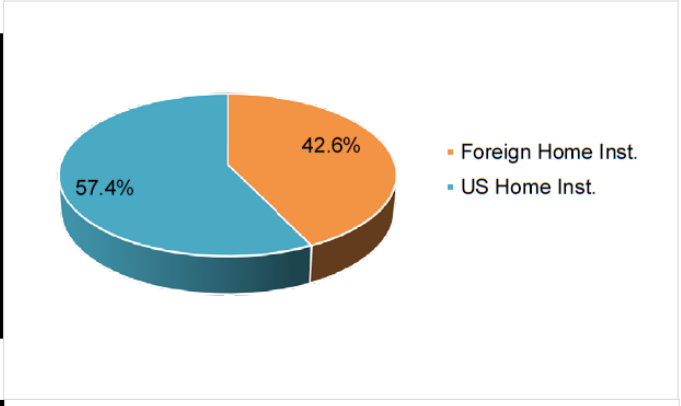
Gender	#	%
# of Distinct Members	204	100.0%
Male	141	69.1%
Female	59	28.9%
Other	2	1.0%
Decline to State	2	1.0%



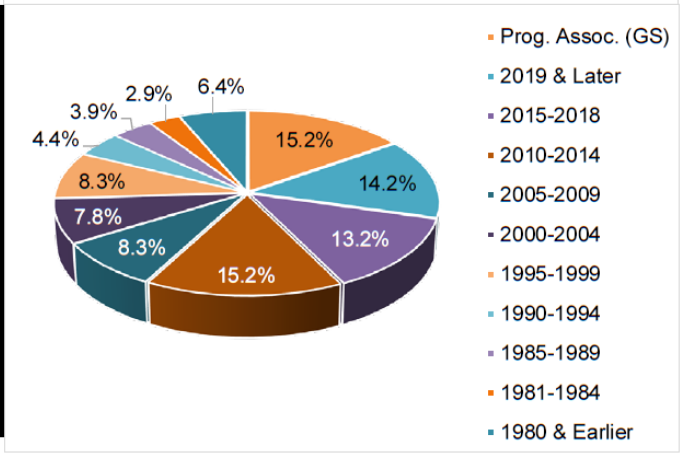
Race/Ethnicity*	#	%
White	148	72.5%
Asian	37	18.1%
Hispanic/Latino	5	2.5%
Black	3	1.5%
Native American	0	0.0%
Pacific Islander	1	0.5%
Decline to State	15	7.4%
Unavailable Info.	0	0.0%
Minorities**	6	6.0%



Citizenships	#	%
Foreign Home Inst.	87	42.6%
US Home Inst.	117	57.4%
Foreign Citizens	104	51.0%
US Citizen & Perm. Residents	100	49.0%
US Citizens	77	37.7%
US Permanent Residents	23	11.3%



Year of Ph.D	#	%
Prog. Assoc. (GS)	31	15.2%
2019 & Later	29	14.2%
2015-2018	27	13.2%
2010-2014	31	15.2%
2005-2009	17	8.3%
2000-2004	16	7.8%
1995-1999	17	8.3%
1990-1994	9	4.4%
1985-1989	8	3.9%
1981-1984	6	2.9%
1980 & Earlier	13	6.4%
Total # of Distinct Members	204	100.0%

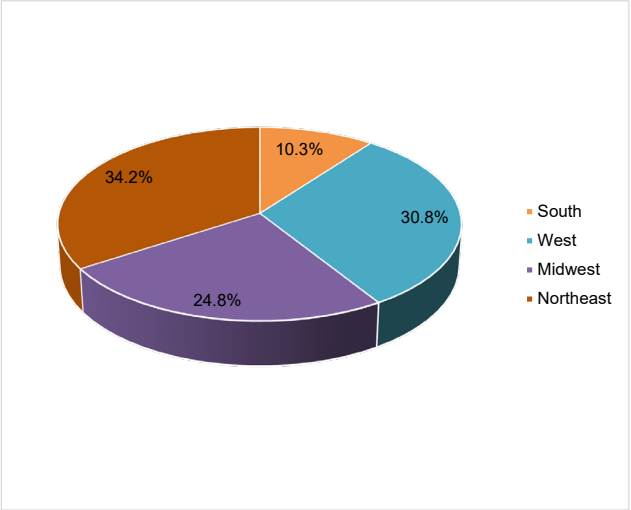


**Race/ethnicity selections are non-exclusive.*

***Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.*

2021-22 Program Members Classified by State

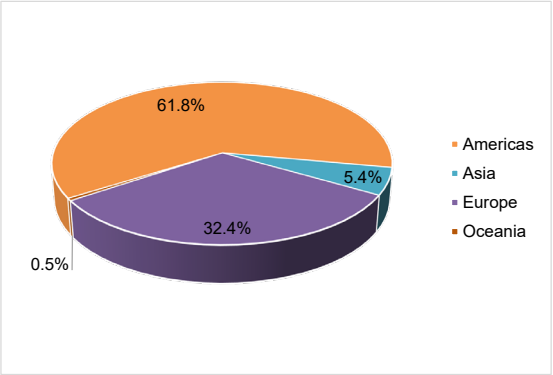
State	#	%	*2020 Census*
South	**12**	**10.3%**	*38.1%*
AL	1	0.9%	*1.5%*
AR	0	0.0%	*0.9%*
DE	0	0.0%	*0.3%*
DC	0	0.0%	*0.2%*
FL	2	1.7%	*6.5%*
GA	0	0.0%	*3.2%*
KY	0	0.0%	*1.4%*
LA	0	0.0%	*1.4%*
MD	1	0.9%	*1.9%*
MS	0	0.0%	*0.9%*
NC	1	0.9%	*3.1%*
OK	1	0.9%	*1.2%*
SC	0	0.0%	*1.5%*
TN	2	1.7%	*2.1%*
TX	3	2.6%	*8.8%*
VA	1	0.9%	*2.6%*
WV	0	0.0%	*0.5%*
West	**36**	**30.8%**	*23.7%*
AK	0	0.0%	*0.2%*
AZ	0	0.0%	*2.2%*
CA	24	20.5%	*11.9%*
CO	2	1.7%	*1.7%*
HI	0	0.0%	*0.4%*
ID	0	0.0%	*0.6%*
MT	2	1.7%	*0.3%*
NM	0	0.0%	*0.6%*
NV	0	0.0%	*0.9%*
OR	0	0.0%	*1.3%*
UT	3	2.6%	*1.0%*
WA	5	4.3%	*2.3%*
WY	0	0.0%	*0.2%*
Midwest	**29**	**24.8%**	*20.8%*
IA	0	0.0%	*1.0%*
IL	7	6.0%	*3.9%*
IN	6	5.1%	*2.0%*
KS	5	4.3%	*0.9%*
MI	5	4.3%	*3.0%*
MN	0	0.0%	*1.7%*
MO	0	0.0%	*1.9%*
ND	0	0.0%	*0.2%*
NE	0	0.0%	*0.6%*
OH	4	3.4%	*3.6%*
SD	0	0.0%	*0.3%*
WI	2	1.7%	*1.8%*
Northeast	**40**	**34.2%**	*17.4%*
CT	6	5.1%	*1.1%*
MA	10	8.5%	*2.1%*
ME	0	0.0%	*0.4%*
NH	0	0.0%	*0.4%*
NJ	0	0.0%	*2.8%*
NY	20	17.1%	*6.1%*
PA	1	0.9%	*3.9%*
RI	3	2.6%	*0.3%*
VT	0	0.0%	*0.2%*
Other	**0**	**0.0%**	*0.0%*
PR	0	0.0%	*0.0%*
Other	0	0.0%	*0.0%*
Total	**117**	**100.0%**	*100.0%*



**Regions based on US Census classification*

2021-22 Program Members Classified by Countries

Africa			**0**
Americas			**126**
	Central America	Costa Rica	1
	North America	Canada	4
		United States	117
	South America	Argentina	1
		Brazil	2
		Chile	1
Asia			**11**
	East Asia	China	2
		Japan	2
		Korea, Republic of	1
	South Central Asia	Iran, Islamic Republic of	1
	Western Asia	Israel	5
Europe			**66**
	Northern Europe	Finland	4
		Sweden	5
		United Kingdom	16
	Eastern Europe	Poland	1
		Ukraine	1
	Southern Europe	Italy	5
		Portugal	2
		Spain	1
	Western Europe	Austria	4
		France	15
		Germany	6
		Netherlands	2
		Switzerland	4
Oceania			**1**
	Australia and New Zealand	Australia	1
Grand Total			**204**



**Regions based on United Nations classification*

2.4 Workshop Participant List

(See email attachment)

2.5 Workshop Participant Summary*

Scientific Workshops	Total Participants	Available Demographics*	US Citizens & Perm. Res.	%‡	Women	%‡	Minorities†	%‡	US Home Inst.	%‡
9 Hybrid Workshops										
Connections & Introductory Workshop: Universality and Integrability in Random Matrix Theory and Interacting Particle Systems, Part 1	198	174	74	*42.5%*	43	*24.7%*	5	*6.8%*	104	59.8%
Connections & Introductory Workshop: Universality and Integrability in Random Matrix Theory and Interacting Particle Systems, Part 2	148	133	59	*44.4%*	38	*28.6%*	3	*5.1%*	87	65.4%
Connections Workshop: Complex Dynamics - from special families to natural generalizations in one and several variables	124	114	40	*35.1%*	40	*35.1%*	4	*10.0%*	57	50.0%
Connections Workshop: The Analysis and Geometry of Random Spaces	98	92	35	*38.0%*	26	*28.3%*	2	*5.7%*	52	56.5%
Integrable Structures in Random Matrix Theory and Beyond	132	122	47	*38.5%*	31	*25.4%*	2	*4.3%*	72	59.0%
Introductory Workshop: Complex Dynamics - from special families to natural generalizations in one and several variables	125	116	42	*36.2%*	39	*33.6%*	4	*9.5%*	58	50.0%
Introductory Workshop: The Analysis and Geometry of Random Spaces	117	107	46	*43.0%*	29	*27.1%*	2	*4.3%*	62	57.9%
Adventurous Berkeley Complex Dynamics	136	123	44	*35.8%*	38	*30.9%*	6	*13.6%*	55	44.7%
The Analysis and Geometry of Random Spaces	110	106	33	*31.1%*	27	*25.5%*	2	*6.1%*	49	46.2%
1 In Person Workshop										
Chern-Simons and Other Topological Field Theories	77	74	53	*71.6%*	10	*13.5%*	5	*9.4%*	69	93.2%
3 Virtual Workshops										
Workshop on Mathematics and Racial Justice	316	294	266	*90.5%*	161	*54.8%*	62	*23.3%*	279	94.9%
Hot Topics: Foundations of Stable, Generalizable and Transferable Statistical Learning	155	137	61	*44.5%*	47	*34.3%*	5	*8.2%*	106	77.4%
Hot Topics: Regularity Theory for Minimal Surfaces and Mean Curvature Flow	88	83	30	*36.1%*	22	*26.5%*	6	*20.0%*	59	71.1%
All 13 Workshops Total	**1,824**	**1,675**	**830**	***49.6%***	**551**	***32.9%***	**108**	***13.0%***	**1,109**	***66.2%***

Education & Outreach Workshops	Total Participants	Available Demographics*	US Citizens & Perm. Res.	%‡	Women	%‡	Minorities*	%‡	US Home Inst.	%‡
3 Hybrid Workshops										
Critical Issues in Mathematics Education 2022: Initiating, Sustaining, and Researching Mathematics Department Transformation of Introductory Courses for STEM Majors	224	215	189	*87.9%*	126	*58.6%*	39	*20.6%*	201	93.5%
May 12, a Celebration for Women in Mathematics, year 2022	176	160	74	*46.3%*	132	*82.5%*	14	*18.9%*	106	66.3%
Blackwell Tapia Conference 2021	145	142	120	*84.5%*	62	*43.7%*	68	*56.7%*	140	98.6%
All 3 Workshops Total	**545**	**517**	**383**	***74.1%***	**320**	***61.9%***	**121**	***31.6%***	**447**	***86.5%***

All 16 Workshops Total	**2,369**	**2,192**	**1,213**	***55.3%***	**871**	***39.7%***	**229**	***18.9%***	**1,556**	***71.0%***

† Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the total number of US citizens & Permanent Residents.

‡ Percentage among those for whom information is available.

** Registration for workshops was encouraged, but not required for virtual participants or speakers. Therefore while total participant counts are comprehensive, demographic information is only available for registered participants.*

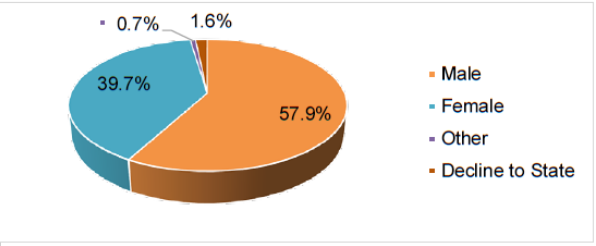
NOTE: Workshops participants are distinct within each workshop, but some individuals may have attended more than one workshop. Statistics include both virtual and in-person attendees. In-person wrokshop attendance in 2021-22 was restricted to MSRI program members and workshop speakers/organizers. Approximately 1,762 individuals attended workshops virtually (though some of the virtual participants were program members and may have also attended workshops in person).

*Note individual workshop data in section 2.5 is distinct but overall workshop data is not, as some participants attended multiple workshops.

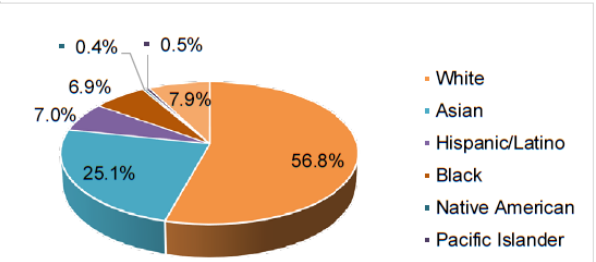
2.6 Workshop Participant Demographic Data

2021–22 Workshop Participants Demographic Summary

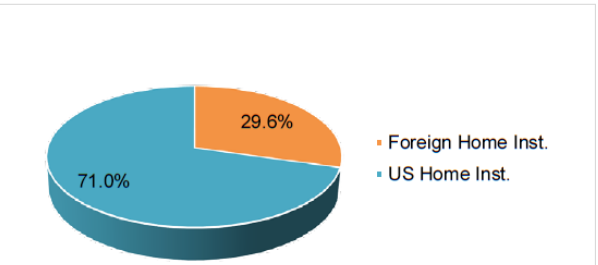
Gender	#	% excl. unavail.‡	% overall
# of Participants	2369	100.0%	100.0%
Male	1270	57.9%	53.6%
Female	871	39.7%	36.8%
Other	16	0.7%	0.7%
Decline to State	35	1.6%	1.5%
Unavailable Info.*	177	n/a	7.5%



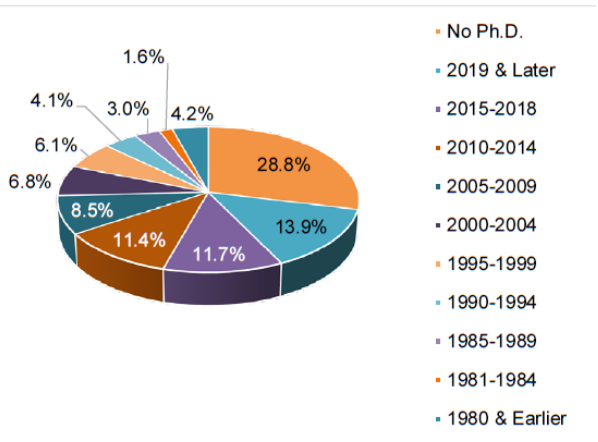
Race/Ethnicity*	#	% excl. unavail.‡	% overall
White	1245	56.8%	52.6%
Asian	550	25.1%	23.2%
Hispanic/Latino	154	7.0%	6.5%
Black	152	6.9%	6.4%
Native American	8	0.4%	0.3%
Pacific Islander	11	0.5%	0.5%
Decline to State	174	7.9%	7.3%
Unavailable Info.*	177	n/a	7.5%
Minorities**	229	19.0%	19.0%



US Based/Citizenship	#	% excl. unavail.‡	% overall
Foreign Home Inst.	649	29.6%	27.4%
US Home Inst.	1556	71.0%	65.7%
Unavailable Info.*	164	n/a	6.9%
US Citizen & Perm. Residents	1207	55.1%	50.9%
Foreign Citizens	985	44.9%	41.6%
Unavailable Info.*	177	n/a	7.5%
US Citizen	1049	47.9%	44.3%
Perm. Residents	158	7.2%	6.7%



Year of Ph.D.	#	% excl. unavail.‡	% overall
No Ph.D.	631	28.8%	26.6%
2019 & Later	305	13.9%	12.9%
2015-2018	256	11.7%	10.8%
2010-2014	249	11.4%	10.5%
2005-2009	186	8.5%	7.9%
2000-2004	148	6.8%	6.2%
1995-1999	134	6.1%	5.7%
1990-1994	89	4.1%	3.8%
1985-1989	66	3.0%	2.8%
1981-1984	35	1.6%	1.5%
1980 & Earlier	93	4.2%	3.9%
Unavailable Info.‡	177	n/a	7.5%
Total # Participants	2369	100.0%	100.0%



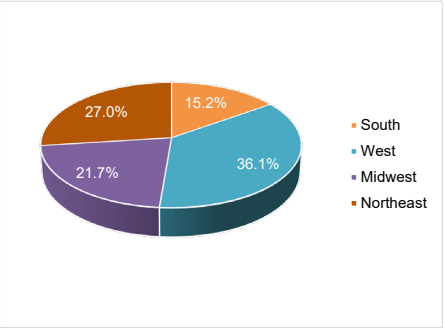
*Race/ethnicity selections are non-exclusive.

**Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.

‡ Registration was encouraged, but not required for virtual participants or speakers; therefore while total participant counts are comprehensive, demographic information is only available for registered participants. Percentages are calculated from among those for whom demographic information is available.

2021–22 Workshop Participants Classified by State

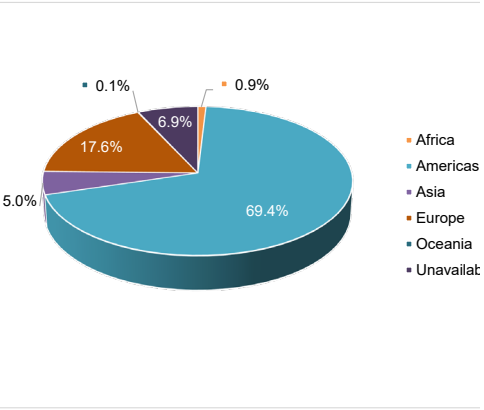
State	#	%	*2020 Census*
South	**236**	**15.2%**	*38.1%*
AL	8	0.5%	*1.5%*
AR	4	0.3%	*0.9%*
DE	3	0.2%	*0.3%*
DC	11	0.7%	*0.2%*
FL	20	1.3%	*6.5%*
GA	30	1.9%	*3.2%*
KY	7	0.4%	*1.4%*
LA	5	0.3%	*1.4%*
MD	13	0.8%	*1.9%*
MS	0	0.0%	*0.9%*
NC	25	1.6%	*3.1%*
OK	3	0.2%	*1.2%*
SC	6	0.4%	*1.5%*
TN	19	1.2%	*2.1%*
TX	63	4.0%	*8.8%*
VA	18	1.2%	*2.6%*
WV	1	0.1%	*0.5%*
West	**562**	**36.1%**	*23.7%*
AK	0	0.0%	*0.2%*
AZ	18	1.2%	*2.2%*
CA	418	26.9%	*11.9%*
CO	24	1.5%	*1.7%*
HI	5	0.3%	*0.4%*
ID	4	0.3%	*0.6%*
MT	15	1.0%	*0.3%*
NM	0	0.0%	*0.6%*
NV	0	0.0%	*0.9%*
OR	15	1.0%	*1.3%*
UT	16	1.0%	*1.0%*
WA	47	3.0%	*2.3%*
WY	0	0.0%	*0.2%*
Midwest	**337**	**21.7%**	*20.8%*
IA	5	0.3%	*1.0%*
IL	68	4.4%	*3.9%*
IN	51	3.3%	*2.0%*
KS	26	1.7%	*0.9%*
MI	90	5.8%	*3.0%*
MN	18	1.2%	*1.7%*
MO	6	0.4%	*1.9%*
ND	0	0.0%	*0.2%*
NE	8	0.5%	*0.6%*
OH	32	2.1%	*3.6%*
SD	0	0.0%	*0.3%*
WI	33	2.1%	*1.8%*
Northeast	**420**	**27.0%**	*17.4%*
CT	35	2.2%	*1.1%*
MA	99	6.4%	*2.1%*
ME	8	0.5%	*0.4%*
NH	3	0.2%	*0.4%*
NJ	24	1.5%	*2.8%*
NY	179	11.5%	*6.1%*
PA	48	3.1%	*3.9%*
RI	23	1.5%	*0.3%*
VT	1	0.1%	*0.2%*
Other	**1**	**0.1%**	*0.0%*
PR	1	0.1%	*0.0%*
Unavailable	0	0.0%	*0.0%*
Total	**1556**	**100.0%**	*100.0%*



**Regions based on US Census classification*

2021–22 Workshop Participants Classified by Country

Africa			**22**
	Eastern Africa	Ethiopia	1
	Northern Africa	Algeria	6
	Western Africa	Ghana	6
		Nigeria	7
		Senegal	2
Americas			**1644**
	Central America	Mexico	3
	North America	Canada	53
		United States	1556
	South America	Argentina	6
		Bolivia	1
		Brazil	15
		Chile	7
		Colombia	1
		Ecuador	1
		Peru	1
Asia			**119**
	East Asia	China	31
		Japan	6
		Korea, Republic of	7
		Taiwan	1
	South-central Asia	India	39
		Iran, Islamic Republic of	1
		Pakistan	3
	South-eastern Asia	Indonesia	1
		Philippines	3
		Singapore	1
	Western Asia	Iraq	1
		Israel	19
		Saudi Arabia	4
		Turkey	1
		United Arab Emirates	1
Europe			**418**
	Eastern Europe	Hungary	3
		Poland	3
		Romania	6
		Russian Federation	6
		Ukraine	4
	Northern Europe	Denmark	4
		Finland	25
		Ireland	1
		Norway	2
		Sweden	24
		United Kingdom	102
	Southern Europe	Italy	27
		Portugal	9
		Slovenia	1
		Spain	27
	Western Europe	Austria	16
		Belgium	8
		France	76
		Germany	34
		Netherlands	9
		Switzerland	31
Oceania			**2**
	Australia & NZ	Australia	1
		New Zealand	1
Unavailable Info.*			**164**
Grand Total			**2369**



Regions based on United Nations classifications.

** Registration was encouraged, but not required for virtual participants or speakers; therefore while total participant counts are comprehensive, demographic information is only available for registered participants.*

2.7 Program Publication List

(Uploaded to Public Access Repository)

2.8 Program Publication Work-In-Progress List

(See email attachment)

3. Postdoctoral Program

3.1 Description of Activities

The postdoctoral program at MSRI is central to MSRI's mission of continued excellence in research in the mathematical sciences. Today, MSRI's programs bring together researchers from all over the world to discuss developments in the most exciting areas of fundamental mathematics. They strongly catalyze research and generate many new collaborations. The programs provide extraordinary opportunities and training for young researchers. MSRI is also recognized for its groundbreaking work on inclusivity and for its public programs. Perhaps the most important way in which MSRI enhances the world's mathematical research is as an incubator. Participants in MSRI's programs form intense new collaborations that lead to fundamental advances in the field, maturing over a period of years or even decades. MSRI's postdocs engage with fellow mathematicians from all over the world to develop their interests and contribute to the science community.

During the 2021-22 academic year, MSRI selected 29 postdoctoral scholars with research interests in the programs that MSRI offers. Of those postdocs, 20 were primarily funded by the NSF Core Grant, and 9 "named" postdoctoral fellows were privately funded by the Berlekamp, Gamelin, Huneke, and Viterbi Endowments, as well as the Vincent Della-Pietra, Stephen Della-Pietra, Uhlenbeck, and Strauch Postdoctoral Fellowship Grants. The NSF provided approximately 51% of the funding for the postdoctoral program while 27% of funding came from private sources, 13% from endowments, and 9% from the NSA.

Of the 29 Postdoctoral Fellows at MSRI, 12 (41%) were women, 19 (66%) came from a US institution, and 6 (21%) were U.S. Citizens or Permanent Residents. Among the US/PR postdocs, 2 (33%) were from underrepresented racial/ethnic groups. The program organizers were extremely satisfied with the Postdoctoral program and believed that it was by all accounts an enormous success.

Here are additional details on the Postdoctoral Fellows for each program.

UNIVERSALITY AND INTEGRABILITY IN RANDOM MATRIX THEORY AND INTERACTING PARTICLE SYSTEMS – Fall 2021

Bailey, Emma

Name: Emma Bailey
Year of Ph.D.: 2020
Institution of Ph.D.: University of Bristol, UK
Dissertation title: Generalized moments of characteristic polynomials of random matrices
Ph.D. advisor: Bjorn Poonen

Mentor while at MSRI: Prof. John Keating

Pre-MSRI Institution: University of Bristol/Heilbronn Institute
Position: Heilbronn Research Fellow
Mentor: N/A

Post-MSRI Institution (or company): City University New York
Position: Research Associate / Adjunct Assistant Professor
Anticipated length (or specify if tenure-track): 2 years

Summary of MSRI Experience

Various early stage discussions with numerous people including Alex Soshnikov, Greta Panova, Jonathon Husson, Gaultier Lambert, Promit Ghosal, Ken McLaughlin, Thomas Kriecherbauer, Alexandre Krajenbrink. Discussed and broadly solved a problem with Gaultier Lambert, currently writing up the research project with a view to turning it in to a paper early next year. Inspired by various discussions with members, I've improved two research projects that I was working on prior to coming to MSRI (with non-members).

Did you find your experience at MSRI beneficial? Why or why not?

Yes, absolutely. It is great to mingle with both experts in the field and peers in such a wonderful environment (especially in post-2020 times). There is plenty of opportunity at MSRI for the 'chance' discussions that are so difficult to do not-in-person.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I imagine that my fellowship will certainly help me find a future position. The opportunity to meet and work with the cast here at MSRI has undoubtedly broadened my network. Additionally, the career-themed seminars were very helpful and insightful.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I only had limited engagement with the hybrid portion of the program. At the beginning I could not come to MSRI until my second vaccine had kicked in, so I participated for the first few days online. In that sense, I found the hybrid part good in that it gave me some sense of 'being involved', but naturally it was still lacking.

At the very beginning, I talked to Nick Cook and Ivan Corwin — at that point we were all participating remotely — on the Sococo platform, but this didn't seem to get used much at all (neither did the Slack).

Although I don't believe this is a new hybrid feature, I very much appreciated having recorded talks so that I could go back and revisit parts — or occasionally catch up at a later date.

I got the sense that very few people were joining in remotely outside of the conferences. I was skeptical at first regarding the benefits of watching a remote talk collectively in Simons, but actually I think it was an improvement on watching it alone — particularly when it came to the Q+A session at the end (provided people remembered the catch-box-mic).

Desiraju, Harini

Name: Harini Desiraju
Year of Ph.D: 2021
Institution of Ph.D.: Scuola Internazionale Superiore di Studi Avanzati
Dissertation title: Painlevé tau-functions and Fredholm determinants
Ph.D. advisor: Marco Bertola, Tamara Grava

Mentor while at MSRI: Alexander Its

Pre-MSRI Institution: University of Birmingham
Position at that institution: Postdoc
Mentor (if applicable): Marta Mazzocco

Post-MSRI institution (or company): University of Sydney
Position: Postdoc
Anticipated length (or specify if tenure-track): 3 years
Mentor (if applicable): Nalini Joshi, Milena Radnović
Summary of MSRI Experience

I worked on four main projects while here at MSRI. Two of them were with Andrei Prokhorov (a fellow postdoc) and Alexander Its (mentor), on combinatorics of Tracy-Widom distribution and Riemann-Hilbert

problem on a torus. Both these projects are in some way an extension of my previous work. The postdoc seminars through summer were a wonderful opportunity and I started collaborating with Promit Ghosal and Andrei Prokhorov on a rather ambitious problem of bringing together the integrable and probabilistic interpretations of the conformal block. We obtained preliminary results and are in the process of writing. But this project is long term and we have many problems to work on, lined up. Finally, I also started another project with Alexandre Krajenbrink on a machine learning algorithm to study Lax pairs of integrable systems. I took advantage of the programs at Simons institute to further my knowledge of computer science.

From an outreach standpoint, I conducted a MathCircle session at Stanford and participated in a Numberphile video (one of the coolest experiences!)

I also organised the 5 min talks here at MSRI, gave a mini course, attended the course by Gerard Ben Arous, and participated in all the events.

Did you find your experience at MSRI beneficial? Why or why not?

My experience here was extremely fruitful. Not only was it a great platform to present my work, but to find connections between adjacent fields.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I already had a position lined up after MSRI. But, I am confident this semester will prove to be a pivotal moment in my career to come, mainly because of the professional development seminars and the exposure I had.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I was in contact with Nalini Joshi, who was a virtual participant. We have discussed a variety of problems every two weeks.

Franceschini, Chiara

Name: Chiara Franceschini
Year of Ph.D.: 2018
Institution of Ph.D.: Università di Ferrara, Italy
Dissertation title: Orthogonal Stochastic Duality from and Algebraic point of view
Ph.D. advisor: Cristian Giardinà

Mentor while at MSRI: Pablo A. Ferrari

Pre-MSRI Institution: IST - Lisbon
Position: Post-doc
Mentor (if applicable): Patricia Gonçalves

Post-MSRI Institution: Università di Modena e Reggio Emilia
Position: Research Fellow
Anticipated length (or specify if tenure-track): 3 years (3+2)
Mentor (if applicable): NA

Summary of MSRI Experience

I arrived in MSRI fearing that my research was a bit far from the main theme of the program, but I have soon realized there were actually many people interested as well as potential collaborators. I had both superficial and deeper interactions. Starting from the latter:

i) I have begun a project together with Promit Ghosal and Kevin Yang, starting from the self-duality function for multi-species wasep we are trying to see if we can get - at the level of a macroscopic SPDE - couple KPZ equations.

ii) My mentor introduced me to a new project he was working on: it regards a system of inhomogeneous hard rod. He showed me how the hydrodynamics works and now we would like to study fluctuations.

Regarding more superficial interactions:

i) I have discussed about algebraic approach to duality with Jan de Gier who was here for few days. However, we are already planning to continue the discussion next year when he will be in Italy and I have invited him to give a talk in my future university.

ii) I have discussed with Guillaume Barraquand and Yier Lin (and I plan to discuss also with Hindy Drillick) regarding some open problems we have with duality, however there is nothing concrete at this moment.

Besides this I also had online contact with two researchers who were supposed to come to MSRI in person, but could not due to issues related to covid and VISA.

i) With Jeffrey Kuan we started to work on multivariate orthogonal duality functions for multi-species asymmetric exclusion process before the program started. He also came visit me in Berkeley in August for a week but unfortunately at that time he was prohibited from entering the building and we had to work in coffee shops.

ii) I had a project in mind to develop with Luisa Andreis while here but she had to cancel her visit and so we postponed the project for next year since I really wanted to take advantage of in person collaborations (and also because it was impossible to find a reasonable time to talk with Europe as morning in MSRI were quite dense of talks).

Last I mentioned the fact that, after meeting Ellen Saada here she invited me to give a talk in Paris in January and to spend two weeks there to discuss more since she didn't stay for a long time.

Did you find your experience at MSRI beneficial? Why or why not?

My experience at MSRI has been beneficial beyond any of my initial expectations. I managed to create personal and scientific interactions which will be contacts for the rest of my life. I also have the impression that I will have a lot of potential research to keep working on once back home and some of this was just born during a casual lunch in the patio.

I have never won anything before coming to Berkeley and when I was awarded with the Uhlenbeck postdoctoral fellowship, I felt I didn't deserve it. However, I think this has pushed me to really do the best I could in order to 'earn it afterwards', as Ivan Corwin suggested during one of the panel sections (which I found all extremely helpful for young researchers who wants to continue their job in academia). Overall, both from a personal and a professional perspective, I can already see how MSRI has impacted my life. I have new friends and colleagues that I plan to visit again in the future and I have been invited to prestigious math conferences next year (Oberwolfach and Montreal (CRM) for example).

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

It has definitely helped me. It is enough to mention that before moving to Berkeley I basically didn't have any position besides a few month of my past post doc position in Lisbon and once here I won two different very good positions I could choose from!

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I think I participated in person to more than 90% of the activities as I really missed real interaction and I was experiencing some 'zoom fatigue' accumulated by more than one year of pandemic. I cannot talk for other people, but if I really want to follow a talk, it needs to be presential. On the other hand, I guess it was nice to have the possibility to connect virtually. As I have already mentioned, I decided to focus on in person discussions only in order to maximize the time spent here. Coming from Europe, I really saw the MSRI semester as my opportunity to understand the mathematics people do in the US and to find contacts and collaborators here. Even if I physically was in Simons auditorium most of the time to follow the talks I took advantage the possibility of connecting my iPad to have a better view of the blackboard or the main screen, which are not super clear from seats behind (I also need new glasses prescriptions though).

Gharakhloo, Roozbeh

Name: Roozbeh Gharakhloo
Year of Ph.D: 2019
Institution of Ph.D.: Indiana University Purdue University Indianapolis
Dissertation title: Asymptotic Analysis of Structured Determinants via the Riemann-Hilbert Approach
Ph.D. advisor: Alexander Its

Mentor while at MSRI: Pavel Bleher

Pre-MSRI Institution: Colorado State University
Position at that institution: Postdoctoral Fellow
Mentor (if applicable): Kenneth McLaughlin

Post-MSRI institution (or company): Colorado State University
Position: Postdoctoral Fellow
Anticipated length (or specify if tenure-track): seven months
Mentor (if applicable): Kenneth McLaughlin

Summary of MSRI Experience

I attended the following activities at MSRI:

1. Connections and Introductory Workshop: Universality and Integrability in Random Matrix Theory and Interacting Particle Systems, Part 1

2. Connections and Introductory Workshop: Universality and Integrability in Random Matrix Theory and Interacting Particle Systems, Part 2
3. Integrable Structures in Random Matrix Theory and Beyond
4. Research Talks
5. Riemann-Hilbert open problem session
6. Professional Development panels

Attending the research talks and the workshops helped me to know about the recent developments in the field and get some inspiration to start thinking about new problems: specifically, the talks by Dan Romik, Karl Liechty, Alexander Its (in the RH open problem session), Marco Bertola, Pavel Wiegmann, to name a few.

Papers I worked on:

1. Integral Operator for 2j-k\j-2k systems (Began at MSRI)
   Coauthor: Percy Deift
   Status of Manuscript: Rough/Draft

2. Phase Diagram and Topological Expansion in the Complex Quartic Random Matrix Model (Completed at MSRI, It will be posted on arXiv in a few days.)
   Coauthors: Pavel Bleher, Kenneth McLaughlin
   Status of Manuscript: Working Notes

3. Recurrence Relations and Christoffel-Darboux identity for Toeplitz+Hankel Determinants (Progressed at MSRI)
   Coauthor: Alexander Its
   Status of Manuscript: Rough/Draft

4. Regular Regimes of Complex Random Matrix Models are Open (The mathematical work was finished at MSRI, we are writing a paper now.)
   Coauthors: Pavel Bleher and Kenneth McLaughlin
   Status of Manuscript: Working Notes

5. Title Riemann-Hilbert Approach to the Lieb-Liniger Equation (Progressed at MSRI)
   Coauthors: Alexander Its, Kenneth McLaughlin, Maxim Yattselev
   Status of Manuscript: Working Notes

6. Strong Szego Theorem for Multi-Bordered Toeplitz Determinants (Progressed at MSRI)
   Status of Manuscript: Working Notes

Did you find your experience at MSRI beneficial? Why or why not?

The fact that I had access to many world-class experts in the field was simply amazing. If it was not for MSRI, I could not simply approach Percy Deift and initiate a research project with him as simply as it happened. The fact that my collaborators were all in the same program (especially Alexander Its, Kenneth McLaughlin, and Pavel Bleher) helped significantly for the faster progress of the projects. Attending the research talks helped me find inspiration to start thinking about new problems. Specifically, the talks by Dan Romik, Karl Liechty, Alexander Its, Marco Bertola, Pavel Wiegmann, to name a few.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I am positive that it will help me find a position in the future. I have no doubt that having the MSRI experience in my CV is a big plus for me when a mathematician who knows about MSRI reviews my file.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

Yes, I did virtually attend some talks. But I did not collaborate with the virtual participants. I think the main reason was that having many outstanding researchers in residence at MSRI was so nice that I used all my time with people present at MSRI.

I liked the hybrid format for three reasons:

1. The researchers who were not able to physically be present at MSRI could give talks and enrich the program with their interesting talks.
2. I had the flexibility to attend the talks from my office, for the few times that I had to multi-tasking at a specific time.
3. Once I had some Covid symptoms (but not the Covid itself) and I was advised to stay home. In those days it was very helpful to be able to attend the talks virtually.

Hegde, Milind

Name: Milind Hegde
Year of Ph.D.: 2021
Institution of Ph.D.: UC Berkeley
Dissertation title: Probabilistic and geometric methods in last passage percolation
Ph.D. advisor: Alan Hammond and Shirshendu Ganguly

Mentor while at MSRI: Leonid Petrov

Pre-MSRI Institution: UC Berkeley
Position: Graduate student
Mentor (if applicable): Alan Hammond and Shirshendu Ganguly

Post-MSRI Institution (or company): Columbia University
Position: Postdoc
Anticipated length (or specify if tenure-track): 3.5 years
Mentor (if applicable): Ivan Corwin

Summary of MSRI Experience

I have had a very fruitful experience this semester at MSRI. I spoke to many researchers, in both informal and collaborative modes, and began exploring several projects. I had discussions with Philippe Sosoe on a stationary version of the O'Connell-Yor polymer. With Shirshendu Ganguly and Yujin Kim, we began discussions on a question about chaos of the top eigenvector in the critical window under a natural dynamic on the GUE. I have been thinking about obtaining sharp one-point upper tail bounds for the Airy_2 process using purely Brownian Gibbsian resampling techniques along with its properties of stationarity and extremality as a Gibbs measure, with a technique of bootstrapping reminiscent of work on discrete planar last passage percolation models I undertook with Shirshendu Ganguly a few years ago. This project also has connections to and overlap with another area of investigation I have begun with Shirshendu, on obtaining multi-point asymptotics and limit shapes under large deviations of the narrow-wedge solution to the KPZ equation using the tangent method. Along with Shirshendu, Promit Ghosal, and Sayan Das, we are thinking about adapting techniques developed to study the geodesic watermelon in planar LPP (a zero-temperature model) to understand the continuum directed random polymer, and through it obtain new estimates about the single slice point process of the KPZ line ensemble. I have also had discussions with Sayan Das about certain discrete positive temperature models with associated line ensembles with the aim of proving their tightness. Finally, I have had weekly discussions with my mentor Leo Petrov which may result in a collaboration in the future, as well as brief discussions with Promit and Amol Aggarwal

Did you find your experience at MSRI beneficial? Why or why not?

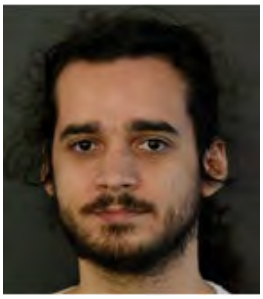
I found my experience at MSRI very beneficial. The chance to easily meet, talk to, and collaborate with so many researchers in my field is invaluable, and I have gained a lot. The many talks and workshops have also given me a good overview and a better idea of adjacent fields that I hope to build on in the future.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Yes, I feel I will definitely be benefited in finding a future position because of my fellowship. In particular, the projects and collaborations I have been able to initiate as a result of my fellowship will expand my research output and research breadth. These aspects will both directly bolster my profile, and also provide me a foundation that I can build upon during my time at Columbia so that I can have a stronger profile when I am searching for a position in the future.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I participated almost completely in-person, except for a handful of talks that I attended remotely. This flexibility to attend a talk remotely was very useful and welcome, as it allowed me to participate even when other commitments and constraints would have prevented me from attending in-person. However, I did not collaborate with virtual participants, mainly because it was hard to initiate conversations with people I did not know beforehand and who were only present virtually.



Husson, Jonathan

Name: Jonathan Husson
Year of Ph.D: 2019
Institution of Ph.D.: ENS de Lyon
Dissertation title: Large deviations and convergence of spectrum of random matrices
Ph.D. Advisor: Alice Guionnet

Mentor while at MSRI: Gérard Ben Arous

Pre-MSRI Institution: ENS de Lyon
Position at that institution: Post-doc
Mentor (if applicable): Alice Guionnet

Post-MSRI institution (or company): University of Michigan
Position: Post-doc
Anticipated length (or specify if tenure-track): 2.5 years
Mentor (if applicable): Mark Rudelson

Summary of MSRI Experience

During my stay at MSRI, participating to the three programmatic workshops gave me the opportunity to see an overview of scientific areas

that I would not necessarily have had otherwise. As a researcher on random matrix theory, I was able to learn much about integrable systems and KPZ universality through the talks and informal discussions with the other participants, professors and postdocs.

Beyond the three workshops, I also attended the bi-weekly Chancellor Professor course given by Gérard Ben Arous on Random matrices and Random Landscapes. This class, which spanned the whole semester gave a comprehensive review of the interplay between random matrices, spin glasses, machine learning.

I had the opportunity to speak twice during the program. The first time for the graduate student program where I gave a short course on large deviations and random matrix theory. The second time was a research talk where I presented my own results.

I had the opportunity to start two collaborations with other participants of the program, one with Alice Guionnet, Ofer Zeitouni, and Ben McKenna and another one with only Ben McKenna. Beyond those collaborations, I also had also ongoing discussions with Alessandra Occelli.

The weekly mentoring provided by Gérard Ben Arous enabled me to get feedback on my research, with helpful recontextualizing and suggestions for new research directions. During the program I was also able to keep on working on two ongoing papers with one of them I posted on ArXiv and for which I got early feedback from some of the participants.

Did you find your experience at MSRI beneficial? Why or why not?

I found my stay at MSRI to be very beneficial. It was a privileged opportunity to make contact with prominent researchers of my scientific community. The program also enabled me to see a broad picture of the current state of research in areas I would have got less interested in otherwise. The in-person character of the program makes it very easy to have discussions with professors or other postdocs. The presence of mini-courses was also beneficial especially since I was not at all familiar with some of the subjects of the program.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I think my fellowship will be very helpful in finding a position in the future. Apart from the institutional prestige of MSRI, I was able to make myself and my research known before a large audience of senior researchers. Discussions and advices about academic prospects and

applications, for instance during the professional development seminar will also prove helpful in finding a position.

At last, I am confident that some of the contacts made during the program, if not leading immediately to collaborations will do so in the future.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

The hybrid format was helpful to follow and participate in talks when circumstances prevented me from being in person at MSRI. Although I occasionally participated virtually, I always privileged in-person participation as much as possible. During the program, I didn't collaborate with any virtual participant I didn't know beforehand. The main reason for that being that the barrier to have discussions conducive to collaborations with virtual participants after their talks is higher virtually that in-person.

Krajenbrink, Alexandre

Name: Alexandre Krajenbrink
Year of Ph.D: 2019
Institution of Ph.D.: Ecole Normale Supérieure
Dissertation title: Beyond the typical fluctuations: a journey to the large deviations in the Kardar-Parisi-Zhang growth model.
Ph.D. advisor: Pierre Le Doussal

Mentor while at MSRI: Mark Adler

Pre-MSRI Institution: SISSA (Intl. School for Advanced Studies)
Position at that institution: Postdoc
Mentor (if applicable): Pasquale Calabrese

Post-MSRI institution: SISSA (Intl. School for Advanced Studies)
Position: Postdoc
Anticipated length (or specify if tenure-track): 1.5 years
Mentor (if applicable): Pasquale Calabrese

Summary of MSRI Experience

My semester at the MSRI has been extremely rich and intense. It was firstly for me the occasion to meet a number of faculties and postdocs in the field of integrability that I never met before, it was also the occasion to meet some of my collaborators that I haven’t seen in almost two years due to the covid pandemic. My time at the MSRI was a combination of pursuing existing research projects and developing new ones, along the lines of classical integrable systems, large deviations of the KPZ equation

and their relation with numerical analysis, optimal transport. I engaged collaborations and discussions on new projects with:

- Harini Desiraju
- Percy Deift
- Promit Ghosal
- Guillaume Barraquand

The new research directions I explored are

- Applying ideas and numerical schemes of optimal transport theory and Schrödinger bridges theory to the theory of the large deviations of the KPZ equation
- Applying ideas from deep-learning and symbolic regression to automate the finding and discovery of Lax pairs for integrable systems.
- Bringing closer the concept of the Marchenko theory of solutions of integrable systems and Fredholm determinants with applications to systems like the derivative nonlinear Schrödinger equation.

On the chapter of broader impact projects, I finished organizing during the beginning of the semester a hackathon of quantum computing in Paris, gathering >100 graduate students and quantum enterprises, aiming to develop and foster the quantum ecosystem, both for the universities and the quantum companies.

Did you find your experience at MSRI beneficial? Why or why not?

The MSRI was extremely beneficial for many reasons. It offered a total freedom to pursue the research activities I wanted. It also gathered every single expert of my field who were very approachable during the semester due to the organization of the MSRI. It allowed me to get new research perspectives and translate my thoughts and results from my specific niche of research to others due to the fruitful discussions I engaged during the semester. The length of the program also allowed to explore creative directions that are usually not possible during a meeting of a few days.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

This fellowship definitely helped me broaden my research interest and broaden my research network in field of mathematics where I did not have many contacts yet. Having a larger vision will help me find a future position since my work will also be known my more and more researchers. The exposure provided by the program really helps in that matter.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I was at the MSRI in-person for the whole duration of the program but I still assisted to a few seminars online. Since most scientific events all over the world are running online, there is sometimes a conflict of schedule between an interesting talk from outside MSRI and one at MSRI. Having a hybrid format allows to listen to the talks later on or to listen to talks in the office while doing some paperwork on the side. This was very positive I think. I did not collaborate with virtual participants except the people I was working with before MSRI. In general virtual participants were also on different time zones, making it difficult to start a research effort per se. Something that could be improved is how virtual participants interact with the speakers. Using the zoom chat is quite involved for the speaker. I know some places use a discord or slack channel in parallel of the talk to have a more efficient way of communicating.

Lin, Yier

Name: Yier Lin
Year of Ph.D: 2021
Institution of Ph.D.: Columbia University
Dissertation title: Large deviations of the KPZ equation, Markov duality and SPDE limits of the vertex models
Ph.D. advisor: Ivan Corwin

Mentor while at MSRI: Firas Rassoul-Agha

Pre-MSRI Institution: Columbia University
Position at that institution: Graduate student
Mentor (if applicable): Ivan Corwin

Post-MSRI institution: University of Chicago, Department of Statistics
Position: William H. Kruskal Instructor
Anticipated length (or specify if tenure-track): 1.5 yr or 2.5 yr
Mentor (if applicable): n/a

Summary of MSRI Experience

My experiences at MSRI are overall good. I have attended seminars and mini-courses weekly. I also give a talk and a minicourse. I have discussions with different researchers and broaden my knowledge. New research topics arise from my discussion with other program participants which leads to new collaborations and in-progress papers. I also have weekly meetings with my mentor, Firas Rassoul Agha. We are collaborating on one project now.

The papers I am working on:

- Classification of the stationary distribution for the stochastic higher spin six vertex model
- Mixing operator and Strassen's law (with Shalin Parekh)

Research projects and collaboration:

- Stationary distribution for the multi-color vertex model (with Amol Aggarwal)
- Problems related with t-PNG model (with Hindy Drillick)
- Martin boundary of the beta random walk in random invariant (with Christian Noack, Firas Rassoul Agha, Timo Seppalainen).

Did you find your experience at MSRI beneficial? Why or why not?

Yes. The MSRI provides the opportunity to bring people from different places together. I would never have the opportunity to talk and communicate with leading researchers from all over the world.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Yes, The fellowship provides me the chance to collaborate with other participants and new research topics that I come up with. Also, the bi-weekly broader impact session gives us suggestions on how to give a presentation, to write a NSF proposal and manage broader impact.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

The hybrid format is overall good. I learned as much through virtual seminars as in person. I have not collaborated with virtual participants but I am collaborating with people (Timo Seppalainen, Arjun Krishnan) outside the program virtually. The benefits are being able to bring people who cannot come to MSRI to present their work and communicate. The drawback is that for online attendees, it is harder for them to ask questions during a talk. In the future, we should think about how to better include them in the discussion.

McKenna, Benjamin

Name: Benjamin McKenna
Year of Ph.D.: 2021
Institution of Ph.D.: Courant Institute, New York City
Dissertation title: Non-invariant random matrices and landscape complexity
Ph.D. advisor: Gérard Ben Arous and Paul Bourgade

Mentor while at MSRI: Alice Guionnet and Mariya Shcherbina

Pre-MSRI Institution: Courant Institute, New York University
Position: Ph.D. student
Mentor (if applicable): Gérard Ben Arous and Paul Bourgade

Post-MSRI Institution: IST Austria (Institute of Science and Technology)
Position: Fulbright fellow (essentially postdoc)
Anticipated length (or specify if tenure-track): Six months
Mentor (if applicable): Laszlo Erdös

(Also from September 2022 to August 2024 I will be at Harvard, Position: Postdoctoral Fellow (in CMSA, the Center of Mathematical Sciences and Applications, not the Math Department), Anticipated length:Two years, Mentor: Horng-Tzer Yau)

Summary of MSRI Experience

In my fellowship, I mostly worked on two types of projects: First I worked on landscape complexity, the main area of my thesis, primarily working by myself but talking with Gerard Ben Arous. I started several projects in this area (non-Gaussian landscapes, TAP complexity and BRST supersymmetry), but it's not clear yet which ones will pan out. I also spent a lot of time working with Jonathan Husson and Alice Guionnet on large deviations for random matrices; along with Ofer Zeitouni we are making good progress on a joint project that different subsets of us had discussed in previous years and found too difficult at the time. Separately I am working with Jonathan on making rigorous some related works in the physics literature. Finally, I learned a lot about supersymmetry from talking with Mariya Shcherbina, which is an area I knew nothing about before.

Did you find your experience at MSRI beneficial? Why or why not?

Absolutely! On an emotional level it was so, so great seeing so many people in three dimensions. I really feel like a part of a community, which was sometimes hard to believe in the early pandemic. Mathematically, I think the kinds of questions I'm asking matured a lot from talking to

everyone here, even if I didn't get any papers actually done yet - my personal list of problems changed very significantly in the last four months, and I have a more realistic sense of what's interesting and what's possible. It was also great for me to start working with peers rather than just senior people, and also to practice juggling multiple projects (until now I had only worked intensively on one project at a time). In fact I found juggling multiple projects to be unexpectedly difficult, but it's an important skill to have and I was glad for the chance to start practicing it.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Yes, certainly. I had the opportunity to build out my professional network, both of people I know -- i.e. professors who can attach my face to my name -- and people I've worked with, in that it's important to collaborate not just with senior faculty but also with one's peers, and I could meet and work with such peers here.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I did not do that much hybrid stuff. I did watch some talks virtually live, but the most important thing is that the talks are recorded forever, which is amazing, for a few reasons: (a) I watched a handful of talks shortly after they happened (if I had another meeting during the actual appointment), (b) some talks I did not watch now but want to watch after the program, when I have time to catch up, (c) some talks I don't have particular plans to watch but might watch in a few years if I get interested in a topic, (d) I can put recordings of my own talks on my website and use them on the job market. I never really used Sococo and did not really collaborate with any virtual participants; I think if there had been participants I really wanted to work with who happened to be virtual I would have made it happen, but the bumping-into-and-chatting connections didn't really happen. The main drawback of virtual participation for me is that I sort of hate Zoom at this point, and try to spend as little time on it as possible. Also, I ended up spending about one day a week working from home, but that was to actually get a bunch of work done so I didn't log into anything virtual or talk to anybody.

I can't think of anything that could be improved as an in-person participant. I was super happy talking to people in person and did as little virtual stuff as possible, and it was great. I imagine stuff could be improved for the virtual participants - I feel a little bad for them - but I'm not sure what.

Noack, Christian

Name: Christian Noack
Year of Ph.D: 2018
Institution of Ph.D.: University of Wisconsin- Madison
Dissertation title: On stationary exactly solvable 1+1 dimensional lattice directed polymer models
Ph.D. advisor: Timo Seppäläinen

Mentor while at MSRI: Shirshendu Ganguli and Alan Hammond

Pre-MSRI Institution: Cornell University
Position at that institution: Visiting Assistant Professor
Mentor (if applicable): Philippe Sosoe

Post-MSRI institution (or company): Purdue
Position: Visiting Assistant Professor
Anticipated length (or specify if tenure-track): 6 months
Mentor (if applicable):

Summary of MSRI Experience

Attending several interesting lectures and workshops, learning a lot of new material, getting ideas for future research, and learning professional skills/how to best go about obtaining a tenure-track position.

Giving a talk in front of world class experts.

Collaborating with several other MSRI postdocs and members:

- Philippe Sosoe and I are in an exploratory phase of a paper inspired by an MSRI talk
- Yier Lin, Chris Janjigian, Firas Rasoul-Agha, Timo Seppalainen, and I are in the rough draft phase of a new paper concerning geodesics.

Did you find your experience at MSRI beneficial? Why or why not?

Yes, very. For every single reason mentioned above.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Yes. The professional development workshops were very illuminating into how the hiring side functions, and specifically what they look for and how they hire.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

The hybrid format was absolutely crucial for me. I attended most things online, as my allergies have gotten very bad, and the lack of rain in Berkeley and warmer temperature kept them going constantly. I therefore would generally fail the UC-Berkeley "daily prescreen" which made attending things via Zoom essential. For this reason I collaborated with several people virtually. Benefits were the ability to still interact and attend events while not able to be on campus. Downside, as always with mathematics on Zoom, is that there's no comparison to in person collaboration in front of a chalk board (but that is a general comment about Zoom, and in no way a negative reflection on the MSRI).

I really don't think much could have been improved. It simply is the hand we were dealt this semester with covid, delta, omicron, etc. The constant mask wearing for long periods of time made me extremely uncomfortable when attending in person, but I understand and recommend this be the requirement for the foreseeable future. The only way to improve the experience: help solve the pandemic and its mutations so that we can attend lectures and collaborate in person mask-free!!

Occelli, Alessandra

Name: Alessandra Occelli
Year of Ph.D.: 2019
Institution of Ph.D.: University of Bonn
Dissertation title: KPZ universality for last passage percolation models
Ph.D. advisor: Patrik L. Ferrari

Mentor while at MSRI: Ivan Corwin

Pre-MSRI Institution: Instituto Superior Tecnico, Lisboa
Position: Post-Doc
Mentor (if applicable): Patricia Gonçalves

Post-MSRI Institution (or company): Instituto Superior Tecnico, Lisboa
Position: Post-Doc
Anticipated length (or specify if tenure-track): 2 months (2 years position)
Mentor (if applicable): Patricia Gonçalves

Summary of MSRI Experience

During this semester I focused my attention on attending talks on last passage percolation models and other KPZ models to extend my research perspective, and attending introductory courses on topics that are quite

far from techniques I am familiar with, but that I would like to integrate in my research, like Riemann-Hilbert problems.

A project that has started during this semester is a joint work-in-progress together with D. Betea and D. Ofner, a program associate. It examines stationary half-space Hammersley last passage percolation via orthogonal polynomials on the unit circle and on the real line. The goal is to compute tail estimates for the distribution if this model when the size of the system goes to infinity.

In general we want to obtain a combinatorial, probabilistic, and asymptotic result for a Hammersley last passage percolation model in the half-quadrant with two external sources. We attack the problem via the original approach of Baik--Rains for the case of the full quadrant: symmetric functions, matrix integrals over the orthogonal group, Toeplitz and Hankel determinants, and asymptotics of OPUCs with weight e^{t(z+z^{-1}}. As a byproduct we plan to obtain asymptotic results on averages of characteristic polynomials for orthogonal matrices distributed as e^{t tr (U)} dU where dU stands for Haar measure. A worthy goal (beyond the scope of this project) would then be to replace t tr(U) by $tr(V(U))$ for any polynomial V.

Another aspect I wanted to approach is the use of large deviation techniques to obtain result on last passage percolation models with general weights and geometries for which standard techniques (like steepest descent analysis) fail. These discussion have been carried out with Alice Guyonnet, program organiser, and Jonathan Husson, program post-doc, who has also taught me the main results and techniques in large deviation theory.

In parallel, I continued working on other projects that I started before the semester, one on hydrodynamic limit for multispecies particle systems with P. Gonçalves, one with D. Betea on cylindrical LPP, that was recently submitted and appeared on arxiv, arXiv:2111.15538.

Did you find your experience at MSRI beneficial? Why or why not?

Apart from starting collaborations on LPP problems from a different point of view and approach (OPUC or LDP, as explained above), my goals for this semester were the following: expanding my knowledge on integrable systems and random matrices, learning about large deviation problems, and learning about Riemann-Hilbert problems. While I believe I had some success with the first two goals, the third topic was not particularly approachable for someone without familiarity: even the introductory courses were not meant pedagogically (like the introductory

course on IPS) with the result that at least in my case the third goal was not fulfilled.

A beneficial aspect of this semester was the presence of so many peer researchers working on very similar fields that made very easy to have feedbacks on various topics. The fact that they all come from different parts of the world made also possible to learn more about academic systems and carrier paths in university in other countries. Essential information at my career stage.

My stay at MSRI also gave me the chance to have experiences I would have not had otherwise, for example being interviewed for a newsletter, or recording a video for a math YouTube channel.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

This position will definitely benefit my CV, but I don't think it practically helped in finding a position at the end of the semester. This is because I mostly discussed with peers (postdocs, program associates). I had the chance to discuss with an organizer, but there were arrangements for collaborations and future positions before the semester started, so it was mostly an occasion to meet and discuss in person.

Probably discussions with peers and my mentor on the US academic career path has helped me to widen my choices for job applications and to consider applying outside of Europe.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

The most useful aspect of hybrid activities was the freedom in attending talks. I felt more free to attend the beginning of a talk from my office and stop watching it if it turned out not to be of my interest/comprehension.

I did not have the chance to collaborate virtually with participants, I believe that one of the best aspects of the program was the presence of so many researcher in the same building for a relatively long time, so I preferred using this chance to talk in person.

Something that could be improved is the quality of videos for blackboard talks.

Oregero Jr., Jeffrey

Name: Jeffrey A. Oregero Jr.
Year of Ph.D: 2021
Institution of Ph.D.: University at Buffalo, The State University of New York
Dissertation title: The focusing nonlinear Schrodinger equation with periodic boundary conditions: Spectral theory and semiclassical dynamics
Ph.D. advisor: Gino Biondini

Mentor while at MSRI: Percy Deift

Pre-MSRI Institution: University at Buffalo, The State University of New York
Position at that institution: Graduate student
Mentor (if applicable): Gino Biondini

Post-MSRI institution (or company): University of Central Florida
Position: Postdoctoral Scholar
Anticipated length (or specify if tenure-track): 1.5 years
Mentor (if applicable): Alexander Tovbis

Summary of MSRI Experience

- Organized the professional development seminars this semester as MSRI. This included finding research members to serve as panelists for each of the seminars.
    - Topics: Writing a grant, Giving a good seminar, Job search, Writing papers and research statements, Broader impacts of research in mathematics
- Gave a seminar at MSRI in Simons Auditorium titled "Spectral theory of non-self-adjoint Dirac operators on the circle".
- Gave a seminar via Zoom at the University of Michigan mathematics department's integrable systems and random matrix series (ISRMT) seminar titled “The focusing nonlinear Schrodinger equation on the circle: Spectral theory, elliptic finite-gap potentials, and soliton gases”.
- Extended research from my dissertation that resulted in a new paper titled “Elliptic finite-band potentials of the non-self-adjoint Dirac operator”.
    - (The work is currently being written and acknowledgment of MSRI will appear in the manuscript for giving me the opportunity to focus on this work while here.)
- I began work on a new project with my mentor Percy Deift. The theme of this work is "universality in computation" and the topic is "emergence of solitons". Some discussion/collaboration of this work with Prof. Tom Trogdon at the University of Washington

occurred as well. I hope to be able to visit Tom this summer to discuss the project some more.

- I began work on a new project on the long-time asymptotic analysis of the interactions between solitons and dispersive shocks in focusing nonlinear media. The main tool in the analysis of the problem is the nonlinear steepest descent method for oscillatory Riemann-Hilbert problems (pioneered by Percy Deift and Xin Zhou). Moreover, I expect to have an ongoing collaboration with Mateusz Piorkowski regarding this project (a postdoc that I met during my stay at MSRI). His work on similar problems for the KdV equation makes for a strong pairing.
- During my postdoc at MSRI I also had the opportunity to learn the nonlinear steepest descent method for Riemann-Hilbert problems. This should have a lasting impact on my research as it is an extremely powerful tool in mathematics finding applications in dynamical systems, orthogonal polynomials, random matrix theory, and beyond!
- I served as a referee for an article submitted to the Journal of Nonlinear Science.
- I was introduced to a lot of really great people!

Did you find your experience at MSRI beneficial? Why or why not?

Yes, my experience was extremely beneficial. It gave me the opportunity to extend the results from my dissertation. I was able to explore new directions of research with the privilege to discuss these ideas with experts. Also, very importantly, I was introduced to many researchers and made aware of important open problems in integrable systems and random matrix theory. Finally, I was able to do some service activities such as organizing professional development seminars and serving as a referee on an article submitted to the Journal of Nonlinear Science.

In my opinion the event organizers, as well as the MSRI staff, did an excellent job ensuring I had a beneficial experience.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Yes, I believe my fellowship will help when looking for future positions. Importantly, I was able to network with a large number of research professors in the field of integrable systems while at MSRI. Hopefully, some of them would be willing to write a letter of recommendation on my behalf for future job applications. Finally, a postdoctoral fellowship at MSRI is viewed as being very prestigious and looks good on your curriculum vitae.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

For the most part, I participated in the program activities in person. Moreover, I found it harder to form collaborations with members that were only participating virtually as I did not interact with them on a regular basis. On the other hand, virtual participation seems like the best option for members to participate who cannot be at MSRI physically. One recommendation would be to hold multiple "random teas" to force more interaction with virtual participants.

Piorkowski, Mateusz

Name: Mateusz Piorkowski
Year of Ph.D.: 2021
Institution of Ph.D.: University of Vienna, Faculty of Mathematics
Dissertation title: Global and Local Parametrix Problems in Riemann-Hilbert Theory
Ph.D. advisor: Gerald Teschl

Mentor while at MSRI: Percy Deift

Pre-MSRI Institution: University of Vienna, Faculty of Mathematics
Position at that institution: PhD student
Mentor (if applicable):

Post-MSRI institution (or company): Erwin Schrödinger Institute
Position: Postdoc
Anticipated length (or specify if tenure-track): 4 months
Mentor (if applicable):

Summary of MSRI Experience

I had the wonderful chance to start two new collaborations. For the main part of my stay I was working with Percy Deift on the Riemann-Hilbert problem for orthogonal polynomials with logarithmic singularities in the weight functions. Additionally, with Igor Krasovsky, Alexander Its and Percy Deift I started a new collaboration on the Riemann-Hilbert analysis of the Ising chain model.

Additionally, I have talked with numerous other researchers about possible research topics for the coming years.

Did you find your experience at MSRI beneficial? Why or why not?

It was a very beneficial time, as it allowed me to meet and talk with the people whose work I studied. This did not happen during my PhD, in fact,

I hardly ever met anyone working on Riemann-Hilbert problems. Additionally I will certainly benefit greatly from people in my field knowing me and my work. Getting to be known to a wider community would be almost impossible on the basis of my papers alone.

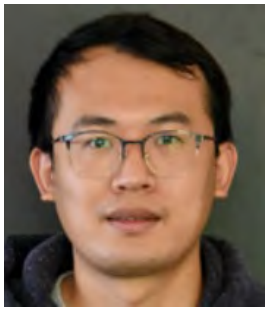
Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

More people know about me and my work. I also received a lot of helpful information concerning future postdoc positions and people that might be interested in working with me. In fact, I am applying to one of those positions right now.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I was lucky to be able to participate on site in most of the events. All my collaborators that I mentioned earlier were also on site most of the time, so I did not feel the need to try to find collaborators virtually. I believe the hybrid format was beneficial to participants who could not be at the MSRI in person, even though building new collaborations would certainly be more difficult in such cases, at least for me.

At the same time, it is hard to see how the virtual experience of online participants could have been improved, without assuming some major technological advances.



Zhu, Yizhe

Name: Yizhe Zhu
Year of Ph.D.: 2021
Institution of Ph.D.: University of California San Diego
Dissertation title: Spectral analysis of sparse random graphs and hypergraphs
Ph.D. advisor: Ioana Dumitriu

Mentor while at MSRI: Antti Knowles

Pre-MSRI Institution: University of California San Diego
Position at that institution: Ph.D. student
Mentor (if applicable): Ioana Dumitriu

Post-MSRI institution (or company): University of California Irvine
Position: Visiting Assistant Professor
Anticipated length (or specify if tenure-track): 2.5 years
Mentor (if applicable): Roman Vershynin

Summary of MSRI Experience

I continued my work during my Ph.D. study and explored several new directions. I finished two papers. One is with Ioana Dumitriu and Haixiao Wang, on spectral clustering algorithms for community detection in random hypergraphs, using random matrix techniques. Another one is with Zhichao Wang, where we explore a new nonlinear random matrix model from the study of neural networks.

I came with an ongoing project with Ioana Dumitriu on the extreme singular values of sparse random matrices, and we made significant progress during the program. My mentor Antti Knowles explained several key ideas in his work on sparse Erdos-Renyi graphs and that helped me to overcome technical difficulties in my project. I also talked to Gaultier Lambert on characteristic polynomials of random graphs and formed a new collaboration with him on a project to study characteristic polynomial of random digraphs, and we have written down part of the proof.

I presented my work on community detection in random hypergraphs and I also continued this project to study a more general model using the non-backtracking operator. We made good progress and this would help us to understand sparse random hypergraphs better from a random matrix perspective. I also benefit from Gérard Ben Arous' course on random matrix and random landscape, which gave me a new idea on the application of random matrix theory to data science.

Did you find your experience at MSRI beneficial? Why or why not?

I found my experience beneficial through many discussions with other members here. I got to know many people's work and und Various research talks broaden my horizon in this area, and the professional development seminar gave me many good tips on career development. The working environment is very nice and friendly.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

It will help me find a future position. I explored several new ideas here and I hope to finish the work soon after the program. The professional development seminar talks about job applications, grant applications, and career development in general, and that helps for future job applications.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I attended the lecture of Gérard Ben Arous virtually and it works well. I collaborated with online participants through Zoom meetings. It's beneficial to have virtual elements. For example, all the talks can be accessible if it's hard to come to MSRI and one can always watch afterward.

THE ANALYSIS AND GEOMETRY OF RANDOM SPACES – Spring 2022

Glücksam, Adi

Name: Adi Glücksam
Year of Ph.D: 2018
Institution of Ph.D.: Tel Aviv University
Dissertation title: Measurably entire functions and related questions
Ph.D. advisor: Mikhail Sodin

Mentor while at MSRI: Eero Saksman

Pre-MSRI Institution: Northwestern University
Position at that institution: Boaz Assistant Professor
Mentor (if applicable): Steve Zelditch

Post-MSRI institution (or company): Northwestern University
Position: Boaz Assistant Professor
Anticipated length (or specify if tenure-track): 2 more years
Mentor (if applicable): Steve Zelditch

Summary of MSRI Experience

(1) The combinatorial Method: While I had the theorem proved, I was looking for a new example of how to apply this method.
- A discussion with Pekka Pankka helped me find a very easy and natural example in a very general context.
- Several discussions with Nageswari Shanmugalingam convinced me that extending this method to general metric spaces (with some restrictions) would be interesting. She also invited me to come visit Cincinnati and talk to people there.
- Eero gave me a reference to find information for the introduction.
Status- I need to write an introduction, but this paper is ready.

(2) An open problem of Erdos: Erdos asked does there exist an entire function so that the number of points on a circle where the maximum modulus is attained tends to infinity as the radius tends to infinity. It has been shown that such a function exists where along a subsequence(!) of radii the number tends to infinity. Not much progress has been made since then.

Before the semester started, I was talking to Leticia Pardo Simon about this project after hearing her talk at Cavid seminar. We did not make any serious progress remotely. During the semester we found an approximation for a solution to this question.
Status- We need to write an introduction, but this paper is ready.

(3) In addition I started three projects:

(i) Constructing Wondering domains (joint with Leticia Pardo Simon and Vasiliki Evdoridou).
(ii) Representation models for MST and related questions (joint with Pietro Poggi-Corradini, Moon Duchin, Dylan Thurston, Annina Iseli, and Eric Babson who is not from MSRI this semester).
(iii) Translation invariant measures on solutions of some(?) elliptical PDEs (joint with Eero Saksman)

This is just the beginning, we are trying to understand what we need if we want to replicate techniques similar to the ones used in my PhD.

Did you find your experience at MSRI beneficial? Why or why not?

Yes. I got the opportunity to talk to many people about my research as well as just general career advice and hear different points of views.

I missed out on many of the social things. It would be easier for mothers if these things are (at least sometimes) done at MSRI and if they are planned well in advance as getting a babysitter last minute is not easy.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Because I got a lot done academically, and it literally put my research on hyperspeed, I believe that not only the fact that I was here would be beneficial (as a line in my CV), but also everything I managed to achieve, and the relationships I did manage to form. However, the market is brutal these days so one can never know.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

It was good and bad at the same time.

On one hand, it was good because I got to watch seminars and lectures online when I couldn't make it (due to having a young child, covid etc.)

On the other hand, I did not communicate at all with participants who were not around. It is crucially important that one has the opportunity for corridor chats. For example- all the career advice I asked for was in an informal capacity (at least at first). Also- to manage to work with someone online, at least for myself, I have to create some kind of a working relationship first.

Iseli, Annina

Name: Annina Iseli
Year of Ph.D: 2018
Institution of Ph.D.: University of Bern, Switzerland
Thesis title: Dimension and projections in normed spaces and Riemannian manifolds
Ph.D. advisor: Zoltán Balogh

Mentor while at MSRI: Moon Duchin

Pre-MSRI Institution: University of California, Los Angeles
Position at that institution: Postdoc
Mentor (if applicable): Mario Bonk

Post-MSRI institution (or company): University of Fribourg, Switzerland
Position: Postdoc
Anticipated length (or specify if tenure-track): 1.5 years
Mentor (if applicable): Stefan Wenger

Summary of MSRI Experience

I was in the fortunate situation that my previous work as well as my research interests overlapped with both programs that took place at MSRI this spring. This meant that I had even more activities to choose from and people to interact with.

I participated in the following seminars on a weekly basis: Mario Bonk's learning seminar on conformal dimension, Nuria Fagella's essential seminar on complex dynamics, and Charles Favre's reading group on arithmetic dynamics. Also, I gave talks in three of the MSRI seminars. I also attended most of the career panels for postdocs that were organized by Jack Burkhard.

Together with Peter Lin, I have co-organized the Junior Seminar for the program. It was a weekly seminar for postdocs and PhD students (latter faculty was kindly asked not to attend). Every week, one of the participants gave a talk about a topic of their interest or expertise aiming to introduce their non-expert peers to their topic in a catchy and comprehensive way rather than presenting own results. This gave the speaker the freedom to experiment and deviate from the usual format of research talks and to also address not-yet-formal ideas and questions in a safe framework. Moreover, it created a great atmosphere for the audience to ask naive yet essential questions on the newly learned topic.

I have had mathematical discussion with various participants of both programs. The following two projects are already fairly concrete and I expect them to result in publications in the future:

- With Moon Duchin, Dylan Thurston, Pietro-Poggi Corradini, Adi Glucksam, and Eric Babson: we are working on various questions on random spanning trees some of which stem from open questions about redistricting algorithms. In particular, we are investigating the relationship between MST and UST sampling of spanning trees on different types of graphs.
- With Misha Hlushchanka: in previous work with Mario Bonk we had proven a result about eliminating Thurston obstructions for maps with four postcritical points. During this semester, Misha and I have started working on generalizing this to five and more postcritical points.
- In addition, I have had a few insightful but so far rather superficial interactions that may develop into concrete projects in the future:
- I have talked to Jeremy Kahn as well as Rebecca Winarski about questions related to ramification portraits and the dynamical Hurwitz problem.
- Yilin Wang has introduced me to an interesting open uniqueness problem for families of arcs on the sphere satisfying a hyperbolic geodesic property.
- I have talked with Daniel Meyer and Peter Lin about certain deterministic examples that may underline some of Peter's results on random snowspheres.

Did you find your experience at MSRI beneficial? Why or why not?

I have benefited in many ways from this postdoc semester at MSRI:

- It has given me the opportunity to reconnect with the math community after two difficult pandemic years where I felt academically isolated and buried in (online) teaching. During this semester, I have built connections with many mathematicians in both programs. Some became friends, some became collaborators, some became both.
- I have started several collaborations. I am positive that some of them will lead into publications over the next few months and years. Also, I have found several interesting research problems that I will continue or start working on in the future.
- I have learned a lot of new and interesting mathematics that will be useful to my current and future projects. I came into this semester with a fairly broad background in metric analysis and some expertise in rather specific topics in complex dynamics. This semester gave me the opportunity to catch up on a broader base knowledge and skillset in complex dynamics and to combine my knowledge on certain geometric or combinatorial objects with

probabilistic aspects. It was very beneficial to be able to choose seminars and talks from both programs, to learn from various experts in both worlds (in learning seminars but also in informal conversations), and to talk to peers who were in the process of learning about the same topics.

- The Junior Seminar that I co-organized (see my answer to the above question) was a success. It gave postdocs and PhD students the opportunity to learn about what their peers who are not in their exact field of research work on. It definitely broadened my horizon on the variety of questions that people in my broader area of research work on and I was very happy with the rather informal, creative framework that we chose for the seminar.
- I loved the mentoring program for postdocs and Moon Duchin has been a wonderful mentor to me. Not only have we started a math project; she has also generously shared insights into her own career path and decisions and has given me very concrete and useful advice on career, collaborations, job applications, and research talks.
- It has been inspiring to get to know many established mathematicians in my field each of which has their very own approach to math and life and has in their unique way built a successful career for themselves. In particular, it was of great value to meet and interact with some of the few female mathematicians in my field who are at an advanced career stage.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I believe that my fellowship will benefit my future job search in several ways: I have started new projects that will eventually lead to publications which will be important for my publication record. Moreover, this semester has provided me an excellent platform for networking and for presenting my research to a big group of people in my field. Also, this semester at the MSRI has been great for my mindset in terms of my mathematical work and career for all the reasons that I have mentioned in my answers above.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

At the beginning I was skeptical about the hybrid format but I ended up liking it a lot more than I thought. In particular, it gave people with children or people who had to travel for research during the semester more flexibility. Also, people who had to stay home with Covid for some days did not completely miss out on the program activities.

The technology was set up really well, there were hardly any technical issues, and even the talks given by remote speakers had sort of an in-person feel from the Simons auditorium. A big compliment to IT services for making this entire hybrid format work so smoothly. I would not have believed that this is possible.

I participated in most activities in-person and was thrilled about spending a full semester without having to participate in too many Zoom activities. The recordings complimented the in-person participation greatly as they gave me the opportunity to rewatch parts of talks in which I was not able to catch all details life.

Finally, and I can hardly stress this enough, I wish to emphasize that remote activities and remote collaborations cannot in any way replace in person participation. The vast majority of reasons why this semester was so beneficial to me and my future career is tied to the in-person part of the program. I considered the hybrid format a great addition and not an alternative to an in-person program.

Jego, Antoine

Name: Antoine Jego
Year of Ph.D: 2021
Institution of Ph.D.: University of Vienna / University of Cambridge
Dissertation title: Contribution to multiplicative chaos theory / Thick points of random and multiplicative chaos
Ph.D. advisor: Nathanaël Berestycki

Mentor while at MSRI: Zhen-Qing Chen

Pre-MSRI Institution: University of Vienna
Position at that institution: PhD candidate
Mentor (if applicable): Nathanaël Berestycki

Post-MSRI institution (or company): EPFL (Lausanne)
Position: Postdoc
Anticipated length (or specify if tenure-track): 2+1 years
Mentor (if applicable): Juhan Aru

Summary of MSRI Experience

I mainly participated in three weekly activities: the junior seminar, the AGRS research seminar and the reading group of Liouville CFT. This helped me broaden my perspectives. I especially liked the reading group since it allowed me to considerably deepen my understanding of this line of research. The rest of the time, I was collaborating with some people. During the program, I started three new projects and more importantly I started working with three different people who were not already

collaborating with me. Wei Qian was in MSRI for the whole duration of the program and Tom Hutchkroft and Xin Sun spent a week in MSRI. I consider these three collaborations very fruitful and we have already made considerable progress.

i) Thick points of Branching Brownian motion in 4D, with Nathanaël Berestycki and Tom Hutchkroft
ii) A conformal invariant field found in the Brownian loop soup, with Wei Qian and Titus Lupu
iii) Sinh-Gordon model, with Nathanaël Berestycki and Xin Sun

Did you find your experience at MSRI beneficial? Why or why not?

Very beneficial. I could broaden my research and start interesting projects in areas that were not completely in my area of expertise. I was almost overwhelmed with projects and ideas and found it difficult to find enough time to write things down (I consider this as a good sign).

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

It didn't help me find my next position since I already had it before the beginning of the program. On the other hand, it will certainly help me in the future since it gave me the opportunity to understand a bit more the American institutions.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I almost exclusively participated physically in program activities, although I found it very convenient that talks were recorded. Indeed, I sometimes could not attend the talks live and I watched a few of them later when I had more time. I think it was beneficial to have these activities in the hybrid format. The drawback is that it becomes a bit harder to ask questions: speaking in a microphone can be a bit intimidating.

Junnila, Janne

Name: Janne Junnila
Year of Ph.D: 2018
Institution of Ph.D.: University of Helsinki
Dissertation title: Contributions to the theory of multiplicative chaos
Ph.D. advisor: Eero Saksman

Mentor while at MSRI: Nathanaël Berestycki

Pre-MSRI Institution: EPFL
Position at that institution: Postdoc
Mentor (if applicable): Juhan Aru

Post-MSRI institution (or company): University of Helsinki
Position: Postdoc
Anticipated length (or specify if tenure-track): 2-3 years
Mentor (if applicable): n/a

Summary of MSRI Experience

I stayed at the AGRS programme for the whole spring and went to most of the talks and learning seminars. I felt after two years of pandemic it was very refreshing to get a glimpse on what everyone has been doing. I also learned a lot outside of my usual research topics, as an example of which I would like to mention one week during which I ended up having a closer look at Virasoro algebras and their connection to the BPZ equations, a topic on which I then gave a lecture in the Liouville Quantum Gravity learning seminar.

Research-wise I mostly focused on two projects:
1) Extremal trajectories of branching random walks in average sense.
This was a problem I discussed both with Eero Saksman as well as my mentor Nathanaël Berestycki.

The asymptotic height of the maximal particle of a BRW at time t is well-known. I was interested in a related but somewhat different question: how large proportion of time can the trajectory (ancestry) of a particle stay close to the maximum in the worst case.

The original motivation for studying this problem comes from the study of the regularity of holomorphic multiplicative chaos distribution on the torus, but I also found it a nice question on its own.

I was able to find a rather simple argument in the BRW case which at least morally should be enough to tackle the original problem, assuming that one could reduce the problem on the continuous log-correlated field to a BRW, e.g. via some Slepian style argument. The project will probably thus be continued in two directions: First of all trying to finish the original application, and secondly finding more optimal results in the case of BRW or Brancing Brownian Motion.

2) Uniqueness up to homotopy type of loops with geodesic property.

This was a problem which Yilin Wang introduced during one of her talks, and I ended up discussing it with her and Steffen Rohde.

The question is whether there is a unique loop through n fixed points on the Riemann sphere of given homotopy type which has the following geodesic property: Every arc between two consecutive points is a hyperbolic geodesic in the complement of the rest of the arcs.

We had a new idea of trying to solve the problem via variational methods, by employing Hadamard's variational formula to control the harmonic measure of one side of the curve. We made some partial progress, as we found an argument to show that there is no continuous perturbation of a geodesic loop to a nearby different geodesic loop fixing the same points.

The approach still feels like it could lead to a solution after some extra work. Lately there were also some new ideas by Peter Lin for a completely different approach in the case where there are 4 fixed points, so we will see how the story develops.

Did you find your experience at MSRI beneficial? Why or why not?

I found my experience very positive. Being able to spend the whole spring dedicated to research while surrounded by so many great mathematicians working on similar problems has been a unique opportunity for which I am very grateful to the MSRI. It has been nice to meet new people and I think some seeds may have been planted for possible future collaborations as well.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

My next position at University of Helsinki was probably going to happen in any case, but for the one after that - who knows! I think having been a postdoctoral fellow at MSRI can only help in my future applications.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I did participate virtually during the first week of the programme when I had to wait for my covid booster shot to take effect. I think the virtual lectures were very well organized, with the box and everything, and I also think it was definitely beneficial to have the opportunity for people to attend virtually. Many interesting questions and comments were asked via zoom. When it comes to collaboration, however, I think it is just quite hard to implement the same level of interaction between virtual participants, and I ended up only discussing in person.

Landry, Therese-Marie

Name: Therese-Marie Basa Landry
Year of Ph.D: 2022
Institution of Ph.D.: University of California, Riverside
Dissertation title: Towards Analysis on Fractals: Piecewise C^1-Fractal Curves, Spectral Triples, and the Gromov-Hausdorff Propinquity
Ph.D. advisor: Michel Lapidus

Mentor while at MSRI: Masha Gordina

Pre-MSRI Institution: University of California, Riverside
Position at that institution: PhD Student
Mentor (if applicable): Michel Lapidus

Post-MSRI institution (or company): Fields Institute (7/1/22-12/31/22); University of California, Santa Barbara (starts 7/1/22, renewable up to 3 years)
Position: Postdoctoral Fellow with the Thematic Program on Nonsmooth and Lorentzian Geometry (Fields Institute), Visiting Assistant Professor (UC Santa Barbara)
Anticipated length (or specify if tenure-track): Fields Postdoctoral Fellowship (6 months), UC Santa Barbara Visiting Assistant Professor Position (renewable up to 3 years)
Mentor (if applicable): George Elliott (for the Fields Institute position), Björn Birnir (for the UC Santa Barbara position)

Summary of MSRI Experience

I am very excited about the opportunities I have had during this program to both broaden my research scope and refine my noncommutative geometry toolkit. Spectral triples are noncommutative generalizations of differentiable structure.

My time at MSRI afforded me the chance to develop a spectral triple on an inductive limit C*-algebra that can also be realized as an inductive limit of spectral triples. Spectral triples exist for inductive limit C*-algebras that are noncommutative Cantor sets, which are inductive limits of finite-dimensional C*-algebras. This spectral triple is a noncommutative solenoid, which is an inductive limit of rotation algebras. Noncommutative solenoids can also be represented as twisted group C*-algebras and a bounded doubling condition with respect to length functions was used to build a spectral triple that also induces quantum compact metric space structure. I am now working on a paper describing these results and hope to soon submit it for publication. I have also begun another project developing semifinite spectral triples, which are an extension of spectral triples where the compactness requirements for the generalized Dirac operator are relaxed, thereby extending the

range of settings which can be viewed as noncommutative Riemannian manifolds. My long term goals as a noncommutative fractal geometer include the development of spectral triples that are suitable for capturing the essential aspects of metric measure spaces, as well as that of Dirichlet forms. The lectures given by Mario Bonk and Pekka Pankka on conformal dimension gave me a good sense of developments in the subject. I am also glad to have met Nages Shanmugalingam. As a noncommutative geometer looking to build structures suitable for analysis on fractals, I found her talks very informative, as well as those given by Li Chen on Dirichlet forms. Mathav Murugan also directed my attention to a paper by Davies on noncommutative metrics and analysis on graphs and as a consequence of my time and interactions with the members of this program, I feel ready to start considering some of the questions posed in that paper. I am also glad to have the benefit of interactions with established probabilists like Masha Gordina. During the workshop associated with the program, I started considering some ideas for operator algebras on random fractals which I hope to pursue in future work. Most importantly, I established a new network of contacts with whom I feel comfortable soliciting research perspectives and advice.

Did you find your experience at MSRI beneficial? Why or why not?

My time at MSRI was an absolutely transformational one. When I was a Masters student at San Francisco State, I used to attend the Connections Workshops, so I was more than elated at the chance to be at MSRI for my first postdoctoral position. As a noncommutative fractal geometer, participating in the Analysis and Geometry of Random Spaces program gave me an opportunity to branch out research-wise and develop some new perspectives. In particular, I am grateful to the research members of this program for their generosity with their time, expertise, and experience. I am also thankful to David Eisenbud and Helene Barcelo for their conversation and professional advice at this critical time in my transition from graduate student to postdoc. For an early career mathematician like myself, the experience of the MSRI community in residence at the same time was particularly validating for my sense of belonging in the greater mathematical community. Besides getting some new ideas for research and other kinds of professional initiatives, I feel like the kindness and professionalism of everyone at MSRI also gave me the inspiration and confidence to pursue them.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I think my next two postdoctoral positions can be directly traced to my MSRI postdoc. This is because when I applied for the Fields Institute Postdoctoral Fellowship last fall, I think that having the (then) upcoming

MSRI Postdoctoral Fellowship on my CV strengthened my application substantially. Since I received the offer from the Fields Institute the following January, I was able to update all my other applications with both this development and the opportunity I had at MSRI to co-organize the Career Development Panels for the postdocs. I then received the offer of a Visiting Assistant Professor position at UC Santa Barbara. I also think that getting to be around so many experienced mathematicians while navigating the job market had a positive impact on the choices I made and the attitude with which I approached the process.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

Since this was my first in-person program after the start of the pandemic, I did not attend any lectures that were given virtually or attend any lectures virtually. That said, I think I was fortunate to be able to make such a priority and I do think virtual activities should remain a component of MSRI programs as they allow for greater flexibility in participation for those who are caring for family members or are having visa issues.

Lin, Peter

Name: Peter Lin
Year of Ph.D: 2019
Institution of Ph.D.: University of Washington
Dissertation title: Conformal Welding of Dendrites
Ph.D. advisor: Steffen Rohde

Mentor while at MSRI: Fredrik Viklund

Pre-MSRI Institution: Stony Brook University
Position at that institution: Postdoc
Mentor (if applicable): Chris Bishop

Post-MSRI institution (or company): Stony Brook University
Position: Postdoc
Anticipated length (or specify if tenure-track): 1 year
Mentor (if applicable): Chris Bishop

Summary of MSRI Experience

I co-organized the AGRS junior seminar (with Annina Iseli), and I attended research and learning talks in both AGRS and COMD programs.

With Steffen Rohde, I made progress on finishing two ongoing projects: "Shapes of Trees (with Oleg Ivrii and Emanuel Sygal)" and "Conformal Welding of Dendrites".

I gave a talk in the 'Analysis and Geometry of Random Spaces' workshop about some work in progress on conformal structures of stochastic subdivision rules. On this project I received useful feedback and suggestions from several different people from both the AGRS and COMD programs, throughout the whole semester.

Other than that, I had many mathematical discussions of varying depth and formality. Some of these have led to ideas for new projects, and of these I expect some of them will lead to published papers.

Did you find your experience at MSRI beneficial? Why or why not?

Yes, it was a truly unique experience to be in a building full of mathematicians working in areas so closely related to my own. The staff also did an excellent job in helping to create the right conditions for a productive semester.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Yes, it was exciting to form new connections, both within mathematics and with the people in my field. I am sure that this will help me find a future position.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I found it convenient to watch the talks on zoom at times, and the dedicated camera man was useful for this purpose. Other than that, I did not have any interaction with virtual participants, as it is much easier to talk in person.

Richards, Larissa

Name: Larissa Richards
Year of Ph.D: 2021
Institution of Ph.D.: University of Toronto
Dissertation title: Convergence Rates of Random Discrete Model Curves Approaching SLE Curves in the Scaling Limit.
Ph.D. advisor: Ilia Binder

Mentor while at MSRI: Tom Alberts

Pre-MSRI Institution: Lancaster University
Position at that institution: Senior Research Associate
Mentor (if applicable): Amanda Turner

Post-MSRI institution (or company): University of Leeds
Position: Researcher
Anticipated length (or specify if tenure-track): 2 years
Mentor (if applicable): Amanda Turner

Summary of MSRI Experience

There were many wonderful activities during my time at the program. Let me begin with the weekly research seminars. I attended and learned a lot of interesting in mathematics in the two learning seminars LQG and KPZ and Ubiquitous Diff(S1) that is both useful in my current research and broadening my understanding. The weekly research seminar had many interesting talks and provided me a lot of insight into the area and attending the workshops were fantastic. For my specific research activities, I continued my current project with Amanda Turner as well as my papers with Ilia Binder. My mentor Tom Alberts introduced me to an interesting new question through discussions. In addition, through conversations with Alan Sola I had some interesting new ideas and approaches on my current project. It was invaluable having people easily accessible and around for conversations and to bounce ideas off of.

Did you find your experience at MSRI beneficial? Why or why not?

Yes, my experience at MSRI was extremely beneficial. The amount of knowledge I gained in such a short time through learning seminars and discussions are invaluable and only this type of program could facilitate such an expedited process.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I believe that my time here will help me in the future with finding a position. It has introduced me to many wonderful mathematicians and given me the opportunity to learn from them in a short time.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

Yes, I virtually participated in program activities. It was extremely helpful when I was unable to attend in person due to child care constraints. I was able to attend from home and not miss out on any seminars or workshops. I continued my project with Amanda Turner who was attending virtually. Otherwise, I did not. There was not much of a time virtually for introductions and I did not feel I met anyone to begin a collaboration through my attendance in that aspect.

Wang, Yilin

Name: Yilin Wang
Year of Ph.D: 2019
Institution of Ph.D.: ETH Zurich
Dissertation title: On the Loewner energy of simple planar curves
Ph.D. advisor: Wendelin Werner

Mentor while at MSRI: Nikolai Makarov

Pre-MSRI Institution: MIT
Position at that institution: C.L.E Moore Instructor (postdoc)
Mentor (if applicable): Scott Sheffield

Post-MSRI institution (or company): IHES Institut des Hautes Etudes Scientifiques
Position: Junior Professor
Anticipated length (or specify if tenure-track): 5 years
Mentor (if applicable): N/A

Summary of MSRI Experience

My experience at MSRI was amazing, and it is hard to believe that it has already come to an end. I have learned a lot, especially through workshops, reading groups, and discussions with the leading experts in the field who are also present at MSRI. I find it a rare opportunity to have so many experts nearby, and I could ask many questions easily (and feel very comfortable about it).

Collaborations at MSRI that I participated in include "representation of the Virasoro algebra and SLE" with Masha Gordina and Wei Qian; "Virasoro, quadratic differentials and Loewner-Kufarev chain" with Fredrik Viklund and Curt McMullen; "Jordan curves with geodesic property" with Steffen Rohde and Janne Junnila; "Radial SLE and resampling property" with Vivian Healey; "Small deviations of SLE loop measure" with Fredrik Viklund and Marco Carfagnini; "Shear coordinates of Weil-Petersson homeomorphism" with Catherine Wolfram, etc. Some of them started during the program, while others began before it.

Did you find your experience at MSRI beneficial? Why or why not?

I found my experience extremely beneficial. I had contact and developed collaboration with people slightly further away from the community that I was familiar with. Discussing freely and easily with many experts in the field and in person makes ideas circulate efficiently, which deem to be fruitful. I was also glad to meet many talented students. I also benefited greatly from the reading group that I organized with Masha Gordina and

Eveliina Peltola. We could focus on the papers we are interested in and go through them in detail together, particularly by combining our expertise.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

It allowed me to learn many new things and new fields, broaden my scope, and connected me to many other participants. It helped my future research (and job prospect consequently) in many ways.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I enjoyed very much the hybrid format of workshops and reading groups, both as an in-person attendee or as a remote attendee. While the speaker is on Zoom, the experience of attending in person was surprisingly good. It is also convenient to sometimes attend the talk on Zoom if I cannot come to the institute.

I have also collaborated with virtual participants but rather on existing projects. I prioritized collaboration with people present at MSRI and find it hard or unappealing to start new collaboration with remote participants.

The wifi connection is not very stable at MSRI so I chose to not give talks from the institute.

COMPLEX DYNAMICS: FROM SPECIAL FAMILIES TO NATURAL GENERALIZATIONS IN ONE AND SEVERAL VARIABLES – Spring 2022

Burkart, Jack

Name: Jack Burkart
Year of Ph.D: 2021
Institution of Ph.D.: Stony Brook University
Dissertation title: Transcendental Julia Sets with Fractional Packing Dimension
Ph.D. advisor: Christopher Bishop

Mentor while at MSRI: André de Carvalho

Pre-MSRI Institution: University of Wisconsin Madison
Position at that institution: Postdoc
Mentor (if applicable): Alexei Poltoratski

Post-MSRI institution (or company): University of Wisconsin Madison
Position: Postdoc
Anticipated length (or specify if tenure-track): Until Spring 2024
Mentor (if applicable): Alexei Poltoratski & Andrew Zimmer

Summary of MSRI Experience

Initially when I arrived, I collaborated on a previously ongoing project with Leticia Pardo-Simón and Adi Glücksam about the max modulus set of entire functions. My contribution ultimately didn't work out, but we still had good discussions and I learned a great number of interesting new problems I may be able to think about (and have people to discuss with!) in the future. I have started collaborating with Lukas Geyer on a project on the Hausdorff dimension of Julia sets of non-polynomial entire functions. While the work is preliminary and many things need to be checked, progress so far is promising. I think this will become a paper. I spent time finishing the writeup on one paper, fixing some lemmas and small but tedious issues, and responding to a referee report for another. I plan on having a discussion with Tim Mesikepp in the other program about some topic of mutual interest in geometric function theory, and I hope that can lead to a collaboration moving forward. I spent a good deal of time discussing other open questions I have informally with others, and I learned some new technical tools in complex dynamics that I think will help me moving forward.

Outside of doing mathematics, I co-organized with Therese Marie Landry the Career Development Seminar, on topics of writing referee reports, grant writing, collaboration, diversity equity and inclusion, and opportunities in industry. This was a good deal of work but ultimately enjoyable. I gave many research and expository talks in both senior and

junior seminar series. While I am officially part of the complex dynamics program, I enjoyed interacting with the analysis and probability group, and found some common overlap with several individuals that I did not expect (Pekka Pankka, and Vyron Vellis, who visited for a couple weeks).

Did you find your experience at MSRI beneficial? Why or why not?

I did. Professionally, meeting a large group of new people will pay off dividends later on in my career. Mathematically, I started one very promising new project and I think there is potential for one more. I learned many things beyond my area of expertise as well - I benefitted from having time to simply read and think I wouldn't otherwise have had. Organizing a seminar is also very valuable experience I can use going forward.

I particularly enjoyed being able to spend time with many research like-minded postdocs and graduate students. Meeting so many young specialists in the fields you are interested in is a treat.

I also enjoyed working with my mentor, Andre. We don't have much overlapping research interests, but we had a lot of productive career discussions, and he gave me some great help on my talks and other things I participated in!

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

I do think so. I met a huge number of new people, which will keep me alert to different opportunities I would otherwise have been unaware of. I got to learn some new mathematical tools as well, and I hope I can use them moving forward to write more papers.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I was in person the whole semester and infrequently used the hybrid structure to participate. It was mostly when I just wanted to watch a talk from outside of my office. I think having the option added some great flexibility. I did not collaborate much with the virtual participants. It's difficult to find time not around talks to have discussions with them; this is simply a difficulty around zoom though, and I am not sure how that can be realistically improved.

Evdoridou, Vasiliki

Name: Vasiliki Evdoridou
Year of Ph.D: 2016
Institution of Ph.D.: The Open University
Dissertation title: Rates of Escape Under Iteration of Analytic Functions
Ph.D. advisor: Professors Phil Rippon and Gwyneth Stallard

Mentor while at MSRI: Tanya Firsova

Pre-MSRI Institution: The Open University
Position at that institution: Postdoctoral Research Associate
Mentor (if applicable): Professor Gwyneth Stallard

Post-MSRI institution (or company): University of Liverpool
Position: Postdoctoral Research Associate
Anticipated length (or specify if tenure-track): 15 months
Mentor (if applicable): Professor Lasse Rempe

Summary of MSRI Experience

I gave a research talk at the Connections workshop, a mini-course at the Introductory workshop and a survey talk in one of the seminars. I also gave a lecture as part of a mini-course at the Colloquium of the Department of Mathematics, University of Hawaii at Manoa.

I started a research project with N. Fagella, L. Geyer and L. Pardo Simon on the Teichmuller space of entire functions and its relation to wandering domains. This has been a very interesting project and I've been learning a lot of new things.

I have also been discussing with A. Glücksam and L. Pardo-Simón about was to use subharmonic functions to construct entire functions with specific properties. This is the beginning of a project that will aim at constructing wandering domains using a new method.

Finally, I was one of the organizers of the May 12 Women in Maths event, which took place virtually and in person at MSRI.

Did you find your experience at MSRI beneficial? Why or why not?

It was great to be surrounded by so many colleagues with similar research interests. The programme allowed for several mathematical discussions and interesting talks to take place and for new projects to be started. I learnt a lot of new things and got a broader idea on the research interests of other groups in the field, which is important.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

It does not seem so at the moment. Any offers I got were from posts I applied for before moving to MSRI. It will probably be helpful in terms of new research projects and improving my cv when applying for permanent jobs.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I participated at all activities in person, and I only collaborated with other members that were at MSRI. It was the case that almost all members participated in person. However, I think hybrid is the way to go forward since it allows people who cannot travel to participate at exciting events and collaborate with anyone. The hybrid form also allowed people from all over the world to join the conferences and seminar talks and interact with the members. I think it's ideal if members are in residence since the day-to-day interaction cannot be replaced, but I support the idea of hybrid seminars and conferences. I think the hybrid mode worked very well at MSRI.

He, Yan Mary

Name: Yan Mary He
Year of Ph.D: 2018
Institution of Ph.D.: The University of Chicago
Dissertation title: Some theorems in Kleinian groups and complex dynamics
Ph.D. advisor: Danny Calegari and Peter Shalen

Mentor while at MSRI: Sarah Koch

Pre-MSRI Institution: University of Oklahoma
Position at that institution: Assistant Professor
Mentor (if applicable):

Post-MSRI institution (or company): University of Oklahoma
Position: Assistant Professor
Anticipated length (or specify if tenure-track): Tenure-track
Mentor (if applicable):

Summary of MSRI Experience

My semester at MSRI was very productive. I have been actively participating a number of research seminars; for example, the Research Seminar, the Arithmetic Dynamics seminar and the StonyBrook-MSRI

joint research seminar. From these seminars, I have learned about the most recent research development of the field. In addition, the semester provided an excellent opportunity for me to exchange ideas with experts in the field. In particular, I have gained new ideas to start research projects in arithmetic dynamics which is a new area of research for me.

Did you find your experience at MSRI beneficial? Why or why not?

I find my experience at MSRI beneficial. The research environment at MSRI is vibrant and stimulating. Participating various research seminars and talking with experts in the field generated many new ideas for my own research.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

My fellowship helped me to advance my research career. Thanks to the fellowship, I had the opportunity to learn new mathematics which generates many interesting ideas for my research.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I like the hybrid format of the program. It provides flexibility of the location for the speaker and the audience. Moreover, the technology team at MSRI does an excellent job so that the quality of the livestream and the recording is great.

Hlushchanka, Mikhail

Name: Mikhail Hlushchanka
Year of Ph.D: 2017
Institution of Ph.D.: Jacobs University Bremen
Dissertation title: Invariant graphs, tilings, iterated monodromy groups
Ph.D. advisor: Dierk Schleicher, Daniel Meyer

Mentor while at MSRI: Dylan Thurston

Pre-MSRI Institution: Utrecht University
Position at that institution: Junior Assistant Professor
Mentor (if applicable): Iourii Kouznetsov, Gunther Cornelissen

Post-MSRI institution (or company): Utrecht University
Position: Junior Assistant Professor
Anticipated length (or specify if tenure-track): 1 year
Mentor (if applicable): Iourii Kouznetsov, Gunther Cornelissen

Summary of MSRI Experience

During the program, I have been actively involved in several ongoing and new collaborations (see the list below).

Theme A: Critically fixed (anti)rational maps
Project A.1 (joint with Nikolai Prochorov): The project was initiated in January 2021. We develop a combinatorial classification of all critically fixed Thurston maps, design an algorithm that recovers a canonical model for a given map, and provide an explicit solution to some instances of the twisting problem. During the program, we completed the project and are finishing the preprint. Nikolai also presented a poster about this work during the conference in May.

Project A.2 (joint with Yusheng Luo and Sabyasachi Mukherjee): The project was initiated in May 2022. We describe how different hyperbolic components of critically fixed rational maps interact with each other. We also characterize which critically fixed rational maps arise as mattings. This work extends the recent results of my collaborators in the antiholomorphic setup.

Project A.3 (joint with Lukas Geyer): The project was initiated in March 2022. We develop a combinatorial classification of all critically fixed anti-Thurston maps (similarly to the rational case). Lukas presented the current progress in this project at the COMD Research Seminar in May. We are also working on an algorithm that will recover a canonical model for a given map and on the global curve attractor problem in this setup.

The obtained classification/decomposition of anti-Thurston maps in Project A.3 should also correspond to a classification/decomposition of the relevant Kleinian reflection groups (in the spirit of Sullivan's dictionary). Jointly with Lukas Geyer, Russell Lodge, Yusheng Luo, and Sabyasachi Mukherjee, we plan to work this out after the program.

Theme B: Conformal dimension in complex dynamics
(Joint with Mario Bonk and Daniel Meyer) The project was started before the MSRI program. We study the conformal dimension of the visual spheres associated with expanding Thurston maps. For some special families, we calculate it explicitly. These preliminary results are being written now.

Theme C: Combinatorial models of rational maps
(Joint with Vladlen Timorin) The project was initiated in March 2022. We study a natural algorithm for constructing invariant trees for pcf rational maps using a pullback operation. Computer experiments suggest that this algorithm converges. Currently, we can provide a theoretical

explanation of this only for some special families of maps. In particular, in Project A.1, we prove that the algorithm indeed converges for the class of critically fixed rational maps.

Theme D: Thurston's theory for entire transcendental functions
(Joint with Kostya Drach, Dima Dudko, Bernhard Reinke, and Dylan Thurston) This ambitious project aims to extend Dylan Thurston's positive characterization of rational maps to the transcendental setting. The idea of this project originated before the MSRI program. Unfortunately, most of the colleagues were present in person only for a minimal period, so the current progress is relatively modest. Nevertheless, we plan to continue this collaboration after the program.

In addition, I had multiple stimulating discussions (e.g., with Laurent Bartholdi, André de Carvalho, Curtis McMullen, InSung Park, and Dylan Thurston) during the program that suggested exciting prospective projects (for instance, related to my recent joint work with Dima Dudko and Dierk Schleicher on the decomposition of pcf rational maps).

Did you find your experience at MSRI beneficial? Why or why not?

The program allowed me to have extensive in-person collaborations with international colleagues that will result in several papers. I also greatly benefitted from the Learning Seminars. In particular, after the "Polynomial Arithmetic Dynamics" seminar, I could see perspectives for collaboration with my Number Theory/Algebraic Geometry colleagues at my home institution (Utrecht University).

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Thanks to the fellowship, I have significantly broadened my research perspective and network. I also extensively advertised my past and current research work to colleagues (This is of particular importance, as due to Covid, there were only limited options for this in the last two years). In addition, my mentor, Dylan Thurston, has been advising me on grant and job applications. All these aspects will help me in the search for a future position.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

Undoubtedly, in-person participation in such a semester program is much more attractive and productive. Nonetheless, the hybrid aspects of the program worked out for me quite well. Due to Visa and Covid issues, my

arrival at the MSRI was delayed, and the hybrid format of the program allowed me to get involved from the beginning. I attended the Introductory Workshop of the AGRS, as well as a few seminar talks, online and was very happy with the quality of the virtual elements. I also started collaborations with several online participants (see Project A.2, Theme C, and Theme D), who approached me by email during the program. In addition, the possibility to join the talks online greatly extends the potential audience, which allows for broader advertisement of research work.

Pardo-Simón, Leticia

Name: Leticia Pardo-Simón
Year of Ph.D: 2019
Institution of Ph.D.: University of Liverpool (UK)
Dissertation title:
Ph.D. advisor: Lasse Rempe

Mentor while at MSRI: Nuria Fagella Rabionet

Pre-MSRI Institution: University of Manchester (UK)
Position at that institution: Postdoc
Mentor (if applicable):

Post-MSRI institution (or company): University of Manchester (UK)
Position: Postdoc
Anticipated length (or specify if tenure-track): 2.5 years
Mentor (if applicable):

Summary of MSRI Experience

- I have delivered three talks: in the connections workshop, in a thematic seminar and in the junior seminar.
- I have co-organized the 12May Women in Maths event.
- I co-delivered a minicourse in transcendental dynamics at The University of Hawaii at Manoa.
- I have started a project with Nuria Fagella, Vasiliki Evdoridou and Lukas Geyer on the Teichmuller space of wandering domains.
- I am currently preparing a manuscript with Adi Glucksam (AGRS programme) on the maximum modulus set of entire functions.
- I am discussing with Evdoridou and and Glucksam on problems concerning wandering domains.
- I have had mathematical discussions with other members and visitors, including Jack Burkart, Lukas Geyer, Lasse Rempe, David Marti-Pete, Kostya Drach and Jonguk Yang.

Did you find your experience at MSRI beneficial? Why or why not?

I have found my experience greatly beneficial. By delivering and attending talks, I have engaged in many inspiring discussions with members from both programmes. As a result, I have learned new techniques on the construction of entire functions using subharmonic functions, whose applications I am currently exploring with collaborators. I also believe that being exposed so intensively to so many topics has given me a broader vision and understanding of the field, that I sense will be useful in the coming years. The career development seminar series and junior seminars have also been very interesting and thought-provoking.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

The fellowship has widened my network and deepened my perspectives on my area of research, which I believe will play a crucial role to secure a permanent position when the time comes.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I attended most talks and events in person, but I also joined some virtually the week I was sick. I think it worked really well. It is very useful that IT support is always helping and zooming in the blackboards when needed. I didn't collaborate with virtual participants but I interacted with them when delivering talks and it worked fine. My colleagues in Europe appreciated the opportunity.

However, I must say that I did not engage as much when talks were delivered virtually and projected in the Simmons auditorium. For me, it makes a great difference when the speaker is in the same room.

Yang, Jonguk

Name: Jonguk Yang
Year of Ph.D: 2017
Institution of Ph.D.: University of Toronto
Dissertation title: Applications of Renormalization to Irrationally Indifferent Dynamics
Ph.D. advisor: Michael Yampolsky

Mentor while at MSRI: Liz Vivas

Pre-MSRI Institution: Stony Brook University
Position at that institution: Milnor Lecturer

Mentor (if applicable): Mikhail Lyubich

Post-MSRI institution (or company): University of Zurich
Position: Post-doc
Anticipated length (or specify if tenure-track): 2 years
Mentor (if applicable): Corinna Ulcigrai

Summary of MSRI Experience

1) I continued my collaboration with Sylvain Crovisier, Misha Lyubich and Enrique Pujals on a priori bounds for infinitely renormalizable Hénon maps. Since Misha was also a member of the semester program at MSRI, we had ample opportunities to meet and work in person. As a result, we were able to make significant progress on completing our manuscript.

2) I started a new collaboration with a fellow MSRI member André de Carvalho. After many extremely fruitful discussions, we believe we can prove the Pruning Front Conjecture (introduced by Cvitanovic in 1990) for the infinitely renormalizable Hénon maps with sufficiently small Jacobian. This amounts to an explicit description of the global topological structure of the dynamics of such maps, including generating a symbolic coding of all heteroclinic intersections and tangencies. This is an exciting breakthrough, since before speaking with André, I had believed that the dynamics of Hénon maps were too complicated to admit such an elegant description.

3) Inspired by the discussions I have had with Misha and André, I realized that, based on my work on a priori bounds for infinitely renormalizable Hénon maps, I can prove the no wandering domains theorem for such maps.

4) I continued my collaboration with Kostya Drach on rigidity of polynomial dynamics. Prior to starting my fellowship, I already had the rigidity result for polynomials featuring a Siegel disk of bounded type rotation number. However, the semester program gave me ample opportunities to discuss with my coauthor (who was able to visit MSRI as a participant in the program). As a result, we realized that the aforementioned result actually fits into a much larger framework pertaining to the dynamics of any general polynomial. This led to the formulation of a decomposition theorem for polynomial dynamics, which reduces the study of general polynomials to the special cases of infinitely renormalizable polynomials and polynomials with an irrationally indifferent fixed point of unbounded type rotation number.

Did you find your experience at MSRI beneficial? Why or why not?

My experience at MSRI exceeded my expectations. I cannot imagine an environment more conducive to research and collaboration. The facilities are perfect—especially the view from our windows. The program manager and staff at MSRI made sure that the participants could make the most out of the program.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

The fellowship absolutely will help me find future positions. I am very happy that I had this opportunity to get to know so many wonderful mathematicians (whom I barely interacted with before the fellowship). I also feel that the program allowed me to advertise my results to a much larger audience. Lastly, I was able to have countless casual but deeply meaningful discussions with other members of the program about our field of research, which was an invaluable learning experience for me that I feel will pay great dividends for my future projects.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

I participated both in person and online. I did not collaborate with any new virtual participants. It was definitely beneficial to have both virtual and in-person elements.

COMPLEMENTARY PROGRAM 2021-22

Briggs, Benjamin

Name: Benjamin Briggs
Year of Ph.D: 2018
Institution of Ph.D.: University of Toronto
Dissertation title: Local Commutative Algebra and Hochschild Cohomology Through the Lens of Koszul Duality
Ph.D. advisor: Ragnar-Olaf Buchweitz

Mentor while at MSRI: David Eisenbud

Pre-MSRI Institution: University of Utah
Position at that institution: Postdoc (Wylie assistant professor)
Mentor (if applicable): Srikanth Iyengar

Post-MSRI institution (or company): University of Copenhagen
Position: Postdoc (Marie Curie postdoctoral fellow)
Anticipated length (or specify if tenure-track): 2 years
Mentor (if applicable): Jesper Grodal and Nathalie Wahl

Summary of MSRI Experience

I was in a strange position this year being hosted by MSRI without any programs at all close to my research area. While this was sometimes an isolating experience, I also had an unprecedented amount of time for research, as well as intellectual freedom, and this let me deepen and broaden my expertise. I had semi-regular meetings with David Eisenbud where we discussed interesting problems connected with our research - we talked in especially great detail about the homotopy Lie algebra, an object that has been important in my previous work. By luck another researcher in my area, Özgür Esentepe, was based at MSRI during the spring semester as a complementary member - we were able to meet regularly and start a project on non-commutative hypersurface rings. Over the year I took research visits to the University of Utah, Auburn University, and the University of Nebraska, I gave several seminar talks at MSRI, and (either remotely or in person) at other institutions. The freedom to divide my time as I saw fit meant that I could spend a large amount of the spring semester constructing an application for the Marie Skłodowska-Curie Postdoctoral Fellowship. Aside from all this, my (academic) year really consisted mostly of innumerable zoom meetings with new and old collaborators, making steady progress on new and old projects, with a good number of finished and unfinished papers to show for it.

Did you find your experience at MSRI beneficial? Why or why not?

I am definitely in a better position mathematically than I was a year ago. I already mentioned the intellectual freedom that came with this position - I was able to branch out and (for instance) write a paper on topology (with the help of a topologist, Steven Amelotte), which was previously very far from my area of expertise. As another example, I spent the year working (gradually) on a book project with Luchezar Avramov and Srikanth Iyengar.

Do you feel your fellowship has helped (or will help) you with finding a future position? If so, in what way?

Absolutely yes. I was fortunate to have a subsequent postdoctoral position already lined up when I arrived at MSRI, but I feel more confident now about finding a permanent position when that time comes. While at MSRI I applied for and obtained a Marie Skłodowska-Curie Postdoctoral Fellowship, and this will make a significant difference to my time in Copenhagen, and to my cv. I was also lucky enough to have some of my papers accepted into very good journals while at MSRI, which will also probably make a difference in the long run.

Please comment on your experience with the hybrid format of the program. Was it beneficial to have both virtual and in-person elements? Are there ways the experience could be improved?

Since I wasn't involved in the programs I don't think this applies to me so much. I've attended countless zoom talks this year, but none based at MSRI. David Eisenbud held his seminars at the outside black board, and aside from occasionally being cold it was a really nice environment for talks and discussions.

3.2 Postdoctoral Fellow Placement List (29)

Family Name	First Name	Pre-MSRI Institution	Pre-MSRI AMS Group	Post-MSRI Institution	Post-MSRI AMS Group
Bailey	Emma	U. of Bristol	Foreign	CUNY	Public Large
Briggs	Benjamin	U. of Utah	Public Medium	U. of Copenhagen	Foreign
Burkart	Jack	U. of Wisconsin Madison	Public Large	U. of Wisconsin Madison	Public Large
Desiraju	Harini	U. of Birmingham	Foreign	U. of Sydney	Foreign
Evdoridou	Vasiliki	The Open U.	Foreign	The Open U.	Foreign
Franceschini	Chiara	IST - Lisbon	Foreign	U. di Modena e Reggio Emilia	Foreign
Gharakhloo	Roozbeh	Colorado State U.	Public Medium	Colorado State U.	Public Medium
Glucksam	Adi	Northwestern U.	Private Large	Northwestern U.	Private Large
He	Yan Mary	U. of Oklahoma	Public Small	U. of Oklahoma	Public Small
Hegde	Milind	UC Berkeley	Public Large	Columbia U.	Private Large
Hlushchanka	Mikhail	Utrecht U.	Foreign	Utrecht U.	Foreign
Husson	Jonathan	ENS de Lyon	Foreign	U. of Michigan	Public Large
Iseli	Annina	UC Los Angeles	Public Large	U. of Fribourg, Switzerland	Foreign
Jego	Antoine	U. of Vienna	Foreign	EPFL	Foreign
Junnila	Janne	EPFL	Foreign	U. of Helsinki	Foreign
Krajenbrink	Alexandre	SISSA	Foreign	SISSA	Foreign
Landry	Therese	UC Riverside	Public Small	UC Santa Barbara	Public Large
Lin	Yier	Columbia U.	Private Large	U. of Chicago	Private Large
Lin	Peter	Stony Brook U.	Public Large	Stony Brook U.	Public Large
McKenna	Benjamin	Courant Institute, NYU	Private Large	IST Austria; Harvard U.	Foreign; Private Large
Noack	Christian	Cornell U.	Private Large	Purdue U.	Public Large
Occelli	Alessandra	IST - Lisbon	Foreign	IST - Lisbon	Foreign
Oregero	Jeffrey	U. at Buffalo, SUNY	Public Medium	U. of Central Florida	Public Small
Pardo Simon	Leticia	U. of Manchester (UK)	Foreign	U. of Manchester (UK)	Foreign
Piorkowski	Mateusz	U. of Vienna	Foreign	Erwin Schrödinger Inst.	Foreign
Richards	Larissa	Lancaster U.	Foreign	U. of Leeds	Foreign
Wang	Yilin	MIT	Private Large	IHES	Foreign
Yang	Jonguk	Stony Brook U.	Public Large	U. of Zurich	Foreign
Zhu	Yizhe	UC San Diego	Public Large	UC Irvine	Public Medium

Highlights

US Institutions are classified by the AMS into categories based on the size of their doctoral program and based on their Public or Private status.

A majority of the MSRI postdocs came from Foreign and Public Large institutions. Of the 10 postdocs coming from Foreign institutions, 8 returned to a Foreign institution, and the other two went to Public Large institutions.

Of the 6 postdocs coming from Public Large institutions, 2 returned to Public Large institutions, 2 went to Foreign institutions, one went to a Private Large institution, and the last went to a Public Medium institution.

Of the 5 postdocs who came from Private Large institutions, 3 went back to a Private Large institution (including one postdoc who will also hold a Foreign position), one postdoc went to a Public Large institution, and one additional postdoc went to a Foreign institution.

Three postdocs came from Public Medium institutions, of whom one returned to a Public Medium institution, one went to a Public Small institution, and one went to a Foreign institution.

Two postdocs came from Public Small institutions, of whom one returned to a Public Small institution and one went to a Public Large institution.

3.3 Postdoctoral Fellow Participant Summary

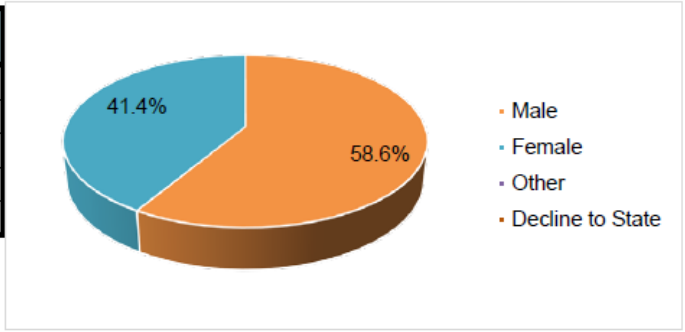
Programs	Distinct Postdocs	Women	%	Minorities*	%	US Home Institution	%	US Citizens & Perm. Res.
Universality and Integrability in Random Matrix Theory and Interacting Particle Systems	14	4	28.6%	1	25.0%	9	64.3%	4
Complex Dynamics: from special families to natural generalizations in one and several variables	6	3	50.0%	0	0.0%	3	50.0%	1
The Analysis and Geometry of Random Spaces	8	5	62.5%	1	100.0%	6	75.0%	1
Complementary Program 2021-22	1	0	0.0%	0	0.0%	1	100.0%	0
Total # of Distinct Postdocs	**29**	**12**	**41.4%**	**2**	**33.3%**	**19**	**65.5%**	**6**

** Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.*

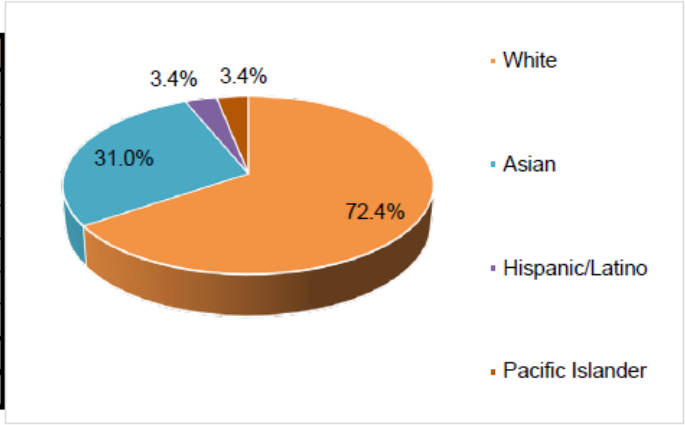
3.4 Postdoctoral Fellow Demographic Data

2021–22 Postdoctoral Fellows Demographic Summary

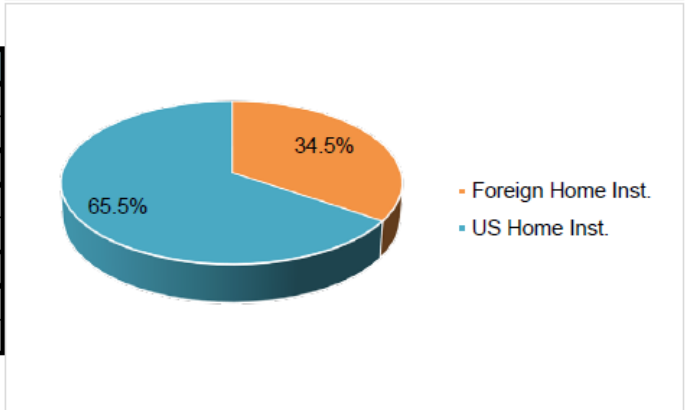
Gender	#	%
# of Distinct Members	29	100.0%
Male	17	58.6%
Female	12	41.4%
Other	0	0.0%
Decline to State	0	0.0%



Race/Ethnicity*	#	%
White	21	72.4%
Asian	9	31.0%
Hispanic/Latino	1	3.4%
Black	0	0.0%
Native American	0	0.0%
Pacific Islander	1	3.4%
Decline to State	0	0.0%
Unavailable Info.	0	0.0%
Minorities**	2	33.3%



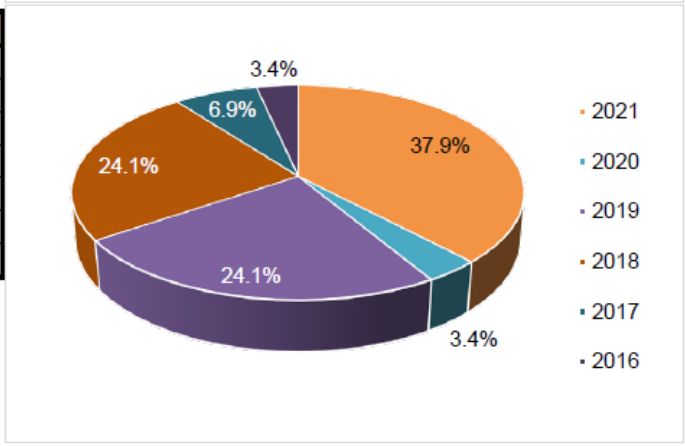
Citizenships	#	%
Foreign Home Inst.	10	34.5%
US Home Inst.	19	65.5%
Foreign Citizens	23	79.3%
US Citizens & Perm. Res.	6	20.7%
US Citizens	6	20.7%
US Permanent Residents	0	0.0%



Year of Ph.D	#	%
2021	11	37.9%
2020	1	3.4%
2019	7	24.1%
2018	7	24.1%
2017	2	6.9%
2016	1	3.4%
Total # of Distinct Members	29	100.0%

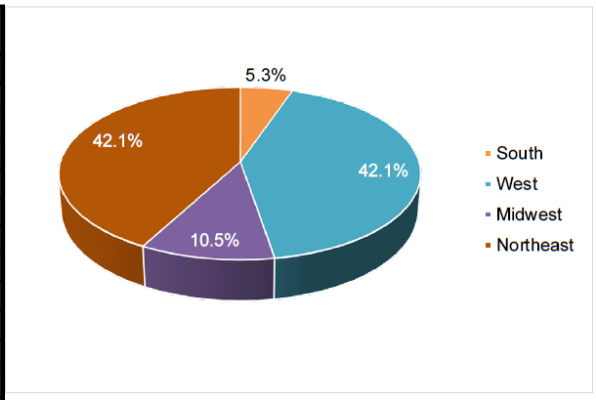
**Race/ethnicity selections are non-exclusive.*

***Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.*



2021–22 Postdoctoral Fellows Classified by State

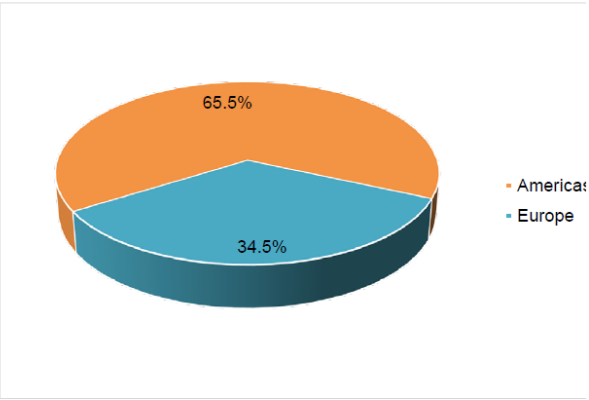
State	#	%	*2020 Census*
South	**1**	**5.3%**	*38.1%*
AL	0	0.0%	*1.5%*
AR	0	0.0%	*0.9%*
DE	0	0.0%	*0.3%*
DC	0	0.0%	*0.2%*
FL	0	0.0%	*6.5%*
GA	0	0.0%	*3.2%*
KY	0	0.0%	*1.4%*
LA	0	0.0%	*1.4%*
MD	0	0.0%	*1.9%*
MS	0	0.0%	*0.9%*
NC	0	0.0%	*3.1%*
OK	1	5.3%	*1.2%*
SC	0	0.0%	*1.5%*
TN	0	0.0%	*2.1%*
TX	0	0.0%	*8.8%*
VA	0	0.0%	*2.6%*
WV	0	0.0%	*0.5%*
West	**8**	**42.1%**	*23.7%*
AK	0	0.0%	*0.2%*
AZ	0	0.0%	*2.2%*
CA	6	31.6%	*11.9%*
CO	1	5.3%	*1.7%*
HI	0	0.0%	*0.4%*
ID	0	0.0%	*0.6%*
MT	0	0.0%	*0.3%*
NM	0	0.0%	*0.6%*
NV	0	0.0%	*0.9%*
OR	0	0.0%	*1.3%*
UT	1	5.3%	*1.0%*
WA	0	0.0%	*2.3%*
WY	0	0.0%	*0.2%*
Midwest	**2**	**10.5%**	*20.8%*
IA	0	0.0%	*1.0%*
IL	1	5.3%	*3.9%*
IN	0	0.0%	*2.0%*
KS	0	0.0%	*0.9%*
MI	0	0.0%	*3.0%*
MN	0	0.0%	*1.7%*
MO	0	0.0%	*1.9%*
ND	0	0.0%	*0.2%*
NE	0	0.0%	*0.6%*
OH	0	0.0%	*3.6%*
SD	0	0.0%	*0.3%*
WI	1	5.3%	*1.8%*
Northeast	**8**	**42.1%**	*17.4%*
CT	0	0.0%	*1.1%*
MA	1	5.3%	*2.1%*
ME	0	0.0%	*0.4%*
NH	0	0.0%	*0.4%*
NJ	0	0.0%	*2.8%*
NY	7	36.8%	*6.1%*
PA	0	0.0%	*3.9%*
RI	0	0.0%	*0.3%*
VT	0	0.0%	*0.2%*
Other	**0**	**0.0%**	*0.0%*
PR	0	0.0%	*0.0%*
Other	0	0.0%	*0.0%*
Total	19	100.0%	*100.0%*



**Regions based on US Census classification*

2021–22 Postdoctoral Fellows Classified by Country

Africa			**0**
Americas			**19**
	North America	United States	19
Asia			**0**
Europe			**10**
	Northern Europe	United Kingdom	3
	Southern Europe	Portugal	2
		Italy	1
	Western Europe	Austria	1
		France	1
		Switzerland	1
		Netherlands	1
Oceania			**0**
Grand Total			**29**



**Regions based on United Nations classification*

3.5 Postdoctoral Research Member Summary

Postdoctoral Research Members (PD/RMs) are individuals who qualify at the Postdoctoral Fellows level, but were invited as Research Members. This usually happens when they are ineligible for the postdoctoral fellowship for some reason, for example, they are unable to attend the full length of the program. In 2021-22, there were seven PD/RM at MSRI.

Programs	Distinct PDRMs	Women	%	Minorities*	%	US Home Institution	%	US Citizens & Perm. Res.
Universality and Integrability in Random Matrix Theory and Interacting Particle Systems	2	0	0.0%	0	*0.0%*	2	0.0%	1
Complex Dynamics: from special families to natural generalizations in one and several variables	3	0	0.0%	0	*0.0%*	1	33.3%	1
The Analysis and Geometry of Random Spaces	1	0	0.0%	0	*0.0%*	0	0.0%	1
Complementary Program 2021-22	1	0	0.0%	1	*0.0%*	1	0.0%	1
Total # of Distinct PDRMs	**7**	**0**	***0.0%***	**1**	***25.0%***	**4**	***57.1%***	**4**

** Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.*

4. Graduate Program

In 2021-22, 879 graduate students participated in MSRI's activities, including workshops (586 graduate students), summer graduate schools (262 graduate students), and programs (31 graduate students). While most graduate students were participants in our workshops or summer graduate schools, a smaller number were invited as 'Program Associates' in our semester-long programs.

4.1 Summer Graduate School (SGS)

Attending one of these summer schools can be a very motivating and exciting experience for a student; participants have often said that it was the first experience where they felt like real mathematicians, interacting with other students and mathematicians in their field. While MSRI had originally planned 12 SGS for 2021, in the end we hosted 7 summer graduate schools, all of which were held virtually to mitigate COVID-19 risks. Three of the summer schools were jointly organized with other institutions, including one school that was re-scheduled from summer 2020:

- *Foundations and Frontiers of Probabilistic Proofs (originally scheduled for summer 2020)* was held in cooperation with Zurich Information Security and Privacy Center at ETH Zurich (ZISC).
- *Séminaire de Mathématiques Supérieures 2021: Microlocal Analysis: Theory and Applications* and
- *2021 CRM-PIMS Summer School in Probability* were held in cooperation with the Centre de Recherches Mathématicques (Montréal, Canada).

Graduate students from one of MSRI's Academic Sponsor Institutions or from Departments of Mathematics at U.S. universities are eligible to attend the summer schools. For each institution, MSRI provides support for up to two students per summer and, under our "2+1+1" policy, MSRI will support a third and fourth student if one of the students is female and another is from a group that is underrepresented in the mathematical sciences. MSRI covers travel expenses up to $600 for students from U.S. and Canadian universities (depending on the point of origin), and $700 for students from other sponsoring institutions, as well as room and board and local expenses.

The summer graduate schools and the open enrollment period for the summer of year n+1 are announced in August of year n. Graduate students must be nominated by their Director of Graduate Studies during the enrollment period. MSRI accepts nominees on a first-come first-served basis up to the limits of the capacity of each school, which is around 40-50 for schools hosted by MSRI. If the chosen school is already full, the students are either kept on a waiting list or the nominating institution may make nominations to other schools until their quota is reached.

Below, we list the 7 Summer Graduate Schools that took place during the summer of 2021. Altogether 45 organizers, lecturers and TAs, and 262 graduate students participated in these schools. Women comprised 26% of the students and of the 116 students who were U.S. citizens or Permanent Residents, 27 (23%) were from historically underrepresented groups including (non-exclusively) 7 (6%) who identified themselves as Black, 21 (18%) as Hispanic/Latinx, and 2 (2%)

as Native American. See the table in section 4.2 for detailed demographic data. For a complete report on each SGS, please refer to the Appendix (Section 13).

SGS 1: Séminaire de Mathématiques Supérieures 2021: Microlocal Analysis: Theory and Applications
May 03, 2021 – August 13, 2021
Location: Virtual
Organizers: Suresh Eswarathasan (Dalhousie University), Dmitry Jakobson (McGill University), Katya Krupchyk (UC, Irvine), Stephane Nonnenmacher (Université de Paris XI)

SGS 2: 2021 CRM-PIMS Summer School in Probability
May 24, 2021 - June 18, 2021
Location: Virtual
*Organizers: **Louigi Addario-Berry** (McGill University), Omer Angel (University of British Columbia), Alexander Fribergh (University of Montreal), Mathav Murugan (University of British Columbia), Edwin Perkins (University of British Columbia)*

SGS 3: Sparsity of Algebraic Points
June 7, 2021 - June 18, 2021
Location: Virtual
*Organizers: Philipp Habegger (University of Basel), **Hector Pasten** (Pontificia Universidad Católica de Chile)*

SGS 4: Mathematics of Big Data: Sketching and (Multi-) Linear Algebra
June 21, 2021 - July 2, 2021
Location: Virtual
*Organizers: **Kenneth Clarkson** (IBM Research Division), Lior Horesh (IBM Thomas J. Watson Research Center), Misha Kilmer (Tufts University), Tamara Kolda (Sandia National Laboratories; MathSci.ai), Shashanka Ubaru (IBM Thomas J. Watson Research Center)*

SGS 5: Gauge Theory in Geometry and Topology
July 5, 2021 - July 16, 2021
Location: Virtual
*Organizers: Lynn Heller (Universität Hannover), Francesco Lin (Columbia University), **Laura Starkston** (UC, Davis), Boyu Zhang (University of Maryland)*

SGS 6: Random Conformal Geometry
July 19, 2021 - July 30, 2021
Location: Virtual
*Organizers: Mario Bonk (UC, Los Angeles), Steffen Rohde (University of Washington), **Fredrik Viklund** (Royal Institute of Technology)*

SGS 7: Foundations and Frontiers of Probabilistic Proofs
July 26, 2021 - August 06, 2021
Location: Virtual
Organizers: Alessandro Chiesa (UC, Berkeley), Tom Gur (University of Warwick)

4.2 Summer Graduate Schools 2021 Participant Summary

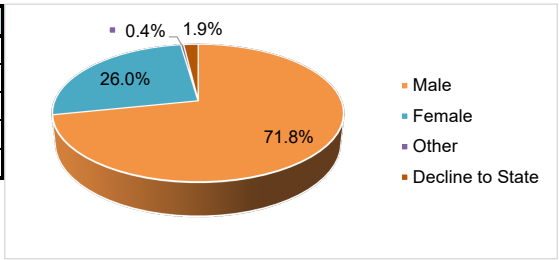
Virtual Summer Graduate Schools	# of Students	Women	%	Minorities*	%	US Home Institution	%	US Citizens & Perm. Res.
2021 CRM-PIMS Summer School in Probability‡	30	5	16.7%	3	*25.0%*	26	86.7%	12
Foundations and Frontiers of Probabilistic Proofs‡	15	9	60.0%	3	*37.5%*	14	93.3%	8
Gauge Theory in Geometry and Topology	57	5	8.8%	5	*20.0%*	47	82.5%	25
Mathematics of Big Data: Sketching and (Multi-) Linear Algebra	57	22	38.6%	12	*41.4%*	51	89.5%	29
Random Conformal Geometry	28	5	17.9%	0	*0.0%*	21	75.0%	8
Séminaire de Mathématiques Supérieures 2021: Microlocal Analysis: Theory and Applications‡	27	8	29.6%	2	*14.3%*	24	88.9%	14
Sparsity of Algebraic Points	48	14	29.2%	2	*10.0%*	42	87.5%	20
Total # of Students	**262**	**68**	***26.0%***	**27**	***23.3%***	**225**	***85.9%***	**116**

** Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the total number of US citizens & Permanent Residents.*

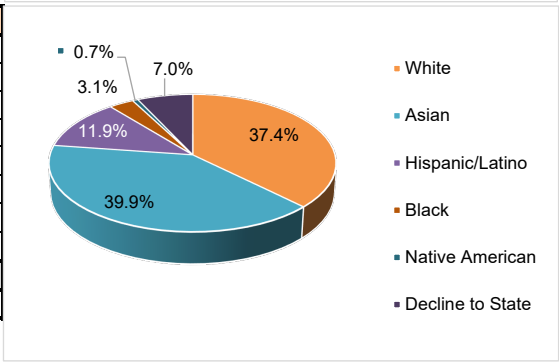
‡ The number of students listed were those sponsored by MSRI. Joint summer schools had at least as many other participants sponsored by the host institution.

2021 Summer Graduate Schools Demographic Summary

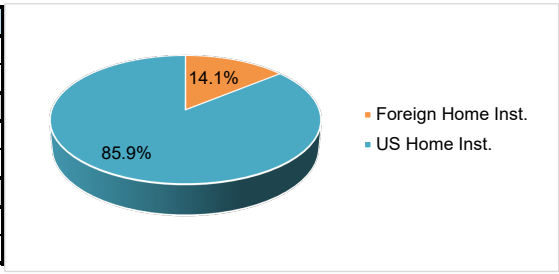
Gender	#	%
# of Students	262	100.0%
Male	188	71.8%
Female	68	26.0%
Other	1	0.4%
Decline to State	5	1.9%



Race/Ethnicity*	#	%
White	107	37.4%
Asian	114	39.9%
Hispanic/Latino	34	11.9%
Black	9	3.1%
Native American	2	0.7%
Pacific Islander	0	0.0%
Decline to State	20	7.0%
Unavailable Info.	0	0.0%
Minorities**	27	23.3%



Citizenships	#	%
Foreign Home Inst.	37	14.1%
US Home Inst.	225	85.9%
US Citizens & Perm. Res.	116	44.3%
Foreign Citizens	146	55.7%
US Citizens	115	99.1%
US Permanent Residents	1	0.9%

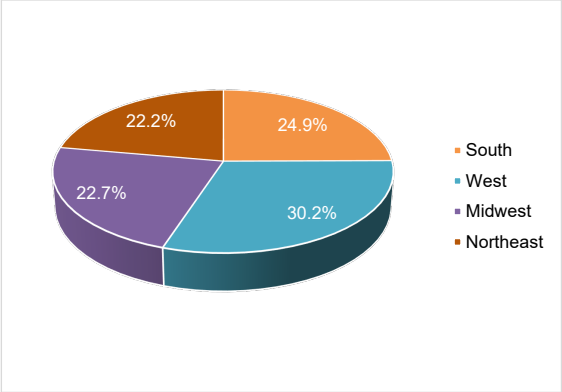


**Race/ethnicity selections are non-exclusive.*

***Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.*

2021 Summer Graduate School Students Classified by States

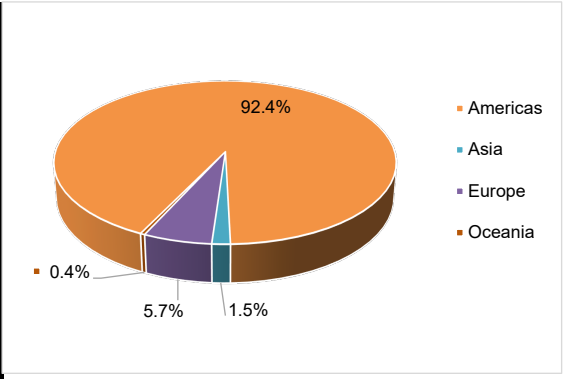
State	#	%	*2020 Census*
South	**56**	**24.9%**	***38.1%***
AL	2	0.9%	*1.5%*
AR	1	0.4%	*0.9%*
DE	1	0.4%	*0.3%*
DC	0	0.0%	*0.2%*
FL	4	1.8%	*6.5%*
GA	7	3.1%	*3.2%*
KY	1	0.4%	*1.4%*
LA	6	2.7%	*1.4%*
MD	4	1.8%	*1.9%*
MS	1	0.4%	*0.9%*
NC	8	3.6%	*3.1%*
OK	4	1.8%	*1.2%*
SC	0	0.0%	*1.5%*
TN	3	1.3%	*2.1%*
TX	10	4.4%	*8.8%*
VA	4	1.8%	*2.6%*
WV	0	0.0%	*0.5%*
West	**68**	**30.2%**	***23.7%***
AK	0	0.0%	*0.2%*
AZ	5	2.2%	*2.2%*
CA	42	18.7%	*11.9%*
CO	6	2.7%	*1.7%*
HI	0	0.0%	*0.4%*
ID	0	0.0%	*0.6%*
MT	0	0.0%	*0.3%*
NM	1	0.4%	*0.6%*
NV	0	0.0%	*0.9%*
OR	7	3.1%	*1.3%*
UT	2	0.9%	*1.0%*
WA	5	2.2%	*2.3%*
WY	0	0.0%	*0.2%*
Midwest	**51**	**22.7%**	***20.8%***
IA	4	1.8%	*1.0%*
IL	15	6.7%	*3.9%*
IN	8	3.6%	*2.0%*
KS	3	1.3%	*0.9%*
MI	5	2.2%	*3.0%*
MN	1	0.4%	*1.7%*
MO	3	1.3%	*1.9%*
ND	3	1.3%	*0.2%*
NE	2	0.9%	*0.6%*
OH	2	0.9%	*3.6%*
SD	0	0.0%	*0.3%*
WI	5	2.2%	*1.8%*
Northeast	**50**	**22.2%**	***17.4%***
CT	3	1.3%	*1.1%*
MA	16	7.1%	*2.1%*
ME	0	0.0%	*0.4%*
NH	1	0.4%	*0.4%*
NJ	7	3.1%	*2.8%*
NY	12	5.3%	*6.1%*
PA	9	4.0%	*3.9%*
RI	0	0.0%	*0.3%*
VT	2	0.9%	*0.2%*
Other	**0**	**0.0%**	***0.0%***
PR	0	0.0%	*0.0%*
Other	0	0.0%	*0.0%*
Total	**225**	**100.0%**	***100.0%***



**Regions based on US Census classification*

2021 Summer Graduate School Students Classified by Countries

Africa			**0**
Americas			**242**
	Central America	Mexico	3
	North America	Canada	14
		United States	225
Asia			**4**
	Eastern Asia	China	1
		Taiwan	3
Europe			**15**
	Southern Europe	Italy	4
		Spain	2
	Western Europe	Austria	1
		Germany	4
		Switzerland	3
	Northern Europe	Sweden	1
Oceania			**1**
	Australia & New Zealand	Australia	1
Grand Total			**262**



**Regions based on United Nations classification*

4.3 Program Associates

Program Associates (graduate students participating in the programs) benefit greatly from the opportunity to interact with leaders of a field and postdoctoral fellows, gaining intense exposure to current ideas and trends in their area of specialization. They were closely supervised and benefited from all member privileges, including shared office space. Each Program Associate was provided with an access card to the building, which allows them to use the premises at any time, as well as bus, library and sports facilities access passes. There were 31 graduate students who were in residence at MSRI as Program Associates during the academic year 2021–22.

Program Associates do not typically receive funding as they are often able to receive support through their advisors or home institutions but, thanks to private funding, MSRI has recently introduced "named" Program Associate Fellowships that include funding of $12,000 for the duration of the program. Eight such Program Associate Fellows were supported during the 2021-22 academic year.

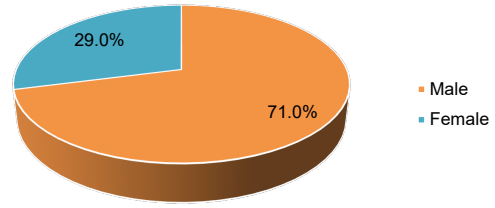
4.4 Program Associate Data

Programs	Distinct Prog. Assoc.	Women	%	Minorities*	%	US Home Institution	%	US Citizens & Perm. Res.
Universality and Integrability in Random Matrix Theory and Interacting Particle Systems	10	3	30.0%	0	0.0%	6	60.0%	4
The Analysis and Geometry of Random Spaces	13	3	23.1%	0	0.0%	6	46.2%	3
Complex Dynamics: from special families to natural generalizations in one and several variables	8	3	37.5%	1	25.0%	5	62.5%	4
Complementary Program 2021-22	0	0	0.0%	0	0.0%	0	0.0%	0
Total # of Distinct PAs	**31**	**9**	***29.0%***	**1**	***9.1%***	**17**	***54.8%***	***11***

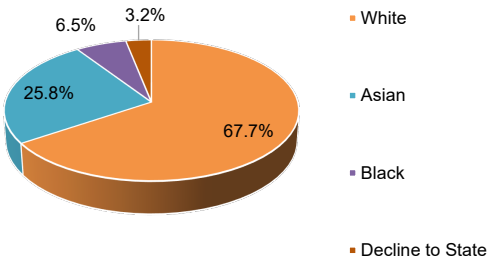
** Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.*

2021-22 Program Associate Demographic Summary

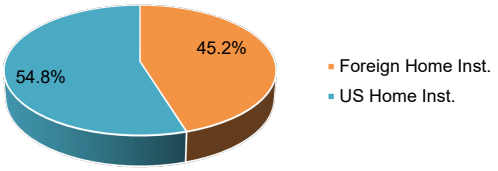
Gender	#	%
# of Distinct Members	31	100.0%
Male	22	71.0%
Female	9	29.0%
Decline to State	0	0.0%



*Race/Ethnicity**	#	%
White	21	67.7%
Asian	8	25.8%
Hispanic/Latino	0	0.0%
Black	2	6.5%
Native American	0	0.0%
Pacific Islander	0	0.0%
Decline to State	1	3.2%
Unavailable Info.	0	0.0%
Minorities**	1	9.1%



Citizenships	#	%
Foreign Home Inst.	14	45.2%
US Home Inst.	17	54.8%
Foreign Citizens	20	64.5%
US Citizens & Perm. Res.	11	35.5%
US Citizens	11	35.5%
US Permanent Residents	0	0.0%

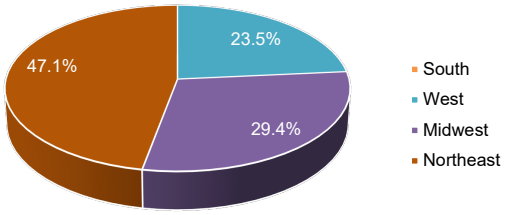


**Race/ethnicity selections are non-exclusive.*

***Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.*

2021-22 Program Associates Classified by State

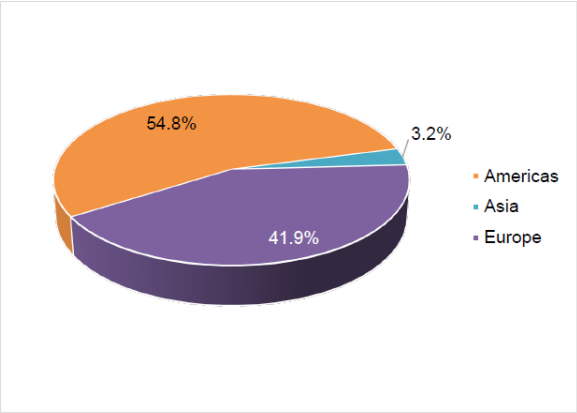
State	#	%	*2020 Census*
South	**0**	**0.0%**	***38.1%***
AL	0	0.0%	*1.5%*
AR	0	0.0%	*0.9%*
DE	0	0.0%	*0.3%*
DC	0	0.0%	*0.2%*
FL	0	0.0%	*6.5%*
GA	0	0.0%	*3.2%*
KY	0	0.0%	*1.4%*
LA	0	0.0%	*1.4%*
MD	0	0.0%	*1.9%*
MS	0	0.0%	*0.9%*
NC	0	0.0%	*3.1%*
OK	0	0.0%	*1.2%*
SC	0	0.0%	*1.5%*
TN	0	0.0%	*2.1%*
TX	0	0.0%	*8.8%*
VA	0	0.0%	*2.6%*
WV	0	0.0%	*0.5%*
West	**4**	**23.5%**	***23.7%***
AK	0	0.0%	*0.2%*
AZ	0	0.0%	*2.2%*
CA	2	11.8%	*11.9%*
CO	0	0.0%	*1.7%*
HI	0	0.0%	*0.4%*
ID	0	0.0%	*0.6%*
MT	1	5.9%	*0.3%*
NM	0	0.0%	*0.6%*
NV	0	0.0%	*0.9%*
OR	0	0.0%	*1.3%*
UT	0	0.0%	*1.0%*
WA	1	5.9%	*2.3%*
WY	0	0.0%	*0.2%*
Midwest	**5**	**29.4%**	***20.8%***
IA	0	0.0%	*1.0%*
IL	0	0.0%	*3.9%*
IN	1	5.9%	*2.0%*
KS	0	0.0%	*0.9%*
MI	3	17.6%	*3.0%*
MN	0	0.0%	*1.7%*
MO	0	0.0%	*1.9%*
ND	0	0.0%	*0.2%*
NE	0	0.0%	*0.6%*
OH	1	5.9%	*3.6%*
SD	0	0.0%	*0.3%*
WI	0	0.0%	*1.8%*
Northeast	**8**	**47.1%**	***17.4%***
CT	2	11.8%	*1.1%*
MA	1	5.9%	*2.1%*
ME	0	0.0%	*0.4%*
NH	0	0.0%	*0.4%*
NJ	0	0.0%	*2.8%*
NY	5	29.4%	*6.1%*
PA	0	0.0%	*3.9%*
RI	0	0.0%	*0.3%*
VT	0	0.0%	*0.2%*
Other	**0**	**0.0%**	***0.0%***
PR	0	0.0%	*0.0%*
Other	0	0.0%	*0.0%*
Total	**17**	**100.0%**	***100.0%***



**Regions based on US Census classification*

2021-22 Program Associates Classified by Country

Africa			**0**
Americas			**17**
	North America	United States	17
Asia			**1**
	Western Asia	Israel	1
Europe			**13**
	Northern Europe	Finland	1
		Sweden	2
		United Kingdom	2
	Southern Europe	Italy	2
	Western Europe	Austria	2
		France	3
		Germany	1
Oceania			**0**
Grand Total			**31**



**Regions based on United Nations classification*

4.5 Graduate Student List

(Participants who attended 2021-22 workshops, excluding Summer Graduate Schools)
(See e-mail attachment)

4.6 Graduate Student Data*

(Participants who attended 2021-22 workshops, excluding Summer Graduate Schools)

Scientific Workshops	Total Participants	US Citizens & Perm. Res.	%	Women	%	Minorities†	%	US Home Inst.	%
8 Hybrid Workshops									
Connections & Introductory Workshop: Universality and Integrability in Random Matrix Theory and Interacting Particle Systems, Part 1	42	16	*38.1%*	10	*23.8%*	1	*6.3%*	34	81.0%
Connections & Introductory Workshop: Universality and Integrability in Random Matrix Theory and Interacting Particle Systems, Part 2	34	14	*41.2%*	8	*23.5%*	1	*7.1%*	29	85.3%
Connections Workshop: Complex Dynamics - from special families to natural generalizations in one and several variables	35	7	*20.0%*	14	*40.0%*	2	*28.6%*	18	51.4%
Connections Workshop: The Analysis and Geometry of Random Spaces	31	6	*19.4%*	8	*25.8%*	2	*33.3%*	17	54.8%
Integrable Structures in Random Matrix Theory and Beyond	27	10	*37.0%*	9	*33.3%*	0	*0.0%*	23	85.2%
Introductory Workshop: Complex Dynamics - from special families to natural generalizations in one and several variables	31	7	*22.6%*	13	*41.9%*	2	*28.6%*	16	51.6%
Introductory Workshop: The Analysis and Geometry of Random Spaces	32	9	*28.1%*	8	*25.0%*	2	*22.2%*	17	53.1%
Adventurous Berkeley Complex Dynamics	34	8	*23.5%*	14	*41.2%*	3	*37.5%*	14	41.2%
The Analysis and Geometry of Random Spaces	32	6	*18.8%*	10	*31.3%*	2	*33.3%*	13	40.6%
1 In Person Workshop									
Chern-Simons and Other Topological Field Theories	17	9	*52.9%*	1	*5.9%*	1	*11.1%*	17	100.0%
3 Virtual Workshops									
Workshop on Mathematics and Racial Justice	24	20	*83.3%*	12	*50.0%*	7	*35.0%*	22	91.7%
Hot Topics: Foundations of Stable, Generalizable and Transferable Statistical Learning	53	8	*15.1%*	21	*39.6%*	1	*12.5%*	40	75.5%
Hot Topics: Regularity Theory for Minimal Surfaces and Mean Curvature Flow	40	5	*12.5%*	6	*15.0%*	2	*40.0%*	26	65.0%
All 12 Workshops Total	**432**	**125**	***28.9%***	**134**	***31.0%***	**26**	***20.8%***	**286**	***66.2%***

Education & Outreach Workshops	Total Participants	US Citizens & Perm. Res.	%	Women	%	Minorities*	%	US Home Inst.	%
3 Hybrid Workshops									
Critical Issues in Mathematics Education 2022: Initiating, Sustaining, and Researching Mathematics Department Transformation of Introductory Courses for STEM Majors	32	22	*68.8%*	19	*59.4%*	9	*40.9%*	29	90.6%
May 12, a Celebration for Women in Mathematics, year 2022	83	40	*48.2%*	71	*85.5%*	5	*12.5%*	65	78.3%
Blackwell Tapia Conference 2021	39	29	*74.4%*	21	*53.8%*	14	*48.3%*	39	100.0%
All 3 Workshops Total	**154**	**91**	***59.1%***	**111**	***72.1%***	**28**	***30.8%***	**133**	**86.4%**

All 15 Workshops Total	**586**	**216**	***36.9%***	**245**	***41.8%***	**54**	***25.0%***	**419**	***71.5%***

† Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Perm. Residents.

*Note that the overall graduate student data in section 4.6 is not distinct as some participants attended multiple workshops, but the statistics of individual workshop found in Section 13, Appendix, were calculated on distinct participant data.

5. Undergraduate Program

5.1 Description of Undergraduate Program

The MSRI Undergraduate Program (MSRI-UP) is a comprehensive summer program designed for undergraduate students who have completed two years of university-level mathematics courses and would like to conduct research in the mathematical sciences. The main objective of MSRI-UP is to identify talented students, especially those from underrepresented groups, who are interested in mathematics and make available to them meaningful research opportunities, the necessary skills and knowledge to participate in successful collaborations, and a community of academic peers and mentors who can advise, encourage, and support them through a successful graduate program.

This objective is designed to contribute significantly toward increasing the number of graduate degrees in the mathematical sciences, especially doctorates, earned by U.S. citizens and permanent residents by cultivating heretofore untapped mathematical talent within the U.S. Black, Hispanic/Latino, and Native American communities.

MSRI-UP 2021 was held virtually due to the COVID-19 pandemic. See the separately submitted report of grant DMS-1659138 for more details. During the summer, each of the 18 student participants:

- participated in the mathematics research program under the direction faculty and graduate students mentors
- completed a research project done in collaboration with other MSRI-UP students
- gave a presentation and write a technical report on his/her research project
- attended a series of colloquium talks given by leading researches in their fields
- attended workshops aimed at developing skills and techniques needed for research careers in the mathematical sciences, and
- learned techniques that will maximize a student's likelihood of admissions to graduate programs as well as the likelihood of winning fellowships

After the summer, each student:

- had an opportunity to attend a national mathematics or science conference where students were able to present their research
- becomes part of a network of mentors that will provide continuous advice in the long term as the student makes progress in his/her studies
- will be contacted regarding future research opportunities

MSRI-UP 2021 – Parking Functions: Choose Your Own Adventure
June 12, 2021 to July 24, 2021

The theme of the 2021 MSRI-UP was “Parking Functions: Choose Your Own Adventure" and the research leader was Dr. Pamela Harris, Associate Professor of Mathematics at Smith College.

Parking functions are combinatorial objects defined as follows: Let $\mathbb{N} := \{1, 2, 3, \ldots\}$ and for $n \in \mathbb{N}$ define $[n] := \{1, 2, 3, \ldots, n\}$. Consider n parking spaces numbered linearly from 1 to n on a one-way street. Suppose there are n cars, denoted $c_1, c_2, \ldots, c_n$, with parking preferences $p_1, p_2, \ldots, p_n$, respectively. Car c_i drives down the one-way street and if it finds p_i (its preferred parking spot) unoccupied, it parks there; if it is taken, it would attempt to park in the next available spot along the one-way street. A parking function of length n is an n-tuple in $\mathbb{R}$ consisting of the parking preferences that allows all n cars to park following the aforementioned method. Motivated by the numerous generalizations of this family of combinatorial objects, this research program will focus on the study of generalized parking functions via algebraic, combinatorial, and probabilistic methods.

6. Summer Research in Mathematics

6.1 Description of Summer Research in Mathematics

Existing women's mathematics conferences are valuable collaborative opportunities, but they are also very short in duration, usually lasting only a week, meaning projects started during those conferences remain unfinished once the participants return to their usual professional and personal responsibilities. MSRI's Summer Research in Mathematics (SRiM) program was created in response to this problem. The program provides space, funding, and the opportunity for in-person collaboration to small groups of mathematicians, especially women and gender-expansive individuals, with established projects. Such groups may apply for funding to spend two weeks or more together at MSRI where they will live and work in close proximity to one another and can make use of the Institute's resources. This focused, distraction-free collaboration can accelerate the completion of their research project and provide an opportunity for a deeper research experience than may have been possible otherwise.

Due to the COVID-19 pandemic, the 18 groups (82 researchers in total) that were originally selected to participate in the postponed SRiM 2020 program were re-invited to participate in the summer of 2021. The ongoing pandemic again prevented groups from convening onsite at MSRI and complicated or prevented other travel plans, but groups still met at satellite locations around the world, collaborated virtually, or combined virtual and in-person collaboration. MSRI provided funding to pay for group members' travel expenses and provided equipment, software, and technical support for virtual collaborations.

7. African Diaspora Joint Mathematics Program

7.1 Description of ADJOINT

The African Diaspora Joint Mathematics Workshop (ADJOINT) is a year-long program designed to provide the opportunity for in-person research collaboration to U.S. mathematical and statistical scientists, especially those from the African diaspora. Small groups of researchers work for an intense period of two weeks during the summer under the guidance of renowned African American scientists, who act as research leaders. After an intensive two-week research period, ADJOINT continues throughout the academic year (and beyond) by providing research groups with support for periodic virtual meetings and travel funds to enable visits among collaborators. Additional support is provided so that results can be presented at national and international conferences and published in peer-reviewed journals. A special session is organized annually at the Joint Mathematics Meeting (attended by thousands of mathematicians each year) to specifically highlight the research conducted by ADJOINT participants.

Research leaders are selected for their active, internationally renowned research portfolios and their strong history of mentorship. Each research leader proposes a topic on which their respective research group will collaborate during the two-week research period. The topics are published in advance of the application period. When applications have closed, they are reviewed by the ADJOINT Directorate and about twenty applicants are selected to participate. The selection rubric is designed to identify researchers for whom the program will have the most significant impact on their career and professional network. Following the summer session, the program provides conference and travel support to the participants in order to increase opportunities for collaboration, maximize researcher visibility, and foster a sense of community.

8. Appendix – Final Reports of Activities in 2021-22

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Universality and Integrability in Random Matrix Theory and Interacting Particle Systems

August 16, 2021 to December 17, 2021
MSRI, Berkeley, CA
USA

Organizers:

Ivan Corwin (Columbia University)
Percy Deift (New York University, Courant Institute)
Ioana Dumitriu (University of California, San Diego)
Alice Guionnet (École Normale Supérieure de Lyon)
Alexander Its (Indiana University, Purdue)
Herbert Spohn (Technische Universität Munchen)
Horng-Tzer Yau (Harvard University)

FINAL REPORT: UNIVERSALITY AND INTEGRABILITY IN RANDOM MATRIX THEORY AND INTERACTING PARTICLE SYSTEMS

I. CORWIN, P. DEIFT, I. DUMITRIU, A. GUIONNET, A. ITS, H. SPOHN, H.T. YAU

1. Introduction

In 1999 and 2010 MSRI hosted highly successful programs focused on the fruitful interface between random matrix theory and other fields, in particular interacting particle systems. The current 2021 jumbo semester program builds on the community that was formed and fostered by these earlier programs, and on the tremendous progress over the past decade in these areas, for instance in the robust theory of universality for random matrix eigenvalue statistics, or the rich integrable structure uncovered behind a host of interacting particle systems and random growth models.

Despite the challenges in planning and then in day-to-day operations presented by the COVID-19 pandemic, this program went off very smoothly and already has had dramatic effects on its participants through the formation of new collaborations, enhancement and growth of the community, mentorship of junior researchers, and wide dissemination of outcomes.

Over the course of the program 91 researchers visited MSRI, most of those for close to the full duration of the program. While COVID prevented a number of overseas participants, and also resulted in more longer-term visitors, and limited in-person conference activities, there was an unexpected silver-lining. Those participants who were around in person really go to know each other both mathematically and socially. On top of that, since this was the first in-person activity for most likely all of the participants, there was a general positive feeling and interest in talking, working together and listening to each other.

2. Research Developments

Random matrix theory has many roots, perhaps explaining why it has so successfully thrived as a research areas bridging mathematics and many other disciplines (such as statistics, physics, computer science, data science, numerical analysis, biology, ecology, engineering, operations research). In statistics, Wishart began the study of sample covariance matrices in the 1920s. Quite separately in nuclear physics, Wigner introduced and studied certain Gaussian matrix ensembles invariant under classical symmetry groups (i.e. conjugation by orthogonal, unitary or symplectic matrices) in the 1950s.

Goldstein and von Neumann came upon random matrix theory at a similar time from the perspective of numerical analysis and estimation of condition numbers. In number theory, in a surprising development in the 1970s, Montgomery recognized that random matrix statistics described the non-trivial zeros of the Riemann Zeta function. More recently, there have been a host of new motivations and sources for problems in random matrix theory, or new uses of the tools which have been developed in its study. It is this constant growth and expansion of the field which has made it one of the most dynamic and exciting areas of mathematics.

While some applications of random matrix theory techniques come quite naturally, others (like the number theory ones mentioned above) come as a surprise and take a while to fully develop. In the late 1990s, such a mysterious link was discovered between random matrix ensembles and a few interacting particle systems, namely the longest increasing subsequence problem for random permutations and the closely related totally asymmetric simple exclusion process. This linked random matrix theory to a vibrant and growing area of probability and non-equilibrium statistical mechanics, and led to a bevy of new problems, methods and results. The origins of the link have been progressively exposed over time and have further connected these fields to asymptotic representation theory, quantum integrable systems and algebraic combinatorics.

Interacting particle systems arise as probabilistic models of real world systems such as traffic, queues, and mass transport; and through certain transforms or limits they also relate to random interface growth, random walks in random media, stochastic optimization problems, and stochastic PDEs. These types of systems have been actively studied since the 70s in probability, as well as other more applied fields including non-equilibrium statistical mechanics.

Within random matrix theory, and more broadly probability and statistical mechanics, there are often two complementary themes – universality and integrability. Universality refers to the idea that randomness smooths out microscopic difference between systems and hence only certain key phenomenological properties of a system will control the large scale or long time behavior. The simplest instance of this concept at play is the central limit theorem for independent identically distributed random variables where, after fixing the mean and variance, all sums have the same universal Gaussian limit. Integrability (or sometimes exact solvability) refers to the search for models which enjoy enhanced algebraic structure which enables exact calculations and precise asymptotics. Indeed, with the central limit theorem example, coin flipping admits exact formulas in terms of binomial distributions which yielded for the first time (in 1738) the Gaussian distribution (long before it was proved universal around 1900). In a sense, universality says that many systems share a common limit, and integrability identifies precisely what that limit is.

In the last decade since (and in many ways spurred by) the 2010 MSRI program, there have been many research developments in the above identified themes. We briefly list these here and then expand later upon a few which saw breakthroughs during this semester.

- Universality for Wigner matrices, beta ensembles, log/coulomb gases, and plasmas in higher dimension
- Universality of band matrices and probabilistic quantum unique ergodicity
- Non-normal matrices and smallest singular values
- Sparse or heavy tailed random matrices
- Free probability
- Products of random matrices
- Universality in matrix numerical computations
- Random matrices and number theory
- Random matrices and data science
- Integrability of beta ensembles and tridiagonal matrices
- Macdonald processes
- Stochastic vertex models, algebraic Bethe ansatz and Markov duality
- Equilibrium vertex models
- KPZ universality class
- Weak universality of the KPZ equation
- KPZ in condensed matter physics
- Orthogonal polynomials and Hankel / Toeplitz determinants with singularities
- Classical integrable systems associated to KPZ models
- Conformal blocks and random matrices
- Conserved quantities and generalized Gibbsian ensembles for classical integrable systems

3. Organizational Structure

There were seven organizers, with Ivan Corwin serving as the lead and as the HR-representative. Percy Deift oversaw the mentoring of postdocs. Corwin, Deift, Guionnet, Its and Spohn were present for the entire semester; Dumitriu was able to spend a substantial portion in the middle of the program in-person as well. Yau was unable to attend.

The main scheduled day-to-day activities at MSRI were 5-minute introductory talks, seminars, mini-courses, Chancellor course, open problem sessions, program associate seminars and career development panels. We will detail the organization of these below. While the first half of the program focused more on mini-courses, open problem sessions, colloquia, and short-talks, the second half moved more towards research seminars. This strategy was meant to draw in postdocs and program associated (and other junior participants) early on and provide them with approachable introductions to various areas. As the semester progressed, it was natural to transition to more technical talks focused on specifics in research.

To avoid overloading people with activities, we tried to limit the number of talks per day to at most one, though sometimes mini-courses or open problem sessions went for longer than the standard one-hour slot. After a month and a half, there was some feedback that we had too intense of a schedule, so we reduced the frequency of talks a bit more to accommodate an increase in informal discussion and collaboration that had naturally

developed. In addition to the steady-state activities at MSRI, there were workshops that we will also briefly review below.

All activities were streamed on zoom as well as recorded. Online participation was common and, in the case of the workshops, quite substantial.

3.1. **5-minute introductory talks.** There were organized by Harini Desiraju (postdoc) and ran over six sessions from late August until mid-September. Over 50 program members gave talks here, most in-person in the auditorium, though some also remote (if they were not yet present at MSRI, or entirely unable to attend in-person for the semester). As a matter of future practice, we believe that it is a good idea to invite everyone associated with a program to give such a talk at the beginning, even if their visit will not occur until later. Doing this created research links from very early on and also helped to include remote participants into the MSRI activities before they were able to attend in-person.

3.2. **Seminars.** There was a total of 48 seminars and 4 colloquia delivered during the semester. The scheduling of these talks was decided by a committee involving organizers and research professors (Gerard Ben Arous, Ivan Corwin, Percy Deift, Ioana Dumitriu, Alice Guionnet, Alexander Its, Antti Knowles, Firas Rassoul-Agha, Herbert Spohn). This group meet every few weeks to determine the activities for the upcoming period of time. Ivan Corwin then implemented the decisions of this group, inviting and scheduling speakers to particular time slots. The scheduling was done through a Google calendar that Corwin set up and shared with Sierra Sutherland. To avoid having a conflicting calendar with the MSRI one, this Google calendar was not shared with participants. However, it would be very nice for future meetings if the MSRI calendar could be linked to Google, both from an organizer perspective (it was much easier to keep track and input information) and from a participant perspective.

Besides the seminars, the 4 colloquia focused on very broad themes with an aim of being motivational for certain research areas. Even the seminars were meant to be broadly approachable and early on we sent the following explicit instructions for talks: "Take great care to make talks approachable for the diverse audience present in the program. In particular, go slowly and gently; introduce subjects clearly and with proper motivation; state results but do not go into great technical details." Speakers generally did an excellent job heeding these instructions.

By the end of the semester, everyone who wanted to give a seminar (including remote participants) had the opportunity. Benjamin McKenna (postdoc) worked with the seminar organizers to ensure that every postdoc gave a seminar during the first half of the program.

3.3. **Mini-courses.** In the first two months, there were 6 mini-courses, each spanning between 2 and 4 hours. Among the lecturers were 3 postdocs (Desiraju, Lin and Prokhorov) and 2 program associate (Parekh and Yang), as well as 3 early career research members (Kozlowski, Lambert, Sosoe). It was intentional to have more junior-level researchers give these courses. Indeed, when someone senior speakers, more junior participants may be

hesitant to display their lack of understanding at the material. Given the importance of these background mini-courses, we felt that junior speakers would make the material more approachable and spark further discussion off-line. This proved true. However, in some cases, the speakers were a bit overly ambitious and sought to include too much material, or not enough historical motivation.

3.4. **Chancellor course.** Gerard Ben Arous delivered lectures at UC Berkeley every Tuesday and Thursday morning on the subject of "Random Matrices and Random Landscapes". During the first few weeks, while people adjusted to COVID rules and determined their risk levels, these lecturers were simulcast in the MSRI auditorium. Throughout the program, they were also available on zoom. Benjamin McKenna (postdoc) served as a teaching assistant for this course, and also gave a few of the lectures. This course was well attended, both by MSRI members and others from UC Berkeley (including some visiting the Simons center which had a program on machine learning that has some connections to the subject).

3.5. **Open problem sessions.** There were seven open problem sessions throughout the semester. Each one included a few members who had been invited to prepare a short presentation on the problem and motivation. There were well attended sessions and also provided people with the opportunity to propose problems impromptu. They were primarily in the first two months to help spark discussion and research collaborations.

3.6. **Program associate seminars.** The program associates (Yujin Kim and Weitao Zhu) organized a weekly Friday seminar. The initial purpose of this was to invite a postdoc to come and expand upon one or two subjects either from the seminars of the current or upcoming week. This format seemed to work well, and gave the program associates a chance to learn more of the background that was mainly assumed in the seminar talks. Besides this weekly seminar, there were two short-talk sessions which gave the program associated the chance to give 25 minute long seminars to the broader program audience. Talks were given by Sayan Das, Yujin Kim, Guido Mazzuca, Daniel Ofner, Kevin Yang, and Weitao Zhu.

3.7. **Career development panels.** There were five career development panels organized by Jeffrey Oregero (postdoc). These typically involved 3-4 more senior members and lasted an hour and a half. The focus was primarily on the postdocs and program associates, though they were often attended by more senior members as well. The five subjects (in chronological order) were:

- Understanding the NSF panel review process and how to write a successful research proposal
- How to give a colloquium and public speaking
- Job search
- How to write good papers and form productive collaborations
- Broader impact activities

By focusing on NSF grants early on, we hoped to help postdocs and junior participants who were finishing up their first grant applications. Then, we turned to giving talks, also early on so as to help training speakers for their own seminar talks at MSRI. The job search panel and broader impacts panel came later to coincide with hiring season, and the panel on writing and collaborations was midway through the semester, as such activities were likely picking up among MSRI members.

3.8. **Workshop.** These are discussed in greater depth in the individual reports, though we briefly discuss them in the context of the wider program here.

There was initially hope that the workshops would allow for a large number of in-person short-term visitors. However, with the rising levels of COVID due to the Delta variant, this ended up being impossible. A hybrid workshop must have a lighter load of talks both to accommodate the various time-zones of participants and their limited capacity to sit in front of a screen. As such, we split the first workshop into two parts, one in late August and the other in late September. This permitted a more relaxed pace with greater time for discussion. The talks were distributed between in-person and remote speakers. Besides the long-term participants, a few speakers were permitted to attend for the week.

In the second part of the first workshop, we devoted the first two days to the "Connections" workshop which featured talks from a number of female participants in the program, as well as a panel focused on "Work-life balance". Besides this, we also organized two short-talk discussion sessions. A dozen or so speakers pre-recorded short talks and then discussed their material and answered questions during these sessions. This could have run better – many of the more senior participants were not sufficiently aware of how to access these short talks. It was unfortunate that this connections workshop was unable to include participants in person, since it is considerably harder to develop the desired connections through a screen. Still, the talks were all very good and well attended.

There was one additional topical workshop focused on "Integrable Structures in Random Matrix Theory and Beyond" that occurred in the second month. Again, this was hybrid format, though most of the talks were in-person, either because the speakers were long-term participants, or they were permitted to visit for the week.

4. Postdoctoral Fellows

There were 16 postdocs in our program and they brought with them a wide variety of interests, expertise and plenty of energy. The postdocs seems to integrate well with the more senior research members and professors as well as the program associates. As noted above, all postdocs gave seminars or mini-courses in the first two months, and some ended up participating in other activities such as the open problem sessions and program associate seminars. Each postdoc was paired with a mentor who was physically present and with whom they would meet weekly. This seemed to work quite well at sparking new relationships and making sure postdocs were guided in their time at MSRI. Each mentor prepared a mid-term report which helped keep the pair on track.

There was one instance of a pairing which seems not to have worked so well – it involved two mentors who were both UC Berkeley faculty, and one postdoc. Due to the testing requirements, the UC Berkeley faculty found it harder to meet the requirements to attend in-person activities at MSRI, and this also meant that the mentorship pair did not meet with sufficient frequency. It is possible that without COVID this would be improved, though it is also possible that pairing postdocs with UC Berkeley faculty might not be the best approach since those faculty members may already have lots of other mentoring duties at Berkeley that they are unable to escape at MSRI.

The postdocs were really like life of the program. They proposed many of the mini-courses, and were very active in the open problem sessions and discussions after seminars. They also mixed well with more senior participants at lunch which was mainly on the 2nd floor outdoor patio (to accommodate COVID restrictions).

Many of the most exciting developments out of the program were due to postdocs. We will relate a few here, and others in the highlights and breakthroughs section.

5. Graduate Students

There were 10 program associated in the program (half for the full duration and half for the first two or so months). The program associates all came with their advisors and hence received mentorship from that relationship. All program associates were invited to give 25-minute talks to the full program, and six did so. Additionally, this group organized its own weekly seminar (detailed above) which involved a postdoc presenting on material related to the current or next week's program. The significant involvement of graduate students in MSRI programs is fairly recent development and is trickier than with postdocs. Graduate students often are not as independent in developing relationships and collaborations, and also can be overwhelmed by the sheer vastness of the field to which they are suddenly exposed.

At one point, some of the program associates inquired about having an additional mentor to their advisor in the program, as a means to get to know more people. We did not implement this plan since there are challenges in having both a mentor and advisor. In retrospect, there may be a way to do this without creating an issue – for instance each program associate could be paired with a postdoc as a mentor, instead of with another senior research member or professor. It seems that the program associates anyway developed close connections with the postdocs, so this would naturally complement and accelerate that process.

6. Inclusivity

This theme was pervasive throughout the program. The composition of our organizing team for the program (Ioana Dumitriu and Alice Guionnet) and for the two workshops (Ioana Dumitriu, Alice Guionnet, Alisa Knizel, Sylvia Serfaty, Tamara Grava, Sandrine Peche) had a strong proposition of top women in the field. This gender diversity was also

clear among the other ranks of membership in the program with between 20%-30% female participation at every level (and 25.6% overall). In terms of under-represented minorities, there were two (one postdoc and one research member), though this is indicative of the limited pool that applied, despite efforts at recruitment. In the associated workshops, women represented over 37% all speaker slots.

Panel discussions, especially those on work-life balance and on broader impact activities and NSF grants were also important part to the inclusivity of the program. In particular, many of the younger participants were unaware of some of the possibilities for broader impact activities in which they could participate, and were also unaware that NSF treats broader impact not just as impact of the research outside the field, but also in terms of the work of an individual researcher in impacting society, including through outreach, mentorship and knowledge dissemination. During the panel discussions on these subjects, many participants seemed to be awoken to these possibilities and to the importance of pursuing them both for their inherent value and for their value in hiring and procuring grants.

The fact that all talks were broadcast on zoom and videotaped also made them much more accessible than in previous times. In particular, at least one long-term participate suffered from allergies preventing in-person participation at time – yet through zoom they were able to stay involved throughout. In another example, one of the organizers for the connections workshop was 9 months pregnant at the time and yet able to participate remotely. Likely there are other similar stories.

7. Highlights and Breakthroughs

While it is always hard to fully understand the impact of a program until the dust has settled and years have passed, there are always very strong indications that this program has defined new research directions, sparked new collaborations and provided our community with the fuel for a new decade of breakthroughs. Here we will survey some of surprising advances during the semester, without great care in the ordering or grouping (which is hard since so many of them involved collaborations across fields).

- A profound conceptual outcomes of the semester is the understanding that the fusion of integrability and randomness will be a new principal focus of the theory of integrable systems. Of course, the process has already started some time ago with the emergence of the field of "integrable probability". Some recent developments within this general umbrella which have been specifically featuring during the semester include the exciting discovery of the classical integrable structures in KPZ models and their use to the studying of the tail asymptotics of the models. These are works of Amir, Corwin and Quastel, the works of Borodin and Gorin, the works of Corwin and Ghosal, the works of Cafasso and Claeys, the works of Krajenbrink and Doussal and the works of Quastel and Remenik. All these works have been presented and discussed during the program. The second fundamental conceptual development is the realization of the importance of studying the deterministic

integrable PDEs and ODEs for random initial data, i.e. the importance of studying the stationary measures generated by the classical integrable Hamiltonians. This topic has been discussed through the program, and specifically in the talks on this matter given by Spohn, Grava, McLaughlin and Kriecherbauer. Strictly speaking the issue had already been present in the past studies of integrable systems since works of McKean, Vaninsky, Kuksin in the 80s and 90s, but it is only during the last decade as it has gradually moved to the center of the theory of integrable systems (in part due to interest from the physics of quantum quenches). The program has highlighted this fact very precisely, and it is clear that this is going now to be a mainstream direction in the theory.

- Among the more tradition directions, it is worth noting that among the "most wanted problems" in integrable systems, the rigorous asymptotic analysis of the correlation functions for the non free-fermionic quantum fields and statistical mechanics models ranks high. The most recent advances in these areas have been very well presented in the several lectures during the semester, including those of Kozlowski, Lambert, and Ramirez. A remarkable observation that came from this part of the program is that the non-free fermionic statistical and quantum field integrable models have a key common feature: they both are described in terms of the operator valued Riemann-Hilbert problems. Hence yet another message of the program is the need to extend the standard Riemann-Hilbert techniques, such as the nonlinear steepest descent method, to an operator valued setting.
- Multispecies interacting particle systems and stochastic vertex models have been an active area of study for many years, though recent advances in their integrable structures and dualities have opened up many directions of study. One such direction which was taken up during the semester by Ghosal, Franceschini and Yang is to derive stochastic PDE limits for the coupled system of height functions (each recording the number of the various types of particles). This exciting work in progress relies upon duality methods (Franceschini's expertise) as well as stochastic PDE methods (Yang and Ghosal's expertise). Another direction involving multispecies particles is ongoing work of Aggarwal, Corwin and Ghosal to construct the ASEP speed process. Specifically, consider an infinite system of particles where particle i starts at position i for all $i \in \mathbb{Z}$. Particles move and carry their labels as follows – for each bond, the particles swap at rate p if they are ordered increasingly, and at rate q if they are ordered decreasingly. Conjecturally, each particle should asymptotically achieve a limiting speed and these speeds should have a complicated correlation structure. The ongoing work achieves this aim and was advanced considerably during the program.
- The corner growth model, or evolution of TASEP from step initial data, is one of the main-stay processes in integrable probability. Remarkably, a few years ago Petrov and Saenz discovered a simple Markov process that mapped the law of the growth model backwards in time. The results followed from the Yang-Baxter equation. During his visits to MSRI, Saenz asked Petrov whether this back-in-time process could be applied to general initial data or whether it was particular to the step case. Remarkably, after

looking at this from several vertex model points of view, Petrov and Saenz figured out a new more transparent point of view which allows them to extend their result to arbitrary initial data, all integrable particle systems in $1+1$ dimension and also add the element of "rewriting the history of the process". This observation certainly required the time spent together in person at MSRI.

- There has been a great deal of excitement in the past year or two from new developments in the study of random tiling models. For instance, Aggarwal stunned the community with a proof of the Cohn-Kenyon-Propp conjecture about universal local fluctuations for general lozenge tiling models – a proof that relies heavily on ideas from random matrix theory universality. During this program, talks of Aggarwal and Huang highlighted the newest advances in this area, namely the universality of the arctic circle boundary to the Airy line ensemble. These methods, again, rely on a mixture of tools from loop equations to couplings and exact formulas, and generated a lot of interest, especially from people in random matrix theory universality. Some other exciting developments related to random tilings and dimers involve work completed by Corteel, Li and Vuletic during the semester. They studied the asymptotic (limit shapes, boundaries and Gaussian free field fluctuations) for dimer coverings on graphs that are called "rail yards", by techniques related to Macdonald processes. Also, they collaborated on asymptotics of "lecture hall" tableaux, via Schur process techniques. Corteel and Vuletic also pursued a project to generalize a hook formula for d-complete partially ordered sets (posets) for the Macdonald weights (a work still in progress). Adler and van Moerbeke also continued their study of the "Master Kernel" for random dimer models during the semester.
- The presence of boundary conditions for interacting particle systems can induce curious phase transitions and change the steady state behavior of the system. There were a number of developments in this area discussed and advanced during the program. In the first seminar of the semester, Barraquand reported on identities between full and half-space models of directed polymers – the spurred a collaboration between him, Corwin and Das to develop half-space line ensembles related to the log-gamma polymer, and to use that along with the identities to prove the conjectural phase diagram for the model. Another development in this direction was reported by Sasamoto later in the program and involved new identities between half-space models that has the potential to yield related asymptotics. In his workshop talk, Corwin also reported on the stationary measure for models with left and right boundaries, including the open KPZ equation. The structure of the stationary measure in terms of path integrals is compelling and now Barraquand and Corwin are working to lift this structure to all integrable open boundary models such as open ASEP, vertex models and polymer models. This would be a remarkable development since the previous toolbox relied entirely on the Matrix Product Ansatz, which is quite challenging from the perspective of asymptotics. Liechty, Occelli, and Vuletic also engaged on the subject of free boundary last passage percolation, and Occelli and Corwin discussed models involving weights that decay based on the diagonal distance from the origin.

- During his stay at MSRI, Schnelli started a collaboration with a statistician at Stanford, Rong Ma, a student of Tony Cai and now a postdoc of David Donoho. Rong is interested in applications of Schenlli's recent results on convergence rate to the Tracy-Widom laws and will hopefully be able to provide numerical evidence that is currently lacking. This collaboration was sparked entirely due to Schnelli's visit to MSRI.
- Ferrari, Franceschini and Spohn began to consider one-dimensional billiard balls (segments of the same size, called rods) that travel ballistically and exchange velocities at collisions. The initial positions and velocities are generated by a two dimensional (position-speed) non-homogeneous Poisson point process by dilating each point to a segment, but keeping the inter point distances, by pushing the other points. The hydrodynamic limit of this process was performed by Boldrighini, Dobrushin and Sukhov in 1982 and the second order corrections by Boldrighini and Sukhov in 1997. The collaboration shows that the space-time picture of the system can be seen as a non-homogeneous Poisson straight-line process, which is related to a surface introduced by Lantuéjoul, inspired by the Chentsov construction of the Levy Brownian function. The rescaling parameter ϵ divides the intensity measure of the Poisson process and multiplies the rod length. When ϵ goes to zero, the empirical measure converges to a dilated version of the intensity measure of the Poisson process. The corrections order $\sqrt{\epsilon}$ converge to a non-homogeneous Levy Brownian function, a Gaussian process governed by a distance given by the intensity measure of the set of lines crossing a segment. The corrections order ϵ converge to a function of the variance of the Levy Brownian function.
- Another new research project has been undertaken to connect research in the analysis of integrable systems with hydrodynamic theory rooted in statistical physics. This followed the presentations given by Mazucca, Grava, Kriecherbauer, McLaughlin, Ferrari and Spohn. This represents a collaboration between researchers studying regular solitonic gasses and researchers studying statistical hard-rod dynamics.
- During his visit to MSRI, Oregero was able to extend the research from his dissertation resulting in a new paper "Elliptic finite-band potentials of the non-self-adjoint Dirac operator" (in preparation). This work is in collaboration with Gino Biondini, Alexander Tovbis, and Xudan Luo. The work studies the spectrum of a non-self-adjoint Dirac operator (spatial half of Lax pair for focusing NLS) with elliptic potential $A \cdot dn(x, m)$ with A real, dn a Jacobi elliptic function, and m the elliptic parameter. The new results were motivated by a question Deift asked Oregero at the beginning of the semester: "What happens to the spectrum as A goes to $A + 1$, and so forth?" The quick answer is that a "spectral band" (or spine) propagates from the real axis of the spectral variable to the imaginary axis. Ultimately, the band shrinks and a "spectral gap" opens. For A integer one gets an exact count of the genus of the Riemann surface for the corresponding algebro-geometric solution of the focusing NLS equation on the circle. This work has application to the study of "soliton gases" in focusing nonlinear media with periodic data that is next to be explored.

- During the 2010 MSRI program Pfrang, Deift and Menon presented an answer to the question "How long does it take to compute the eigenvalues of a random symmetric matrix?" Remarkably, the answer led to interesting connections between computation and random matrix theory. This led to a series of important papers collectively referred to as "universality in computation". The new project (formulated this semester at MSRI) is to answer the question: "How long does it take for a soliton to emerge from radiation?" It is hoped that the recent developments in the numerical solution of Riemann-Hilbert problems by Trogdon and Olver will be useful in answering this question. Importantly, Deift, Oregero and Trogdon are interested in the statistics of the "emergence of solitons" phenomenon.
- Oregero and Piorkowski formulated a new project while at MSRI pertaining to the study of the interactions between solitons and dispersive shocks in focusing nonlinear media. The main tool of analysis to study this problem is the nonlinear steepest-descent method for oscillatory Riemann-Hilbert problems first formulated by Deift and Zhou.
- Desiraju, Its and Prokhorov started a project to analyze the Riemann-Hilbert setting on the Riemann surfaces of non zero genus. There is, of course, a vast literature on this issue. However, the existing general theory does not really works well in the concrete examples and they are specifically studying two models: an elliptic form of Painlevé VI and the Landau-Lifshitz equation. As it was observed already in the 80s (Sklyanin, Mikhailov), the crucial role in the setting of the relevant Riemann-Hilbert problem in the integralble models, is played by the intrinsic symmetries of the model. This leads to the possibility of choosing non-generic Cauchy kernels and avoid the analytical obstacles present in the generic case. In the recent work of Desiraj and co-authors, they have produced the relevant Cauchy kernel for the case of Painleve VI, however it is not very suitable for asymptotic analysis. During the MSRI program this trio believes they found a proper modifcation of her kernel and also the proper setting for the Riemann-Hilbert problem for the Landau-Lifshitz equation. The next step is the development of the analog of Deift-Zhou nonliner steepest descent method for the oscillatory Riemann-Hilbert problems posed on the Riemann surfaces.
- Deift, Its, Krasovsky and Piorkowski embarked on a project to evaluate the long-time asymptotics for the autocorrelation function of the transverse Ising chain at the critical magnetic field. The goal is to calculate next terms, including the constant one, in the asymptotics whose leading term had been found in the 1994 paper of Deift and Zhou. This is one of the examples of the "constant problem" – the most challenging part of the asymptotic analysis of integrable models. Recently, a proper technique was finally developed for such problems and they are applying it to the model. The presence of the critical magnetic field adds serious difficulties to the analysis.
- The modern theory of integrable systems began with the discovery in 1967 that the Korteweg de Vries (KdV) equation was completely integrable. This was shortly followed by the discovery that many other systems of interest such as NLS and the Sine-Gordon equation, were also integrable. The main tool for the analysis of the asymptotic behavior

of solutions of such integrable systems is the Riemann-Hilbert / non-linear steepest descent method. Whereas many systems have been analyzed using this method, it is an irony, and a long-standing challenge, that the longtime behavior of solutions of KdV itself has not yet been rigorously analyzed. The technical reason for this situation is that the Riemann-Hilbert problem for KdV is singular in a variety of ways. Over the semester at MSRI, Percy Deift, Ken McLaughlin and Thomas Kriecherbauer have been able to resolve these singularities, using a dbar extension of the steepest descent method, leading after more than 50 years to a full and rigorous derivation of the longtime behavior of solutions of KdV.

- An evolving group, now including Manuela Girotti, Tamara Grava, Alexander Its, and Ken McLaughlin, began considering the asymptotic analysis of so-called primitive solutions recently found by Dyachenko, Zakharov and Zakharov. This is a continuation of 2019 work of Girotti, Grava, Robert Jenkins, and McLaughlin where they showed how a simplified sub-class of primitive potentials arise as a limit of N-soliton solutions where $N \to \infty$, and developed the long-time asymptotic analysis of these solutions. The project aims to expand the analysis to the full collection of primitive potentials, and study the phenomena associated with the interaction of two gasses with different characteristic features. The connection to a large-N soliton gas was established early in the semester, and a road map for the asymptotic analysis of the Riemann-Hilbert problem was identified in the waning hours of the program. The analysis will be developed in the months after the program ends.
- Its and Kozlowski initiated a project regarding correlation functions in quantum field theories. The two-point correlation functions in $1 + 1$ dimensional integrable quantum field theories are described by series of multiple integrals: their nth summand is given by an n-fold integral. The integrands depend on the various parameters present in the model, in particular on the Minkowskian distance between the operators building up the correlation function. Various heuristics from physics predict that these correlators manifest a universal behaviour in the limit of vanishing Minkowskian distance whose essential features are captured by a conformal field theory. It is of great interest to be able to establish such predictions rigorously by a direct analysis of this regime on the level of the series. While rather intricate, the series representing these two-point functions still bare certain structural similarities with the Fredholm series for the Fredhlom determinant of an operator $id + V$ with V and integrable integral operator. The duo managed to find a way of making the best of these similarities so as to device a promising approach, mixing Riemann–Hilbert problems and approximations by density, which could allow to tackle this long-standing open problem in universality. Kozlowski detailed some of these ideas in his mini-course early in the semester.
- Bleher, Gharakhloo, and McLaughlin collaborated on geometric combinatorics of quartic matrix models, and finished the paper at the end of the semester. Amongst the results is a rigorous connection between the asymptotic behavior of combinatorial coefficients counting 4-valent maps on Riemann surfaces and the Painlevé I equation, a longstanding

conjecture. The study of the interaction of a soliton with a regular gas was also finalized during the semester, in a collaboration between Girotti, Grava, Jenkins, McLaughlin, and Minakov.

- Through the postdoc seminars, Desiraju, Ghosal and Prokhorov Harini started collaborating on a rather ambitious problem of bringing together the integrable and probabilistic interpretations of the conformal block. They obtained preliminary results and are in the process of writing. But this project is long term and there are many problems to work on, lined up.
- Desiraju and Krajenbrink developed a machine learning algorithm to study Lax pairs of integrable systems. This took advantage of a program down the hill at the Simons institute on machine learning.
- Gibbsian line ensemble techniques played an important role in many investigations during the program. Hegde, Ganguly and Kim began discussions on a question using these tools to study chaos of the top eigenvector in the critical window under a natural dynamic on the GUE. This builds on recent work of Ganguly and Hammond. Corwin, Hegde, Hammond and Matetski discussed questions regarding exception times for the KPZ fixed point and use of Brownian Gibbs resampling techniques, the KPZ fixed point formulas and the directed landscape as a means to access these exceptional times. Hegde worked to obtain sharp one-point upper tail bounds for the $Airy_2$ process using purely Brownian Gibbsian resampling techniques along with its properties of stationarity and extremality as a Gibbs measure, with a technique of bootstrapping reminiscent of work on discrete planar last passage percolation models he undertook with Ganguly a few years ago. This project also has connections to and overlap with another area of investigation Hegde and Ganguky worked on to obtain multi-point asymptotics and limit shapes under large deviations of the narrow-wedge solution to the KPZ equation using the tangent method. Das, Ganguly, Ghosal, and Hegde are thinking about adapting techniques developed to study the geodesic watermelon in planar LPP (a zero-temperature model) to understand the continuum directed random polymer, and through it obtain new estimates about the single slice point process of the KPZ line ensemble.
- Lin and Parekh worked on proving a version of Strassen's law for the short-time behavior of stochastic PDEs, and Lin worked on classification of the stationary distribution for the stochastic higher spin six vertex models, in part through discussions with Aggarwal and Corwin.
- Drillick and Lin began an investigation into the scaling limit of the t-PNG model, recently introduced by Aggarwal, Borodin and Wheeler. They seek to prove convergence of the model to the KPZ equation as a stochastic process.
- Lin, Noack, Rassoul Agha and Seppalainen began a project to indentify the "Martin boundary" of the beta random walk in random invariant using tools like Busemann functions and some results from the integrability of the model.

- McKenna worked on landscape complexity, the main area of his thesis, primarily with Gerard Ben Arous. This includes projects about non-Gaussian landscapes, TAP complexity and BRST supersymmetry.
- Large deviations for random matrices were thoroughly discussed, to apply beyond invariant ensembles. Guionnet, Husson and McKenna worked on large deviations for finite rank perturbation of non -Gaussian matrices. Guionnet, Husson and Occelli applied large deviation techniques to obtain result on last passage percolation models with general weights and geometries for which standard techniques (like steepest descent analysis) fail.
- Betea, Occelli and Ofner started a project during the semester which examines the stationary half-space Hammersley last passage percolation via orthogonal polynomials on the unit circle and on the real line. The goal is to compute tail estimates for the distribution if this model when the size of the system goes to infinity. In general they want to obtain a combinatorial, probabilistic, and asymptotic result for a Hammersley last passage percolation model in the half-quadrant with two external sources. They attack the problem via the original approach of Baik–Rains for the case of the full quadrant: symmetric functions, matrix integrals over the orthogonal group, Toeplitz and Hankel determinants, and asymptotics of OPUCs with weight $e^{t(z+z^{-1}}$. As a byproduct they plan to obtain asymptotic results on averages of characteristic polynomials for orthogonal matrices distributed as $e^{t\cdot\mathrm{tr}(U)}dU$ where dU stands for Haar measure. A worthy goal (beyond the scope of this project) would then be to replace $t\cdot\mathrm{tr}(U)$ by $\mathrm{tr}(V(U))$ for any polynomial V.
- Dumitriu, Wang and Y. Zhu completed work on spectral clustering algorithms for community detection in random hypergraphs, using random matrix techniques, and Wang and Y. Zhu explored a new nonlinear random matrix model from the study of neural networks. Dumitriu and Y. Zhu studied the extreme singular values of sparse random matrices, and made significant progress during the program. Knowles explained several key ideas in his work on sparse Erdos-Renyi graphs and that helped Dumitriu and Y. Zhu overcome technical difficulties in their project. Lambert and Y. Zhu also initiated work on characteristic polynomials of random digraphs.
- Di Francesco and Kedem are in the final stage of completion of their proof of a long-standing conjecture on the relationship between the (q,t)-Macdonald theory of symmetric polynomials and q-difference operators and the combinatorial setting of cluster algebras. Macdonald polynomials can be defined for arbitrary root systems, however a systematic construction of commuting difference operators of which they are the common eigenfunctions was still incomplete. This duo filled this gap, and managed to prove that in the limit of the parameter t infinite, the complete set of commuting operators is part of the initial cluster of a suitable quantum cluster algebra attached to the root system, called the Q-system cluster algebra. The proof uses many ingredients: (1) from representation theory, the spherical Double Affine Hecke Algebra representations and automorphisms (2) from symmetric polynomial theory, the Koornwinder polynomials and

their associated q-difference operators obtained by van Diejen, Rains in particular (3) from combinatorics, the systems of hard particles and Viennot-like sign reversing involutions. The last remaining hole in the proof was mended thanks to a crucial conversation at MSRI with Barraquand, who worked on q-Whittaker processes, closely related to our setting. Di Francesco, Kedem and Petrov started a potential collaboration on the use of Koornwinder polynomials and q-difference operators to generalize Macdonald processes.

- Aggarwal, Colomo and Di Francesco began informal collaboration on the combinatorics of two-dimensional integrable lattice models with emphasis on determinantal formulas for special choices of boundary conditions. In particular, they considered ice models on the triangular lattice, and the use of Yang-Baxter symmetry to establish connections to problems of domino tilings of particular domains of the plane, as well as KPZ scaling in the six and twenty vertex model.
- Here is a brief instance of the type of many-body interaction that was facilitated by MSRI during the semester. When arriving at the MSRI, to Grava and Mazzuca, and separately Spohn realized that they had all been working on the Ablowitz-Ladik discretization of the nonlinear Schrodinger equation, a famous integrable wave equation. For a confining potential given through a finite polynomial, Grava and Mazzuca were able to prove the structure of the generalized free energy. Guionnet and Memin had recently managed to prove such a result for the Toda lattice with a general confining potential by using methods from the theory of large deviations for Beta ensembles. Now, with such techniques, Mazzuca and Memin joined forces and are confident to arrive at a complete result for the AL system. Independently, Grava, Kriecherbauer, Mazzuca and McLaughlin, had accumulated extensive molecular dynamics simulations for the momentum-momentum time correlation function of the Toda lattice in thermal equilibrium. At MSRI, Spohn explained his predictions based on generalized hydrodynamics (GHD) and a quantitative comparison now seems to be in reach, a check on both the theory and the quality of the numerical scheme. Finally, McLaughlin reported on a research project together with Girotti, Grava, Jenkins, and Minakov, joining the party from a completely unexpected direction. They had been studying the dynamics of the modified Korteweg-De Vries equation. The bulk of the wave field is initially prepared as a cnoidal wave, a space-time quasi-periodic solution of mKdV, smoothly cut-off at infinity. From the left a high velocity soliton is moving in and interacts with the cnoidal wave, thereby moving in a random-like fashion. When evolving and interacting with the cnoidal wave, the soliton velocity is no longer constant. According to GHD the effective soliton velocity should be determined by the collision rate ansatz. This is what was established by this group using methods from inverse scattering theory.
- The study of random matrices beyond the Gaussian ensembles universality class and the transition to other universality classes was an important theme of the semester. Alt and Knowles, together with Raphael Ducatez, studied in impressive details the adjacency matrix of the Erdös-Rényi graph at the critical scale where the average degree is of order of the logarithm of the dimension. During the program, they continued their

work on the delocalization and localization of eigenvectors of Erdös-Rényi graphs. They worked out the precise region in spectral and density space where the eigenvectors are completely delocalized. This led to the publication "The completely delocalized region of the Erdös-Rényi graph". They also found a proof of localization in a large region of the phase diagram where localization is expected to occur. This argument will be developed in detail and written up in the months following the semester. Aggarwal, Knowles, and Lopatto initiated a project on the delocalization of the eigenvectors of Erdös-Rényi graphs in the regime of constant expected degree. It is known that some eigenvectors are localized near the periphery of the graph. The aim of this project is twofold: to show that the complementary set of eigenvectors is delocalized, and that all eigenvectors are delocalized away from the boundary of the graph. This is an ambitious long-term project, which was initiated during the semester. Knowles and Lopatto, together with Kyle Luh, worked on establishing a sharp transition in the fluctuations of mesoscopic linear eigenvalue statistics of heavy-tailed random matrices. In the phase diagram depending on the tail exponent of the entries and the spectral scale of the linear statistic, they conjecture and aim to establish a region of GOE-like fluctuations, and a complementary region with different fluctuations specific to heavy-tailed matrices.

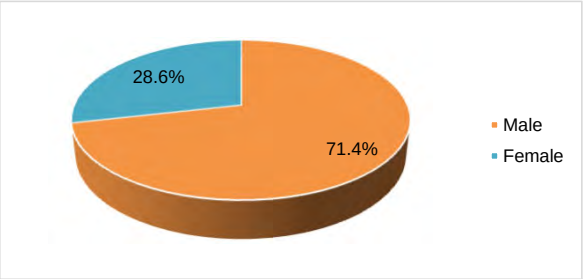
- Tatyana and Marya Shcherbina in a series of breakthrough papers studied the transition in the local fluctuations of the spectrum of diverse models of band matrices using supersymmetry: they were the first to establish such a transition at the critical width proportional to the square root of the dimension. During the program, they used again super-symmetry to study rank-one imaginary perturbations for Hermitian band matrices.
- Aggarwal, Bordenave, Lopatto and Guionnet attacked the study of the mobility edge for heavy tail matrices, to understand the exact transition between localized and delocalized eigenvectors of matrices with alpha-stable entries.

Postdoc Pre/Post-MSRI Institution Group

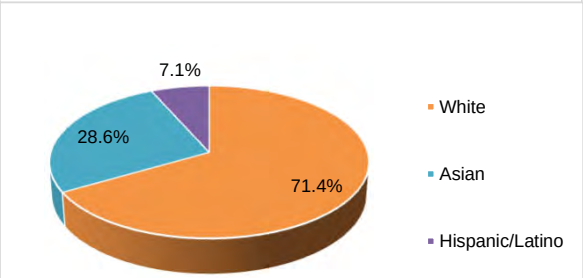
Family Name	First Name	Pre-MSRI Institution	Pre-MSRI Group	Post-MSRI Institution	Post-MSRI Group
Bailey	Emma	U. of Bristol	Foreign	CUNY	Public Large
Desiraju	Harini	U. of Birmingham	Foreign	U. of Sydney	Foreign
Franceschini	Chiara	IST - Lisbon	Foreign	U. di Modena e Reggio Emilia	Foreign
Gharakhloo	Roozbeh	Colorado State U.	Public Medium	Colorado State U.	Public Medium
Hegde	Milind	UC Berkeley	Public Large	Columbia U.	Private Large
Husson	Jonathan	ENS de Lyon	Foreign	U. of Michigan	Public Large
Krajenbrink	Alexandre	SISSA	Foreign	SISSA	Foreign
Lin	Yier	Columbia U.	Private Large	U. of Chicago	Private Large
McKenna	Benjamin	Courant Institute, NYU	Private Large	IST Austria; Harvard U.	Foreign; Private Large
Noack	Christian	Cornell U.	Private Large	Purdue U.	Public Large
Occelli	Alessandra	IST - Lisbon	Foreign	IST - Lisbon	Foreign
Oregero	Jeffrey	U. at Buffalo, SUNY	Public Medium	U. of Central Florida	Public Small
Piorkowski	Mateusz	U. of Vienna	Foreign	Erwin Schrödinger Inst.	Foreign
Zhu	Yizhe	UC San Diego	Public Large	UC Irvine	Public Medium

2021-22 UIRM Postdoctoral Fellow Demographic Summary

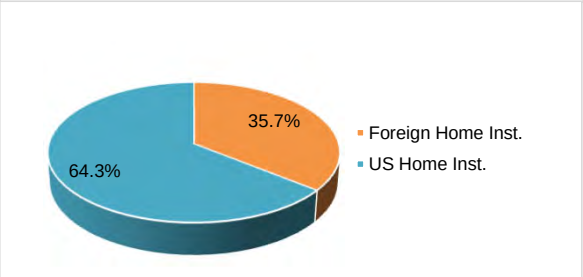
Gender	#	%
# of Distinct Members	14	100.0%
Male	10	71.4%
Female	4	28.6%
Decline to State	0	0.0%



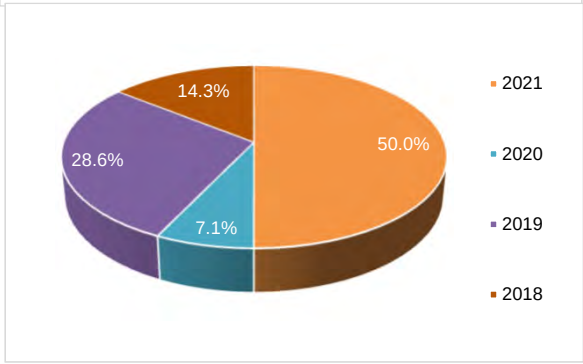
*Race/Ethnicity**	#	%
White	10	71.4%
Asian	4	28.6%
Hispanic/Latino	1	7.1%
Black	0	0.0%
Native American	0	0.0%
Pacific Islander	0	0.0%
Decline to State	0	0.0%
Unavailable Info.	0	0.0%
Minorities**	1	25.0%



Citizenships	#	%
Foreign Home Inst.	5	35.7%
US Home Inst.	9	64.3%
US Citizen & Perm. Residents	4	28.6%
Foreign Citizens	10	71.4%
US Citizens	4	28.6%
US Permanent Residents	0	0.0%



Year of Ph.D	#	%
2021	7	50.0%
2020	1	7.1%
2019	4	28.6%
2018	2	14.3%
2017	0	0.0%
2016	0	0.0%
Total # of Distinct Postdocs	14	100.0%

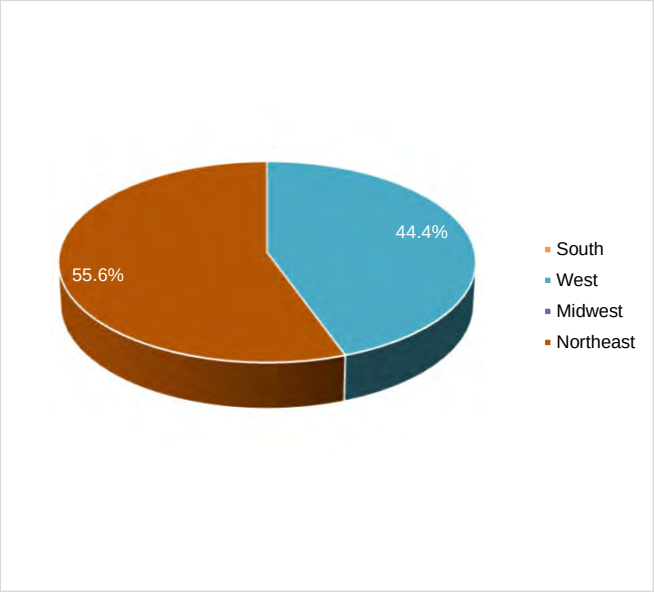


**Race/ethnicity selections are non-exclusive.*

***Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.*

2021-22 UIRM Postdoctoral Fellow Classified by States

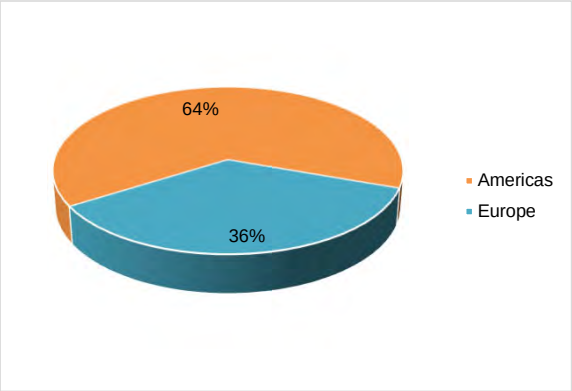
State	#	%	*2020 Census*
South	**0**	**0.0%**	***38.1%***
AL	0	0.0%	*1.5%*
AR	0	0.0%	*0.9%*
DE	0	0.0%	*0.3%*
DC	0	0.0%	*0.2%*
FL	0	0.0%	*6.5%*
GA	0	0.0%	*3.2%*
KY	0	0.0%	*1.4%*
LA	0	0.0%	*1.4%*
MD	0	0.0%	*1.9%*
MS	0	0.0%	*0.9%*
NC	0	0.0%	*3.1%*
OK	0	0.0%	*1.2%*
SC	0	0.0%	*1.5%*
TN	0	0.0%	*2.1%*
TX	0	0.0%	*8.8%*
VA	0	0.0%	*2.6%*
WV	0	0.0%	*0.5%*
West	**4**	**44.4%**	***23.7%***
AK	0	0.0%	*0.2%*
AZ	0	0.0%	*2.2%*
CA	3	33.3%	*11.9%*
CO	1	11.1%	*1.7%*
HI	0	0.0%	*0.4%*
ID	0	0.0%	*0.6%*
MT	0	0.0%	*0.3%*
NM	0	0.0%	*0.6%*
NV	0	0.0%	*0.9%*
OR	0	0.0%	*1.3%*
UT	0	0.0%	*1.0%*
WA	0	0.0%	*2.3%*
WY	0	0.0%	*0.2%*
Midwest	**0**	**0.0%**	***20.8%***
IA	0	0.0%	*1.0%*
IL	0	0.0%	*3.9%*
IN	0	0.0%	*2.0%*
KS	0	0.0%	*0.9%*
MI	0	0.0%	*3.0%*
MN	0	0.0%	*1.7%*
MO	0	0.0%	*1.9%*
ND	0	0.0%	*0.2%*
NE	0	0.0%	*0.6%*
OH	0	0.0%	*3.6%*
SD	0	0.0%	*0.3%*
WI	0	0.0%	*1.8%*
Northeast	**5**	**55.6%**	***17.4%***
CT	0	0.0%	*1.1%*
MA	0	0.0%	*2.1%*
ME	0	0.0%	*0.4%*
NH	0	0.0%	*0.4%*
NJ	0	0.0%	*2.8%*
NY	5	55.6%	*6.1%*
PA	0	0.0%	*3.9%*
RI	0	0.0%	*0.3%*
VT	0	0.0%	*0.2%*
Other	**0**	**0.0%**	***0.0%***
PR	0	0.0%	*0.0%*
Other	0	0.0%	*0.0%*
Total	**9**	**100.0%**	***100.0%***



**Regions based on US Census classification*

2021-22 UIRM Postdoctoral Fellow Classified by Country

Africa			**0**
Americas			**9**
	North America	United States	9
Asia			**0**
Europe			**5**
	Western Europe	Austria	1
		France	1
	Southern Europe	Italy	1
		Portugal	2
Oceania			**0**
Grand Total			**14**



**Regions based on United Nations classification*

Universality and Integrability in Random Matrix Theory and Interacting Particle Systems

Program Summary

Role	Distinct Members	%	US Citizens & Perm. Res.	%	Women	%	Minorities*	%
Organizers	6	6.7%	4	66.7%	2	33.3%	0	0.0%
Research Professors	23	25.6%	13	56.5%	6	26.1%	0	0.0%
Postdoctoral Fellows	14	15.6%	4	28.6%	4	28.6%	1	25.0%
PD/RM	2	2.2%	1	50.0%	0	0.0%	0	0.0%
Research Members	35	38.9%	20	57.1%	8	22.9%	1	5.0%
Program Associates	10	11.1%	4	40.0%	3	30.0%	0	0.0%
Total # of Distinct Members	**90**	**100.0%**	**46**	***51.1%***	**23**	***25.6%***	**2**	***4.3%***

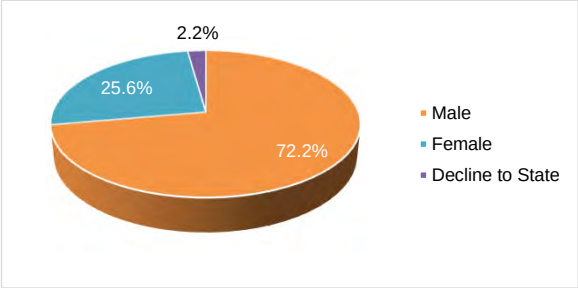
** Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the total number of US citizens & Permanent Residents.*

Home Institution AMS Grouping

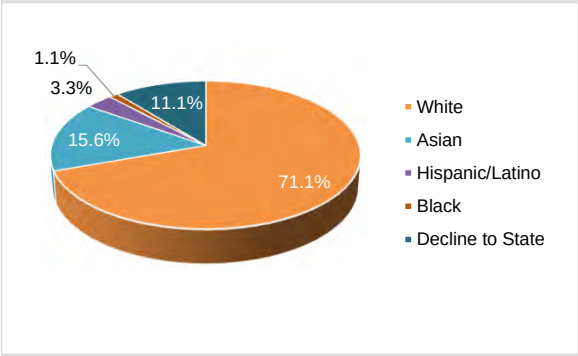
	US								
Role	**Private Large**	**Private Small**	**Public Large**	**Public Medium**	**Public Small**	**Group M or B**	**Non-Group**	**Foreign**	**Total**
Organizers	2	0	1	0	1	0	0	2	6
Research Professors	4	0	5	3	1	1	1	8	23
Postdoctoral Fellows	3	0	2	1	0	2	0	6	14
PD/RM	1	0	1	0	0	0	0	0	2
Research Members	6	0	8	2	2	1	0	16	35
Program Associates	6	0	0	0	0	0	0	4	10
Total	**22**	**0**	**17**	**6**	**4**	**4**	**1**	**36**	**90**
%	***24.4%***	***0.0%***	***18.9%***	***6.7%***	***4.4%***	***4.4%***	***1.1%***	***40.0%***	***100.0%***

2021–22 UIRM Program Members Demographic Summary

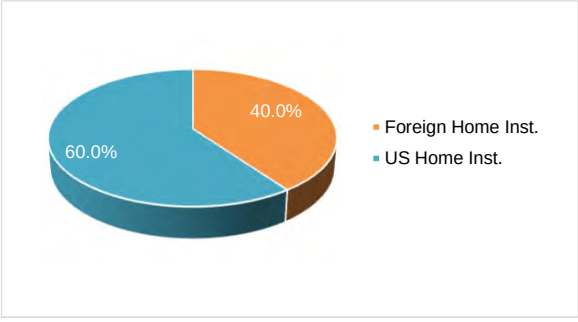
Gender	#	%
# of Distinct Members	90	100.0%
Male	65	72.2%
Female	23	25.6%
Other	0	0.0%
Decline to State	2	2.2%



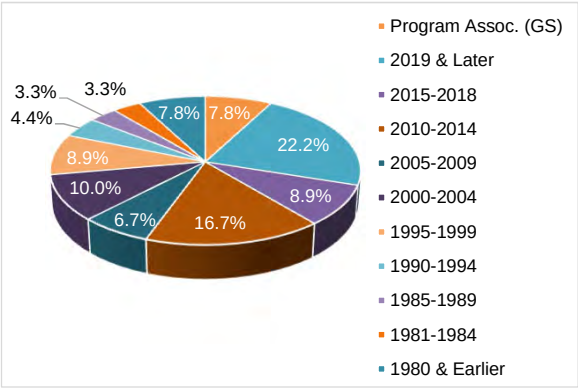
Race/Ethnicity*	#	%
White	64	71.1%
Asian	14	15.6%
Hispanic/Latino	3	3.3%
Black	1	1.1%
Native American	0	0.0%
Pacific Islander	0	0.0%
Decline to State	10	11.1%
Unavailable Info.	0	0.0%
Minorities**	2	4.3%



Citizenships	#	%
Foreign Home Inst.	36	40.0%
US Home Inst.	54	60.0%
US Citizens & Perm. Residents	46	51.1%
Foreign Citizens	44	48.9%
US Citizens	34	37.8%
US Permanent Residents	12	13.3%



Year of Ph.D	#	%
Program Assoc. (GS)	7	7.8%
2019 & Later	20	22.2%
2015-2018	8	8.9%
2010-2014	15	16.7%
2005-2009	6	6.7%
2000-2004	9	10.0%
1995-1999	8	8.9%
1990-1994	4	4.4%
1985-1989	3	3.3%
1981-1984	3	3.3%
1980 & Earlier	7	7.8%
Total # of Distinct Members	90	100.0%

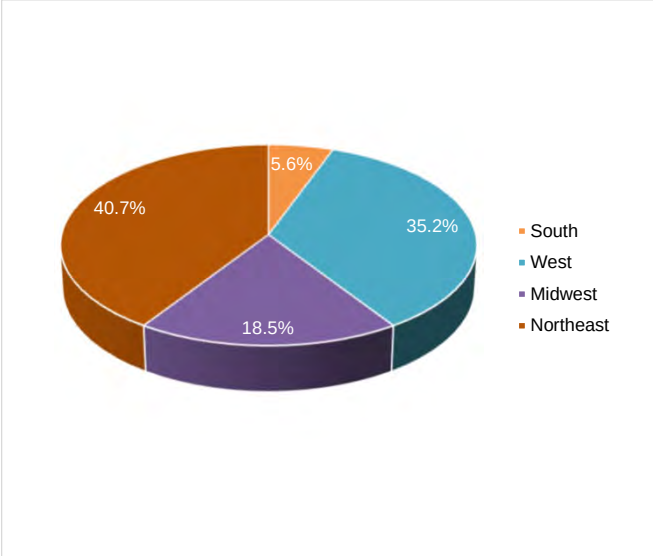


**Race/ethnicity selections are non-exclusive.*

***Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.*

2021–22 UIRM Program Members Classified by State

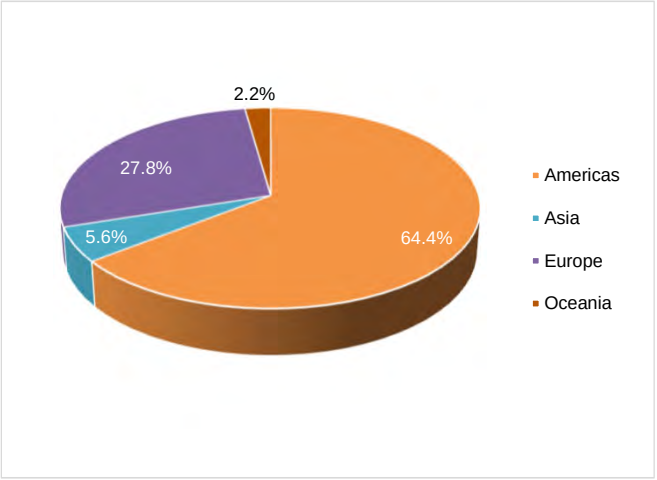
State	#	%	*2020 Census*
South	**3**	**5.6%**	***38.1%***
AL	0	0.0%	*1.5%*
AR	0	0.0%	*0.9%*
DE	0	0.0%	*0.3%*
DC	0	0.0%	*0.2%*
FL	0	0.0%	*6.5%*
GA	0	0.0%	*3.2%*
KY	0	0.0%	*1.4%*
LA	0	0.0%	*1.4%*
MD	1	1.9%	*1.9%*
MS	0	0.0%	*0.9%*
NC	1	1.9%	*3.1%*
OK	0	0.0%	*1.2%*
SC	0	0.0%	*1.5%*
TN	0	0.0%	*2.1%*
TX	0	0.0%	*8.8%*
VA	1	1.9%	*2.6%*
WV	0	0.0%	*0.5%*
West	**19**	**35.2%**	***23.7%***
AK	0	0.0%	*0.2%*
AZ	0	0.0%	*2.2%*
CA	15	27.8%	*11.9%*
CO	2	3.7%	*1.7%*
HI	0	0.0%	*0.4%*
ID	0	0.0%	*0.6%*
MT	0	0.0%	*0.3%*
NM	0	0.0%	*0.6%*
NV	0	0.0%	*0.9%*
OR	0	0.0%	*1.3%*
UT	1	1.9%	*1.0%*
WA	1	1.9%	*2.3%*
WY	0	0.0%	*0.2%*
Midwest	**10**	**18.5%**	***20.8%***
IA	0	0.0%	*1.0%*
IL	5	9.3%	*3.9%*
IN	2	3.7%	*2.0%*
KS	1	1.9%	*0.9%*
MI	1	1.9%	*3.0%*
MN	0	0.0%	*1.7%*
MO	0	0.0%	*1.9%*
ND	0	0.0%	*0.2%*
NE	0	0.0%	*0.6%*
OH	0	0.0%	*3.6%*
SD	0	0.0%	*0.3%*
WI	1	1.9%	*1.8%*
Northeast	**22**	**40.7%**	***17.4%***
CT	1	1.9%	*1.1%*
MA	4	7.4%	*2.1%*
ME	0	0.0%	*0.4%*
NH	0	0.0%	*0.4%*
NJ	0	0.0%	*2.8%*
NY	15	27.8%	*6.1%*
PA	1	1.9%	*3.9%*
RI	1	1.9%	*0.3%*
VT	0	0.0%	*0.2%*
Other	**0**	**0.0%**	***0.0%***
PR	0	0.0%	*0.0%*
Other	0	0.0%	*0.0%*
Total	**54**	**100.0%**	***100.0%***



**Regions based on US Census classification*

2021–22 UIRM Program Members Classified by Countries

Africa			**0**
Americas			**58**
	Central America	Costa Rica	1
	North America	Canada	1
		United States	54
	South America	Argentina	1
		Chile	1
Asia			**5**
	Eastern Asia	Japan	1
	Western Asia	Israel	4
Europe			**25**
	Eastern Europe	Ukraine	1
	Northern Europe	Sweden	1
		United Kingdom	4
	Southern Europe	Italy	4
		Portugal	2
	Western Europe	Austria	1
		France	6
		Germany	3
		Switzerland	3
Oceania			**2**
	Australia & New Zealand	Australia	2
Grand Total			**90**



**Regions based on United Nations classification*

Universality & Integrability in Random Matrix Theory & Interacting Particle Systems
August 16, 2021 - December 17, 2021

Total Program Members:	90
Total Survey Respondants:	87
Response Rate:	97%

While at MSRI my research program was advanced in the following ways:

Q1. I learned new ideas/techniques which are applicable to my problems

Yes	85	98%
No	2	2%
Total Responses	87	

Q2. I had opportunities to present my work to new audiences

Yes	81	93%
No	6	7%
Total Responses	87	

Q3. I initiated research with new collaborators

Yes	71	82%
No	16	18%
Total Responses	87	

Q4. I initiated research in new areas

Yes	64	74%
No	23	26%
Total Responses	87	

Q5. My research was advanced in these other ways:

Link to Qualitative Responses

Q6. If your answer to any of the above set of questions was no, what opportunities should MSRI provide to mitigate this?

Link to Qualitative Responses

Q7. MSRI aims to provide a supportive environment for all program participants. How satisfied were you with this aspect of your experience?

1 - Least Satisfying	0	0%
2	0	0%
3	2	2%
4	9	10%
5 - Most Satisfying	75	87%
Total Responses (Exclusive of N/A)	86	100%

Q8. What suggestions would you have for MSRI to provide a more supportive environment?

Link to Qualitative Responses

MSRI Experience - For Postdoctoral Fellows: Please rate your level of satisfaction with...

Q9. Your assigned mentor:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	3	18%
5 - Most Satisfying	14	82%
Total Responses (Exclusive of N/A)	17	100%

Q10. Your overall mentoring experience:

1 - Least Satisfying	0	0%
2	0	0%
3	1	5%
4	5	26%
5 - Most Satisfying	13	68%
Total Responses (Exclusive of N/A)	19	100%

Q11. The lunch meeting with the directorate:

1 - Least Satisfying	0	0%
2	0	0%
3	2	12%
4	3	18%
5 - Most Satisfying	12	71%
Total Responses (Exclusive of N/A)	17	100%

Q12. What suggestions do you have to improve the mentoring experience at MSRI?

Link to Qualitative Responses

MSRI Experience - For Graduate Students

Q13. How much did the Graduate Student Seminar increase your ability to benefit from MSRI's other scientific activities?

1 - Least Satisfying	0	0%
2	2	11%
3	2	11%
4	5	28%
5 - Most Satisfying	9	50%
Total Responses (Exclusive of N/A)	18	100%

MSRI Experience - Program Seminar: Please rate your level of satisfaction with...

Q14. Learning new ideas and techniques:

1 - Least Satisfying	0	0%
2	0	0%
3	9	11%
4	24	28%
5 - Most Satisfying	52	61%
Total Responses (Exclusive of N/A)	85	100%

Q15. Forming new acquaintances and collaborations:

1 - Least Satisfying	0	0%
2	3	4%
3	6	7%
4	26	31%
5 - Most Satisfying	48	58%
Total Responses (Exclusive of N/A)	83	100%

Q16. The opportunity to present your own work:

1 - Least Satisfying	1	1%
2	0	0%
3	6	8%
4	11	14%
5 - Most Satisfying	59	77%
Total Responses (Exclusive of N/A)	77	100%

MSRI Experience - General Information

Q17. My office accomodations were

1 - Least Satisfying	0	0%
2	0	0%
3	6	7%
4	12	14%
5 - Most Satisfying	68	79%
Total Responses (Exclusive of N/A)	86	100%

Q18. Professionally, my overall satisfation with MSRI was

1 - Least Satisfying	0	0%
2	0	0%
3	2	2%
4	11	13%
5 - Most Satisfying	73	85%
Total Responses (Exclusive of N/A)	86	100%

MSRI Experience - Feedback

Q19. Did you participate in any of the activities associated with the other MSRI programs or workshops? If so, which ones? Did you find them valuable?

Link to Qualitative Responses

Q20. What aspects of the program, environment, facilities, and relationships with colleagues were most beneficial to you?

Link to Qualitative Responses

Q21. What suggestions would you have for improvements at MSRI?

Link to Qualitative Responses

Q22. What suggestions would you have for future MSRI programs or workshops?

Link to Qualitative Responses

MSRI Experience - Computing Services and Facilities

Q23. How would you rate the computing staff for the support you received while at MSRI		
1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	4	5%
5 - Most Satisfying	70	95%
Total Responses (Exclusive of N/A)	74	100%

Q24. How would you rate the computing equipment you used at MSRI:		
1 - Least Satisfying	0	0%
2	1	2%
3	3	5%
4	14	22%
5 - Most Satisfying	45	71%
Total Responses (Exclusive of N/A)	63	100%

Q25. How could we improve our computing services?

Link to Qualitative Responses

Q26. How could we improve our computing equipment and software environment?

Link to Qualitative Responses

MSRI Experience - Relocation Advisory Services: How would you rate the following services you received from MSRI?

Q27. Housing Assistance		
1 - Least Satisfying	1	2%
2	1	2%
3	6	10%
4	9	15%
5 - Most Satisfying	42	71%
Total Responses (Exclusive of N/A)	59	100%

Q28. School and Childcare Assistance		
1 - Least Satisfying	0	0%
2	1	9%
3	1	9%
4	2	18%
5 - Most Satisfying	7	64%
Total Responses (Exclusive of N/A)	11	100%

Q29. Visa Assistance		
1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	4	10%
5 - Most Satisfying	36	90%
Total Responses (Exclusive of N/A)	40	100%

Q30. How could we improve our relocation advisory services?

Link to Qualitative Responses

MSRI Experience - Administrative Support Services

Q31. How would you rate the administrative support you received while at MSRI

1 - Least Satisfying	0	0%
2	0	0%
3	1	1%
4	3	4%
5 - Most Satisfying	81	95%
Total Responses (Exclusive of N/A)	85	100%

Q32. How could we improve our administrative services?

Link to Qualitative Responses

Q33. Your comments about MSRI:

Link to Qualitative Responses

MSRI Experience - Online Experience

Q34. Please tell us what worked well with respect to the online aspects of the program:

Link to Qualitative Responses

Q35. Did you participate in virtual programmatic activities prior to arriving at MSRI? If so, please describe.*

This question was added for the Spring 2022 semester.

Q36. Are you planning on participating in programmatic activities after leaving MSRI? If so, please describe.*

This question was added for the Spring 2022 semester.

Online Experience - How often did you attend talks…

Q37. Virtually from my residence in Berkeley*

1 - Never	*	*
2	*	*
3	*	*
4	*	*
5 - Almost Always	*	*
Total Responses (Exclusive of N/A)	*	*

Q38. Virtually from my office at MSRI*

1 - Never	*	*
2	*	*
3	*	*
4	*	*
5 - Almost Always	*	*
Total Responses (Exclusive of N/A)	*	*

Q39. In person, while using a device to follow along on Zoom*

1 - Never	*	*
2	*	*
3	*	*
4	*	*
5 - Almost Always	*	*
Total Responses (Exclusive of N/A)	*	*

Q40. In person, without following along on Zoom*

1 - Never	*	*
2	*	*
3	*	*
4	*	*
5 - Almost Always	*	*
Total Responses (Exclusive of N/A)	*	*

Q41. Is there anything that would increase the benefit of the virtual options above?*

This question was added for the Spring 2022 semester.

*These questions were added for the Spring 2022 semester.

MSRI
Mathematical Sciences Research Institute

17 Gauss Way Berkeley, CA 94720-5070 p: 510.642.0143 f: 510.642.8609 www.msri.org

The Analysis and Geometry of Random Spaces

January 18, 2022 to May 27, 2022
MSRI, Berkeley, CA
USA

Organizers:

Mario Bonk (University of California, Los Angeles)
Joan Lind (University of Tennessee)
Steffen Rohde (University of Washington)
Eero Saksman (University of Helsinki)
Fredrik Viklund (Royal Institute of Technology)
Jang-Mei Wu (University of Illinois at Urbana-Champaign)

AGRS Organizer Report

1. Introduction

The program *The Analysis and Geometry of Random Spaces* took place from January 18, 2022 to May 27, 2022 at MSRI in Berkeley. The organizers were Mario Bonk (University of California, Los Angeles), Joan Lind (University of Tennessee), Steffen Rohde (University of Washington), Eero Saksman (University of Helsinki), Fredrik Viklund (Royal Institute of Technology) and Jang-Mei Wu (University of Illinois at Urbana-Champaign).

The program was devoted to the investigation of universal analytic and geometric objects that arise from natural probabilistic constructions, often motivated by models in mathematical physics. Prominent examples for recent developments are the Schramm-Loewner evolution, the continuum random tree, Bernoulli percolation on the integers, random surfaces produced by Liouville Quantum Gravity, and Jordan curves and dendrites obtained from random conformal weldings and laminations. The lack of regularity of these random structures often results in a failure of classical methods of analysis. One goal of this program was to enrich the analytic toolbox to better handle these rough structures.

2. Research developments

It was intended that the program had a broad mathematical scope and would bring together mathematicians from different research communities, in particular from analysis and probability. Accordingly, a detailed description of all research directions pursued during the program would exceed the available space. So in the following we will focus on one research area that was central to the program, namely the Gaussian Free Field (GFF) and the theory of random surfaces appearing in Liouville Quantum Gravity (LQG). There have been tremendous recent advances in this area. Many participants were interested in these developments and a weekly study seminar devoted to this subject took place during the whole duration of the program. We were also able to invite some of the "main players" in this area to our workshops to give us a first-hand account.

The Gaussian Free Field (GFF) is a two-dimensional analog of Brownian motion. It is closely related to random surfaces, which appeared in the physics literature already in the early 1980s in connection with Conformal Field Theory. Based on the GFF on can now give a rigorous definition of these objects.

The GFF is a "field" $\{\Gamma(p)\}_{p\in D}$ of Gaussian random variables $\Gamma(p)$ indexed by points $p = (x, y) \in \mathbb{R}^2$ in a two-dimensional (bounded) region $D \subset \mathbb{R}^2$. Here one assumes that the Gaussians $\Gamma(p)$ have expectation 0 and covariance given by

$$\mathbf{E}[\Gamma(p)\Gamma(q)] = G_D(p, q),$$

where G_D denotes the Green function in D (associated with the Dirichlet problem for the Laplacian on D).

In principle, by the general theory of Gaussian processes, these requirements should be enough to characterize the random function $p \in D \mapsto \Gamma(p)$ uniquely, if it exists. Unfortunately, the Gaussian Free Field in fact does *not* exist as a random *function*. An intuitive

explanation is that the Green function $G_D(p,q)$ blows up as $p \to q$, requiring each $\Gamma(p)$ to have infinite variance which is impossible.

Fortunately, one *can* make sense of the GFF as a random *generalized function*, that is, a random *distribution*. With some probabilistic and functional analytic machinery, existence of the GFF can be shown by using random infinite series, or by looking at scaling limits of discrete versions.

Based on the GFF one can give a rigorous definition of a "random surface". This is inspired by the work of the physicist Polyakov and others in the 1980s, and the mathematical treatment of Gaussian multiplicative chaos by Kahane in the same decade. One would like to consider two-dimensional manifolds equipped with a (random) Riemannian metric given by the expression

$$ds^2 = e^{\gamma\Gamma(p)}(dx^2 + dy^2) \tag{1}$$

with $\gamma > 0$ serving as a parameter. Since the Gaussian Free Field is a distribution and not a function, this expression is ill-defined: there is no known way of exponentiating a general distribution. Nevertheless, by considering regularizations Γ_ϵ of the GFF, it is possible, when $0 < \gamma < 2$, to make sense of a random area measure as

$$\lim_{\epsilon \to 0} \epsilon^{\gamma^2/2} e^{\gamma\Gamma_\epsilon(p)} dx\, dy.$$

With substantial further work, which is based on very recent advances, one can now give a precise meaning to the random metric in (1). The associated geometric structures, known as γ-LQG surfaces are too rough to be Riemannian manifolds in the usual sense; indeed, viewed as metric spaces, they have Hausdorff dimensions strictly greater than 2. Thus the search for "typical" or "randomly selected" surfaces once more leads to exotic objects, and has provided impetus for the development of new probabilistic and geometric tools to define and handle such spaces.

The random spaces one obtains as LQG-surfaces can be identified with scaling limits of certain discrete objects, just as Brownian motion is a limit of random walks. For instance, for certain natural models of triangulations chosen "uniformly at random", rescaling the resulting graph distances in a suitable way, as the number of faces goes to infinity, yields a scaling limit known as the Brownian map. This limiting random metric space has now been identified, in law, with a certain LQG-surface with parameter $\gamma = \sqrt{8/3}$. Remarkably, it has also been proven that if one conformally embeds in a canonical way the planar uniform triangulations in the limiting sequence, then the rescaled counting measure on the faces converges to a $\sqrt{8/3}$-LQG area measure. Scott Sheffield's talk during the Introductory Workshop of the program provided a good overview of these ramifications.

There are also deep connections of this theory with Conformal Field Theory. Indeed, the correlation functions in this theory can be expressed in terms of negative moments of certain Gaussian multiplicative chaos measures. Recently, what is known as Liouville Conformal Field Theory was given a precise mathematical definition and this led to establishing several long-standing predictions made originally by physicists (such as the celebrated DOZZ formula). Remi Rhodes and Antti Kupiainen, two of the researchers whose work spearheaded

this progress, gave an account on these developments in the Introductory Workshop and the Topical Workshop, respectively.

3. Organizational Structure

After two years of the pandemic, the program was the first in-person mathematical meeting for the vast majority of the participants. Everybody was grateful and excited for the opportunity to meet in person.

The framework for our program was provided by the three programmatic workshops and several weekly research- and study seminars. All workshops and most of the seminars were in hybrid format, allowing for remote access and for viewing of the recordings. Overall, the idea was to keep the schedule relatively light in order to give participants plenty of opportunities for research interactions. The parallel program on *Complex dynamics* had many activities and talks of interest to a large number of participants of our program, and vice versa, so that we also tried to accommodate their schedules and workshops.

The first two workshops took place at the very beginning of our program. The *Connections Workshop* January 19–21, 2022 served the purpose of previewing the research themes of the semester program and highlighted the work of women in the field. It was open to all mathematicians. There was be a panel discussion as well as other social events.

The *Introductory Workshop* immediately followed on January 24–28, 2022. It introduced some of the main themes in probability and geometric analysis that were relevant for the program. A series of short mini-courses gave participants the opportunity to learn about important subjects such as the Schramm-Loewner evolution (SLE) or the Gaussian Free Field (GFF). One highlight of this workshop was Scott Sheffield's "visionary" talk about different aspects of random surfaces.

After this workshop both our program and Complex Analysis scheduled a series of five-minute presentation that gave everybody a chance to introduce themselves to the other participants and talk about their research interests.

In a typical non-workshop week, there were several seminars activities. On Mondays both programs had a joined seminar exclusively for early-career mathematicians (graduate students and postdocs). Wednesday afternoons were earmarked for the Research Seminar with one or two talks by participants about their research. This seminar gave all postdocs of the program a venue to present their work.

In addition, there were several study seminars. Notable are two of these seminars that ran during the whole duration of the program: on Tuesday afternoons a two-hour long seminar devoted two various aspects of of the diffeomorphism group of the unit circle (organized by Masha Gordina, Eveliina Peltola, and Yilin Wang), and on Thursday afternoons a two-hour long seminar devoted to random surfaces (organized by Nathanael Berestycki and Ellen Powell). After this seminar on Thursday, the program had a "social hour" in one of the Berkeley restaurants open to all participants for an opportunity to interact in a more informal setting.

The culmination of the program was the Topical Workshop on March 28–April 01, 2022.

Whereas the first two workshops had strong didactical components and set the course for the semester, this third workshop had a more traditional format of 18 hour-long research talks by notable experts. Broadly speaking, the general theme were random structures that exhibit some form of conformal self-similarity such as the Schramm-Loewner evolution (SLE), the Brownian map and random trees, Liouville Quantum Gravity, and Conformal Field Theory. A particular focus was the discussion of analytic tools needed to address the challenges arising from the often rough underlying sets and spaces.

4. Postdoctoral Fellows

The structural setup of the program gave postdocs an opportunity to learn new mathematics, talk to other participants, and enhance their research careers. Every postdoc was assigned a senior mentor with the expectation of regular meetings. They had a chance to introduce themselves in a five-minute presentation, give a more extended research presentations in the research seminar on Wednesdays (every postdoc gave a talk there), and interact with their peers in the Monday seminar for early-career mathematicians. There were several panels and seminars devoted to various aspects of professional development for early career mathematicians. Finally, postdocs had many opportunities for informal social interactions during lunch at MSRI or the regular social activities on Thursday evening.

We think that our postdocs felt well-integrated in our program and were happy with their experience at MSRI. Of course, how well they will benefit from this experience in the future remains to been seen and depends a lot on individual circumstances.

5. Graduate Students

Graduate students had a more fleeting existence in our program as they typically visited only for a short period of time (with some exceptions). It was criticized by some senior participants that they could not bring their PhD students for the full duration of their stay to MSRI, but this problem was unavoidable due to office space limitations (in particular, while the pandemic was still ongoing).

6. Inclusivity

We wanted to make sure that everybody feels welcome during the program and took active measures to ensure this, for example by organizing a social hour on Thursday evening to which everybody was invited. Many women took a prominent and very visible role in our program such as Masha Gordina, Eveliina Peltola, Ellen Powell, and Yilin Wang, just to name a few. It made a striking contrast to the lack of diversity that some of us have seen at other conferences and workshops.

Almost all participants found the program and its organizers to be extremely mindful of equity, diversity, and inclusivity. This is perhaps best illustrated by a testimony given by Therese Landry, one of our postdoctoral fellows:

From the initial invitation through the conclusion of the program and beyond, my postdoctoral experience with the AGRS community made a positive impact on my career. I can

without a doubt attribute the current momentum of my research initiatives and professional involvements to my interactions with the organizers and research members of the AGRS program.

As a first generation Filipina-American and a mother, I can identify with the struggle to feel valued or even accepted in a mathematical community. I applied for a postdoctoral position with the AGRS program when I was completing my PhD at UC Riverside, which is both a Hispanic Serving Institution and an Asian American and Native American Pacific Islander-Serving Institution. While brainstorming possible connections between my work in fractal geometry and noncommutative geometry and the themes of the AGRS program, I first reached out to Mario Bonk with some clarifying questions. He responded quickly to my email and even thanked me for pointing out my work! He also took the time to talk with me after a colloquium talk he gave at UC Riverside. More importantly, his generosity with his time for a newcomer to the subject made me feel like I had intrinsic worth as a mathematician. This same openness and encouragement towards academic engagement has characterized all my interactions with the organizers of the AGRS program. I also very much appreciate the opportunity to gain additional access to the themes of the AGRS program through participation in a relevant graduate summer school offered in between the year of my application and the start of the program.

. . .

As part of the AGRS community in residence at MSRI this past spring, I also had access to a wealth of professional advice not available at my PhD granting institution. My time at MSRI followed my second job application season. Steffen Rohde was especially generous with his time and insight on navigating professional issues, as was Masha Gordina, Vivian Healey, Daniel Meyer, Evelina Peltola, Pietro Poggi-Corradini, and Alan Sola. Other especially positive and impactful connections include but are not limited to Adi Glucksam, Larissa Richards, and Yilin Wang. In particular, the inclusion of so many strong female mathematicians amongst the postdocs was a very validating experience for an early career mathematician like myself. I am very glad and grateful to have been included among them and realize that such an accomplishment with respect to diversity and inclusion on the part of the organizers must have taken extra care and effort.

. . .

Besides many new professional contacts and ideas for future research directions, I gained confidence in my abilities as a mathematician and the motivation to pay forward in the mathematical community the sense of welcome and possibility created by the members of the AGRS program.

7. Highlights and Breakthroughs

Without doubt the most striking and fairly recent development in the general area of the program is the work by Kupiainen, Rhodes, and Vargas in Liouville Quantum Gravity (described above). They developed the first mathematically rigorous Conformal Field Theory that satisfy the so-called Segal axioms. As was already mentioned, Kupiainen and Rhodes

gave talks about this in our workshops and a weekly seminar of the program was devoted to study the foundations of the subject up to the most recent advances.

Compared to this monumental achievement, results that are a direct outcome of the program are necessarily more modest. One notable highlight was inspired by a talk of Yilin Wang (recent recipient of the Mirzakhani New Frontiers Prize and Strauch Postdoctoral Fellow of the program) in one of the workshops. She presented her joint work with Don Marshall and Steffen Rohde on certain types of piecewise-geodesic Jordan curves obtained as minimizers of a Möbius invariant energy (the Loewner energy).

She mentioned that the uniqueness of these minimizers (passing through a given number of points in a given homotopy class) is an open and hard problem. This is related to conformal welding (a important topic during the program) and methods such as Kirillov's variational formula (that made its appearance in one of the study seminars in a completely different context) may be useful.

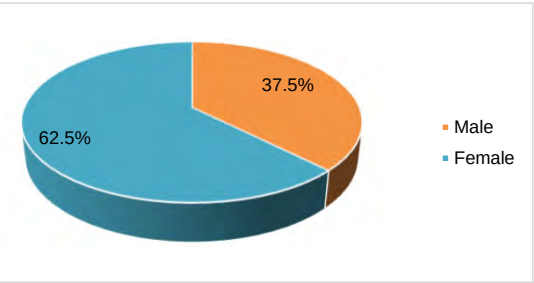
The question caught the attention of quite a few participants, including Kari Astala, Mario Bonk, Janne Junnila, Peter Lin, Curt McMullen, and Steffen Rohde. This led to many fruitful discussions where new ideas were explored and connections to other field were suggested. New collaborations arose and it now seems likely that Yilin Wang's problem will be solved in the very near future.

Postdoc Pre/Post-MSRI Institution Group

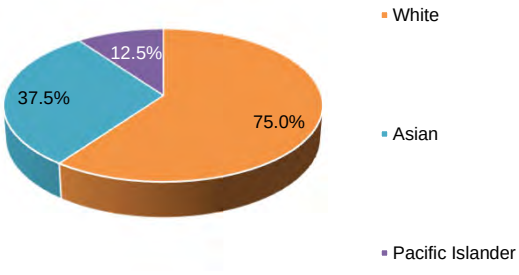
Family Name	First Name	Pre-MSRI Institution	Pre-MSRI Group	Post-MSRI Institution	Post-MSRI Group
Glucksam	Adi	Northwestern U.	Private Large	Northwestern U.	Private Large
Iseli	Annina	UC Los Angeles	Public Large	U. of Fribourg, Switzerland	Foreign
Jego	Antoine	U. of Vienna	Foreign	EPFL	Foreign
Junnila	Janne	EPFL	Foreign	U. of Helsinki	Foreign
Landry	Therese	UC Riverside	Public Small	UC Santa Barbara	Public Large
Lin	Peter	Stony Brook U.	Public Large	Stony Brook U.	Public Large
Richards	Larissa	Lancaster U.	Foreign	U. of Leeds	Foreign
Wang	Yilin	MIT	Private Large	IHES	Foreign

2021-22 AGRS Postdoctoral Fellow Demographic Summary

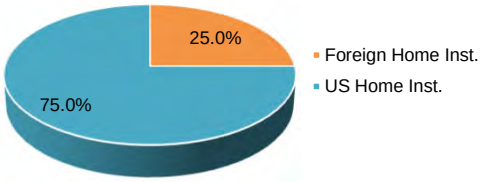
Gender	#	%
# of Distinct Members	8	100.0%
Male	3	37.5%
Female	5	62.5%
Decline to State	0	0.0%



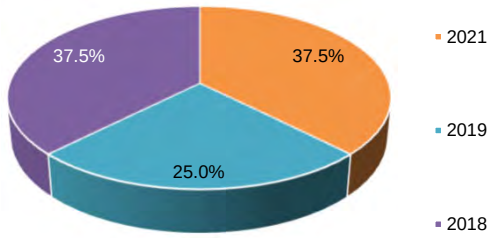
*Race/Ethnicity**	#	%
White	6	75.0%
Asian	3	37.5%
Hispanic/Latino	0	0.0%
Black	0	0.0%
Native American	0	0.0%
Pacific Islander	1	12.5%
Decline to State	0	0.0%
Unavailable Info.	0	0.0%
Minorities**	1	100.0%



Citizenships	#	%
Foreign Home Inst.	2	25.0%
US Home Inst.	6	75.0%
US Citizen & Perm. Residents	1	12.5%
Foreign Citizens	7	87.5%
US Citizens	1	12.5%
US Permanent Residents	0	0.0%



Year of Ph.D	#	%
2021	3	37.5%
2020	0	0.0%
2019	2	25.0%
2018	3	37.5%
2017	0	0.0%
2016	0	0.0%
Total # of Distinct Postdocs	8	100.0%

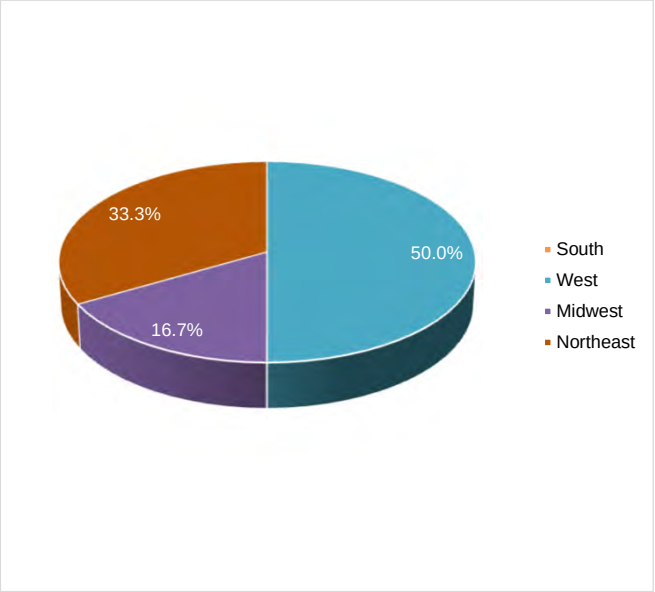


**Race/ethnicity selections are non-exclusive.*

***Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.*

2021-22 AGRS Postdoctoral Fellow Classified by States

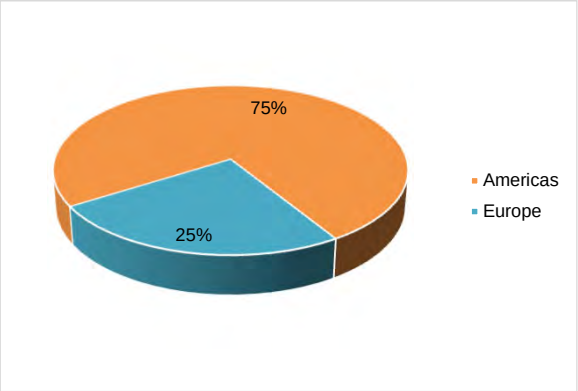
State	#	%	*2020 Census*
South	**0**	**0.0%**	***38.1%***
AL	0	0.0%	*1.5%*
AR	0	0.0%	*0.9%*
DE	0	0.0%	*0.3%*
DC	0	0.0%	*0.2%*
FL	0	0.0%	*6.5%*
GA	0	0.0%	*3.2%*
KY	0	0.0%	*1.4%*
LA	0	0.0%	*1.4%*
MD	0	0.0%	*1.9%*
MS	0	0.0%	*0.9%*
NC	0	0.0%	*3.1%*
OK	0	0.0%	*1.2%*
SC	0	0.0%	*1.5%*
TN	0	0.0%	*2.1%*
TX	0	0.0%	*8.8%*
VA	0	0.0%	*2.6%*
WV	0	0.0%	*0.5%*
West	**3**	**50.0%**	***23.7%***
AK	0	0.0%	*0.2%*
AZ	0	0.0%	*2.2%*
CA	3	50.0%	*11.9%*
CO	0	0.0%	*1.7%*
HI	0	0.0%	*0.4%*
ID	0	0.0%	*0.6%*
MT	0	0.0%	*0.3%*
NM	0	0.0%	*0.6%*
NV	0	0.0%	*0.9%*
OR	0	0.0%	*1.3%*
UT	0	0.0%	*1.0%*
WA	0	0.0%	*2.3%*
WY	0	0.0%	*0.2%*
Midwest	**1**	**16.7%**	***20.8%***
IA	0	0.0%	*1.0%*
IL	1	16.7%	*3.9%*
IN	0	0.0%	*2.0%*
KS	0	0.0%	*0.9%*
MI	0	0.0%	*3.0%*
MN	0	0.0%	*1.7%*
MO	0	0.0%	*1.9%*
ND	0	0.0%	*0.2%*
NE	0	0.0%	*0.6%*
OH	0	0.0%	*3.6%*
SD	0	0.0%	*0.3%*
WI	0	0.0%	*1.8%*
Northeast	**2**	**33.3%**	***17.4%***
CT	0	0.0%	*1.1%*
MA	1	16.7%	*2.1%*
ME	0	0.0%	*0.4%*
NH	0	0.0%	*0.4%*
NJ	0	0.0%	*2.8%*
NY	1	16.7%	*6.1%*
PA	0	0.0%	*3.9%*
RI	0	0.0%	*0.3%*
VT	0	0.0%	*0.2%*
Other	**0**	**0.0%**	***0.0%***
PR	0	0.0%	*0.0%*
Other	0	0.0%	*0.0%*
Total	**6**	**100.0%**	***100.0%***



**Regions based on US Census classification*

2021-22 AGRS Postdoctoral Fellow Classified by Country

Africa			**0**
Americas			**6**
	North America	United States	6
Asia			**0**
Europe			**2**
	Northern Europe	United Kingdom	1
	Western Europe	Switzerland	1
Oceania			**0**
Grand Total			**8**



**Regions based on United Nations classification*

The Analysis and Geometry of Random Spaces

Program Summary

Role	Distinct Members	%	US Citizens & Perm. Res.	%	Women	%	Minorities*	%
Organizers	5	9.6%	3	60.0%	1	20.0%	0	0.0%
Research Professors	12	23.1%	8	66.7%	3	25.0%	0	0.0%
Postdoctoral Fellows	8	15.4%	1	12.5%	5	62.5%	1	100.0%
PD/RM	1	1.9%	1	100.0%	0	0.0%	0	0.0%
Research Members	13	25.0%	4	30.8%	4	30.8%	0	0.0%
Program Associates	13	25.0%	3	23.1%	3	23.1%	0	0.0%
Total # of Distinct Members	**52**	**100.0%**	**20**	***38.5%***	**16**	***30.8%***	**1**	***5.0%***

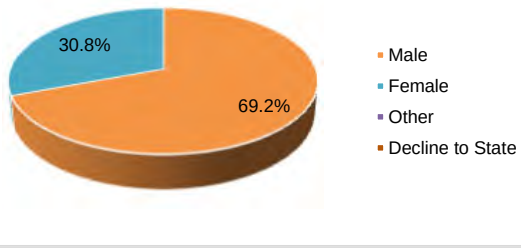
** Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the total number of US citizens & Permanent Residents.*

Home Institution AMS Grouping

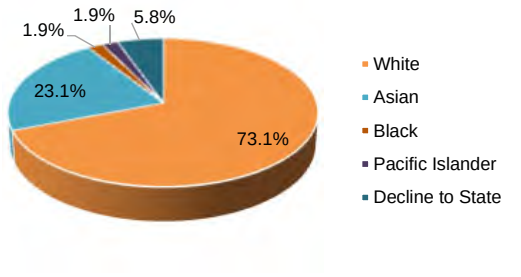
	US								
Role	**Private Large**	**Private Small**	**Public Large**	**Public Medium**	**Public Small**	**Group M or B**	**Non-Group**	**Foreign**	**Total**
Organizers	0	0	2	1	0	0	0	2	5
Research Professors	2	1	1	2	1	0	0	5	12
Postdoctoral Fellows	2	0	2	0	1	0	0	3	8
PD/RM	0	0	0	0	0	0	0	1	1
Research Members	0	0	1	2	2	0	0	8	13
Program Associates	1	0	2	2	1	0	0	7	13
Total	**5**	**1**	**8**	**7**	**5**	**0**	**0**	**26**	**52**
%	***9.6%***	***1.9%***	***15.4%***	***13.5%***	***9.6%***	***0.0%***	***0.0%***	***50.0%***	***100.0%***

2021–22 ARGS Program Members Demographic Summary

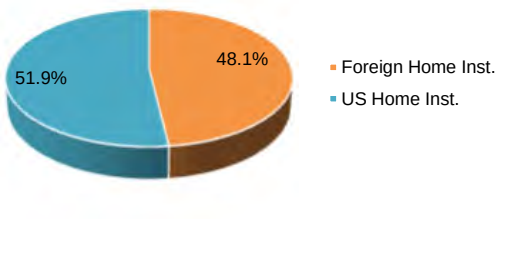
Gender	#	%
# of Distinct Members	52	100.0%
Male	36	69.2%
Female	16	30.8%
Other	0	0.0%
Decline to State	0	0.0%



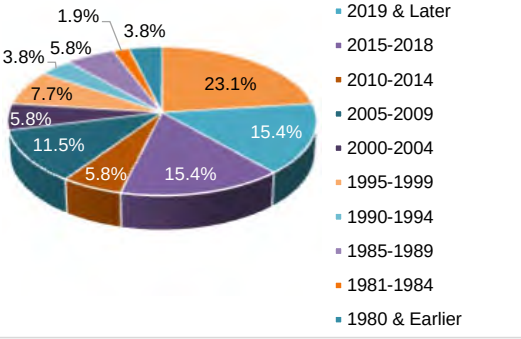
*Race/Ethnicity**	#	%
White	38	73.1%
Asian	12	23.1%
Hispanic/Latino	0	0.0%
Black	1	1.9%
Native American	0	0.0%
Pacific Islander	1	1.9%
Decline to State	3	5.8%
Unavailable Info.	0	0.0%
Minorities**	1	3.1%



Citizenships	#	%
Foreign Home Inst.	25	48.1%
US Home Inst.	27	51.9%
Foreign Citizens	32	61.5%
US Citizens & Perm. Residents	20	38.5%
US Citizens	16	30.8%
US Permanent Residents	4	7.7%



Year of Ph.D	#	%
Program Assoc. (GS)	12	23.1%
2019 & Later	8	15.4%
2015-2018	8	15.4%
2010-2014	3	5.8%
2005-2009	6	11.5%
2000-2004	3	5.8%
1995-1999	4	7.7%
1990-1994	2	3.8%
1985-1989	3	5.8%
1981-1984	1	1.9%
1980 & Earlier	2	3.8%
Total # of Distinct Members	52	100.0%

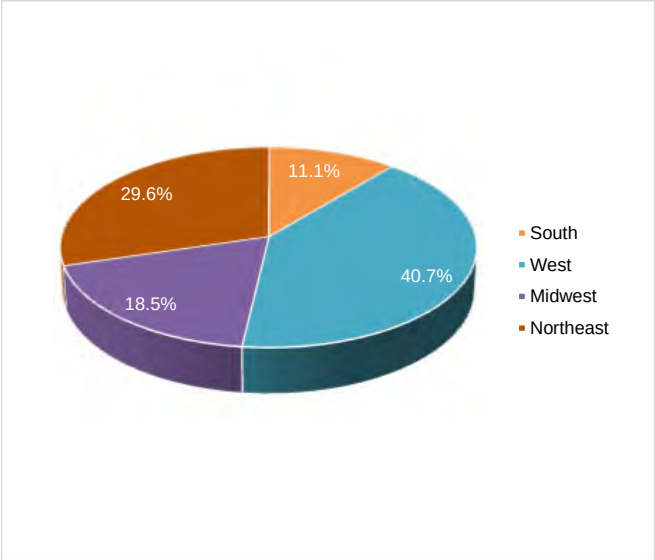


**Race/ethnicity selections are non-exclusive.*

***Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.*

2021–22 AGRS Program Members Classified by State

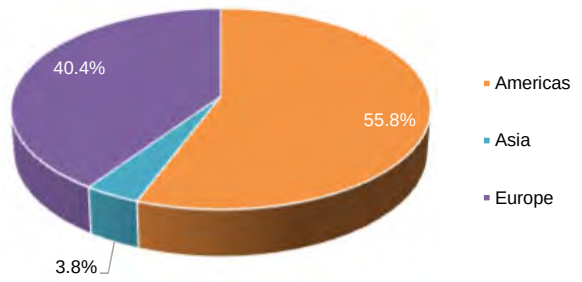
State	#	%	*2020 Census*
South	**3**	**11.1%**	***38.1%***
AL	0	0.0%	*1.5%*
AR	0	0.0%	*0.9%*
DE	0	0.0%	*0.3%*
DC	0	0.0%	*0.2%*
FL	0	0.0%	*6.5%*
GA	0	0.0%	*3.2%*
KY	0	0.0%	*1.4%*
LA	0	0.0%	*1.4%*
MD	0	0.0%	*1.9%*
MS	0	0.0%	*0.9%*
NC	0	0.0%	*3.1%*
OK	0	0.0%	*1.2%*
SC	0	0.0%	*1.5%*
TN	2	7.4%	*2.1%*
TX	1	3.7%	*8.8%*
VA	0	0.0%	*2.6%*
WV	0	0.0%	*0.5%*
West	**11**	**40.7%**	***23.7%***
AK	0	0.0%	*0.2%*
AZ	0	0.0%	*2.2%*
CA	6	22.2%	*11.9%*
CO	0	0.0%	*1.7%*
HI	0	0.0%	*0.4%*
ID	0	0.0%	*0.6%*
MT	0	0.0%	*0.3%*
NM	0	0.0%	*0.6%*
NV	0	0.0%	*0.9%*
OR	0	0.0%	*1.3%*
UT	1	3.7%	*1.0%*
WA	4	14.8%	*2.3%*
WY	0	0.0%	*0.2%*
Midwest	**5**	**18.5%**	***20.8%***
IA	0	0.0%	*1.0%*
IL	2	7.4%	*3.9%*
IN	0	0.0%	*2.0%*
KS	1	3.7%	*0.9%*
MI	0	0.0%	*3.0%*
MN	0	0.0%	*1.7%*
MO	0	0.0%	*1.9%*
ND	0	0.0%	*0.2%*
NE	0	0.0%	*0.6%*
OH	2	7.4%	*3.6%*
SD	0	0.0%	*0.3%*
WI	0	0.0%	*1.8%*
Northeast	**8**	**29.6%**	***17.4%***
CT	4	14.8%	*1.1%*
MA	3	11.1%	*2.1%*
ME	0	0.0%	*0.4%*
NH	0	0.0%	*0.4%*
NJ	0	0.0%	*2.8%*
NY	1	3.7%	*6.1%*
PA	0	0.0%	*3.9%*
RI	0	0.0%	*0.3%*
VT	0	0.0%	*0.2%*
Other	**0**	**0.0%**	***0.0%***
PR	0	0.0%	*0.0%*
Other	0	0.0%	*0.0%*
Total	**27**	**100.0%**	***100.0%***



**Regions based on US Census classification*

2021–22 AGRS Program Members Classified by Countries

Africa			**0**
Americas			**29**
	North America	Canada	2
		United States	27
Asia			**2**
	Eastern Asia	China	1
		Korea, Republic o	1
Europe			**21**
	Northern Europe	Finland	4
		Sweden	4
		United Kingdom	5
	Western Europe	Austria	3
		France	2
		Germany	2
		Switzerland	1
Oceania			**0**
Grand Total			**52**



**Regions based on United Nations classification*

The Analysis and Geometry of Random Spaces

January 18, 2022 - May 27, 2022

Total Program Members:	52
Total Survey Respondants:	49
Response Rate:	94%

While at MSRI my research program was advanced in the following ways:

Q1. I learned new ideas/techniques which are applicable to my problems

Yes	49	100%
No	0	0%
Total Responses	49	

Q2. I had opportunities to present my work to new audiences

Yes	45	92%
No	4	8%
Total Responses	49	

Q3. I initiated research with new collaborators

Yes	43	88%
No	6	12%
Total Responses	49	

Q4. I initiated research in new areas

Yes	40	82%
No	9	18%
Total Responses	49	

Q5. My research was advanced in these other ways:

Link to Qualitative Responses

Q6. If your answer to any of the above set of questions was no, what opportunities should MSRI provide to mitigate this?

Link to Qualitative Responses

Q7. MSRI aims to provide a supportive environment for all program participants. How satisfied were you with this aspect of your experience?

1 - Least Satisfying	1	2%
2	1	2%
3	1	2%
4	7	14%
5 - Most Satisfying	39	80%
Total Responses (Exclusive of N/A)	49	100%

Q8. What suggestions would you have for MSRI to provide a more supportive environment?

Link to Qualitative Responses

MSRI Experience - For Postdoctoral Fellows: Please rate your level of satisfaction with...

Q9. Your assigned mentor:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	2	15%
5 - Most Satisfying	11	85%
Total Responses (Exclusive of N/A)	13	100%

Q10. Your overall mentoring experience:

1 - Least Satisfying	0	0%
2	0	0%
3	1	8%
4	4	31%
5 - Most Satisfying	8	62%
Total Responses (Exclusive of N/A)	13	100%

Q11. The lunch meeting with the directorate:

1 - Least Satisfying	0	0%
2	0	0%
3	2	14%
4	4	29%
5 - Most Satisfying	8	57%
Total Responses (Exclusive of N/A)	14	100%

Q12. What suggestions do you have to improve the mentoring experience at MSRI?

Link to Qualitative Responses

MSRI Experience - For Graduate Students

Q13. How much did the Graduate Student Seminar increase your ability to benefit from MSRI's other scientific activities?

1 - Least Satisfying	0	0%
2	0	0%
3	3	23%
4	5	38%
5 - Most Satisfying	5	38%
Total Responses (Exclusive of N/A)	13	100%

MSRI Experience - Program Seminar: Please rate your level of satisfaction with...

Q14. Learning new ideas and techniques:

1 - Least Satisfying	0	0%
2	0	0%
3	1	2%
4	14	30%
5 - Most Satisfying	32	68%
Total Responses (Exclusive of N/A)	47	100%

Q15. Forming new acquaintances and collaborations:

1 - Least Satisfying	0	0%
2	1	2%
3	3	6%
4	12	26%
5 - Most Satisfying	31	66%
Total Responses (Exclusive of N/A)	47	100%

Q16. The opportunity to present your own work:

1 - Least Satisfying	0	0%
2	1	3%
3	5	13%
4	3	8%
5 - Most Satisfying	29	76%
Total Responses (Exclusive of N/A)	38	100%

MSRI Experience - General Information

Q17. My office accomodations were

1 - Least Satisfying	2	4%
2	0	0%
3	3	6%
4	17	35%
5 - Most Satisfying	26	54%
Total Responses (Exclusive of N/A)	48	100%

Q18. Professionally, my overall satisfation with MSRI was

1 - Least Satisfying	0	0%
2	0	0%
3	2	4%
4	5	10%
5 - Most Satisfying	42	86%
Total Responses (Exclusive of N/A)	49	100%

MSRI Experience - Feedback

Q19. Did you participate in any of the activities associated with the other MSRI programs or workshops? If so, which ones? Did you find them valuable?

Link to Qualitative Responses

Q20. What aspects of the program, environment, facilities, and relationships with colleagues were most beneficial to you?

Link to Qualitative Responses

Q21. What suggestions would you have for improvements at MSRI?

Link to Qualitative Responses

Q22. What suggestions would you have for future MSRI programs or workshops?

Link to Qualitative Responses

MSRI Experience - Computing Services and Facilities

Q23. How would you rate the computing staff for the support you received while at MSRI		
1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	5	11%
5 - Most Satisfying	39	89%
Total Responses (Exclusive of N/A)	44	100%

Q24. How would you rate the computing equipment you used at MSRI:		
1 - Least Satisfying	0	0%
2	0	0%
3	6	15%
4	11	28%
5 - Most Satisfying	23	58%
Total Responses (Exclusive of N/A)	40	100%

Q25. How could we improve our computing services?

Link to Qualitative Responses

Q26. How could we improve our computing equipment and software environment?

Link to Qualitative Responses

MSRI Experience - Relocation Advisory Services: How would you rate the following services you received from MSRI?

Q27. Housing Assistance		
1 - Least Satisfying	2	6%
2	2	6%
3	5	14%
4	7	19%
5 - Most Satisfying	20	56%
Total Responses (Exclusive of N/A)	36	100%

Q28. School and Childcare Assistance		
1 - Least Satisfying	1	10%
2	1	10%
3	1	10%
4	1	10%
5 - Most Satisfying	6	60%
Total Responses (Exclusive of N/A)	10	100%

Q29. Visa Assistance		
1 - Least Satisfying	0	0%
2	1	4%
3	1	4%
4	1	4%
5 - Most Satisfying	22	88%
Total Responses (Exclusive of N/A)	25	100%

Q30. How could we improve our relocation advisory services?

Link to Qualitative Responses

MSRI Experience - Administrative Support Services

Q31. How would you rate the administrative support you received while at MSRI

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	6	13%
5 - Most Satisfying	41	87%
Total Responses (Exclusive of N/A)	47	100%

Q32. How could we improve our administrative services?

Link to Qualitative Responses

Q33. Your comments about MSRI:

Link to Qualitative Responses

MSRI Experience - Online Experience

Q34. Please tell us what worked well with respect to the online aspects of the program:

Link to Qualitative Responses

Q35. Did you participate in virtual programmatic activities prior to arriving at MSRI? If so, please describe.

Link to Qualitative Responses

Q36. Are you planning on participating in programmatic activities after leaving MSRI? If so, please describe.

Link to Qualitative Responses

Online Experience - How often did you attend talks…

Q37. Virtually from my residence in Berkeley

1 - Never	21	43%
2	20	41%
3	6	12%
4	2	4%
5 - Almost Always	0	0%
Total Responses (Exclusive of N/A)	49	100%

Q38. Virtually from my office at MSRI

1 - Never	26	53%
2	19	39%
3	4	8%
4	0	0%
5 - Almost Always	0	0%
Total Responses (Exclusive of N/A)	49	100%

Q39. In person, while using a device to follow along on Zoom

1 - Never	35	71%
2	10	20%
3	3	6%
4	0	0%
5 - Almost Always	1	2%
Total Responses (Exclusive of N/A)	49	100%

Q40. In person, without following along on Zoom

1 - Never	0	0%
2	0	0%
3	0	0%
4	13	27%
5 - Almost Always	36	73%
Total Responses (Exclusive of N/A)	49	100%

Q41. Is there anything that would increase the benefit of the virtual options above?

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Complex Dynamics: From Special Families to Natural Generalizations in One and Several Variables

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COMPLEX DYNAMICS: FROM SPECIAL FAMILIES TO NATURAL GENERALIZATIONS IN ONE AND SEVERAL VARIABLES
FINAL REPORT

SARAH KOCH, JASMIN RAISSY, DIERK SCHLEICHER, AND DYLAN THURSTON

1. Introduction

We had a wonderfully productive and fulfilling visit to MSRI this past spring. It was very rewarding to be back in the presence of other mathematicians, especially after a long period of isolation (due to the pandemic). Members from our program were constantly working together, actively collaborating on new and exciting projects. Even if people could not attend the program in person, then they took advantage of online offerings of all of our seminars and workshops. We are very grateful to have had this valuable opportunity; this document contains our report from a rather successful semester at MSRI.

2. Research Developments

We saw lots of exciting progress on topics that were originally outlined in our proposal, in addition to progress on problems from other parts of complex dynamics. We will mention some specific research highlights in this section.

MLC. One substantial breakthrough that we are particularly proud of concerns one of the deepest and most prominent conjectures in all of dynamical systems, known as *the Mandelbrot set is locally connected*, also known as MLC. This conjecture has challenged the field since the seminal work by Douady and Hubbard in the 1980s, and has inspired work by prominent mathematicians such as Jean-Christophe Yoccoz, Curt McMullen, and, in later years, Mikhail Lyubich and coauthors. Despite 40 years of intense work and much progress, the conjecture is still open in general.

This semester has seen tremendous progress in this direction, by three members here in residence: Dzmitry Dudko, Jeremy Kahn, and Mikhail Lyubich. They announced a result by the name *local connectivity of the Mandelbrot set on the real line*, but they really proved a much stronger result: the Mandelbrot set is locally connected everywhere except possibly at certain endpoints. More precisely, every fiber of the Mandelbrot set is trivial except possibly certain fibers that are associated to only a single external angle (and are infinitely renormalizable). This is significant progress on one of the most important topics in complex dynamics.

Transcendental dynamics. Another direction of intense activity in this program is *transcendental dynamics*. We had a very active group of research on this topic assembled (with an encouraging number of young people, and an encouraging number of female researchers). One of the regular seminars during the entire semester was based on this topic, under the title of *The Essential Seminar* (since transcendental maps have "essential" singularities). Quite a few new research projects have been initiated and developed during this semester, which will result in a number of relevant publications during the coming time. Let us mention one of these directions: one of the most important invariant sets in transcendental dynamics is the *escaping set*, that is the set of all points that converge ("escape") to infinity. One can argue that for transcendental mappings, this set is at least as important as Fatou and Julia sets. It was a famous conjecture, due to Eremenko, that for a large class of transcendental entire functions this set is organized in the form of curves, usually called "rays" (or "hairs"). It was recognized a while ago that this conjecture is wrong in general, and that components of the escaping set could have much more complicated topology than curves (often called "dreadlocks"). However, dreadlocks are complicated and uninviting objects to work on, and functions featuring these are often avoided in research. As a result of this semester, a research project was launched to develop the theory of dreadlocks in a "user-friendly way" so that they can be used in other papers just as easily as if they were just curves.

Date: May 27, 2022.

The final development we would like to mention here concerns the extension of a fundamental theorem of Thurston on rational maps (his "characterization theorem") to the world of transcendental maps. Graduate student member Nikolai Prochorov has taken the lead here, based on earlier work by Schleicher and Shishikura (started at the 1995 program at MSRI), later developed further with Hubbard and, much later, Shemyakov. This project has led to interesting discussions during respective visits with Shishikura, Hubbard, Lyubich, Dudko, Rempe, and others.

Several complex variables. Research in dynamics in several complex variables (SCV for short), has expanded in different directions during this semester, thanks to the possibility of forming connections between the particular expertise of members at MSRI both in SCV and in other branches of complex dynamics. For instance, Núria Fagella, expert in one-dimensional transcendental dynamics, started a new project with Marco Abate and Jasmin Raissy, experts in SCV, on non-autonomus iteration in the unit ball of $\mathbb{C}^n$. We are happy to report some of the breakthroughs and new open research directions and projects in SCV that started during our program at MSRI.

Dynamics of complex Hénon maps was studied from several points of view. As a complex system, Hénon maps are of major interest, due to the fact that all polynomial automorphisms of $\mathbb{C}^2$ can be reduced to compositions of Hénon maps with simpler maps, as shown by Friedland and Milnor. Sébastien Biebler lectured on the recent breakthrough he obtained together with Pierre Berger on the existence of a Hénon map with a wandering domain (and the final version of their paper was accepted for publication during our semester). The main tool in the proof is given by the Newhouse phenomenon. During the semester Biebler also finished writing the first version of a paper in collaboration with Pierre Berger on the typicality of the Newhouse phenomenon, where they prove that, in the C^∞ case, the finiteness of sinks is not typical in the Kolmogorov sense.

Jonguk Yang started a new collaboration with André de Carvalho: using a priori bounds obtained by Yang with Crovisier, Lyubich and Pujals, Yang and de Carvalho believe that they can prove the Pruning Front conjecture, introduced by Cvitanović in 1990, for infinitely renormalizable Hénon maps with sufficiently small Jacobian. This amounts to giving an explicit description of the global topological structure of these maps, including a symbolic coding of the set of all heteroclinic intersections and tangencies. Inspired by this project, Yang should also be able to prove the Non-Wandering Domains Theorem for these maps as well.

The structure of complex Hénon maps has also been studied by Mikhail Lyubich with Romain Dujardin and they are finishing their project on the structure of hyperbolic Hénon maps. Moreover, Mikhail Lyubich designed a project with Anna Miriam Benini to construct conservative Hénon maps with rank one limits.

A promising ongoing project of Sébastien Biebler, Mikhail Lyubich and Jonguk Yang concerns renormalization of dissipative Hénon like maps, and in particular, the rididity problem for infinitely renormalizable maps with a given Jacobian.

Another interesting project of Tanya Firsova, Remus Radu and Raluca Tanase, finalized during the semester, concerns the description of the critical locus for Hénon maps in the HOV region. This is the first description of the critical locus in the non-perturbative case.

The automorphism group of a rational surface, Coxeter groups and positive entropy were also studied during our program by Kyounghee Kim. In particular, she studied the realization problem of subgroups of Coxeter groups.

Dynamics of polynomial skew-products, that is polynomial endomorphisms F of $\mathbb{C}^2$ of the form $F(z,w) = (f(z,w), g(w))$ has been extensively studied in recent years and during our program at MSRI.

Joanna Furno and Scott Kaschner worked on limiting dynamics for two different families of polynomial skew-products, and they expect to finish their work on one of those families soon. Moreover, Alex Kapiamba made a clever suggestion for studying limiting dynamics for sums of power maps and polynomials in several variables that incorporates multiple different polynomial maps at the same time. Scott Kaschner plans to study the limiting dynamics.

Our semester was also the occasion to study the dynamics of other kinds of skew-products. On one hand, Jasmin Raissy, Alan Sola (member of the AGRS program) and Liz Vivas started studying the first dynamical properties of skew-products of the bidisk whose components are rational inner functions. Sola had examined with Ryan Tully-Doyle the iteration of such maps in the easier case where they are of the form $\Phi(z,w) = (\varphi(z,w), w)$, with φ of degree 1 in z. Raissy, Sola and Vivas started studying more involved such skew-products of the form $\Phi(z,w) = (\varphi(z,w), \psi(w))$, where φ is a rational inner map of the bidisk and ψ is a rational inner function of the disk, and both have higher degrees.

On the other hand, Anna Miriam Benini, Jasmin Raissy and Alberto Saracco started studying the dynamics of *transcendental*, that is non-polynomial holomorphic, skew-products of the form $F(z,w) = (f(z,w), g(w))$. In particular, they are working on the natural question whether the Fatou components of the one-dimensional map $f_p(z) := f(z,p)$ on an invariant attracting fiber $\{w = p\}$ can all bulge to Fatou components of the skew-product F, that is, if they all are the intersection of a Fatou component Ω of F with the invariant fiber. Their first results suggest that, in the transcendental context, the answer is more involved than in the polynomial case, even when the invariant fiber is attracting, as for instance Baker domains might not always bulge.

The semester at MSRI was successful also for local holomorphic dynamics. A classical problem in dynamical systems is to find a local model for the behavior of a map in a neighborhood of a fixed point. Jasmin Raissy and Xavier Buff proved that the interplay between discrete and continuous dynamics leads to new surprising examples of local behavior for holomorphic endomorphisms of $\mathbb{C}^2$. More precisely, they are finalizing their project on the dynamics of holomorphic maps of $\mathbb{C}^2$ which are tangent to the identity at a fixed point. They are able to prove that there exist such maps for which the basin of attraction of the fixed point has infinitely many distinct invariant connected components, where orbits converge to the fixed point without being tangent to any direction. This should be the case for the map $(x,y) \mapsto (x + y^2 + 2x^2y, y + x^2 + 2y^2x)$ for instance.

Tanya Firsova, Remus Radu, Jasmin Raissy, Raluca Tanase and Liz Vivas started a collaboration to investigate the existence of hedgehogs for *neutral* germs of biholomorphisms of $\mathbb{C}^2$ at a fixed point, that is germs such that the eigenvalues of the differential at the fixed point are all of modulus one.

Arithmetic dynamics. Arithmetic dynamics is a "new neighbor" to holomorphic dynamics with quite an active life of its own and experiencing rapid development. During our semester we had the opportunity to investigate this further, exploring more connections between complex and arithmetic dynamics at MSRI. Charles Favre completed his joint project with Junyi Xie and Tuyen Truong on the interplay between arithmetic and holomorphic dynamics leading to far-reaching generalizations of the classical entropy formulas. More precisely, Gromov, Dinh and Sibony gave an upper-bound for the topological entropy of any rational map on a projective complex variety. Favre, Xie and Truong extended this bound to arbitrary complete metrized non-Archimedean fields. Their method relies on Berkovich techniques in an essential way.

Favre also completed a project with Juan Rivera-Letelier, where they explored the dynamics of one-dimensional rational maps defined over a complete metrized non-Archimedean field. More precisely, in the case of residual characteristic zero they prove that any rational map has zero Lyapunov exponent if and only if its Julia set is included in a segment. This property is reminiscent of a famous rigidity theorem of A. Zdunik in complex analysis.

Dynamical moduli spaces. A central research topic in complex dynamics concerns dynamical moduli spaces; that is, conformal conjugacy classes of holomorphic dynamical systems of a given degree. For example, the moduli space of quadratic polynomials is isomorphic to the complex plane and contains the Mandelbrot set, M. This moduli space has been extensively studied over the past 40 years with much success. A major goal in the subject is to understand other moduli spaces to the same extent. The moduli space of quadratic rational maps is a natural space to consider next; it is isomorphic to $\mathbb{C}^2$ (as shown by Milnor), and it contains the moduli space of quadratic polynomials. Many of our participants are investigating this moduli space from different perspectives. We mention a few of them here.

There are natural algebraic curves sitting inside the moduli space of quadratic rational maps: the polynomial locus is one such example. The Milnor curve of type (k,n) is defined by the condition that one of the two critical points of a quadratic rational map is periodic of period n after k steps. These curves are smooth, and they have attracted a lot of attention over the past ten years. In particular, it is still unknown if these curves are irreducible over $\mathbb{C}$ (this is equivalent to the question of whether the curves are connected). Of particular interest are the curves Per_n, defined by the condition that one of the two critical points is periodic of period n. When our program began in January 2022, it had been previously verified (via computation) that Per_n is connected for all $1 \leqslant n \leqslant 5$. We are extremely excited to report that two of our younger researchers are responsible for pushing this further at MSRI. We will describe their results.

Caroline Davis, one of our graduate students in residence, was the center of a very active collaboration focused on the curves Per_n. Curt McMullen pointed the group to Milnor's original paper on quadratic rational maps, which contains the key statement that every connected component of Per_n contains quadratic polynomials. This sparked a creative approach to the question of connectivity that Caroline and collaborators are pursuing. She is working to build a combinatorial model of Per_n using the notion of "shared matings". In

particular, if she can show that any pair of polynomials in Per_n is connected by shared matings in her model, then Per_n is connected. Caroline worked extensively with Laurent Bartholdi, on a daily basis, to explore the Per_n curves and manufacture these models. They made extensive progress on Per_6 and Per_7 establishing the connectivity of these curves. We are excited to see where this project takes her.

Rohini Ramadas, one of our postdocs in residence, established a remarkable link between the irreducibility of the Per_n curves (over $\mathbb{C}$) and the irreducibility of the so-called "Gleason polynomials" (over $\mathbb{Z}$). The nth Gleason polynomial $G_n \in \mathbb{Z}[c]$ is the monic polynomial whose roots in $\mathbb{C}$ are exactly the centers of period n of the Mandelbrot set. It is unknown if these polynomials split over the integers. Rohini proved that if G_n is irreducible over $\mathbb{Z}$, then Per_n is irreducible over $\mathbb{C}$. John Doyle, Paul Fili, and Bella Tobin at Oklahoma State University have recently used Magma to verify that the Gleason polynomials G_n are irreducible for n up to period 19. As a consequence, by Rohini's work at MSRI, the Milnor curves Per_n are irreducible for all n up to 19.

Rohini's proof embeds the curve Per_n inside of a Hurwitz space. She studies how Per_n intersects the boundary of the Hurwitz space in the Harris-Mumford compactification. This idea has been quite fruitful in the study of the Milnor curves: Eko Hironaka and Sarah Koch used similar approached to show that a natural covering space of Per_4 has infinitely many connected components. These covering spaces are also an active area of research, and there are many exciting open problems to pursue that tie these research threads together.

Several people are actively involved in studying the curves Per_n. In fact, there were many discussions about organizing a series of workshops centered around all of this research activity, much of which was generated at MSRI this past semester. We will also emphasize that researchers at a variety of different career stages were constantly working together at MSRI as they discussed problems in this area. Some of them include: Laurent Bartholdi, Caroline Davis, Tanya Firsova, Eko Hironaka, Jeremy Kahn, Alex Kapiamba, Sarah Koch, Curt McMullen, Rohini Ramadas, Rob Silversmith, and Becca Winarski.

Many other research projects began over the past couple of months, too numerous to mention. Several projects have taken advantage of the mathematical proximity of the parallel AGRS program; active people in this direction include Annina Iseli, Daniel Meyer, Lukas Geyer, Jack Burkart, and others. Moreover, many people mentioned that this semester served as perfect "therapy" from longterm sufferings after lockdown or substantial administrative duties.

3. Organizational Structure

We were pleasantly surprised with how well our program maintained an online presence. Some of our members could only participate remotely (due to various challenges like the pandemic), and we were initially a little worried that they might not feel as integrated into the group. However, we noticed that many of them attended a large number of our events virtually, and they still interacted with the members in residence on a a regular basis. We thank MSRI for making it particularly easy for people to participate remotely. We would like to specifically mention Vladlen Timorin: there were some unfortunate circumstances that prevented him from attending our program in person. But he was still very much a part of our program, attending every event remotely. We commend him for this level of dedication and hope we will see him in person soon.

Seminars. We had essentially daily seminars, avoiding overlap with those of the parallel AGRS program. These seminars focused on different aspects of our program.

- The principal seminar was the *dynamics seminar* that took place twice a week on Tuesday afternoons, and on Friday mornings (joint with the established Stony Brook dynamics seminar). It covered all aspects of our program, together with some connections beyond.
- The *essential seminar* took place usually on Thursday mornings; it brought together activities related to transcendental dynamics (such maps have "essential" singularities). Many of the meetings in this seminar were structured in the form of mini-courses, often given by a small team of people over several weeks.
- Another relevant seminar was the *algebraic dynamics seminar*, usually also (earlier) on Thursday mornings. This seminar reached out beyond the main focus of the semester, exploring connections to research directions that have become increasingly relevant in recent years.

- On Friday afternoons, we often had a *learning seminar* that featured talks on a variety of different topics, which ranged from talks on original research to expository talks, like the one that Curt McMullen delivered on the work of Dennis Sullivan, the 2022 Abel Prize winner.
- The *junior seminar* met on Monday afternoons; it featured talks by our younger researchers, and attendance was limited to only junior members. This gave the speakers a chance to share their work with their peers in an environment where they did not experience extra (perceived) pressure from more senior members.
- The *Hubbard semigroup* continues to meet regularly. This is an online seminar that meets on Monday and Saturday afternoons. Everyone is welcome, and younger people in particular are encouraged to attend. John Hubbard hosts this seminar, inviting the participants to share their work with the group over Zoom. This is a great environment for younger people to not only interact with Hubbard (a pioneer in the field of complex dynamics), but also to freely exchange ideas as they learn about the research of their peers and colleagues.

Workshops. We ran three workshops: the Connections Workshop, the Introductory Workshop, and the Topical Workshop over the course of our semester. We were pleased with how well each of the workshops went; please see workshop evaluations for more specific information.

Informal discussions. One of the most positive aspects of our time at MSRI was all of the interaction between our participants. Many important discussions organically materialized over lunch, tea, or on an afternoon walk along the beautiful firetrail. Although this time was more unstructured, we appreciate the ample opportunity we had for these kinds of informal interactions that turned out to be quite fruitful.

4. Post-doctoral Fellows

We were thrilled to have a very active group of postdocs in residence at MSRI. We are so proud of the extent to which they interacted with the whole group, and the extent to which they opened up their discussions to anyone who wanted to join. These are exactly the kinds of interactions we were hoping for when we wrote our original proposal, and it was wonderful to see the younger people setting such an example for everyone in the program. We briefly describe some of their projects and interactions below. All of our postdocs were mentored by senior scientists in residence at MSRI.

Rohini Ramadas is a tenure-track assistant professor at the University of Warwick. Rohini proved one of the most exciting results of the program (described in Section 2). She is also working with Xavier Buff and Sarah Koch on a project to catalog the punctures of the Milnor curves in the moduli space of quadratic rational maps, using the language of rescaling limits. During our program, Rohini began a collaboration with Charles Favre to understand arithmetic properties of the "moduli space correspondence", a central object from William Thurston's Topological Characterization of Rational Maps. This past semester has been very productive for Rohini, who has already submitted at least one paper based on her work at MSRI. Rohini gave several talks during our semester, and she was one of the organizers of our main research seminar. Rohini was mentored by Curt McMullen.

Rohini reports:

> *"This semester has tremendously boosted my research program, in terms of momentum, quality and enthusiasm. I learned a lot from attending talks and over several conversations with members. I have gained useful perspectives, and a new understanding of the larger context of my research. In particular, I have a lot better sense than I had before of the current status of the field, and of where things are going. Over the semester, I have gotten to know many researchers in the field, in several career stages and subfields. I'm optimistic that more of these connections will eventually turn into collaborations, and in any case I now have a large community of people I can turn to for mathematical input and professional advice."*

Vasiliki Evdoridou is a postdoc at the Open University. Vasso started two exciting projects at MSRI: one centered on the Teichmüller space of entire functions and wandering domains with Núrria Fagella, Lukas Geyer and Leticia Pardo-Simon, and another project on constructing entire functions using subharmonic functions with Adi Glucksam (from the AGRS program) and Leticia Pardo-Simon. Vasso continues to actively collaborate with these groups, and we look forward to hearing where her projects take her. Vasso was mentored by Tanya Firsova.

Vasso reports:

> *"For the first time I gave a minicourse, which was a great experience. I also gave a research talk and a survey talk at MSRI. I started new collaborations and learned new things including tools from subharmonic functions that can be used to attack questions that i am interested in, and some of the Teichmüller space theory. These new ideas will allow me to take my research further and also develop the theory of wandering domains towards a different direction. Tanya was a great mentor. We met weekly and had very useful discussions mostly on career and applying for jobs. Her advice was very helpful."*

Jack Burkart is a postdoc at the University of Wisconsin. Jack took advantage of every opportunity at MSRI. He collaborated extensively with several other members, and he was one of the most active participants in the whole program. Jack stated a project with Lukas Geyer that resulted from a conversation after a talk Jack delivered in the essential seminar. They are working to prove that all Hausdorff dimensions in $(1, 2)$ occur for Julia sets for entire functions with finitely many singular values. Jack also began working with Tim Mesikepp (in the ARGS program) on a project that concerns a class of Jordan curves in the plane known as the "Weil-Petersson Class". Jack was one of the organizers of the professional development series for both programs AGRS and COMD. Jack was mentored by André Salles de Carvalho.

Jack reports:

> *"I really enjoyed talking about career type things with my mentor, André. That relationship was a big plus overall for the program, I always felt like if there were any issues I had someone to talk to informally."*

And André reports:

> *"Mentoring Jack Burkhart was an enriching experience and a pleasure. He is a talented mathematician and seems well on his way to become an established mathematician. His area of research is not one I am an expert on, which made our conversations more metamathematical: how to deal with career questions, how to make longer term research plans, how to deal with (not always easy or pleasant) interactions with colleagues, etc. Jack, together with Therese, ran panels on career development and I was in one of them on writing research proposals and tapping into research opportunities. I also attended some of the other panels, which were all extremely interesting, and very well directed by Jack and Therese, who prepared interesting and relevant questions and conducted the discussions very ably."*

Misha Hlushchanka is working at Utrecht University, and was mentored by Dylan Thurston. Among the many projects he worked on was deepening the classification of critically fixed rational and anti-rational maps of the sphere, in a joint project with Nikolai Prokhorov. In particular, they went beyond the rational maps to corresponding topological maps of the sphere to itself, of the type that could become rational (dubbed Thurston maps). In another project on branched self-covers, he, together with Mario Bonk and Lukas Geyer from the AGRS program, proved that for many obstructed Thurston maps (i.e., maps that cannot be equivalent to a rational map), the analogue of the Julia set has conformal dimension given by a quantity computed from a canonical curve, confirming a conjecture of Bonk, Geyer, and Pilgrim in these examples. (These obstructed Julia sets give very "bumpy" spheres, of the sort very prominent throughout the AGRS program.)

Insung Park is a postdoc at Stony Brook. He worked on many different projects at MSRI. One nearly-completed highlight with Caroline Davis is proving that matings of quadratic polynomials are almost all Sierpiński carpets. (More precisely, one should restrict to matings of primitive hyperbolic polynomials.) He also started a project with Jeremy Kahn, to study a (non-continuous) point-erasing map on measured foliations, with an eye towards studying the boundary behaviour of the pull-back map, as well as a project with Curt McMullen to find the infimum of the Hausdorff dimension in each component of hyperbolic rational maps.

5. Graduate Students

We were delighted to have an impressively strong group of graduate students in residence at MSRI. We are very proud of the extent to which they interacted with the whole group, and the extent to which they opened up their discussions to anyone who wanted to join. These are exactly the kinds of interactions we were hoping for when we wrote our original proposal, and it was wonderful to see the younger people setting such an example for everyone in the program. We briefly describe some of their projects and interactions below.

Nikolai Prochorov (originally from Belarus, now studying at Aix–Marseille University, directed by Dierk Schleicher) worked on an ambitious research project to extend one of the key ingredients of our program, "Thurston theory", from the established context of rational maps to transcendental maps. This project, and his personal development, benefited enormously from the active environment at MSRI.

Moreover, he developed, jointly with Malavika Mukundan and a postdoc from Paris, Bernhard Reinke, a general program to approximate transcendental entire functions with finitely many singular values by appropriate polynomials. This approximation is based on classical function theoretical methods developed by Nevanlinna and others in the 1800's, but develops these in a function theoretical context. Such approximations have been known since the 1980's for specific transcendental mappings, especially the exponential, but this general development is the appropriate setting for the 2020's, in the spirit of the program "from special families to natural generalizations". Nikolai was an organizer of the junior seminar.

Malavika Mukundan is a young graduate student studying at the University of Michigan under the supervision of Sarah Koch. She too has taken advantage of the opportunities provided by the program. In particular, she managed to redirect her research agenda into a more challenging and promising direction, focusing on a natural family of transcendental mappings that had never been investigated, and exploring relations between parameter spaces of polynomials with varying degrees, but fixed numbers of critical points. In addition, she worked with more senior members on a variation of a classical problem that was known as the "twisted rabbit" problem.

Caroline Davis is a very outgoing graduate student (with Dylan Thurston in Indiana). She has come with a most ambitious research agenda around "matings" of polynoimals into rational maps, and has taken substantial advantage of the opportunties provided by this program and its members. As a result, she has gotten involved in many discussions and collaborations. One interesting connection is that a useful estimate on how many matings exist could be related to a topic investigated for polynomials, called "core entropy" (in discussions with Schleicher). Caroline was an organizer of the junior seminar.

Caroline reports:

> *"Collaboration-wise, the casual environment which surrounded me (a PhD student) with experienced senior faculty was in large part responsible for these insights.... Thanks very much to MSRI and the COMD organizers for an amazing and fun semester that absolutely changed the trajectory of my career!"*

She also actively worked in a wide variety of other projects, many mentioned above, for instance nearly proving that almost every mating of hyperbolic quadratic polynomials is a carpet.

Alex Kapiamba is a graduate student at the University of Michigan working with Sarah Koch. He has made significant progress on the "local connectivity conjecture of the Mandelbrot set" by establishing it, by different tools, for rather different parameters (unbounded primitive combinatorics). This is just one of several accomplishments of this young and ambitious student during this semester: another one is a precise form of an inequality established in the 1990s by Jean-Christophe Yoccoz, where the exact asymptotics of the inequality has been conjectured (and verified numerically) since then, but has remained open until Alex's work. And a third (not even final) piece of his work during this semester, joint with Luca Lomonaco from Brazil, resolves a conjecture on quasiconformal similarity between various "little Mandelbrot sets", concluding decades of work by Branner, Lyubich, Lomonaco, and Petersen. We were very happy to feature Alex as our 'spotlight scientist' in the COMD section of the Emissary.

Danny Stoll is a graduate student working with Sarah Koch at the University of Michigan. Collaborating with Giulio Tiozzo, Caroline Davis, and Malavika Mukundan, Danny is building combinatorial models of the "multiplier curves", special covering spaces of the moduli space of quadratic polynomials. This team of researchers is working to extend their constructions to other families of maps, like the space of cubic polynomials. They continue to have weekly research meetings, and their collaboration is a direct result of their time together at MSRI.

6. Inclusivity

During the program, we included activities for community building, aiming to increase the interest in the subject and encourage participation by junior people including women and underrepresented minorities.

Discord server. At the beginning of the program, we created a discord server for both our program and our companion program. This was essentially a virtual bulletin board where members could post announcements about mathematics, hikes, game nights, walks up the hill, etc. They was a fun and respectful space to advertise for COVID-safe gatherings. For example, to facilitate the establishment of lasting relationships, in addition to the usual lunches and tea breaks, we also organized weekend lunches or teas as a more informal venue to interact both socially and mathematically. We had several social activities, advertised via discord in order to include everyone: post-tea short walks along the firetrail, game nights, weekend hikes, brunches, dinners, parties, etc. We think that these activities helped in including everyone and to create a cohesive group of friends, not just colleagues.

5-minute talks. MSRI encouraged both programs AGRS and COMD to organize "5-minute talks". These 5-minute talks were a very helpful tool to help all of us get to know each other in the beginning of the programs.

The participation of women and underrepresented groups in COMD. We succeeded in our plan to bring together a diverse group of participants ranging from various experts in these fields, to younger researchers who are beginning their studies.

Our program benefited from a very good representation of women as either organizers of the workshops, speakers, or participants. We had planned to have at least one third of women among our participants, and we were able to increase this number by advertising our program and workshops on several websites of societies of women mathematicians: our program counted 43 participants and 18 of them (that is 41.9%) were female.

Our **Connections Workshop** featured lectures on a variety of topics in complex dynamics, given by prominent researchers in the field, as well as presentations by younger participants. It was important for the organizers to highlight the work of female mathematicians. In particular, all of the talks were given by women. There were 7 talks given by junior researchers, which included 1 graduate student and several postdocs. There were also 4 talks given by senior researchers. There was also a panel discussion, "Ask a mathematician", focused on issues particularly relevant to junior researchers, women, and minorities, as well as other social events, like a workshop "cookie walk" which was very well attended.

Our **Introductory Workshop** was built around 4 mini-courses and complemented by 5 talks by leaders in the field. We had a total of 12 speakers and 4 of them were female. Because of the hybrid mode of the workshop, instead of having a full week of all day talks it was chosen to have only morning sessions spread over two weeks. This format allowed a larger number of people to attend the event online. At the same time, this was also really appreciated by the in-person participants, who could facilitate longer discussions with the speakers during the free afternoons.

Our **Topical Workshop** gathered experts in rational dynamics, transcendental dynamics, and dynamics in several complex variables in order to get new perspective and foster discussions in a warm and stimulating atmosphere. We had a total of 19 speakers and 5 of them were female. We also included a poster session to give the opportunity to graduate students and postdocs to present their work.

The presence and involvement of all these women (as either organizers of the workshops, speakers, or participants) significantly improved the quality of the semester. And this was indeed noticed by our participants:

Núria Fagella reports:

> *"It was very exceptional and very nice to have so many women in the program. It made it very special."*

Eko Hironaka reports:

> *"I have never experienced such an easy conviviality and such diversity of career status, geography, gender, race, and background as I've seen this time and it has led to a comfort level among all the members that is refreshing and invigorating."*

There is unfortunately a significant paucity of underrepresented groups working in complex dynamics, especially among the potential relatively senior members of the community. Despite our efforts to alleviate this issue, only 2 of the 43 participants to our program belonged to underrepresented ethnicity groups.

7. Highlights and Breakthroughs

Our research breakthroughs were described above under "Research Developments". To pick just a couple of highlights, the progress on MLC is truly groundbreaking, and there was a tremendous amount of energy around the work on connectivity of Per_n.

Another highlight was a scavenger hunt based on complex dynamics, run during the free afternoon of the third conference. The participants were sent all over the MSRI building, looking for key parts of the Mandelbrot set.

8. Thank You

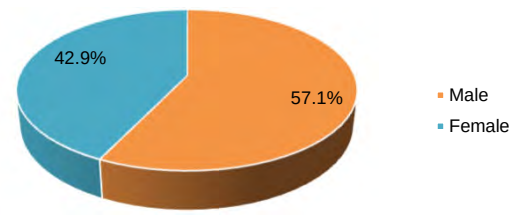
Lastly, we would like to wholeheartedly thank everyone at MSRI for giving us this incredible opportunity. We loved the time we got to spend in such a magical place, studying such beautiful mathematics. We welcomed the chance to do math with real people at chalkboards (instead of with images of people on computer screens over Zoom). All in all, this was an amazingly restorative and stimulating experience. We recognize that hosting an in-person program like ours takes even more work these days than it used to. We treasure our experience at MSRI even more because of this. Thank you.

Postdoc Pre/Post-MSRI Institution Group

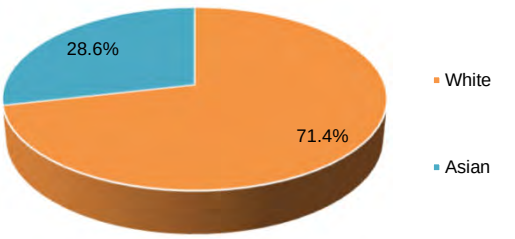
Family Name	First Name	Pre-MSRI Institution	Pre-MSRI Group	Post-MSRI Institution	Post-MSRI Group
Burkart	Jack	U. of Wisconsin Madison	Public Large	U. of Wisconsin Madison	Public Large
Evdoridou	Vasiliki	The Open U.	Foreign	The Open U.	Foreign
He	Yan Mary	U. of Oklahoma	Public Small	U. of Oklahoma	Public Small
Hlushchanka	Mikhail	Utrecht U.	Foreign	Utrecht U.	Foreign
Pardo Simon	Leticia	U. of Manchester (UK)	Foreign	U. of Manchester (UK)	Foreign
Yang	Jonguk	Stony Brook U.	Public Large	U. of Zurich	Foreign

2021-22 COMD Postdoctoral Fellow Demographic Summary

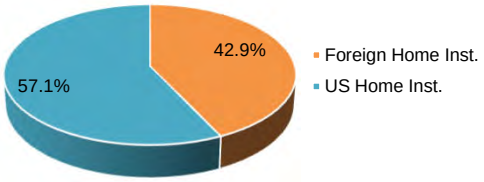
Gender	#	%
# of Distinct Members	7	100.0%
Male	4	57.1%
Female	3	42.9%
Decline to State	0	0.0%



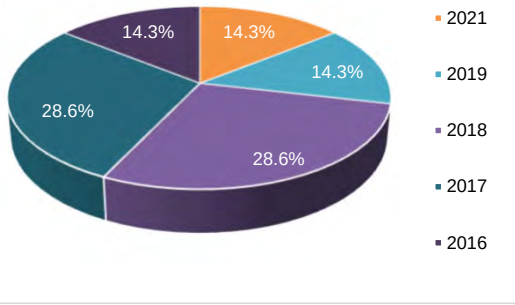
*Race/Ethnicity**	#	%
White	5	71.4%
Asian	2	28.6%
Hispanic/Latino	0	0.0%
Black	0	0.0%
Native American	0	0.0%
Pacific Islander	0	0.0%
Decline to State	0	0.0%
Unavailable Info.	0	0.0%
Minorities**	0	0.0%



Citizenships	#	%
Foreign Home Inst.	3	42.9%
US Home Inst.	4	57.1%
US Citizen & Perm. Residents	1	14.3%
Foreign Citizens	6	85.7%
US Citizens	1	14.3%
US Permanent Residents	0	0.0%



Year of Ph.D	#	%
2021	1	14.3%
2020	0	0.0%
2019	1	14.3%
2018	2	28.6%
2017	2	28.6%
2016	1	14.3%
Total # of Distinct Postdocs	7	100.0%

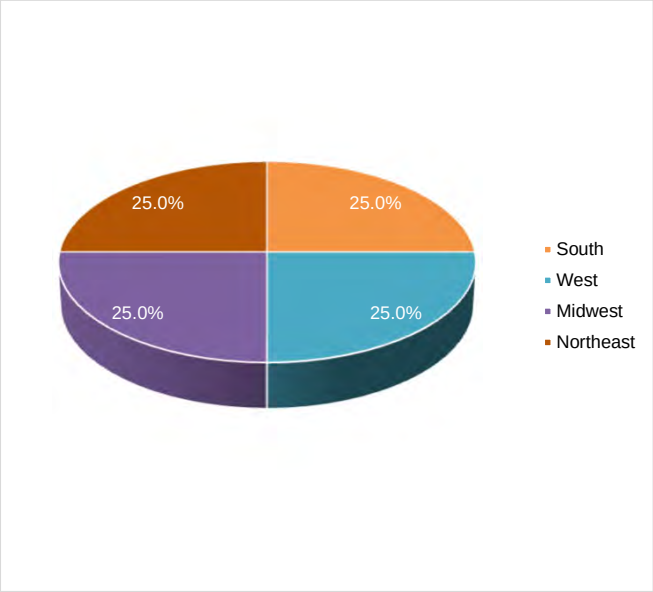


**Race/ethnicity selections are non-exclusive.*

***Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.*

2021-22 COMD Postdoctoral Fellow Classified by States

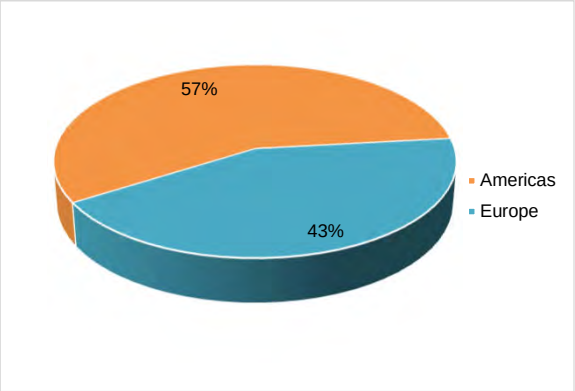
State	#	%	*2020 Census*
South	**1**	**25.0%**	***38.1%***
AL	0	0.0%	*1.5%*
AR	0	0.0%	*0.9%*
DE	0	0.0%	*0.3%*
DC	0	0.0%	*0.2%*
FL	0	0.0%	*6.5%*
GA	0	0.0%	*3.2%*
KY	0	0.0%	*1.4%*
LA	0	0.0%	*1.4%*
MD	0	0.0%	*1.9%*
MS	0	0.0%	*0.9%*
NC	0	0.0%	*3.1%*
OK	1	25.0%	*1.2%*
SC	0	0.0%	*1.5%*
TN	0	0.0%	*2.1%*
TX	0	0.0%	*8.8%*
VA	0	0.0%	*2.6%*
WV	0	0.0%	*0.5%*
West	**1**	**25.0%**	***23.7%***
AK	0	0.0%	*0.2%*
AZ	0	0.0%	*2.2%*
CA	0	0.0%	*11.9%*
CO	0	0.0%	*1.7%*
HI	0	0.0%	*0.4%*
ID	0	0.0%	*0.6%*
MT	0	0.0%	*0.3%*
NM	0	0.0%	*0.6%*
NV	0	0.0%	*0.9%*
OR	0	0.0%	*1.3%*
UT	1	25.0%	*1.0%*
WA	0	0.0%	*2.3%*
WY	0	0.0%	*0.2%*
Midwest	**1**	**25.0%**	***20.8%***
IA	0	0.0%	*1.0%*
IL	0	0.0%	*3.9%*
IN	0	0.0%	*2.0%*
KS	0	0.0%	*0.9%*
MI	0	0.0%	*3.0%*
MN	0	0.0%	*1.7%*
MO	0	0.0%	*1.9%*
ND	0	0.0%	*0.2%*
NE	0	0.0%	*0.6%*
OH	0	0.0%	*3.6%*
SD	0	0.0%	*0.3%*
WI	1	25.0%	*1.8%*
Northeast	**1**	**25.0%**	***17.4%***
CT	0	0.0%	*1.1%*
MA	0	0.0%	*2.1%*
ME	0	0.0%	*0.4%*
NH	0	0.0%	*0.4%*
NJ	0	0.0%	*2.8%*
NY	1	25.0%	*6.1%*
PA	0	0.0%	*3.9%*
RI	0	0.0%	*0.3%*
VT	0	0.0%	*0.2%*
Other	**0**	**0.0%**	***0.0%***
PR	0	0.0%	*0.0%*
Other	0	0.0%	*0.0%*
Total	**4**	**100.0%**	***100.0%***



**Regions based on US Census classification*

2021-22 COMD Postdoctoral Fellow Classified by Country

Africa			**0**
Americas			**4**
	North America	United States	4
Asia			**0**
Europe			**3**
	Northern Europe	Netherlands	1
	Western Europe	United Kingdom	2
Oceania			**0**
Grand Total			**7**



**Regions based on United Nations classification*

Complex Dynamics: from special families to natural generalizations in one and several variables

Program Summary

Role	Distinct Members	%	US Citizens & Perm. Res.	%	Women	%	Minorities*	%
Organizers	5	11.6%	2	40.0%	2	40.0%	0	0.0%
Research Professors	9	20.9%	4	44.4%	3	33.3%	1	25.0%
Postdoctoral Fellows	6	14.0%	1	16.7%	3	50.0%	0	0.0%
PD/RM	3	7.0%	1	33.3%	0	0.0%	0	0.0%
Research Members	12	27.9%	9	75.0%	7	58.3%	0	0.0%
Program Associates	8	18.6%	4	50.0%	3	37.5%	1	25.0%
Total # of Distinct Members	**43**	**100.0%**	**21**	***48.8%***	**18**	***41.9%***	**2**	***9.5%***

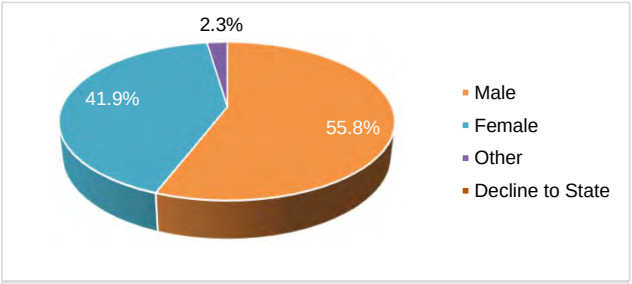
** Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the total number of US citizens & Permanent Residents.*

Home Institution AMS Grouping

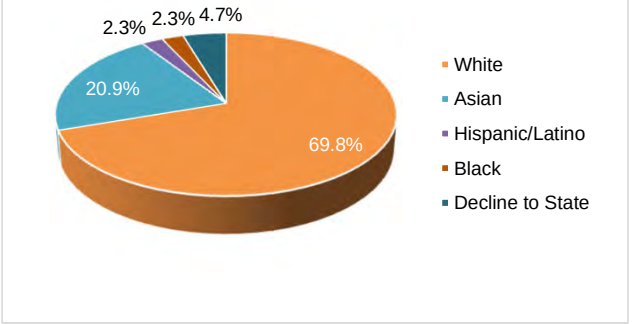
	US								
Role	**Private Large**	**Private Small**	**Public Large**	**Public Medium**	**Public Small**	**Group M or B**	**Non-Group**	**Foreign**	**Total**
Organizers	0	0	2	0	0	0	0	3	5
Research Professors	1	0	2	0	1	0	0	5	9
Postdoctoral Fellows	0	0	2	0	1	0	0	3	6
PD/RM	0	0	0	0	0	0	1	2	3
Research Members	1	0	2	2	1	3	0	3	12
Program Associates	0	0	4	0	1	0	0	3	8
Total	**2**	**0**	**12**	**2**	**4**	**3**	**1**	**19**	**43**
%	***4.7%***	***0.0%***	***27.9%***	***4.7%***	***9.3%***	***7.0%***	***2.3%***	***44.2%***	***100.0%***

2021–22 COMD Program Members Demographic Summary

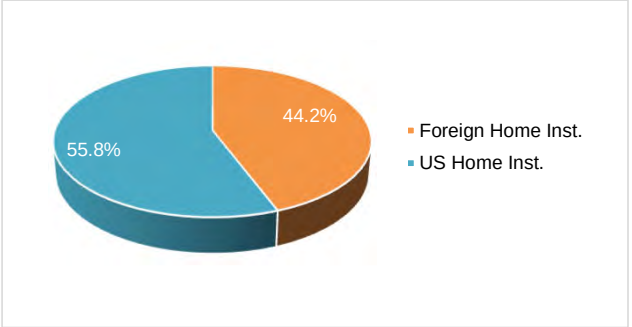
Gender	#	%
# of Distinct Members	43	100.0%
Male	24	55.8%
Female	18	41.9%
Other	1	2.3%
Decline to State	0	0.0%



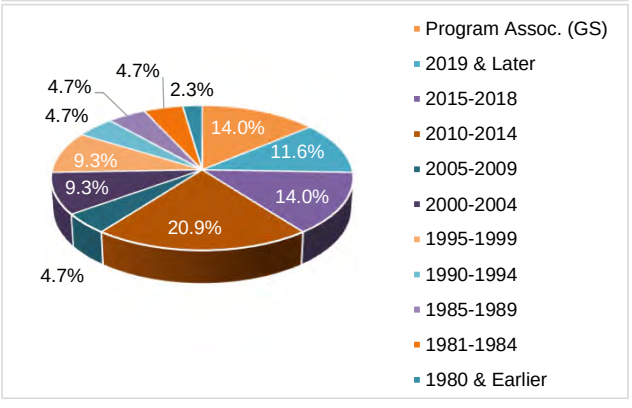
Race/Ethnicity*	#	%
White	30	69.8%
Asian	9	20.9%
Hispanic/Latino	1	2.3%
Black	1	2.3%
Native American	0	0.0%
Pacific Islander	0	0.0%
Decline to State	2	4.7%
Unavailable Info.	0	0.0%
Minorities**	2	9.1%



Citizenships	#	%
Foreign Home Inst.	19	44.2%
US Home Inst.	24	55.8%
Foreign Citizens	22	51.2%
US Citizens & Perm. Residents	21	48.8%
US Citizens	18	41.9%
US Permanent Residents	3	7.0%



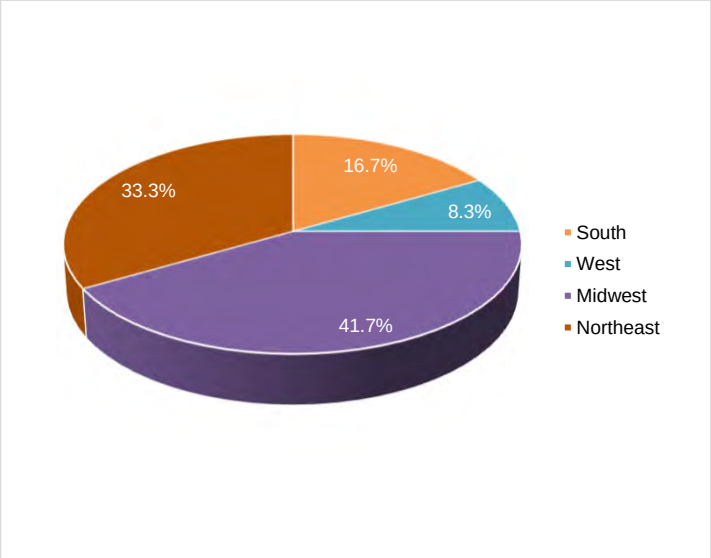
Year of Ph.D	#	%
Program Assoc. (GS)	6	14.0%
2019 & Later	5	11.6%
2015-2018	6	14.0%
2010-2014	9	20.9%
2005-2009	2	4.7%
2000-2004	4	9.3%
1995-1999	4	9.3%
1990-1994	2	4.7%
1985-1989	2	4.7%
1981-1984	2	4.7%
1980 & Earlier	1	2.3%
Total # of Distinct Members	43	100.0%



**Race/ethnicity selections are non-exclusive.*
***Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.*

2021–22 COMD Program Members Classified by State

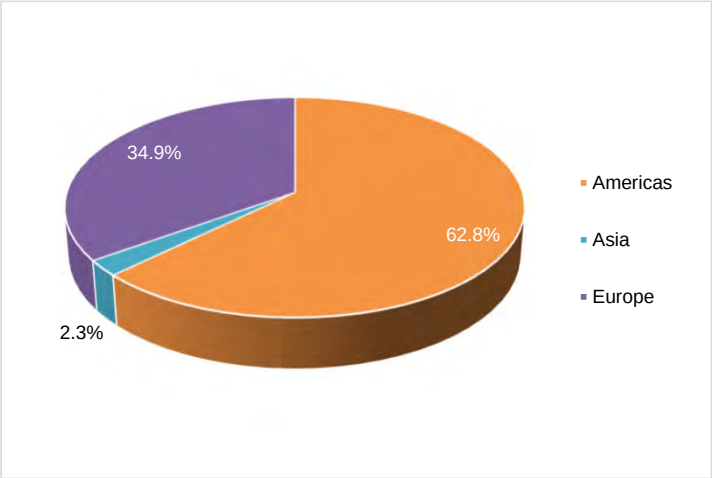
State	#	%	*2020 Census*
South	**4**	**16.7%**	***38.1%***
AL	1	4.2%	*1.5%*
AR	0	0.0%	*0.9%*
DE	0	0.0%	*0.3%*
DC	0	0.0%	*0.2%*
FL	2	8.3%	*6.5%*
GA	0	0.0%	*3.2%*
KY	0	0.0%	*1.4%*
LA	0	0.0%	*1.4%*
MD	0	0.0%	*1.9%*
MS	0	0.0%	*0.9%*
NC	0	0.0%	*3.1%*
OK	1	4.2%	*1.2%*
SC	0	0.0%	*1.5%*
TN	0	0.0%	*2.1%*
TX	0	0.0%	*8.8%*
VA	0	0.0%	*2.6%*
WV	0	0.0%	*0.5%*
West	**2**	**8.3%**	***23.7%***
AK	0	0.0%	*0.2%*
AZ	0	0.0%	*2.2%*
CA	0	0.0%	*11.9%*
CO	0	0.0%	*1.7%*
HI	0	0.0%	*0.4%*
ID	0	0.0%	*0.6%*
MT	2	8.3%	*0.3%*
NM	0	0.0%	*0.6%*
NV	0	0.0%	*0.9%*
OR	0	0.0%	*1.3%*
UT	0	0.0%	*1.0%*
WA	0	0.0%	*2.3%*
WY	0	0.0%	*0.2%*
Midwest	**10**	**41.7%**	***20.8%***
IA	0	0.0%	*1.0%*
IL	0	0.0%	*3.9%*
IN	3	12.5%	*2.0%*
KS	1	4.2%	*0.9%*
MI	4	16.7%	*3.0%*
MN	0	0.0%	*1.7%*
MO	0	0.0%	*1.9%*
ND	0	0.0%	*0.2%*
NE	0	0.0%	*0.6%*
OH	1	4.2%	*3.6%*
SD	0	0.0%	*0.3%*
WI	1	4.2%	*1.8%*
Northeast	**8**	**33.3%**	***17.4%***
CT	0	0.0%	*1.1%*
MA	2	8.3%	*2.1%*
ME	0	0.0%	*0.4%*
NH	0	0.0%	*0.4%*
NJ	0	0.0%	*2.8%*
NY	4	16.7%	*6.1%*
PA	0	0.0%	*3.9%*
RI	2	8.3%	*0.3%*
VT	0	0.0%	*0.2%*
Other	**0**	**0.0%**	***0.0%***
PR	0	0.0%	*0.0%*
Other	0	0.0%	*0.0%*
Total	**24**	**100.0%**	***100.0%***



**Regions based on US Census classification*

2021–22 COMD Program Members Classified by Countries

Africa			**0**
Americas			**27**
	North America	Canada	1
		United States	24
	South America	Brazil	2
Asia			**1**
	Eastern Asia	Japan	1
Europe			**15**
	Northern Europe	United Kingdom	5
	Southern Europe	Italy	1
		Spain	1
	Western Europe	France	6
		Germany	1
		Netherlands	1
Oceania			**0**
Grand Total			**43**



**Regions based on United Nations classification*

Complex Dynamics

January 18, 2022 - May 27, 2022

Total Program Members:	43
Total Survey Respondants:	42
Response Rate:	98%

While at MSRI my research program was advanced in the following ways:

Q1. I learned new ideas/techniques which are applicable to my problems

Yes	42	100%
No	0	0%
Total Responses	42	

Q2. I had opportunities to present my work to new audiences

Yes	40	95%
No	2	5%
Total Responses	42	

Q3. I initiated research with new collaborators

Yes	37	88%
No	5	12%
Total Responses	42	

Q4. I initiated research in new areas

Yes	33	79%
No	9	21%
Total Responses	42	

Q5. My research was advanced in these other ways:

Link to Qualitative Responses

Q6. If your answer to any of the above set of questions was no, what opportunities should MSRI provide to mitigate this?

Link to Qualitative Responses

Q7. MSRI aims to provide a supportive environment for all program participants. How satisfied were you with this aspect of your experience?

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	12	29%
5 - Most Satisfying	30	71%
Total Responses (Exclusive of N/A)	42	100%

Q8. What suggestions would you have for MSRI to provide a more supportive environment?

Link to Qualitative Responses

MSRI Experience - For Postdoctoral Fellows: Please rate your level of satisfaction with...

Q9. Your assigned mentor:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	3	27%
5 - Most Satisfying	8	73%
Total Responses (Exclusive of N/A)	11	100%

Q10. Your overall mentoring experience:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	3	23%
5 - Most Satisfying	10	77%
Total Responses (Exclusive of N/A)	13	100%

Q11. The lunch meeting with the directorate:

1 - Least Satisfying	0	0%
2	0	0%
3	1	8%
4	2	17%
5 - Most Satisfying	9	75%
Total Responses (Exclusive of N/A)	12	100%

Q12. What suggestions do you have to improve the mentoring experience at MSRI?

Link to Qualitative Responses

MSRI Experience - For Graduate Students

Q13. How much did the Graduate Student Seminar increase your ability to benefit from MSRI's other scientific activities?

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	4	36%
5 - Most Satisfying	7	64%
Total Responses (Exclusive of N/A)	11	100%

MSRI Experience - Program Seminar: Please rate your level of satisfaction with...

Q14. Learning new ideas and techniques:

1 - Least Satisfying	0	0%
2	0	0%
3	4	10%
4	11	26%
5 - Most Satisfying	27	64%
Total Responses (Exclusive of N/A)	42	100%

Q15. Forming new acquaintances and collaborations:

1 - Least Satisfying	0	0%
2	0	0%
3	2	5%
4	8	19%
5 - Most Satisfying	32	76%
Total Responses (Exclusive of N/A)	42	100%

Q16. The opportunity to present your own work:

1 - Least Satisfying	1	3%
2	1	3%
3	3	8%
4	6	15%
5 - Most Satisfying	29	73%
Total Responses (Exclusive of N/A)	40	100%

MSRI Experience - General Information

Q17. My office accomodations were

1 - Least Satisfying	0	0%
2	1	2%
3	3	7%
4	11	26%
5 - Most Satisfying	27	64%
Total Responses (Exclusive of N/A)	42	100%

Q18. Professionally, my overall satisfation with MSRI was

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	6	14%
5 - Most Satisfying	36	86%
Total Responses (Exclusive of N/A)	42	100%

MSRI Experience - Feedback

Q19. Did you participate in any of the activities associated with the other MSRI programs or workshops? If so, which ones? Did you find them valuable?

Link to Qualitative Responses

Q20. What aspects of the program, environment, facilities, and relationships with colleagues were most beneficial to you?

Link to Qualitative Responses

Q21. What suggestions would you have for improvements at MSRI?

Link to Qualitative Responses

Q22. What suggestions would you have for future MSRI programs or workshops?

Link to Qualitative Responses

MSRI Experience - Computing Services and Facilities

Q23. How would you rate the computing staff for the support you received while at MSRI		
1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	8	21%
5 - Most Satisfying	30	79%
Total Responses (Exclusive of N/A)	38	100%

Q24. How would you rate the computing equipment you used at MSRI:		
1 - Least Satisfying	0	0%
2	0	0%
3	7	18%
4	14	35%
5 - Most Satisfying	19	48%
Total Responses (Exclusive of N/A)	40	100%

Q25. How could we improve our computing services?

Link to Qualitative Responses

Q26. How could we improve our computing equipment and software environment?

Link to Qualitative Responses

MSRI Experience - Relocation Advisory Services: How would you rate the following services you received from MSRI?

Q27. Housing Assistance		
1 - Least Satisfying	4	12%
2	5	15%
3	2	6%
4	8	24%
5 - Most Satisfying	14	42%
Total Responses (Exclusive of N/A)	33	100%

Q28. School and Childcare Assistance		
1 - Least Satisfying	0	0%
2	1	13%
3	0	0%
4	3	38%
5 - Most Satisfying	4	50%
Total Responses (Exclusive of N/A)	8	100%

Q29. Visa Assistance		
1 - Least Satisfying	0	0%
2	0	0%
3	2	10%
4	1	5%
5 - Most Satisfying	17	85%
Total Responses (Exclusive of N/A)	20	100%

Q30. How could we improve our relocation advisory services?

Link to Qualitative Responses

MSRI Experience - Administrative Support Services

Q31. How would you rate the administrative support you received while at MSRI

1 - Least Satisfying	0	0%
2	0	0%
3	1	2%
4	5	12%
5 - Most Satisfying	35	85%
Total Responses (Exclusive of N/A)	41	100%

Q32. How could we improve our administrative services?

Link to Qualitative Responses

Q33. Your comments about MSRI:

Link to Qualitative Responses

MSRI Experience - Online Experience

Q34. Please tell us what worked well with respect to the online aspects of the program:

Link to Qualitative Responses

Q35. Did you participate in virtual programmatic activities prior to arriving at MSRI? If so, please describe.

Link to Qualitative Responses

Q36. Are you planning on participating in programmatic activities after leaving MSRI? If so, please describe.

Link to Qualitative Responses

Online Experience - How often did you attend talks…

Q37. Virtually from my residence in Berkeley

1 - Never	13	31%
2	20	48%
3	8	19%
4	0	0%
5 - Almost Always	1	2%
Total Responses (Exclusive of N/A)	42	100%

Q38. Virtually from my office at MSRI

1 - Never	15	36%
2	22	52%
3	3	7%
4	1	2%
5 - Almost Always	1	2%
Total Responses (Exclusive of N/A)	42	100%

Q39. In person, while using a device to follow along on Zoom

1 - Never	31	74%
2	5	12%
3	4	10%
4	0	0%
5 - Almost Always	2	5%
Total Responses (Exclusive of N/A)	42	100%

Q40. In person, without following along on Zoom

1 - Never	0	0%
2	1	2%
3	2	5%
4	10	24%
5 - Almost Always	29	69%
Total Responses (Exclusive of N/A)	42	100%

Q41. Is there anything that would increase the benefit of the virtual options above?

Link to Qualitative Responses

Complementary Program 2021-22

August 16, 2021 – July 31, 2022

MSRI

Berkeley, CA

USA

Complementary Program (2021-22)

August 16, 2021 – July 31, 2022

The Complementary Program has a limited number of memberships that are open to mathematicians whose research areas are closely related to those of MSRI's Directorate; additionally, mathematicians who are partners of an invited member of a core program are offered membership in the Complementary Program.

During the 2021-22 year, MSRI had a Complementary Program comprised of one postdoctoral fellow, Benjamin Briggs (University of Utah), and the following 18 researchers: David Anderson (Ohio State University), Bulent Can Özgür Esentepe (University of Connecticut), Hailong Dao (University of Kansas), Joseph Harris (Harvard University), Wade Hindes (Texas State University), Milivoje Lukić (Rice University), Mikhail Mazin (Kansas State University), Andrés R. Vindas Meléndez (University of California, Berkeley), Kent Morrison (American Institute of Mathematics), Bernd Ulrich (Perdue University), Pierre Nolin (City University of Hong Kong), Siamak Yassemi (University of Tehran), Ohad Noy Feldheim (The Hebrew University of Jerusalem), Jerzy Weyman (Jagiellonian University), Swati Patel (University of Warwick), Sylvain Ervedoza (Bordeaux Institute of Mathematics), Palina Salanevich (Utrecht University), and Rob Silversmith (University of Warwick).

David Anderson (*Ohio State University*)
Research Member, January 18, 2022 to May 20, 2022

Spouse of Prof. Liz Vivas, Research Professor in MSRI's "Complex Dynamics" program. Dr. Anderson co-authored a posted paper titled *Identities for Schur-type determinants and Pfaffians* and worked on another titled *Affine degeneracy loci and splitting loci.*

Benjamin Briggs *(University of Utah)*
Postdoctoral Fellow, January 19, 2022 to February 4, 2022

Dr. Briggs co-authored one published paper, *Maximal Tori in HH1 and the Fundamental Group,* and three submitted papers: *On the Lie algebra structure of integrable derivations*, *Product decompositions of moment-angle manifolds and B-rigidity*, and *Cohomological jump loci and duality in local algebra.* He also co-authored three rough drafts and has five papers in the planning stages. MSRI Director, David Eisenbud served as his mentor.

Hailong Dao *(University of Kansas)*
Research Member, January 18, 2022 to May 20, 2022

Dr. Hailong Dao co-authored and published a paper with MSRI Director, David Eisenbud titled *Linearity of Free Resolutions of Monomial Ideals.*

Sylvain Ervedoza ***(Bordeaux Institute of Mathematics)***
Research Member, February 16, 2022 to March 1, 2022

Spouse of "Complex Dynamics" Program Organizer, Jasmin Raissy (Professor at the Bordeaux Institute of Mathematics, Junior Member of the Institut Universitaire de France).

Bulent Can Özgür Esentepe ***(University of Connecticut)***
Research Member, February 3, 2022 to May 27, 2022

Spouse of Larissa Marie Richards, Research Member in MSRI's "The Analysis and Geometry of Random Spaces" spring semester program. Dr. Esentepe collaborated mainly with Dr. Benjamin Briggs. He worked on a project titled *Noncommutative hypersurfaces and Hochschild cohomology*.

Ohad Noy Feldheim ***(The Hebrew University of Jerusalem)***
Research Member, August 20, 2021 to September 17, 2021

Spouse of Dr. Naomi D. Feldheim, Research Member in MSRI's "Universality and Integrability in Random Matrix Theory and Interacting Particle Systems" program.

Joseph Harris ***(Harvard University)***
Research Member, March 11 to March 19, 2022 and July 6 to July 14, 2022

Worked with MSRI Director, David Eisenbud.

Wade Hindes ***(Texas State University)***
Research Member, January 18, 2022 to May 17, 2022

Spouse of Dr. Vivian Healey, Research Member in MSRI's "The Analysis and Geometry of Random Spaces" program. At MSRI, Dr. Hindes co-authored two rough drafts: *Improved asymptotics for semigroup orbit counts,* and *Irreducible polynomials generated by quadratic sequences.*

Milivoje Lukić ***(Rice University)***
Research Member, August 16 to August 27, 2021; October 11 to October 15, 2021; and November 22 to November 24, 2021

Mikhail Mazin ***(Kansas State University)***
Research Member, January 14, 2022 to May 27, 2022

Spouse of Dr. Tanya Firsova, Research Professor in MSRI's "Complex Dynamics" program. Dr. Mazin co-authored the paper *Equivariant K-theory of the space of partial flags* and submitted an article titled *Combinatorics of Triangular Partitions.*

Kent Morrison ***(American Institute of Mathematics)***
Research Member, August 27, 2021 to December 7, 2021

Spouse of Dr. Estelle Basor, Research Professor in MSRI's "Universality and Integrability in Random Matrix Theory and Interacting Particle Systems" program.

Pierre Nolin ***(City University of Hong Kong)***
Research Member, April 6, 2022 to May 10, 2022

Spouse of Dr. Wei Qian, Research Member in MSRI's "The Analysis and Geometry of Random Spaces" program.

Swati, Patel ***(University of Warwick)***
Research Member, August 16, 2021 to September 15, 2021

Spouse of Dr. Axel Saenz Rodriguez, Research Member in MSRI's "Universality and Integrability in Random Matrix Theory and Interacting Particle Systems" program.

Palina Salanevich ***(Utrecht University)***
Research Member, April 5, 2022 to May 25, 2022

Spouse of Dr. Mikhail Hlushchanka, Postdoctoral Fellow in MSRI's "Complex Dynamics" program. Dr. Salanevich collaborated mainly with Dr. Moon Duchin, Research Professor for MSRI's "The Analysis and Geometry of Random Spaces" program. Dr. Salanevich co-authored one submitted paper, *Random Vector Functional Link Networks for Function Approximation on Manifolds*. She commented that "…my time at MSRI allowed me to focus on my own research and make progress on the joint projects with my collaborators from UCLA and UCSD. Also, participation in MSRI program allowed me to expand my professional network."

Rob Silversmith ***(University of Warwick)***
Research Member, January 18, 2022 to May 27, 2022

Spouse of Dr. Rohini Ramadas, Research Member in MSRI's "Complex Dynamics" program.

Bernd Ulrich ***(Purdue University)***
Research Member, December 25, 2021 to January 4, 2022

Worked with MSRI Director, David Eisenbud.

Andrés R. Vindas Meléndez ***(University of California, Berkeley)***
NSF Postdoctoral Fellow, August 17, 2021 to May 23, 2022

Dr. Meléndez submitted two papers during his time at MSRI: *Ehrhart theory of paving and panhandle matroids,* and *Enumerating k-Naples parking functions through Catalan objects*. He also co-authored one published paper titled *Maximal chains in bond lattices.* MSRI's Deputy Director, Hélène Barcelo served as his mentor.

Jerzy Weyman ***(Jagiellonian University)***
Research Member, April 15, 2022 to April 25, 2022

Worked with MSRI Director, David Eisenbud.

Siamak Yassemi ***(University of Tehran)***
Research Member, April 1, 2022 to April 29, 2022

Dr. Yassemi collaborated mainly with MSRI Director, David Eisenbud during his time in the program. He commented that “Eisenbud's seminars given by his group members [were] wonderful and useful.” Dr. Yassemi has expressed interest in attending MSRI’s 2024 programming as a result of his visit.

2021–22 Complementary Program

Program Summary

Role	Distinct Members	%	US Citizens & Perm. Res.	%	Women	%	Minorities*	%
Organizers	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Research Professors	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Postdoctoral Fellows	1	5.3%	0	0.0%	0	0.0%	0	0.0%
PD/RM	1	5.3%	1	100.0%	0	0.0%	1	100.0%
Research Members	17	89.5%	12	70.6%	2	11.8%	0	0.0%
Program Associates	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Guests	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total # of Distinct Members	**19**	**100.0%**	**13**	***68.4%***	**2**	***10.5%***	**1**	***7.7%***

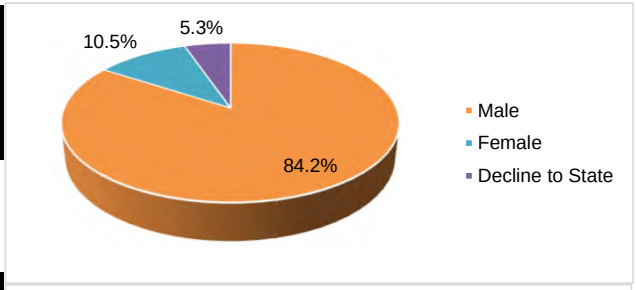
** Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic/Latino, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the total number of US citizens & Permanent Residents.*

Home Institution Grouping

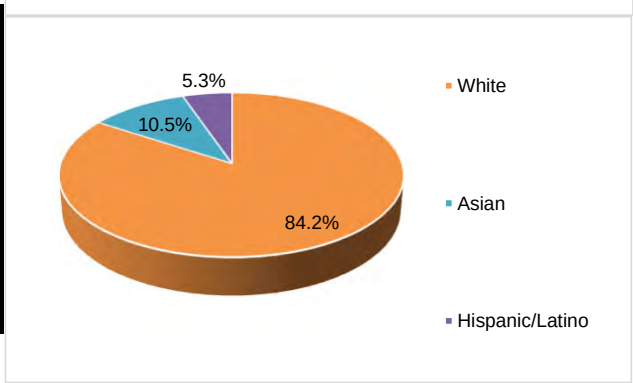
	US								
Role	**Private Large**	**Private Small**	**Public Large**	**Public Medium**	**Public Small**	**Group M or B**	**Non-Group**	**Foreign**	**Total**
Organizers	0	0	0	0	0	0	0	0	0
Research Professors	0	0	0	0	0	0	0	0	0
Postdoctoral Fellows	0	0	0	1	0	0	0	0	1
PD/RM	0	0	1	0	0	0	0	0	1
Research Members	2	0	2	1	3	0	1	8	17
Program Associates	0	0	0	0	0	0	0	0	0
Total	**2**	**0**	**3**	**2**	**3**	**0**	**1**	**8**	**19**
%	***10.5%***	***0.0%***	***15.8%***	***10.5%***	***15.8%***	***0.0%***	***5.3%***	***42.1%***	***100.0%***

2021–22 CP Members Demographic Summary

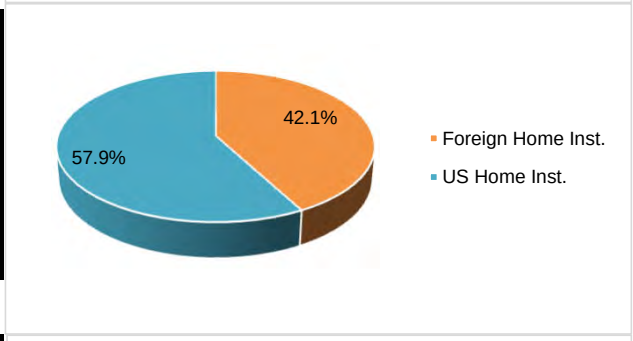
Gender	#	%
# of Distinct Members	19	100.0%
Male	16	84.2%
Female	2	10.5%
Decline to State	1	5.3%



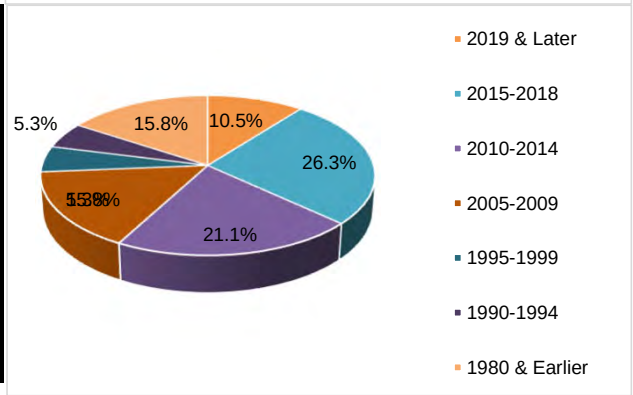
Race/Ethnicity*	#	%
White	16	84.2%
Asian	2	10.5%
Hispanic/Latino	1	5.3%
Black	0	0.0%
Native American	0	0.0%
Pacific Islander	0	0.0%
Decline to State	0	0.0%
Unavailable Info.	0	0.0%
Minorities**	1	7.7%



Citizenships	#	%
Foreign Home Inst.	8	42.1%
US Home Inst.	11	57.9%
US Citizen & Perm. Residents	13	68.4%
Foreign	6	31.6%
US Citizen	9	47.4%
Perm. Residents	4	21.1%



Year of Ph.D	#	%
Program Assoc. (GS)	0	0.0%
2019 & Later	2	10.5%
2015-2018	5	26.3%
2010-2014	4	21.1%
2005-2009	3	15.8%
2000-2004	0	0.0%
1995-1999	1	5.3%
1990-1994	1	5.3%
1985-1989	0	0.0%
1981-1984	0	0.0%
1980 & Earlier	3	15.8%
Total # of Distinct Members	19	100.0%

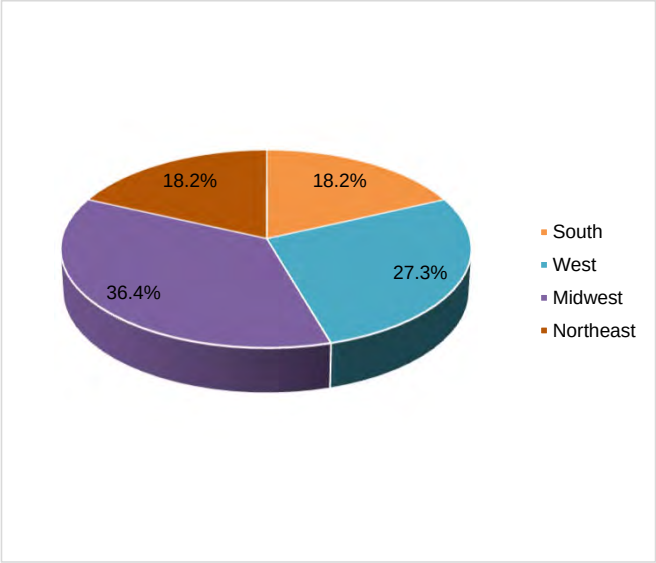


**Race/ethnicity selections are non-exclusive.*

***Minorities are US citizens & Permanent Residents who declare themselves American Indian, Black, Hispanic, or Pacific Islander. Minority percentage is calculated by dividing the number of Minorities by the number of US citizens & Permanent Residents.*

2021–22 CP Members Classified by State

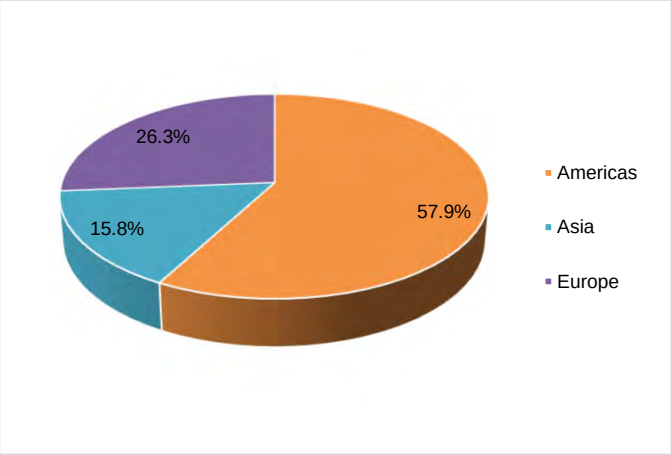
State	#	%	*2020 Census*
South	**2**	**18.2%**	***38.1%***
AL	0	0.0%	*1.5%*
AR	0	0.0%	*0.9%*
DE	0	0.0%	*0.3%*
DC	0	0.0%	*0.2%*
FL	0	0.0%	*6.5%*
GA	0	0.0%	*3.2%*
KY	0	0.0%	*1.4%*
LA	0	0.0%	*1.4%*
MD	0	0.0%	*1.9%*
MS	0	0.0%	*0.9%*
NC	0	0.0%	*3.1%*
OK	0	0.0%	*1.2%*
SC	0	0.0%	*1.5%*
TN	0	0.0%	*2.1%*
TX	2	18.2%	*8.8%*
VA	0	0.0%	*2.6%*
WV	0	0.0%	*0.5%*
West	**3**	**27.3%**	***23.7%***
AK	0	0.0%	*0.2%*
AZ	0	0.0%	*2.2%*
CA	2	18.2%	*11.9%*
CO	0	0.0%	*1.7%*
HI	0	0.0%	*0.4%*
ID	0	0.0%	*0.6%*
MT	0	0.0%	*0.3%*
NM	0	0.0%	*0.6%*
NV	0	0.0%	*0.9%*
OR	0	0.0%	*1.3%*
UT	1	9.1%	*1.0%*
WA	0	0.0%	*2.3%*
WY	0	0.0%	*0.2%*
Midwest	**4**	**36.4%**	***20.8%***
IA	0	0.0%	*1.0%*
IL	0	0.0%	*3.9%*
IN	1	9.1%	*2.0%*
KS	2	18.2%	*0.9%*
MI	0	0.0%	*3.0%*
MN	0	0.0%	*1.7%*
MO	0	0.0%	*1.9%*
ND	0	0.0%	*0.2%*
NE	0	0.0%	*0.6%*
OH	1	9.1%	*3.6%*
SD	0	0.0%	*0.3%*
WI	0	0.0%	*1.8%*
Northeast	**2**	**18.2%**	***17.4%***
CT	1	9.1%	*1.1%*
MA	1	9.1%	*2.1%*
ME	0	0.0%	*0.4%*
NH	0	0.0%	*0.4%*
NJ	0	0.0%	*2.8%*
NY	0	0.0%	*6.1%*
PA	0	0.0%	*3.9%*
RI	0	0.0%	*0.3%*
VT	0	0.0%	*0.2%*
Other	**0**	**0.0%**	***0.0%***
PR	0	0.0%	*0.0%*
Other	0	0.0%	*0.0%*
Total	**11**	**100.0%**	***100.0%***



**Regions based on US Census classification*

2021–22 CP Members Classified by Countries

Africa			**0**
Americas			**11**
	North America	United States	11
Asia			**3**
	South-central Asia	Iran, Islamic Reput	1
	Eastern Asia	China	1
	Westerm Asia	Israel	1
Europe			**5**
	Eastern Europe	Poland	1
	Northern Europe	United Kingdom	2
	Western Europe	France	1
		Netherlands	1
Oceania			**0**
Grand Total			**19**



**Regions based on United Nations classification*

Complementary Program 2021-22

August 16, 2021 - July 31, 2022

Total Program Members:	19
Total Survey Respondants:	16
Response Rate:	84%

While at MSRI my research program was advanced in the following ways:

Q1. I learned new ideas/techniques which are applicable to my problems

Yes	11	69%
No	5	31%
Total Responses	16	

Q2. I had opportunities to present my work to new audiences

Yes	10	63%
No	6	38%
Total Responses	16	

Q3. I initiated research with new collaborators

Yes	12	75%
No	4	25%
Total Responses	16	

Q4. I initiated research in new areas

Yes	10	63%
No	6	38%
Total Responses	16	

Q5. My research was advanced in these other ways:

Link to Qualitative Responses

Q6. If your answer to any of the above set of questions was no, what opportunities should MSRI provide to mitigate this?

Link to Qualitative Responses

Q7. MSRI aims to provide a supportive environment for all program participants. How satisfied were you with this aspect of your experience?

1 - Least Satisfying	0	0%
2	0	0%
3	1	7%
4	5	36%
5 - Most Satisfying	8	57%
Total Responses (Exclusive of N/A)	14	100%

Q8. What suggestions would you have for MSRI to provide a more supportive environment?

Link to Qualitative Responses

MSRI Experience - For Postdoctoral Fellows: Please rate your level of satisfaction with...

Q9. Your assigned mentor:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	0	0%
5 - Most Satisfying	1	100%
Total Responses (Exclusive of N/A)	1	100%

Q10. Your overall mentoring experience:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	1	100%
5 - Most Satisfying	0	0%
Total Responses (Exclusive of N/A)	1	100%

Q11. The lunch meeting with the directorate:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	0	0%
5 - Most Satisfying	1	100%
Total Responses (Exclusive of N/A)	1	100%

Q12. What suggestions do you have to improve the mentoring experience at MSRI?

Link to Qualitative Responses

MSRI Experience - For Graduate Students

Q13. How much did the Graduate Student Seminar increase your ability to benefit from MSRI's other scientific activities?

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	0	0%
5 - Most Satisfying	0	0%
Total Responses (Exclusive of N/A)	0	0%

MSRI Experience - Program Seminar: Please rate your level of satisfaction with...

Q14. Learning new ideas and techniques:

1 - Least Satisfying	0	0%
2	0	0%
3	1	13%
4	1	13%
5 - Most Satisfying	6	75%
Total Responses (Exclusive of N/A)	8	100%

Q15. Forming new acquaintances and collaborations:

1 - Least Satisfying	0	0%
2	0	0%
3	2	22%
4	3	33%
5 - Most Satisfying	4	44%
Total Responses (Exclusive of N/A)	9	100%

Q16. The opportunity to present your own work:

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	1	17%
5 - Most Satisfying	5	83%
Total Responses (Exclusive of N/A)	6	100%

MSRI Experience - General Information

Q17. My office accomodations were

1 - Least Satisfying	0	0%
2	0	0%
3	4	29%
4	2	14%
5 - Most Satisfying	8	57%
Total Responses (Exclusive of N/A)	14	100%

Q18. Professionally, my overall satisfation with MSRI was

1 - Least Satisfying	0	0%
2	0	0%
3	3	19%
4	4	25%
5 - Most Satisfying	9	56%
Total Responses (Exclusive of N/A)	16	100%

MSRI Experience - Feedback

Q19. Did you participate in any of the activities associated with the other MSRI programs or workshops? If so, which ones? Did you find them valuable?

Link to Qualitative Responses

Q20. What aspects of the program, environment, facilities, and relationships with colleagues were most beneficial to you?

Link to Qualitative Responses

Q21. What suggestions would you have for improvements at MSRI?

Link to Qualitative Responses

Q22. What suggestions would you have for future MSRI programs or workshops?

Link to Qualitative Responses

MSRI Experience - Computing Services and Facilities

Q23. How would you rate the computing staff for the support you received while at MSRI

1 - Least Satisfying	0	0%
2	0	0%
3	0	0%
4	3	43%
5 - Most Satisfying	4	57%
Total Responses (Exclusive of N/A)	7	100%

Q24. How would you rate the computing equipment you used at MSRI:

1 - Least Satisfying	0	0%
2	0	0%
3	1	11%
4	4	44%
5 - Most Satisfying	4	44%
Total Responses (Exclusive of N/A)	9	100%

Q25. How could we improve our computing services?

Link to Qualitative Responses

Q26. How could we improve our computing equipment and software environment?

Link to Qualitative Responses

MSRI Experience - Relocation Advisory Services: How would you rate the following services you received from MSRI?

Q27. Housing Assistance

1 - Least Satisfying	1	8%
2	1	8%
3	2	17%
4	2	17%
5 - Most Satisfying	6	50%
Total Responses (Exclusive of N/A)	12	100%

Q28. School and Childcare Assistance

1 - Least Satisfying	0	0%
2	1	17%
3	0	0%
4	1	17%
5 - Most Satisfying	4	67%
Total Responses (Exclusive of N/A)	6	100%

Q29. Visa Assistance

1 - Least Satisfying	0	0%
2	0	0%
3	1	14%
4	1	14%
5 - Most Satisfying	5	71%
Total Responses (Exclusive of N/A)	7	100%

Q30. How could we improve our relocation advisory services?

Link to Qualitative Responses

MSRI Experience - Administrative Support Services

Q31. How would you rate the administrative support you received while at MSRI

1 - Least Satisfying	0	0%
2	0	0%
3	2	14%
4	2	14%
5 - Most Satisfying	10	71%
Total Responses (Exclusive of N/A)	14	100%

Q32. How could we improve our administrative services?

Link to Qualitative Responses

Q33. Your comments about MSRI:

Link to Qualitative Responses

MSRI Experience - Online Experience

Q34. Please tell us what worked well with respect to the online aspects of the program:

Link to Qualitative Responses

Q35. Did you participate in virtual programmatic activities prior to arriving at MSRI? If so, please describe.

Link to Qualitative Responses

Q36. Are you planning on participating in programmatic activities after leaving MSRI? If so, please describe.

Link to Qualitative Responses

Online Experience - How often did you attend talks…

Q37. Virtually from my residence in Berkeley

1 - Never	6	46%
2	3	23%
3	2	15%
4	2	15%
5 - Almost Always	0	0%
Total Responses (Exclusive of N/A)	13	100%

Q38. Virtually from my office at MSRI

1 - Never	7	54%
2	3	23%
3	3	23%
4	0	0%
5 - Almost Always	0	0%
Total Responses (Exclusive of N/A)	13	100%

Q39. In person, while using a device to follow along on Zoom

1 - Never	11	85%
2	1	8%
3	1	8%
4	0	0%
5 - Almost Always	0	0%
Total Responses (Exclusive of N/A)	13	100%

Q40. In person, without following along on Zoom

1 - Never	3	23%
2	1	8%
3	3	23%
4	3	23%
5 - Almost Always	3	23%
Total Responses (Exclusive of N/A)	13	100%

Q41. Is there anything that would increase the benefit of the virtual options above?

Link to Qualitative Responses

Mathematics and Racial Justice

June 9-11 & 16-18, 2021

Virtual Workshop

Organizers:

Caleb Ashley (Boston College),
Ron Buckmire (Occidental College),
Duane Cooper (Morehouse College),
Monica Jackson (American University),
Omayra Ortega (Sonoma State University),
Robin Wilson (California State Polytechnic University, Pomona)

Organizers

First Name	Last Name	Institution
Omayra	Ortega	Sonoma State University
Robin	Wilson	California State Polytechnic University, Pomona
Caleb	Ashley	Boston College
Duane	Cooper	Morehouse College
Monica	Jackson	American University
Ron	Buckmire	Occidental College

Speakers

First Name	Last Name	Institution
Rediet	Abebe	University of California, Berkeley
Emma	Benn	Icahn School of Medicine at Mount Sinai
Robert	Berry	University of Virginia
Maria	De-Arteaga	University of Texas at Austin
Sharad	Goel	Stanford University
Michael	Jones	Mathematical Reviews
Danny	Martin	University of Illinois at Chicago
Darius	McDaniel	Leidos
Brittany	Mosby	Tennessee Higher Education Commission
Stephanie	Somersille	Somersille Math Education Services

Schedule, Notes/Handouts & Videos

Show Schedule, Notes/Handouts & Videos

Agenda View | Calendar View

Show All Collapse

JUN 09, 2021 WEDNESDAY	09:45 AM - 10:10 AM	Welcome and Overview of the Workshop Expectations
	10:10 AM - 11:10 AM	Keynote: Seeking racial equity and social justice in mathematics teaching and learning Robert Berry (University of Arizona)
	11:10 AM - 11:15 AM	Break
	11:15 AM - 12:15 PM	Keynote: Roles for Computing in Social Change Rediet Abebe (University of California, Berkeley)
	12:15 PM - 01:00 PM	Panel (moderated by Lou Matthews) Rediet Abebe (University of California, Berkeley), Robert Berry (University of Arizona)
	01:00 PM - 01:30 PM	Chat and Chew
	01:30 PM - 02:00 PM	Panel: What to expect over the next 5 days
	02:00 PM - 03:00 PM	Networking Happy Hour
JUN 10, 2021 THURSDAY	10:00 AM - 10:10 AM	Welcome: Bias in Algorithms and Technology
	10:10 AM - 11:10 AM	Plenary Talk: Designing for Equity Sharad Goel (Stanford University)
	11:10 AM - 11:25 AM	Break
	11:25 AM - 12:25 PM	Plenary Talk: Sources and consequences of algorithmic bias Maria De-Arteaga (The University of Texas at Austin)
	12:25 PM - 01:00 PM	Chat and Chew
	01:00 PM - 02:00 PM	Panel (moderated by Talitha Washington) Maria De-Arteaga (The University of Texas at Austin), Sharad Goel (Stanford University), Talitha Washington (Clark Atlanta University; Atlanta University Center Consortium)
	02:00 PM - 03:00 PM	Networking Happy Hour
JUN 11, 2021 FRIDAY	10:00 AM - 10:10 AM	Welcome: Public Health Disparities
	10:10 AM - 11:10 AM	Plenary Talk: The Pandemic within The Pandemic Darius McDaniel (Leidos)
	11:10 AM - 11:25 AM	Break
	11:25 AM - 12:25 PM	Plenary Talk: Race and causality in health disparities research: time for a necessary paradigm shift Emma Benn (Icahn School of Medicine at Mount Sinai)
	12:25 PM - 01:00 PM	Chat and Chew
	01:00 PM - 02:00 PM	Panel (moderated by Julie Ivy) Emma Benn (Icahn School of Medicine at Mount Sinai), Darius McDaniel (Leidos)
	02:00 PM - 03:00 PM	Networking Happy Hour

JUN 16, 2021 WEDNESDAY	10:00 AM - 10:10 AM	Welcome: Racial Inequities in Mathematics Education
	10:10 AM - 11:10 AM	Plenary Talk: Teaching to Transgress: Mathematics as a tool for social justice Brittany Mosby (Tennessee Higher Education Commission)
	11:10 AM - 11:25 AM	Break
	11:25 AM - 12:25 PM	Plenary Talk: Rethinking Equity and Inclusion as Racial Justice Models in Mathematics (Education) Danny Martin (University of Illinois at Chicago)
	12:25 PM - 01:00 PM	Chat and Chew
	01:00 PM - 02:00 PM	Panel (moderated by Jalil Cooper) Danny Martin (University of Illinois at Chicago), Brittany Mosby (Tennessee Higher Education Commission)
	02:00 PM - 03:00 PM	Networking Happy Hour
JUN 17, 2021 THURSDAY	10:00 AM - 10:05 AM	Welcome: Fair Division, Allocation, and Representation
	10:05 AM - 11:05 AM	Plenary Talk: Elections and Representation Michael Jones (Mathematical Reviews)
	11:05 AM - 11:15 AM	Break
	11:15 AM - 12:15 PM	Plenary Talk: Once in a Decade Opportunity to Address Gerrymandering Stephanie Somersille (Somersille Math Education Services)
	12:15 PM - 12:45 PM	Chat and Chew
	12:45 PM - 01:45 PM	Plenary Talk: Fair Division and Allocation Michael Jones (Mathematical Reviews)
	01:45 PM - 01:50 PM	Break
	01:50 PM - 02:30 PM	Panel (moderated by Ron Buckmire) Ron Buckmire (Occidental College), Michael Jones (Mathematical Reviews), Stephanie Somersille (Somersille Math Education Services)
	02:30 PM - 03:00 PM	Networking Happy Hour
JUN 18, 2021 FRIDAY	10:00 AM - 10:10 AM	Summary: A Call to Action
	10:10 AM - 11:10 AM	Breakout Sessions - Workshop Thematic Areas
	11:10 AM - 11:25 AM	Break
	11:25 AM - 12:25 PM	Breakout Sessions - Call to Action
	12:30 PM - 01:00 PM	Closing Event

Updated 2 Months Ago By Jennifer Murawski

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Participants

First Name	Last Name	Institution
Aaron	Abrams	Washington and Lee University
Roza	Aceska	Ball State University
Aditya	Adiredja	University of Arizona
Rizwan	Ali	JC Bose University of Science and Technology
Manuchehr	Aminian	California State Polytechnic University, Pomona
Lisa	Apple	Center City Public Charter School
Andrea	Arauza Rivera	California State University, East Bay
Dawn	Archey	University of Detroit Mercy
Federico	Ardila	San Francisco State University
Jayadev	Athreya	University of Washington
Kimberly	Ayers	Carroll College
Eric	Babson	University of California, Davis
Kathie	Bailey	National Academy of Sciences
Earvin	Balderama	California State University, Fresno
Erin	Baldinger	Stanford University
Mario	Banuelos	California State University, Fresno
Hélène	Barcelo	MSRI - Mathematical Sciences Research Institute
Hyman	Bass	University of Michigan
Debasmita	Basu	Montclair State University
Donna	Beers	Simmons University
Therese	Bennett	Southern Connecticut State University
Robert	Berkman	Manhattan Country School
Gabrielle	Bernal	University of Michigan
Kirsten	Bohl	MSRI - Mathematical Sciences Research Institute
Abbey	Bourdon	Wake Forest University
Jennifer	Bowen	The College of Wooster
Robert	Bozeman	Morehouse College
Maritza	Branker	Niagara University
Benjamin	Braun	University of Kentucky
Gina	Braun	Rockford University
James	Broda	University of Oklahoma
Robyn	Brooks	Boston College
Gregory	Budzban	Southern Illinois University
Meredith	Burr	Clemson University
Kariane	Calta	Vassar College
Beth	Campbell Hetrick	Gettysburg College
Catherine	Cannizzo	State University of New York, Stony Brook
Carmen	Caprau	California State University, Fresno
Jon	Chaika	University of Utah
Sunil	Chetty	College of St Benedict and St John's University
Lisa	Claus	Lawrence Berkeley National Laboratory

Participants		
First Name	**Last Name**	**Institution**
Ted	Coe	Northwest Evaluation Association
Jalil	Cooper	Maynard Jackson High School
Kevin	Corlette	University of Chicago
Angelica	Cortes	Modesto Junior College
Anthony	Cortez	California State University, Fresno
Ivan	Corwin	Columbia University
Alissa	Crans	Loyola Marymount University
Scott	Crass	California State Univ, Long Beach
marie	dahleh	Tulane University
Ellie	Dannenberg	University of Denver
Vinci	Daro	Envision Learning Partners
Ryan	Davis	JCPS
Vincent	Davis	UMKC
Dewayne	Derryberry	Idaho State University
Michelle	DeVost	University of California, San Francisco
Jacqueline	Dewar	Loyola Marymount University
Maria Ailynn	Diansuy	Antipolo Institute of Technology
Carrie	Diaz Eaton	Bates College
Behzad	Djafari Rouhani	University of Texas at El Paso
Matthew	Durham	University of California, Riverside
Christina	Edholm	Scripps College
David	Eisenbud	MSRI - Mathematical Sciences Research Institute
Bree	Ettinger	Emory University
Ricela	Feliciano-Semidei	Northern Illinois University
Cos	Fi	Loudoun County Public Schools
Sean	Freeland	West Virginia University
Solomon	Friedberg	Boston College
Eddie	Fuller	Florida International University
Maria	Fung	Worcester State University
Donna	Gabai	Princeton University
Michael	Gagliardo	California Lutheran University
Punit	Gandhi	Virginia Commonwealth University
Jennifer	Garbett	Lenoir-Rhyne University
Kimberly	Gardner	Kennesaw State University
Alejandra	Garrido	Heinrich-Heine-UniversitÃ¤t DÃ¼sseldorf
Teena	Gerhardt	Michigan State University
Joash	Geteregechi	Ithaca College
Sayonita	Ghosh Hajra	California State University, Sacramento
Krista	Gile	University of Massachusetts, Amherst
Edray	Goins	Pomona College
Norma	Gordon	Lesley University

Participants

First Name	Last Name	Institution
Ryan	Grady	Montana State University
Skylar	Grey	University of Wisconsin-Madison
Erin	Griffin	Seattle Pacific University
Helen	Grundman	Bryn Mawr College
Katherine	Harris	North Carolina State University
Angela "Laila"	Hasan	University Southern California
Christine	Haught	Loyola University
Shandy	Hauk	San Francisco State University
Deanna	Haunsperger	Carleton College
Meredith	Hegg	Temple University
Matthew	Heid	San Francisco State University
Dennis	Hejhal	University of Minnesota
Abbe	Herzig	American Mathematical Society
Michael	Hill	University of California, Los Angeles
Stacy	Hoehn	Franklin College
Christel	Hohenegger	University of Utah
Mark	Hoover	University of Michigan
Livia	Hummel	University of Indianapolis
Kenan	Ince	Westminster College
Julie	Ivy	North Carolina State University
Sara	Jensen	Carthage College
Jacqueline	Jensen-Vallin	Lamar University
Christopher	Jett	University of West Georgia
Tiffany	Jokerst	University of California, San Diego
Elizabeth	Jones	Oregon State University
Kristine	Jones	University of Washington
Lakeshia	Jones	University of Arkansas
Laurie	Jordan	Loyola University
Jovan	Julien	Georgia Institute of Technology
Selvi	Kara	University of Utah
Gizem	Karaali	Pomona College
Nadia	Kennedy	New York City College of Technology
Dianne	Kenton	Brock University
Megan	Kerr	Wellesley College
Cathy	Kessel	Consultant
Jaclyn	Kessler	Cerro Coso Community College
Lily	Khadjavi	Loyola Marymount University
Steven	Khan	Brock University
Donald	King	Northeastern University
O'Neill	Kingston	Iowa State University
Robert	Korsan	Carnegie Mellon University
Sherli	Koshy Chenthittayil	University of Connecticut Health
Boyan	Kostadinov	New York City College of Technology

Participants

First Name	Last Name	Institution
Alec	Krueger	Loyola University
Dave	Kung	University of Texas at Austin
Cagatay	Kutluhan	University at Buffalo (SUNY)
Miriam	Kuzbary	Georgia Institute of Technology
Judith	Kysh	San Francisco State University
Gerardo	Lafferriere	Portland State University
Brigitte	Lahme	Sonoma State University
Yvonne	Lai	University of Nebraska
Evelyn	Lamb	Self-employed
Sabine	Lang	University of Denver
Laura	Langdon	California State University, East Bay
Aaron	Lauve	Loyola University
Brian	Lawler	Kennesaw State University
Adrienne	Lazes	Miss Hall's School
Namyong	Lee	Minnesota State University
Mary	Legner	Riverside City College
Rena	Levitt	Minerva Schools at KGI
Tye	Lidman	North Carolina State University
En-Bing	Lin	Central Michigan University
Florence	Lin	University of Southern California
Heather	Lindfors-Navarro	University of Missouri
Jean Marie	Linhart	Central Washington University
Benjamin	Lotto	Vassar College
Priscilla	Macansantos	University of the Philippines Bagui
Kelly	MacArthur	Montana State University
Chitaranjan	Mahapatra	University of California, San Francisco
Johanna	Mangahas	University at Buffalo (SUNY)
Brian	Marcus	University of British Columbia
Anne Marie	Marshall	Lehman College
Delil	Martinez	California Lutheran University
Ariane	Masuda	New York City College of Technology
Bryant	Mathews	Azusa Pacific University
ORNELLA	MATTEI	San Francisco State University
John	McCleary	Vassar College
Kathryn	McCormick	California State University, Long Beach
Moira	McDermott	Syracuse University
Tim	McEldowney	West Virginia University
Reginald	McGee	College of the Holy Cross
Anna	Medvedovsky	Brandeis University
Bryan	Meyer	Grossmont Union High School District
Brittney	Miller	Coe College
Nicholas	Miller	University of California, Berkeley
Danielle	Moloney	North Carolina State University
MurphyKate	Montee	Carleton College

Participants		
First Name	**Last Name**	**Institution**
Rommell	Montenegro	University of California, Berkeley
Monica	Morales	Adelphi University
Maisha	Moses	The Young People's Project
Benjamin	Moynihan	The Algebra Project
Samuel	Munn	University of British Columbia
John	Nardini	North Carolina State University
Benjamin	Nassau	University of Delaware
Christina	Nguyen	San Francisco State University
Jennifer	Noll	Portland State University
Narcrisha	Norman	Embry-Riddle Aeronautical University Worldwide
Sylvia	Nwakanma	San Francisco State University
Kasso	Okoudjou	Tufts University
Angelica	Osorno	Reed College
Jessica	Otis	Newberry College
Brandon	Owashi	Riverside City College
Tracy	Payne	Idaho State University
Kristine	Pelatt	St. Catherine University
Diana	Pell	Riverside City College
Alice	Petillo	Marymount University
Justin	Plummer	North Carolina School of Sciences
Jonathan	Poritz	Colorado State University--Pueblo
David	Powers	Las Positas College
Ryan	Pugh	California State University-Monterey Bay
Eric	Quinto	Tufts University
Ami	Radunskaya	Pomona College
Elizabeth	Rahmel	Carthage College
Julianne	Rainbolt	Saint Louis University
Annie	Raymond	University of Massachusetts Amherst
Sarah	Raynor	Wake Forest University
ROBERT	REED	Mission College
Majerle	Reeves	University of California, Merced
Lydia	Rehder	Carthage College
Kenneth	Ribet	University of California, Berkeley
Leah	Rineck	University of Wisconsin-Madison
Darrius	Robinson	University of Michigan
Hector	Rosario	Julia Robinson Mathematics Festival
Lauren	Rose	Bard College
Andrew	Ross	Eastern Michigan University
John	Ross	Southwestern University
Cristina	Runnalls	California State Polytechnic University, Pomona
Jacob	Russell	Rice University
Nathan	Ryan	Bucknell University
Silvia	Saccon	Bates College
Marc	Sanchez	Riverside City College

Participants

First Name	Last Name	Institution
Justin	Sawon	University of North Carolina
Karen	Saxe	Macalester College
Karl	Schaffer	De Anza College
David	Scott	University of Puget Sound
Sherry	Scott	MSOE
Lynn	Scow	California State University, San Bernardino
Kimberly	Seashore	San Francisco State University
Simone	Sisneros-Thiry	California State University, East Bay
Ruth	Situma	PIMS - Pacific Institute for the Mathematical Sciences
Max	Sklar	Mission College
Erik	Slivken	University of North Carolina
Deirdre	Smeltzer	MAA - Mathematical Association of America
Rebecca	Smith	State University College, SUNY
Mutiara	Sondjaja	New York University, Courant Institute
Julia	St. Goar	Merrimack College
Dick	Stanley	University of California, Berkeley
AJ	Stewart	Seattle University
Amelia	Stone-Johnstone	California State University
Francis	Su	Harvey Mudd College
Kagba	Suaray	California State University Long Beach
Evan	Taylor	Indiana University--Purdue University
Daniel	Teague	North Carolina School of Science and Mathematics
Courtney	Thatcher	University of Puget Sound
Diana	Thomson	Carthage College
Elizabeth	Thoren	Pepperdine University
Dylan	Thurston	Indiana University
Will	Tidwell	Morehead State University
Daniel	Tolosa	Purdue University
Eliana	Tolosa Villarreal	San Francisco State University
Tatiana	Toro	University of Washington
Latifa	Debbi	National Polytechnic School, Algiers, Algeria
Tim	Truitt	University of Louisville
Belin	Tsinnajinnie	WestEd
Anthony	Várilly-Alvarado	San Francisco State University
Christopher	van Bommel	University of Manitoba
Sue	VanHattum	Contra Costa College
Jennifer	Vasquez	University of Scranton
Oscar	Vega	California State University, Fresno
Uzi	Vishne	Bar-Ilan University
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Shmuel	Weinberger	University of Chicago
Anna	Werner	Laney College

Participants		
First Name	**Last Name**	**Institution**
Craig	Wesley	Simons Foundation
Nina	White	University of Michigan
Amy	Wiebe	Freie Universitaet Berlin
Brandy	Wiegers	Central Washington University
Emilie	Wiesner	Ithaca College
Trena	Wilkerson	Baylor University
Jennifer	Wilson	The New School
Rebecca	Winarski	College of the Holy Cross
Joshua	Wiscons	California State University, Sacramento
Carol	Wood	Wesleyan University
Erin	Wood	University of Georgia
Rehana	Patel	African Institute for Mathematical Sciences (AIMS)
Christopher	Wu	College of Alameda
Terrence	Wyberg	University of Minnesota
Cynthia	Wyels	California State University Channel Islands
Joan	Wynne	Florida Local Alliance for Math Literacy & Equity
Haley	Yaple	Carthage College
Feng	Zhu	Technion---Israel Institute of Technology
Heather	Zinn Brooks	Harvey Mudd College

Identifiable Participant Information

Participants		294

Gender		294
Male	41.8%	123
Female	54.8%	161
Other	1.4%	4
Declined to state	2.0%	6

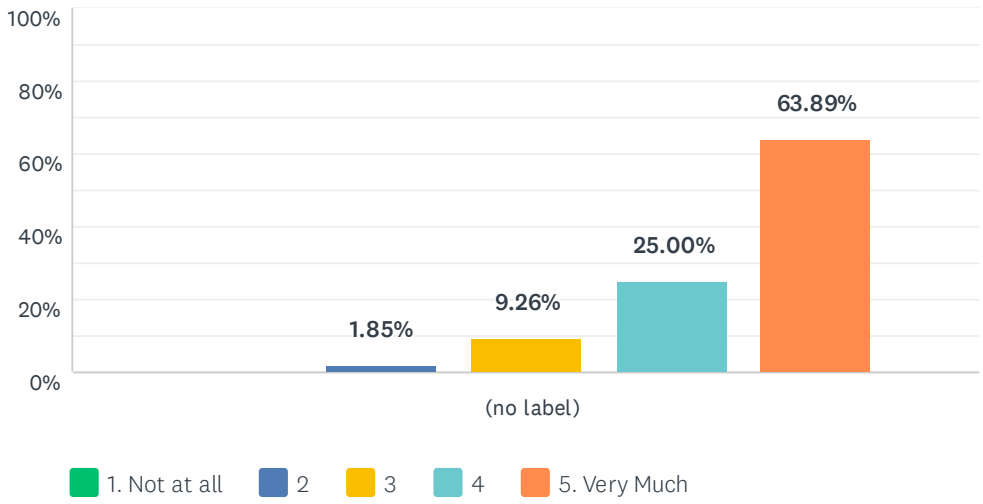
Ethnicity*		313
White	61.7%	193
Asian	10.2%	32
Hispanic	8.6%	27
Pacific Islander	0.3%	1
Black	13.7%	43
Native American	0.6%	2
Declined to state	4.8%	15

* ethnicity specifications are not exclusive

There were 22 unidentifiable participants.

Q1 The workshop was intellectually stimulating

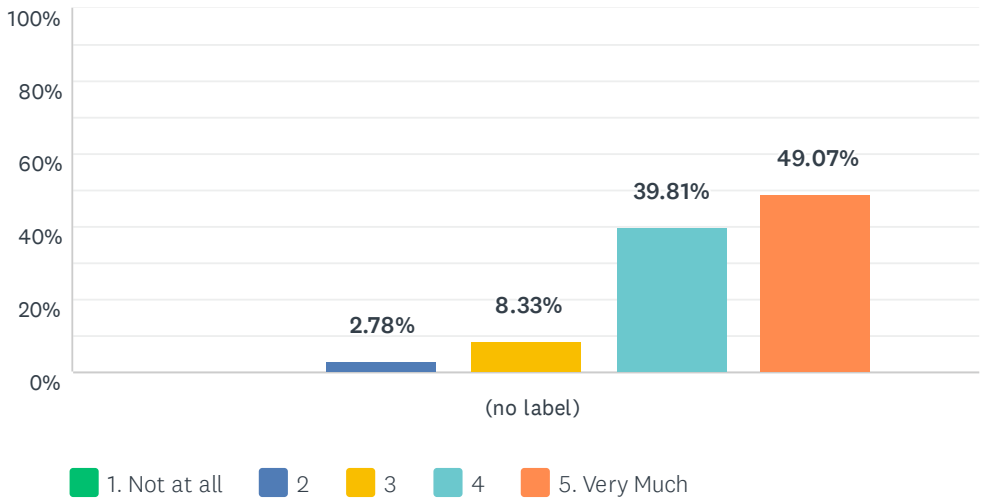
Answered: 108 Skipped: 0



	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	1.85% 2	9.26% 10	25.00% 27	63.89% 69	108	4.51

Q2 My knowledge in the subject matter was increased by the workshop

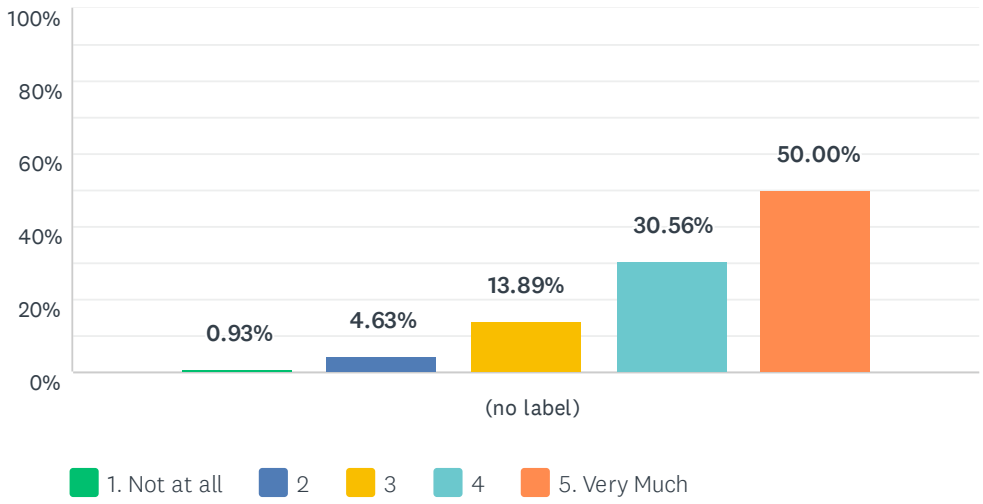
Answered: 108 Skipped: 0



	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.78% 3	8.33% 9	39.81% 43	49.07% 53	108	4.35

Q3 My interest in the subject matter was increased by the workshop

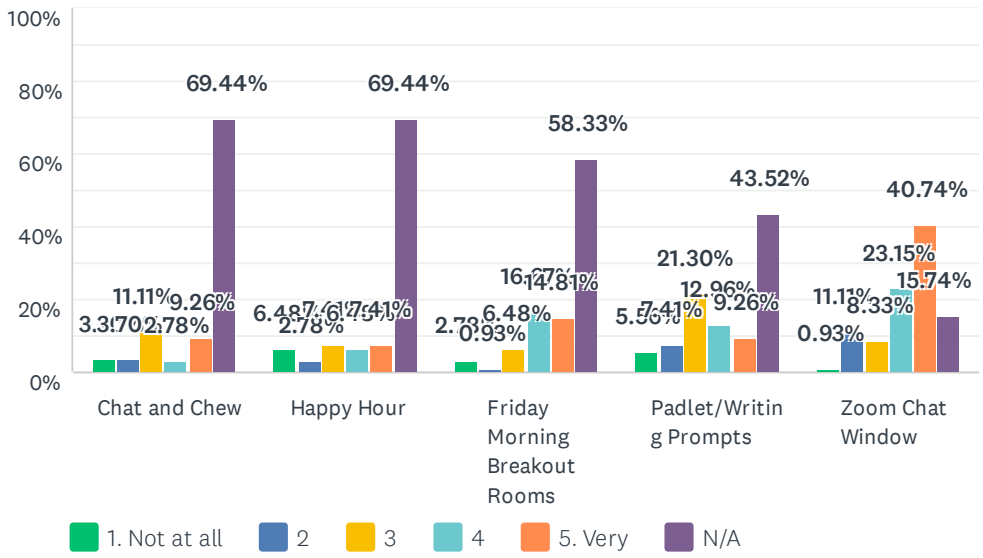
Answered: 108 Skipped: 0



	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.93% 1	4.63% 5	13.89% 15	30.56% 33	50.00% 54	108	4.24

Q4 How useful were the following networking activities?

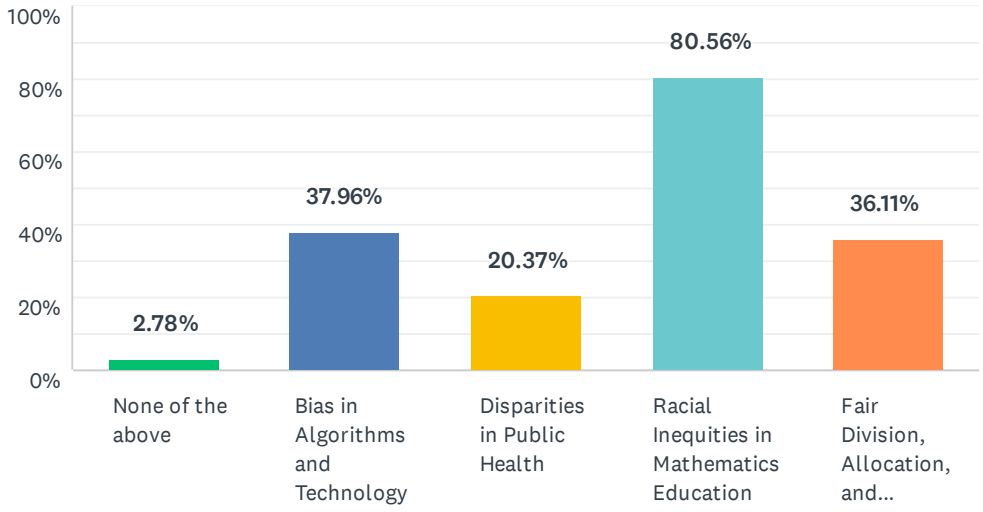
Answered: 108 Skipped: 0



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
Chat and Chew	3.70% 4	3.70% 4	11.11% 12	2.78% 3	9.26% 10	69.44% 75	108	3.33
Happy Hour	6.48% 7	2.78% 3	7.41% 8	6.48% 7	7.41% 8	69.44% 75	108	3.18
Friday Morning Breakout Rooms	2.78% 3	0.93% 1	6.48% 7	16.67% 18	14.81% 16	58.33% 63	108	3.96
Padlet/Writing Prompts	5.56% 6	7.41% 8	21.30% 23	12.96% 14	9.26% 10	43.52% 47	108	3.23
Zoom Chat Window	0.93% 1	11.11% 12	8.33% 9	23.15% 25	40.74% 44	15.74% 17	108	4.09

Q5 I hope to begin or continue work in Mathematics and Racial Justice in the following areas (select all that apply):

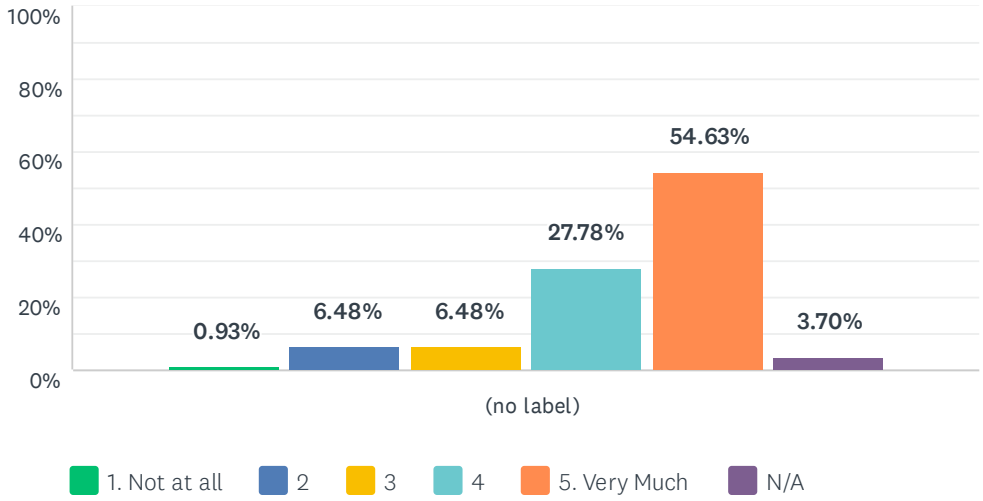
Answered: 108 Skipped: 0



ANSWER CHOICES	RESPONSES	
None of the above	2.78%	3
Bias in Algorithms and Technology	37.96%	41
Disparities in Public Health	20.37%	22
Racial Inequities in Mathematics Education	80.56%	87
Fair Division, Allocation, and Representation	36.11%	39
Total Respondents: 108		

Q6 The workshop was helpful for me to begin or continue work in Mathematics and Racial Justice

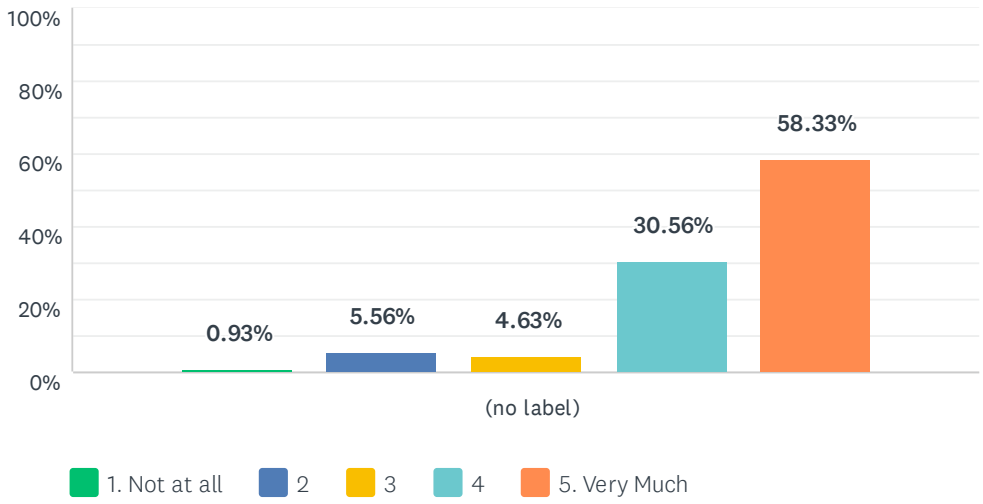
Answered: 108 Skipped: 0



	1. NOT AT ALL	2	3	4	5. VERY MUCH	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.93% 1	6.48% 7	6.48% 7	27.78% 30	54.63% 59	3.70% 4	108	4.34

Q7 The overall experience of the workshop was worthwhile

Answered: 108 Skipped: 0



	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.93% 1	5.56% 6	4.63% 5	30.56% 33	58.33% 63	108	4.40

Q8 Use this space to provide any overall impressions of the conference

Answered: 44 Skipped: 64

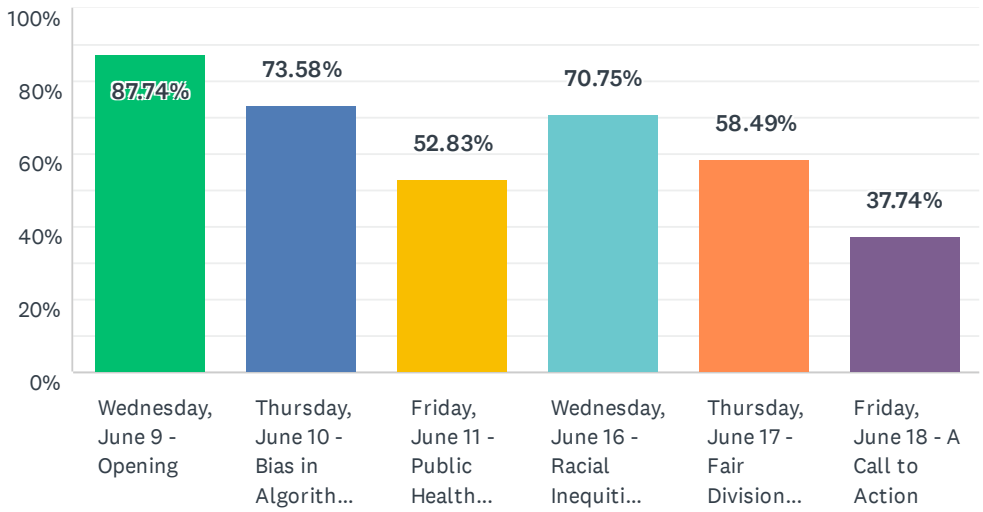
#	RESPONSES	DATE
1	Thank you for your effort and energies in organizing this important workshop.	7/14/2021 8:30 AM
2	Thanks for organizing and inspiring an important event!	6/28/2021 8:02 AM
3	The workshop was well organized and effectively run. The presentations on mathematical topics (fair apportionment; voting procedures, etc) that can be used in discussing racial justice and lessons designed around those themes were very good. I was disappointed to see that when it came to pedagogical strategies or training of teachers, many of the participants seemed to focus on tearing the system down with little thought on how to create a better one. My sense is that too many in schools of education have failed to make inroads on the difficult problem of producing graduates able to teach mathematics to a diverse group of learners and are resorting to considering the more difficult problem of changing society overall.	6/26/2021 3:27 PM
4	Zoom fatigue has made it difficult to focus as much as one would if being present for the workshop. Just like our students, it is difficult to focus with all the distractions.	6/25/2021 11:17 AM
5	interesting speakers, access to library resources was helpful	6/25/2021 10:00 AM
6	The posting of videos and slides is much appreciated -- especially for the days it was not possible to attend due to scheduling conflicts. Dr. Sharad Goel's preprint on "learning to be fair" is relevant to decision making in multiple situations. Dr. Brittany Mosby's suggestions to make education more liberatory can be immediately implemented. Dr. Stephanie Somersille's preprint introducing the GEO metric is relevant for identifying potential gerrymanders. The Suggested Resources for the conference are much appreciated.	6/25/2021 12:00 AM
7	I learned a lot of important history related to racial inequities in math education, and I found it valuable to hear the speakers from that day answer questions and talk more during the panel discussion. I also appreciated the talks on fair division, allocation, and representation, especially Stephanie Somersille's talk on redistricting and gerrymandering. Danny Martin's talk raised important issues of unintended/unanticipated consequences of some efforts, and gave me a lot to think about. Overall, I found the workshop helpful, relevant, and centered on important topics of justice and equity.	6/24/2021 8:05 PM
8	I was hoping to gain a greater understanding of Bias in Algorithms so I can pass it on to my students in linear algebra. It was a great discussion and I'm very happy I was able to make it in the online setting.	6/24/2021 3:15 PM
9	Thank you to the organizing committee! Excellent workshop.	6/24/2021 9:10 AM
10	Very well done - the array of speakers was great: diverse backgrounds, expertise, topics. There was a lot of heart and warmth.	6/24/2021 8:23 AM
11	I would have ranked everything higher than I did if I had realized earlier that this conference existed and was able to carve out more time to attend. Even with my limited attendance, I was very impressed with this conference and hope to attend more like it.	6/24/2021 8:01 AM
12	I really enjoyed what I was able to attend -- primarily the plenary talks due to time constraints. My goal was to increase my awareness and knowledge, and I feel I was able to do so! Thank you for this opportunity!	6/24/2021 7:18 AM
13	Professor Mosby's presentation was thought-provoking, affirming, and fabulous.	6/23/2021 4:53 PM
14	The virtual presentations were more personable than when sitting in a large conference room where you can barely see the presenter's face. The chat made it easy and more comfortable to ask questions. All of the presentations were engaging.	6/23/2021 4:33 PM
15	Thank you to all the organizers, presenters, and support staff.	6/23/2021 3:23 PM
16	Thank you for organizing this valuable workshop! -Boyan	6/23/2021 3:09 PM

17	This workshop was excellent. I was only able to participate live during the first two days, but I am watching the videos for the other days. Thank you to the organizers for making this conference happen!	6/22/2021 12:38 PM
18	I wish there was more discussion on HOW to change mathematics education and curriculum, rather than just talking about why it's important and how it relates to racial inequities.	6/22/2021 9:54 AM
19	I thought this was a great conference and I really appreciated the care that the organizers put into it. One thing that was missing was some working sessions that would happen during conferences. I think this was because it was remote. Although I did appreciate the happy hours and break out rooms as a compromise for this aspect of a conference. I hope that there are future conferences on this topic in person because I think that this conference created a lot of momentum that I would like to see continued.	6/21/2021 3:59 PM
20	All of the speakers had interesting ideas and I appreciated the variety of topics discussed. It would have been helpful if the keynotes had a bit more interaction beyond the chat window (though I recognize how challenging that is). Despite my interest and the excellent and engaging speakers, it was hard to sustain my own participation in long hours on zoom. I really appreciate the diligence with which the organizers set norms for participation and provided resources for further learning. Thanks for organizing this important workshop.	6/21/2021 11:24 AM
21	Thank you to the organizers, the presenters, and the MSRI personnel!	6/21/2021 10:05 AM
22	When registering you really should have put the time zone things were in, I assumed with a tech savy source that you had put the time of the presentations/discussions/etc... in the time zone where you were opening up the web browser, or at least be clear which time zone the presentations where stated for. Because it was not apparant when I registered, I'm glad this was free - as I wasn't able to go to a single thing live, excpet for the first fifteen mins of the first thing - which was mainly just introductions. I still haven't watched through everything I wanted to, as my life is pretty busy at the moment, I hope that they will stay up for a while, so I can watch the recordings.	6/21/2021 7:50 AM
23	I greatly appreciated the keynotes on both Wednesdays. I found them to be provocative and incredibly useful. Many thanks to the organizers.	6/21/2021 7:19 AM
24	The simple act of hearing from and sharing ideas with other STEM educators who are willing to acknowledge that this is an issue and that there ARE helpful things to do is re-energizing.	6/20/2021 11:21 AM
25	The atmosphere of this conference was wonderfully supportive.	6/20/2021 8:46 AM
26	This may have been the most riveting and compelling conference for mathematicians that I have ever attended. Thank you for presenting and amplifying these ideas and perspectives that are crucial to our future.	6/19/2021 1:15 PM
27	It was great but would have been better, in person. Social justice is a topic I've very interested in but balancing with the distractions of home was difficult.	6/19/2021 9:23 AM
28	More time and space to network. Hard to do online, but important	6/19/2021 8:14 AM
29	It was an extraordinary, and extraordinarily important, meeting. Thanks you to the organizers for dreaming it up, to MSRI for hosting, and to all for the hard work and the supportive and thoughtful environment.	6/19/2021 8:00 AM
30	very nice organization.	6/19/2021 1:54 AM
31	All the speakers were very informative and I learned from each. As a teacher I want to continue to help improve inequities in math education. But the other talks really gave me ideas for lessons, labs, or projects involving social justice issues that can educate students about these subjects while at the same time learning math. Thank you!	6/18/2021 11:37 PM
32	In order to facilitate a better survey I'll need a Stats course taught by someone capable of teaching...UMKC was the worst.	6/18/2021 7:56 PM
33	the speakers were great; I could not attend some of the sessions because of the time difference (I live in the Philippines) but the recordings are useful, and the online format has been beneficial for dealing with the travel and other restrictions due to the current world situation on Covid 19. Thank you for this opportunity to attend virtually	6/18/2021 6:14 PM
34	Thanks for organizing this conference/workshop.	6/18/2021 4:48 PM

35	In the near term, I think this workshop will be most useful to me in my teaching (where I see every topic being applicable in some way.) I am on the east coast (and my young children are home with me starting early afternoon), so I wasn't able to participate in any of the networking opportunities. I was at least somewhat familiar with much of the content of the workshop, but I found it very useful to hear how the speakers were able to frame and organize the issues for each topic. Many thanks to the organizers for the excellent workshop.	6/18/2021 4:41 PM
36	The workshops knowledge-based was outstanding!!	6/18/2021 4:11 PM
37	Very useful insights and resources for designing and supporting young minds at the middle and secondary school levels.	6/18/2021 3:41 PM
38	The workshop was thought provoking. It was very well done	6/18/2021 3:13 PM
39	Thank you so much to the organizers, speakers and MSRI for their time and for providing useful information.	6/18/2021 2:58 PM
40	I could only attend a few of the plenary talks but they were excellent. Clearly a great deal of care went into the planning.	6/18/2021 2:45 PM
41	Amazing! All the presentations were incredibly useful and I loved how at the end we were encouraged to make commitments to act. Thank you for making the PowerPoints and the recordings available. The resources that were shared are also going to be very useful. The whole conference was thoughtfully curated and hosted. Congratulations! I'm wondering whether some of the recordings could be shared with colleagues or to a wider audience and if the code to the movie Coded Bias could be shared?	6/18/2021 2:30 PM
42	Overall, the conference had knowledgeable speakers. Some sessions were more relevant to my work, so I enjoyed some plenary talks more than others. I didn't participate in any other sessions outside of the plenary talks and panels, primarily because of 1) Zoom fatigue and 2) desire to devote some time to research and writing this summer.	6/18/2021 2:19 PM
43	I thought the workshop speakers were brilliant. This work should definitely continue.	6/18/2021 2:15 PM
44	This workshop served as a great introduction to a number of issues and directions of research around mathematics and racial justice. The diversity of perspectives was impressive and allowed for a rich discussion across the various fields represented. I found the library of resources that was made available for participants especially useful. I was unable to attend any events on Friday 6/18, so maybe this has already been planned. But it would be great if the many resources that were put into the chat during the workshop could also be added to the resource list that was provided.	6/18/2021 2:11 PM

Q9 Which days did you attend at least a portion of the workshop?

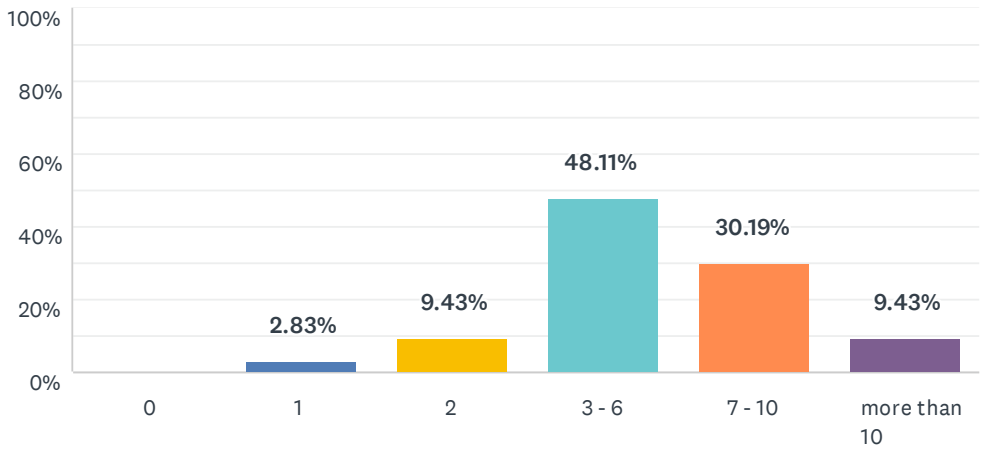
Answered: 106 Skipped: 2



ANSWER CHOICES	RESPONSES	
Wednesday, June 9 - Opening	87.74%	93
Thursday, June 10 - Bias in Algorithms and Technology	73.58%	78
Friday, June 11 - Public Health Disparities	52.83%	56
Wednesday, June 16 - Racial Inequities in Mathematics Education	70.75%	75
Thursday, June 17 - Fair Division, Allocation, and Representation	58.49%	62
Friday, June 18 - A Call to Action	37.74%	40
Total Respondents: 106		

Q10 How many talks did you attend over the course of the workshop?

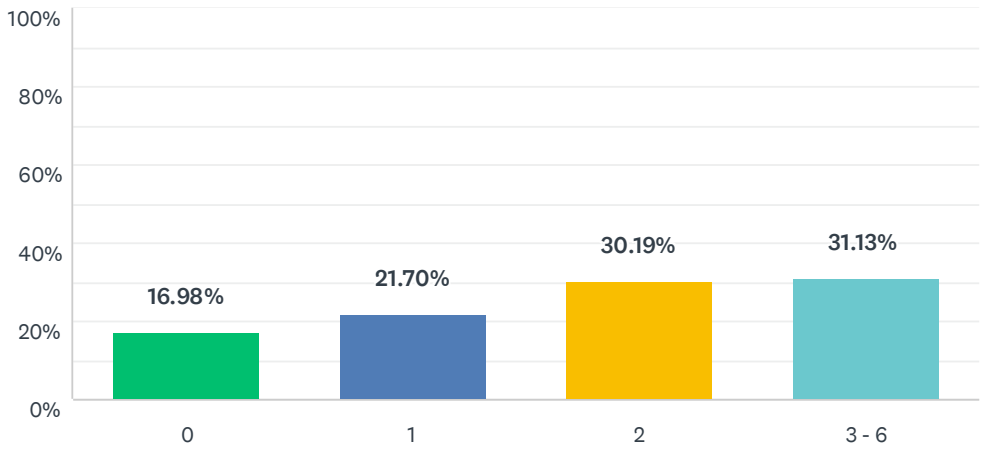
Answered: 106 Skipped: 2



ANSWER CHOICES	RESPONSES	
0	0.00%	0
1	2.83%	3
2	9.43%	10
3 - 6	48.11%	51
7 - 10	30.19%	32
more than 10	9.43%	10
TOTAL		106

Q11 How many panels did you attend over the course of the workshop?

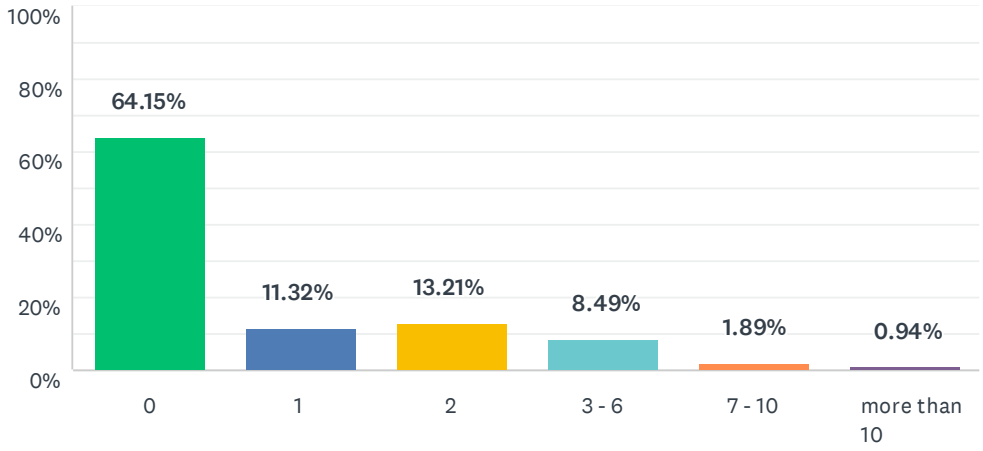
Answered: 106 Skipped: 2



ANSWER CHOICES	RESPONSES	
0	16.98%	18
1	21.70%	23
2	30.19%	32
3 - 6	31.13%	33
TOTAL		106

Q12 How many networking activities (chat & chew, happy hour) did you attend over the course of the workshop?

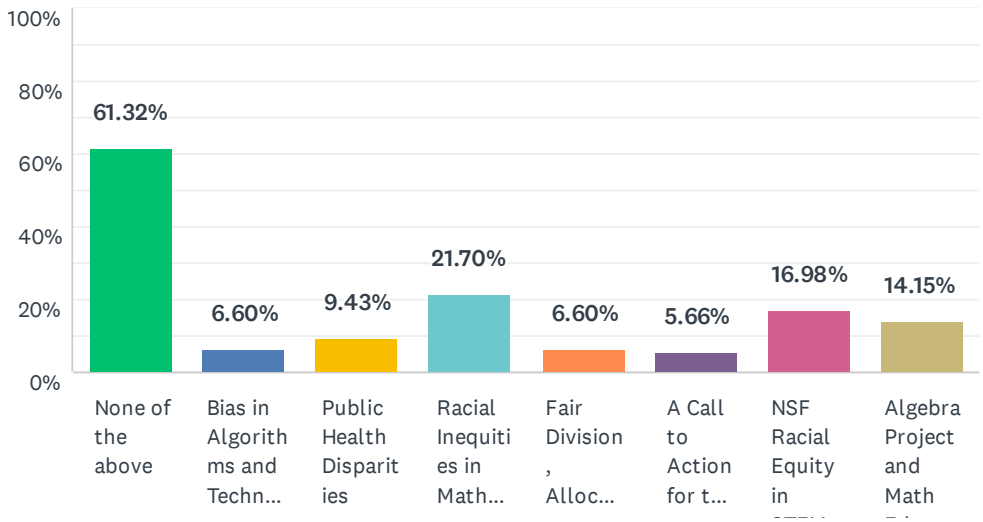
Answered: 106 Skipped: 2



ANSWER CHOICES	RESPONSES	
0	64.15%	68
1	11.32%	12
2	13.21%	14
3 - 6	8.49%	9
7 - 10	1.89%	2
more than 10	0.94%	1
TOTAL		106

Q13 Which breakout sessions did you attend on Friday, June 18th?

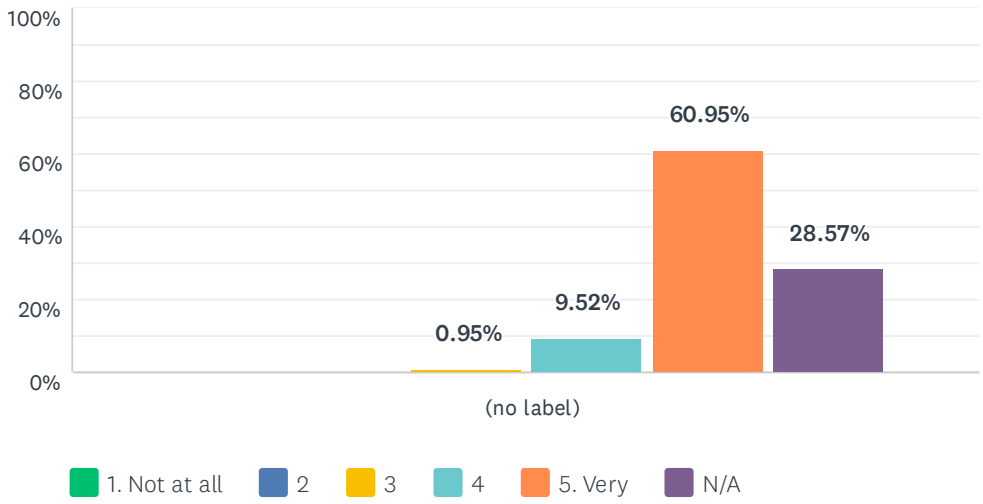
Answered: 106 Skipped: 2



ANSWER CHOICES	RESPONSES	
None of the above	61.32%	65
Bias in Algorithms and Technology	6.60%	7
Public Health Disparities	9.43%	10
Racial Inequities in Math Education	21.70%	23
Fair Division, Allocation, and Representation	6.60%	7
A Call to Action for the AMS: Discussion of AMS Task Force report	5.66%	6
NSF Racial Equity in STEM	16.98%	18
Algebra Project and Math Education	14.15%	15
Total Respondents: 106		

Q14 I found the MSRI staff helpful

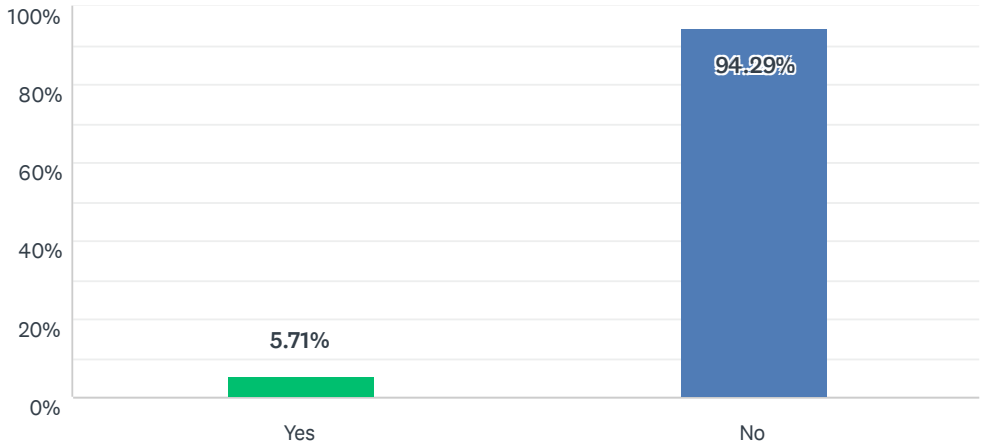
Answered: 105 Skipped: 3



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.95% 1	9.52% 10	60.95% 64	28.57% 30	105	4.84

Q15 Did you experience any technical difficulties accessing the online workshop?

Answered: 105 Skipped: 3



ANSWER CHOICES	RESPONSES	
Yes	5.71%	6
No	94.29%	99
TOTAL		105

#	IF YES, PLEASE EXPLAIN	DATE
1	For the large lecture slide files, perhaps it would be helpful to also post a second version with a smaller file size (in case some participants wish to download the file).	6/25/2021 12:02 AM
2	I think this was on my end, but I got logged out and had to restart everything to rejoin.	6/24/2021 8:52 AM
3	I lost power and internet at home due to the heatwave. Not much I could do except try to stay cool.	6/23/2021 11:37 AM
4	minor glitch easily resolved	6/21/2021 7:19 AM
5	Right now everything in cyber is fraught with overload and malware so this has to be countered before anything will be working on my end.	6/18/2021 8:00 PM
6	Not MSRI's fault.	6/18/2021 2:13 PM

Q16 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 105 Skipped: 3

#	RESPONSES	DATE
1	No barrier, but was dealing with medical issues concurrently. Online made access easier than it would have been.	7/14/2021 8:31 AM
2	An online workshop just can't monopolize my attention the way an in-person experience can. I returned to the real world after most sessions either because of Zoom fatigue or just the regular demands of my life. The flip side is that I might not have been able to attend an in-person workshop, so the virtual programming offered was certainly better than not be able to participate at all.	7/6/2021 12:46 PM
3	.	7/3/2021 7:17 PM
4	It lowered barriers for participation	6/28/2021 8:07 AM
5	- The time zones weren't the most convenient for me (then again, I don't think I was the primary audience since I'm currently based outside the US.) - There were also offline commitments which clashed schedule-wise with the workshop; it's harder to remember to not overschedule when [some] things are online (but that one is maybe also on me.)	6/28/2021 7:47 AM
6	The only impact on me was interaction with other individuals, ie 4 below.	6/26/2021 3:34 PM
7	Being online decreased my participation for there are so many distractions. If I were at the conference, I would not have had the family and work responsibilities as I have when I am either at home or at the office. It is very difficult to focus!	6/25/2021 11:24 AM
8	I don't think I would have been able to participate if it had been in person.	6/25/2021 10:03 AM
9	Having the conference online facilitated my participation, as it made travel unnecessary.	6/25/2021 12:02 AM
10	did not attend social events	6/24/2021 8:29 PM
11	Having the workshop online made it *easier* for me to participate! I am grateful for the opportunity to attend and the ability to join sessions from home (without traveling cross-country). I am also planning to listen/watch the recordings of a couple more talks that I wasn't able to join live due to scheduling conflicts - again, easy to do with the talks having been recorded. I was joining from the Eastern time zone, and I found that the scheduling worked fine for me.	6/24/2021 8:13 PM
12	n/a	6/24/2021 3:16 PM
13	Time zone was not an issue, but virtually participating is hard when life at home is still ongoing.	6/24/2021 2:52 PM
14	It was accessible so I could attend lectures that I would not have had a chance to attend otherwise. Being in person would have made me feel more accountable to attend everything	6/24/2021 2:09 PM
15	I do not think I would have participated if the workshop had NOT been online. So although my schedule prevented me from fully participating, my participation was much greater than it would have otherwise been.	6/24/2021 11:32 AM
16	No	6/24/2021 9:13 AM
17	It being online meant I got to attend some of it. However, the ability to be in person would have been much more beneficial had I been able (timing/funding) to do so.	6/24/2021 8:52 AM
18	It is always more difficult to focus when activities are online, given my home circumstances.	6/24/2021 8:26 AM

19	Due to time difference, many of the sessions were a bit late for my schedule.	6/24/2021 8:18 AM
20	Time difference made it difficult for me to participate after 1pm EDT. The online nature of the workshop made it possible for me to attend at all due to lack of funding and travel being difficult right now due to having small children at home.	6/24/2021 7:23 AM
21	it was easy	6/24/2021 5:27 AM
22	there was a time zone difference and i was able to attend only half of the opening day by waking up all night.So, i was not able to attend rest of the workshop.	6/23/2021 8:32 PM
23	Since the workshop was online, I was able to attend parts of it even though I had other commitments throughout the day. On the flip side, if the workshop were in person and I were able to attend, I would probably have attended more sessions.	6/23/2021 8:10 PM
24	it was very easy to attend	6/23/2021 7:55 PM
25	I would have participated more if it was in person	6/23/2021 6:16 PM
26	I'm actually glad the workshop was online. I wouldn't have been able to attend the workshop in person.	6/23/2021 5:45 PM
27	The east coast time zone challenge was negligible. With my other responsibilities, I couldn't have taken 6 days and traveled to this workshop. Having it online was really really helpful.	6/23/2021 5:33 PM
28	Made it logistically easy to join for parts	6/23/2021 4:55 PM
29	No travel cost. Learn from home. Time difference didn't affect.	6/23/2021 4:44 PM
30	Having the workshop online was very convenient and inexpensive. I found that I was more attentive than when I typically attend a conference in another time zone (jet-lag).	6/23/2021 4:36 PM
31	Honestly, I just had other last minute responsibilities come up. Those would have interfered even if the workshop was in person. The responsibilities were in part due to being non tenure track in a pandemic.	6/23/2021 4:05 PM
32	No barrier due to time zone differences, but the online format allowed me to participate while carrying out other activities at my institution - I really appreciated the opportunity!	6/23/2021 3:52 PM
33	It was tiring being online	6/23/2021 3:38 PM
34	I would not have committed to the full schedule had the meeting take part in person.	6/23/2021 3:35 PM
35	Having the workshop online made it possible for me to attend, so it was very helpful	6/23/2021 3:29 PM
36	I was able to participate; otherwise I would not have been free to travel to CA.	6/23/2021 3:25 PM
37	I was working as well as attending the conference so I wasn’t able to attend everything I would have liked to attend.	6/23/2021 3:25 PM
38	I would have attended all talks over the two weeks but I got sick during the same time. No technical difficulties though.	6/23/2021 3:17 PM
39	I had no difficulties related specifically to the online format. I live in Pacific time, however, so I wasn't affected by time zones. I commend the organizers for having the foresight to break up the conference into two 3-day chunks over two weeks. I feel like this is a distinct advantage the online format can have over an in-person workshop, which is necessarily time constrained.	6/23/2021 3:09 PM
40	There was no specific barrier for me	6/23/2021 2:45 PM
41	If the workshop had been in person I feel like I would have been able to dedicate more time to it as it feels like online creates a competing barrier.	6/23/2021 11:37 AM
42	I would not have been able to participate at all if the workshop had been in person. So, having a virtual workshop was helpful in this regard.	6/22/2021 12:40 PM
43	I live in the central time zones so I wasn't able to attend a lot of the later meetings due to being two hours ahead. However, I'm so thankful that this workshop was available online because otherwise I would not have been able to attend! I'm also grateful that MSRI was able to provide video recording of each discussions so I could watch back any of the panels that I missed.	6/22/2021 9:58 AM

44	I would not have been able to participate at all if travel funding had been necessary to attend in person, so the impact was very positive. The times worked well for me in Central.	6/22/2021 8:33 AM
45	time zone differences were a barrier as the workshop was shortened over the day to make the time make sense.	6/21/2021 10:32 PM
46	Having it online actually allowed me to be able to attend. I really appreciated it.	6/21/2021 4:04 PM
47	I was happy to be able to participate virtually, and there were no circumstances or barriers to my participation other than events at the same time.	6/21/2021 12:33 PM
48	Having the workshop online enabled me to participate, as I would likely not have traveled to CA for this workshop. At the same time, it was a lot of time on zoom, which was difficult to sustain. I also had other commitments which at times interfered with my attendance.	6/21/2021 11:29 AM
49	I would not have been able to attend if it weren't online. This is not pandemic related, just ability to travel at that time, when the Spring term was not over.	6/21/2021 11:01 AM
50	It enabled me to participate despite having work obligations. I was able to attend the sessions I could, which I would otherwise not be able to do if I had to miss two weeks of work.	6/21/2021 10:15 AM
51	Helped: I was able to attend while not sacrificing other ongoing commitments. The times worked fine.	6/21/2021 10:08 AM
52	Time zone differences, yes as I mentioned on the first page.	6/21/2021 7:55 AM
53	Given that I had some prior commitments, it made participating in the two Wednesday sessions easier for me.	6/21/2021 7:20 AM
54	online made the difference	6/21/2021 7:19 AM
55	Easier to be a listener and not a participant.	6/21/2021 6:58 AM
56	Having the workshop on zoom makes it easier to forget times and dates of talks. Also not being there in person meant that other things were scheduled during the day for me. This is probably a personal issue. But if I could have gone in person, it would be much easier to devote more time to the talks/ interaction with others.	6/21/2021 6:29 AM
57	I greatly enjoyed being able to participate virtually. However attending sessions from 12 - 5 pm central wasn't feasible since I was attempting to attend from home. With children out of school and that being lunchtime, it wasn't really easy to join the first session and then the inertia made it harder to log in later. It would have been significantly easier for me if sessions were split before and after lunch (at least I wouldn't have missed so much).	6/21/2021 4:52 AM
58	Work commitments and childcare responsibilities (due to a pandemic-related loss of outside childcare) impacted my ability to participate fully.	6/20/2021 6:07 PM
59	I was able to attend the workshop because it was held online.	6/20/2021 3:51 PM
60	Time zone difference made attending difficult but not impossible.	6/20/2021 2:41 PM
61	Having the workshop online made it much easier for me to attend.	6/20/2021 11:29 AM
62	It was an advantage in that it was recorded and I will be able to go back and watch the sessions I was unable to attend on Wednesday, June 16.	6/20/2021 11:27 AM
63	Having the workshop online enabled me to attend. I've had very little childcare in the last year (due to Pandemic) and would not have had time, energy, or sufficient child care to fly across the country to attend.	6/20/2021 8:49 AM
64	Convenient. Avoided travel.	6/19/2021 5:27 PM
65	Working from home meant I could only participate passively (no mic or camera).	6/19/2021 2:37 PM
66	The workshop being online enabled my participation. I most likely could not have traveled so far for so long had it been in-person only.	6/19/2021 1:21 PM
67	I feel I would have done more networking/made more inroads with other folks in person. Online I mostly attended talks and came away with some new information.	6/19/2021 10:28 AM
68	Might not have attended otherwise.	6/19/2021 10:02 AM

69	It made it possible to attend from where I was.	6/19/2021 9:36 AM
70	Yes, my personal circumstances (i.e. childcare) hampered my ability to participate.	6/19/2021 9:26 AM
71	yes, I could not have attended otherwise	6/19/2021 9:06 AM
72	With a toddler during the pandemic, I would not have been able to attend otherwise. Glad it was online this time. I hope it is in person next the time.	6/19/2021 8:17 AM
73	I would not have been able to travel to Berkeley to attend in person, so the online format was a boon.	6/19/2021 8:03 AM
74	It did not.	6/19/2021 1:58 AM
75	Nothing with the pandemic but just the convenience of opening my laptop and signing in versus driving somewhere was a huge plus.	6/18/2021 11:41 PM
76	Yes as well as time zone differences and the technology used.	6/18/2021 8:00 PM
77	Conferences and meetings online have been difficult for me with family at home with me.	6/18/2021 7:54 PM
78	I am teaching many hours per day right now and I was really happy the workshop was virtual so I could still attend some events.	6/18/2021 7:31 PM
79	Online was good but I had problems staying up (due to the time difference between my country and the US)	6/18/2021 6:16 PM
80	increased my participation availability	6/18/2021 5:51 PM
81	It is easier to attend things when they are online. I would have not been able to attend if it had been face to face.	6/18/2021 4:50 PM
82	If the workshop would have been in person, I would not have attended; so I am very grateful for the online format! Because the workshop started relatively late EDT and I do not currently have after school care due to the pandemic, I wasn't able to attend the second half of most days.	6/18/2021 4:43 PM
83	No barriers.	6/18/2021 4:13 PM
84	I would not have been able to attend, were it held on campus.	6/18/2021 3:49 PM
85	Online allowed me to attend. Had it been in person that would not have been possible.	6/18/2021 3:42 PM
86	I think if it was in person I would better socialize and network with other participants.	6/18/2021 3:34 PM
87	I had other obligations at work	6/18/2021 3:16 PM
88	It made it easier to attend	6/18/2021 3:14 PM
89	It was very helpful having the workshop online.	6/18/2021 3:00 PM
90	It was different but necessary, under the circumstances	6/18/2021 2:46 PM
91	Didn't impact me. Though having it on a day I do grocery shopping, I had to miss part of one day.	6/18/2021 2:46 PM
92	Overlap with other work meetings	6/18/2021 2:42 PM
93	I was glad it was online, I would have been disappointed if I had made the effort to attend in person.	6/18/2021 2:36 PM
94	No barrier. Not clear I would have been able to attend if it was in person.	6/18/2021 2:35 PM
95	Part of the reason I was unable to attend all days was because I was going to Florida for vacation. The fact that I could attend some of the sessions that I was interested in and at the same time be on vacation was super helpful.	6/18/2021 2:21 PM
96	N/A	6/18/2021 2:20 PM
97	It made attending easier. However, I find that long comments in the chat are sometimes distracting. I can understand that people want to say complicated things but it's hard to read and listen at the same time.	6/18/2021 2:16 PM

98	i am in pacific time and the online format was great.	6/18/2021 2:15 PM
99	I would not have been able to participate at all if it was in person. Even still, there were a lot of distractions associated with being home (with children).	6/18/2021 2:14 PM
100	Not needing to get funding was very helpful.	6/18/2021 2:13 PM
101	I'm home with my kids still, which was definitely an impediment. However, if it had been an in-person conference this year I'm not sure I would have been able to attend	6/18/2021 2:10 PM
102	Online made it more accessible. I would not have been able to attend "in person."	6/18/2021 2:07 PM
103	Having the wokshop online made it easier for me to attend.	6/18/2021 2:06 PM
104	No barriers--I would not have been able to go if it was in-person since I have young children at home.	6/18/2021 2:06 PM
105	It was harder to fully immerse myself in the full day of activities.	6/18/2021 2:03 PM

Q17 One important aspect that is sometimes missing due to the online format is interaction between participants. Do you have any suggestions on how we can improve this interaction?

Answered: 60 Skipped: 48

#	RESPONSES	DATE
1	More time in smaller breakout rooms starting from day one -- maybe smaller debrief sessions at the end of each day moderated by someone designated by the organizers.	7/6/2021 12:46 PM
2	Breakout rooms were helpful, more opportunities to engage in small groups and network could make it even better (GatherTown is great for this, but it has accessibility problems).	6/28/2021 8:07 AM
3	More chat rooms during the breakout sessions. Also organizing some about individual organizers or presenters in addition to topics might help.	6/26/2021 3:34 PM
4	I felt that their was ample time and opportunities for interactions. It is difficult to be on Zoom so long. Family and work does not necessarily understand that I want to be online with peers!	6/25/2021 11:24 AM
5	I didn't participate in as many of the chat/chew, happy hour because of the times (EDT).	6/25/2021 10:03 AM
6	For interactive discussion sessions: (1) Consider having breakout rooms with ten or fewer participants in each room, if possible. (2) Consider assigning a discussion leader to each breakout room ... toward facilitating participation of all attendees. This has worked at a number of meetings. You may have already considered this. Thank you for presenting this conference.	6/25/2021 12:02 AM
7	I went to an online ICERM workshop in March, and that workshop used Gather.town for virtual coffee time/happy hour sort of chats. There were spaces designated for particular topics as well as free space. For me, it turned out to be a great way to meet people and join in conversations outside of the talks and panel discussions, and it could be a valuable addition to a workshop like this one.	6/24/2021 8:13 PM
8	no.	6/24/2021 2:52 PM
9	No	6/24/2021 2:09 PM
10	A group activity...perhaps with some kind nominal participation prize?	6/24/2021 8:52 AM
11	I attended Modeling workshop in MSRI in 2019, and I feel the in-person was much more involving and productive. Can't wait to go back!	6/24/2021 8:18 AM
12	I wonder if having a slack or discord channel or something else would have helped? I honestly felt the chat was distracting and hard to follow during the talks. (I don't know how it was during the other sessions). It was helpful to see other's conversations, however.	6/24/2021 7:23 AM
13	no	6/24/2021 5:27 AM
14	regular breaks between lectures and talking about the previous and upcoming lectures may be helpfull.	6/23/2021 8:32 PM
15	To be honest, I was pretty exhausted by all of the online workshops, teaching, and everything in the past year that I couldn't imagine participating more in this one even if the interaction format were the most perfect possible. I thought the format of the workshop was great as it was and witnessed a lot of interactivity by other participants.	6/23/2021 8:10 PM
16	I enjoyed the informal networking that occurred during the breaks and at the end of the day	6/23/2021 7:55 PM
17	You did a good job with happy hour/ breakout rooms.	6/23/2021 6:16 PM
18	I think it was fairly easy to interact with other participants. I would have liked to attend the breakout rooms on math education and fair division, but I only participated in the latter because we were having a helpful conversation and I didn't want to leave. I feel like I may	6/23/2021 5:45 PM

	have missed some networking opportunities in the education room. I wonder if the chat from that room is available.	
19	The breakouts on the last day were good. Maybe more self-selected breakouts, possibly smaller groups throughout?	6/23/2021 5:33 PM
20	have presenters pause periodically during their presentations to respond to questions/interactions happening in the chat	6/23/2021 4:55 PM
21	I regret I was unable to attend the interaction session due to the difference in time zones. However, the pane discussions were outstanding.	6/23/2021 4:36 PM
22	Set up a discord or some asynchronous way for participants to collaborate.	6/23/2021 4:05 PM
23	No - but if you collect some suggestions from others, I'd like to hear about them! :-)	6/23/2021 3:52 PM
24	It was better than I expected. No suggestions at this time.	6/23/2021 3:25 PM
25	That was unfortunately an issue especially in this sort of workshop where you'd hope that people could network and form collaborations. I think that's just the nature of the online format.	6/23/2021 3:25 PM
26	Networking video chatrooms where everyone can participate could help.	6/23/2021 3:17 PM
27	You all are doing it. thank you for such a thoughtful program	6/23/2021 11:37 AM
28	No suggestions. I thought that the organizers did as good of a job as anyone in getting people to interact online.	6/22/2021 12:40 PM
29	Allow more time for the speakers to answer the audiences questions.	6/22/2021 9:58 AM
30	I felt like you did a good job of encouraging the use of chat in general and webcams during some of the sessions, particularly compared to "early pandemic" web conferences. I attended the mastery grading workshop (name to be different as of next year!) in the middle of this one which had open chat with ~500 participants in the main sessions - it was much livelier as a consequence, and because they actively encouraged everyone to chat as much as they pleased. It also meant they had stay on their toes in terms of responding to it and keeping people steady. They did a good job of handling this by having a couple dedicated chat watchers with advance planning on how they would communicate with the speaker(s) in any given session, when moments of Q&A arose or when particularly relevant concerns were raised. So, that's one way of doing it - have a big team just for chat management!	6/22/2021 8:33 AM
31	I don't have any concrete solutions to this issue and I think that with this area you have to be very delicate when facilitating interactions between participants. One thing I think that could be possible is the creation of working groups at the beginning. Then people can build relationships throughout the week. But again, I am just really guessing here.	6/21/2021 4:04 PM
32	Possibly having some intentional breakout rooms? Or making space within the keynotes to do breakout rooms of 4-5 people (even if that's random) and using that as a space for participants to generate questions or think through ideas posed by the speakers.	6/21/2021 11:29 AM
33	Breakout room is the best idea, but the rooms need to have no more than 10 people or else you need a formal facilitator so conversations do not get dominated by a few.	6/21/2021 11:01 AM
34	This was one of the best attempts I've seen! Maybe smaller break-out groups for the chat and chews - let people select their rooms or stay in the main room (with the expectation that if someone chooses a room, they engage).	6/21/2021 10:08 AM
35	Not sure, as I couldn't come live to anything - maybe have breakout groups during some things?	6/21/2021 7:55 AM
36	Looking forward to being live again.	6/21/2021 6:58 AM
37	I thought the on-line format was great. I appreciated how thoughtfully all the sessions were designed and delivered. I could not have attended if the conference had been in person. Thank you for a great conference.	6/20/2021 2:41 PM
38	None	6/20/2021 11:29 AM
39	Always a tough challenge. I thought there was useful chat activity during the talks and panels. And the one happy hour I attended had lively and cordial conversation.	6/20/2021 11:27 AM

40	More polling. Looking at data in small groups.	6/19/2021 5:27 PM
41	Interaction was pretty good but there were times when I would have liked the opportunity to invite one or two people into a "private" breakout room. Platforms like gathertown and sococo are good for this.	6/19/2021 1:21 PM
42	More breakout rooms. Smaller rooms with prompts.	6/19/2021 8:17 AM
43	The organizers did a fantastic job at "hosting" the discussions, keeping them informal and welcoming.	6/19/2021 8:03 AM
44	No.	6/19/2021 1:58 AM
45	Breakout rooms work really well. Maybe at the start or end of a talk. It cuts into the speakers time but could be great for immediate feedback.	6/18/2021 11:41 PM
46	Too many for this space.	6/18/2021 8:00 PM
47	I thought it worked well.	6/18/2021 7:31 PM
48	No suggestion at the moment; MSRI did its best	6/18/2021 6:16 PM
49	I am what people call antisocial, so I did not miss awkward times (AKA social events and netweorking).	6/18/2021 4:50 PM
50	N/A	6/18/2021 4:13 PM
51	NA	6/18/2021 3:49 PM
52	I think having small random breakout rooms for getting to know each other could be helpful.	6/18/2021 3:34 PM
53	The Padlets for each day with the questions are great, however, if it's not included in the day's activities, then it requires people to go back and possibly not do it, not have time to do it or not remember to do it... So if there would be a feedback that is incorporated at the end of each day, then there might be more participation and also we could collectively look at what everyone has said in reflection and possibly the presenters could respond to comments/questions. Jamboards can work well with each question on a different page and everyone can access it —link can be put in Chat—participants could go to the page with the question they have comment about and have 5 minutes for the comments and 10 minutes to look at them together.	6/18/2021 2:46 PM
54	Greater use of breakout rooms	6/18/2021 2:35 PM
55	N/A	6/18/2021 2:20 PM
56	Maybe more breakout sessions with a subject as opposed to sessions that are just labeled "networking." Consider having several simultaneous breakout sessions on the same subject to allow small groups.	6/18/2021 2:16 PM
57	This is very tricky. You might consider facilitating people who already know each other's being able to gather at some point? Duane once noted that there were a number of Berkeley alums there. It might have been nice to have those people have a chance to gather to say hi and reconnect on the topic of the conference.	6/18/2021 2:13 PM
58	Smaller group breakouts	6/18/2021 2:10 PM
59	Some even smaller breakout sessions, perhaps 6 to 8 max, held more than once, with (ideally) the same (or some subset of) people.	6/18/2021 2:07 PM
60	I don't have the energy for virtual interactions while attending a virtual conference. Maybe having follow-up zoom sessions on particular topics at some point after the conference is over?	6/18/2021 2:06 PM

Connections and Introductory Workshop: Universality and Integrability in Random Matrix Theory and Interacting Particle Systems, Part 1

August 23, 2021 – August 27, 2021

Hybrid Workshop

Organizers:

Gérard Ben Arous (New York University, Courant Institute)

Ivan Corwin (Columbia University)

Ioana Dumitriu (University of California, San Diego)

Alice Guionnet (École Normale Supérieure de Lyon)

Alisa Knizel (The University of Chicago)

Sylvia Serfaty (New York University, Courant Institute)

Horng-Tzer Yau (Harvard University)

REPORT ON THE MSRI WORKSHOP
"Connections and Introductory Workshop: Universality and Integrability in Random Matrix Theory and Interacting Particle Systems, Part 1 (Hybrid Workshop)"
August 23 – August 27, 2021

Organizers

- Gérard Ben Arous (New York University, Courant Institute)
- Ivan Corwin (Columbia University)
- Ioana Dumitriu (University of California, San Diego)
- Alice Guionnet (École Normale Supérieure de Lyon)
- Alisa Knizel (The University of Chicago)
- Sylvia Serfaty (New York University, Courant Institute)
- Horng-Tzer Yau (Harvard University)

Scientific Description

This workshop aimed at providing participants with an overview of some of the recent developments in the topics of the semester, with a particular emphasis on universality and applications. This included universality for Wigner matrices and band matrices and quantum unique ergodicity, universality for beta ensembles and log/coulomb gases, KPZ universality class, universality in interacting particle systems, the connection between random matrices and number theory.

Highlights of the Workshop

This workshop was the first hybrid activity for the MSRI program, and about 90 remote participants logged in at a time to attend the talks in addition to the in-person participants. The hybrid format of the workshop actually permitted many younger participants who might not have had the funding to come in person.

Lauren Williams kicked off the workshop with an inspiring talk in which she detailed recent combinatorial results related to the probabilistic model TASEP. The other talk of the day was by Ofer Zeitouni who detailed work related to instabilities in numerical computation of the spectrum of Toeplitz matrices. Tuesday featured three talks, all related to the behavior of the characteristic polynomial for random matrices – computations of its moments (Jon Keating), connections to number theory (Nina Snaith) and relations with Gaussian multiplicative chaos (Reda Chhaibi). Wednesday kicked off with talk by Vadim Gorin detailing how random matrices capture certain correlation structures in the stock market. Jiaoyang Huang described recent results on central limit theorems and Gaussian free field behavior for non-intersecting paths while Tetiana Shcherbyna's talks approached questions of universality for band matrices (respectively). Thursday featured talks by Laszlo Erdos and Jun Yin about universality for Wigner and band matrices (respectively) as well as a talk by Mireille Capitaine which showed

similar types of results as in Huang's talk, but in the context of Wigner and deterministic matrices. The program ended on Friday with two exciting talks. The first was by Alexei Borodin and drew together themes from the previous two MSRI meetings – he related random permutations and the KPZ equation through a new model called the deformed PNG model. Jeremy Quastel ended the meeting on a high note by describing his recent work on constructing the KPZ fixed point and proving its universality.

Despite the challenges presented by a hybrid workshop, there were many questions from both in-person and online participants, and both the in-person and online talks were well received. The program was a wonderful kick-off to the semester.

Organizers		
First Name	**Last Name**	**Institution**
Gérard	Ben Arous	New York University, Courant Institute
Ivan	Corwin	Columbia University
Ioana	Dumitriu	University of California, San Diego
Alice	Guionnet	École Normale Supérieure de Lyon
Alisa	Knizel	University of Chicago
Sylvia	Serfaty	New York University, Courant Institute
Horng-Tzer	Yau	Harvard University
Speakers		
First Name	**Last Name**	**Institution**
Alexei	Borodin	Massachusetts Institute of Technology
Mireille	Capitaine	Centre National de la Recherche Scientifique (CNRS)
Reda	Chhaibi	Université de Toulouse III (Paul Sabatier)
Laszlo	Erdos	Institute of Science and Technology Austria
Vadim	Gorin	University of Wisconsin-Madison
Jiaoyang	Huang	New York University, Courant Institute
Jon	Keating	University of Oxford
Jeremy	Quastel	University of Toronto
Tetiana	Shcherbyna	University of Wisconsin-Madison
Nina	Snaith	University of Bristol
Lauren	Williams	Harvard University
Jun	Yin	University of California, Los Angeles
Ofer	Zeitouni	Weizmann Institute of Science

Mathematical Sciences Research Institute

Connections and Introductory Workshop: Universality and Integrability in Random Matrix Theory and Interacting Particle Systems, Part 1

August 23 to August 27, 2021

Monday, August 23, 2021		
09:10 AM - 09:30 AM		Introductory Remarks
09:30 AM - 10:30 AM	Lauren Williams	Schubert polynomials, the inhomogeneous TASEP, and evil-avoiding permutations
10:45 AM - 11:45 AM	Ofer Zeitouni	On eigenvectors of perturbed Toeplitz matrices

Tuesday, August 24, 2021		
09:30 AM - 10:30 AM	Jon Keating	Moments of Characteristic Polynomials and Integrability
10:45 AM - 11:45 AM	Nina Snaith	Unearthing random matrix theory in the statistics of L-functions: the story of Beauty and the Beast
12:00 PM - 01:00 PM	Reda Chhaibi	On the circle, GMC = CBE

Wednesday, August 25, 2021		
09:30 AM - 10:30 AM	Vadim Gorin	Cointegration, S&P, and random matrices
10:45 AM - 11:45 AM	Jiaoyang Huang	Dynamical Loop Equations
12:00 PM - 01:00 PM	Tetiana Shcherbyna	Transfer matrix approach to random band matrices

Thursday, August 26, 2021		
09:30 AM - 10:30 AM	Mireille Capitaine	Fluctuations of the Stieltjes transform of the empirical spectral distribution of selfadjoint polynomials in Wigner and deterministic diagonal matrices
10:45 AM - 11:45 AM	Laszlo Erdos	Eigenstate thermalisation hypothesis and Gaussian fluctuations for Wigner matrices
12:00 PM - 01:00 PM	Jun Yin	Delocalization of random band matrices in high dimensions

Friday, August 27, 2021		
09:30 AM - 10:30 AM	Alexei Borodin	Deformed Polynuclear Growth in (1+1) Dimensions
10:45 AM - 11:45 AM	Jeremy Quastel	Towards KPZ universality

Participants		
First Name	**Last Name**	**Institution**
Mark	Adler	Brandeis University
Amol	Aggarwal	Columbia University
Gernot	Akemann	Universität Bielefeld
Johannes	Alt	University of Geneva
Emilia	Alvarez	University of Bristol
Luisa	Andreis	Università di Firenze
Jonas	Arista	University of Chile
Benson	Au	University of California, Berkeley
Eric	Babson	University of California, Davis
Jinho	Baik	University of Michigan
Emma	Bailey	City University of New York (CUNY)
Ahmad	Barhoumi	University of Michigan
Guillaume	Barraquand	Centre National de la Recherche Scientifique (CNRS)
Estelle	Basor	AIM - American Institute of Mathematics
Riddhipratim	Basu	International Centre for Theoretical Sciences
Peter	Bates	Michigan State University
Gérard	Ben Arous	New York University, Courant Institute
Lucas	Benigni	University of Chicago
Tomas	Berggren	University of Michigan
Elia	Bisi	Technische Universität Wien
Pavel	Bleher	Indiana University--Purdue University
Natasha	Blitvic	University of Lancaster
Alexei	Borodin	Massachusetts Institute of Technology
Jonathan	Breuer	Hebrew University of Jerusalem
Alexey	Bufetov	Universität Leipzig
Mireille	Capitaine	Centre National de la Recherche Scientifique (CNRS)
Reda	Chhaibi	Université de Toulouse III (Paul Sabatier)
Yang	Chu	University of California, Berkeley
Elizabeth	Collins-Woodfin	University of Michigan
Filippo	Colomo	INFN - National Institute for Nuclear Physics
Nicholas	Cook	Duke University
Sylvie	Corteel	University of California, Berkeley
Ivan	Corwin	Columbia University
Sayan	Das	Columbia University
Huw	Day	University of Bristol
Alfredo	Deaño	Universidad Carlos III de Madrid
Amir	Dembo	Stanford University
Harini	Desiraju	University of Birmingham
Philippe	Di Francesco	University of Illinois at Urbana-Champaign
Adam	Doliwa	University of Warmia and Mazury
Hindy	Drillick	Columbia University
Ioana	Dumitriu	University of California, San Diego
Torsten	Ehrhardt	University of California, Santa Cruz
Elnur	Emrah	Royal Institute of Technology (KTH)
Steven	Evans	University of California, Berkeley
Naomi	Feldheim	Bar-Ilan University
Ohad Noy	Feldheim	Hebrew University of Jerusalem
Pablo	Ferrari	University of Buenos Aires
Andrey	Feuerverger	Dept of Statistical Sciences University of Toronto
Chiara	Franceschini	Instituto Superior Técnico
Aniruddhan	Ganesaraman	Chennai Mathematical Institute
Shirshendu	Ganguly	University of California, Berkeley
Roozbeh	Gharakhloo	Colorado State University
Promit	Ghosal	Massachusetts Institute of Technology
Manuela	Girotti	Saint Mary's University
Massimo	Gisonni	International School for Advanced Studies (SISSA/ISAS)
Vadim	Gorin	University of Wisconsin-Madison
Tamara	Grava	University of Bristol
Suman	Guha	Presidency University
Alice	Guionnet	École Normale Supérieure de Lyon
Alan	Hammond	University of California, Berkeley
Milind	Hegde	University of California, Berkeley
Ella	Hiesmayr	University of California, Berkeley
Zoe	Himwich	Columbia University
Christopher	Hoffman	University of Washington

Participants		
First Name	**Last Name**	**Institution**
Jiaoyang	Huang	New York University, Courant Institute
Jonathan	Husson	École Normale Supérieure de Lyon
Olaniyi	Iyiola	Clarkson University
Sharada	Kalanidhi	Stanford University School of Medicine
Jon	Keating	University of Oxford
Rinat	Kedem	University of Illinois at Urbana-Champaign
Yujin	Kim	New York University, Courant Institute
Alisa	Knizel	University of Chicago
Antti	Knowles	University of Geneva
Karol	Kozlowski	École Normale Supérieure de Lyon
Alexandre	Krajenbrink	International School for Advanced Studies (SISSA/ISAS)
Igor	Krasovsky	Imperial College, London
Thomas	Kriecherbauer	Universität Bayreuth
Jeffrey	Kuan	Harvard University
Gaultier	Lambert	Universität Zürich
Benjamin	Landon	University of Toronto
Han	Le	University of Michigan
Jaehun	Lee	Korea Advanced Institute of Science and Technology (KAIST)
Luen-Chau	Li	Pennsylvania State University
Zhongyang	Li	University of Connecticut
Xiaobin	Li	Southwest (Xinan) Jiaotong University
Yun	Li	University of Wisconsin-Madison
Karl	Liechty	DePaul University
Yier	Lin	Columbia University
Zhipeng	Liu	University of Kansas
Patrick	Lopatto	Institute for Advanced Study
Bingying	Lu	Universität Bremen
Milivoje	Lukic	Rice University
Guido	Mazzuca	International School for Advanced Studies (SISSA/ISAS)
Benjamin	McKenna	New York University, Courant Institute
Theo	McKenzie	University of California, Berkeley
Ken	McLaughlin	Colorado State University
Halima	Meddour	University Batna 2
Francesco	Mezzadri	University of Bristol
Krishnan	Mody	New York University, Courant Institute
Leslie	Molag	Universität Bielefeld
Matteo	Muccioni	Tokyo Institute Of Technology
Patrik	Nabelek	Oregon State University
Christian	Noack	Cornell University
Alessandra	Occelli	Instituto Superior Técnico
Daniel	Ofner	Hebrew University
Jeffrey	Oregero	University at Buffalo (SUNY)
Michel	Pain	New York University, Courant Institute
Greta	Panova	University of Southern California
Elliot	Paquette	McGill University
Leonid	Petrov	University of Virginia
Tuan	Pham	Medical University of Vienna
Mateusz	Piorkowski	MSRI - Mathematical Sciences Research Institute
Andrei	Prokhorov	University of Michigan
Dhanusshya	R	Ethiraj College for Women
Firas	Rassoul-Agha	University of Utah
Daniel	Remenik	Universidad de Chile
David	Renfrew	Binghamton University (SUNY)
Dan	Romik	University of California, Davis
Ilan	Roth	University of California, Berkeley
Mark	Rychnovsky	University of California, Santa Barbara
Ellen	Saada	CNRS, MAP5 lab.
Afshan	Sadiq	Government College
Axel	Saenz	University of Warwick
Timo	Seppalainen	University of Wisconsin-Madison
Sylvia	Serfaty	New York University, Courant Institute
Christian	Serio	Stanford University
Mariya	Shcherbina	B. Verkin Institute for Low Temperature Physics
Tetiana	Shcherbyna	University of Wisconsin-Madison
Guilherme	Silva	Universidade de São Paulo

Participants		
First Name	**Last Name**	**Institution**
Nina	Snaith	University of Bristol
Alexander	Soshnikov	University of California, Davis
Philippe	Sosoe	Cornell University
Herbert	Spohn	Technische Universität München
Nikhil	Srivastava	University of California, Berkeley
Zachary	Stier	University of California, Berkeley
Reena	Tandon	Lovely Professional University
Zhongkai	Tao	University of California, Berkeley
Mikhail	Tikhonov	University of Virginia
Tejaswi	Tripathi	University of Michigan
Li-Cheng	Tsai	Stanford University
Roger	Van Peski	Massachusetts Institute of Technology
Andrés	Vindas Meléndez	University of California, Berkeley
Jani	Virtanen	University of Reading
Dan-Virgil	Voiculescu	University of California, Berkeley
Mirjana	Vuletic	University of Massachusetts
Harriet	Walsh	Laboratoire de Physique, ENS de Lyon
Zhichao	Wang	University of California, San Diego
Haixiao	Wang	University of California, San Diego
Dong	Wang	University of Chinese Academy of Sciences
Lauren	Williams	Harvard University
Xuan	Wu	University of Chicago
Yuanyuan	Xu	Royal Institute of Technology
Kevin	Yang	Stanford University
Fan	Yang	University of Pennsylvania
Wei	Yang	Binghamton University (SUNY)
Maxim	Yattselev	Indiana University--Purdue University
Horng-Tzer	Yau	Harvard University
Ofer	Zeitouni	Weizmann Institute of Science
Ray	Zhang	University of Kansas
Lingfu	Zhang	Princeton University
Chenyang	Zhong	Stanford University
Cong	Zhou	Indiana University
Cong	Zhou	University of San Francisco
Zhengye	Zhou	Texas A & M University
Yizhe	Zhu	University of California, San Diego
Weitao	Zhu	Columbia University

Identifiable Participants Information

Participants		167

Gender		167
Male	73.65%	123
Female	26.35%	44
Other	0.00%	0
Declined to state	0.00%	0

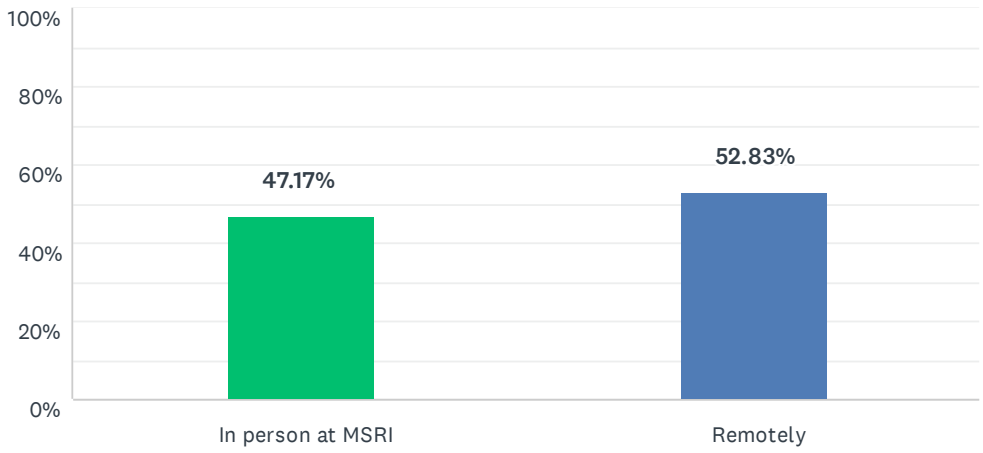
Ethnicity*		175
White	56.00%	98
Asian	28.00%	49
Hispanic	3.43%	6
Pacific Islander	0.00%	0
Black	1.71%	3
Native American	0.00%	0
Mixed	2.29%	4
Declined to state	8.57%	15

* ethnicity specifications are not exclusive

There were 15 unidentifiable participants.

Q1 I primarily participated in the workshop:

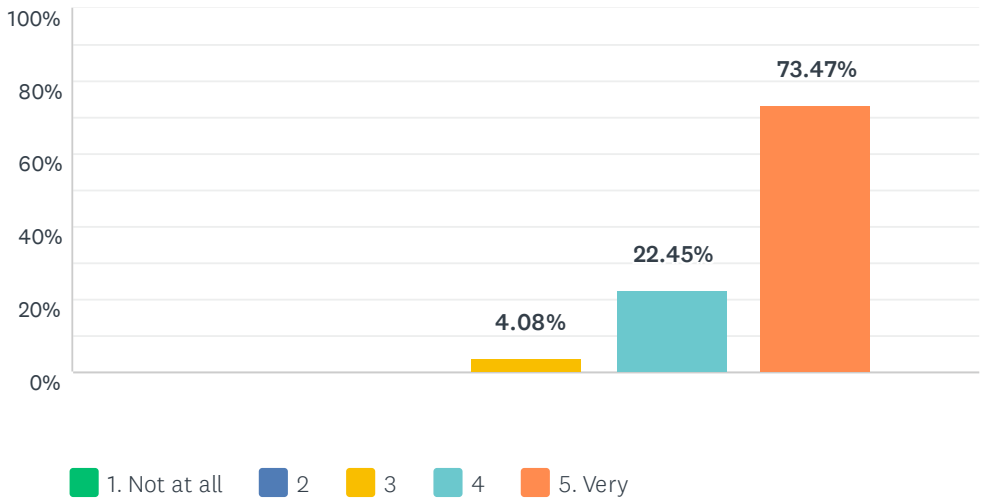
Answered: 106 Skipped: 0



ANSWER CHOICES	RESPONSES	
In person at MSRI	47.17%	50
Remotely	52.83%	56
TOTAL		106

Q2 The workshop was intellectually stimulating

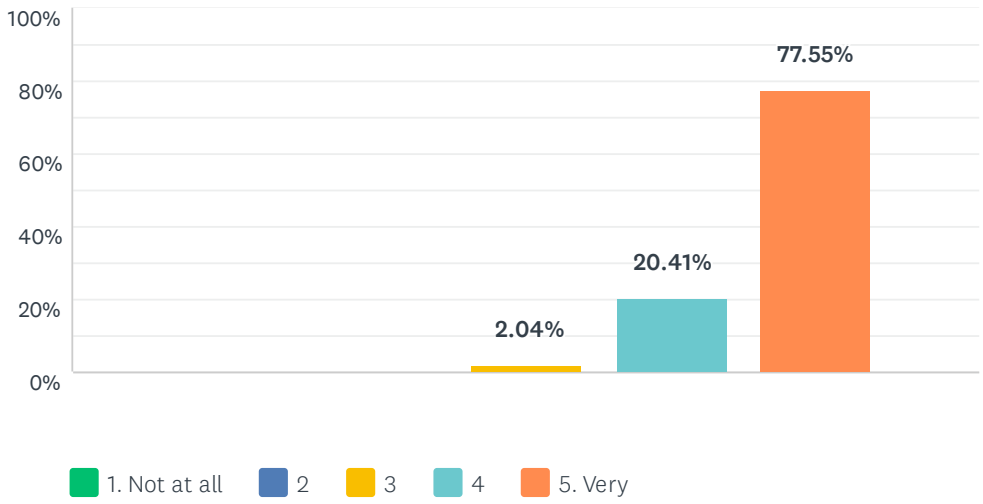
Answered: 49 Skipped: 57



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
	0.00% 0	0.00% 0	4.08% 2	22.45% 11	73.47% 36	49	4.69

Q3 The overall experience of the workshop was worthwhile

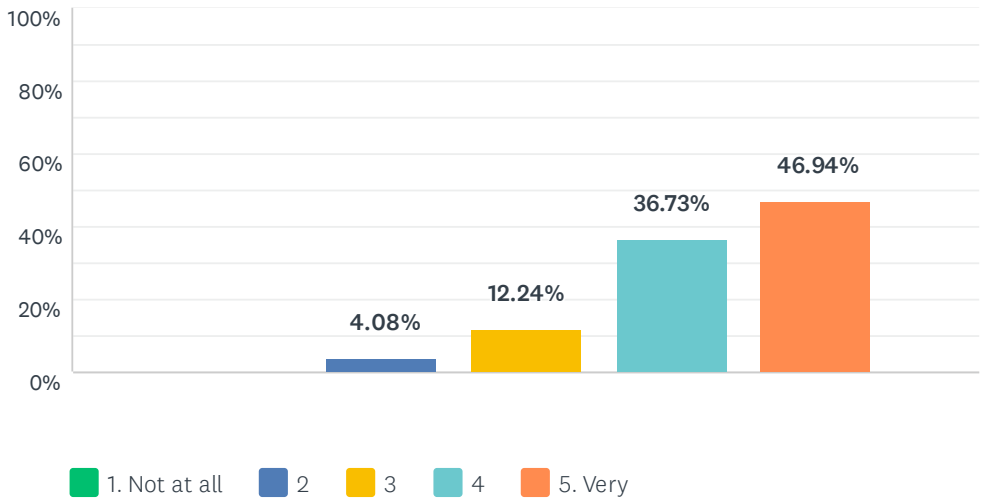
Answered: 49 Skipped: 57



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
	0.00% 0	0.00% 0	2.04% 1	20.41% 10	77.55% 38	49	4.76

Q4 The lectures were at at an appropriate level

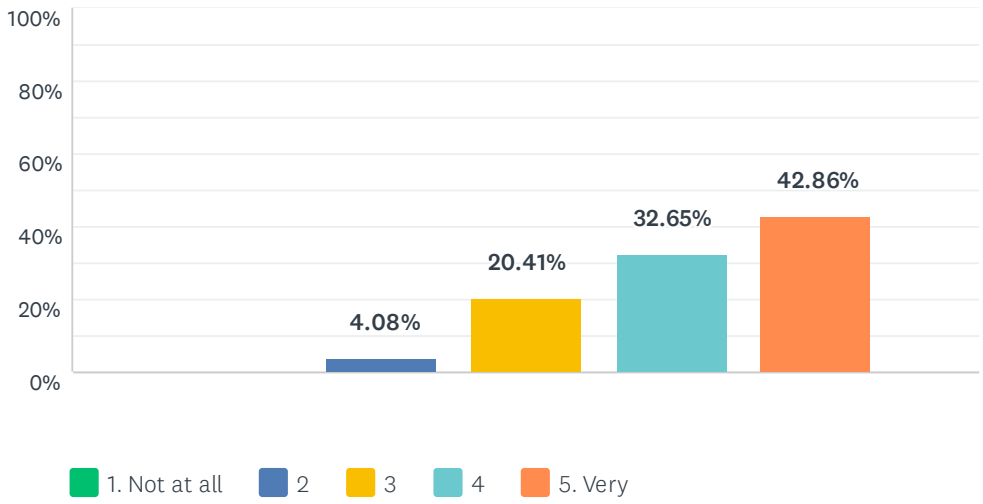
Answered: 49 Skipped: 57



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
	0.00% 0	4.08% 2	12.24% 6	36.73% 18	46.94% 23	49	4.27

Q5 I was well prepared to benefit from the lectures

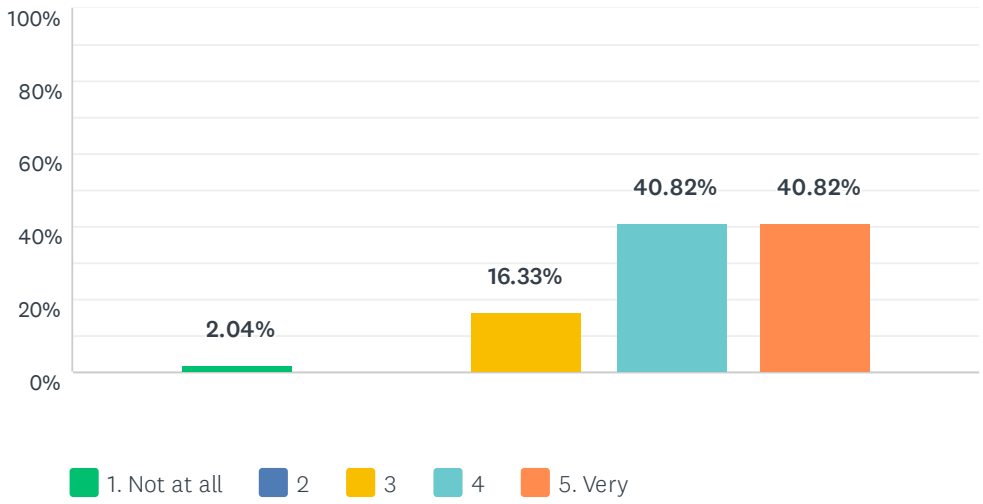
Answered: 49 Skipped: 57



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
	0.00% 0	4.08% 2	20.41% 10	32.65% 16	42.86% 21	49	4.14

Q6 My interest in the subject matter was increased by the workshop

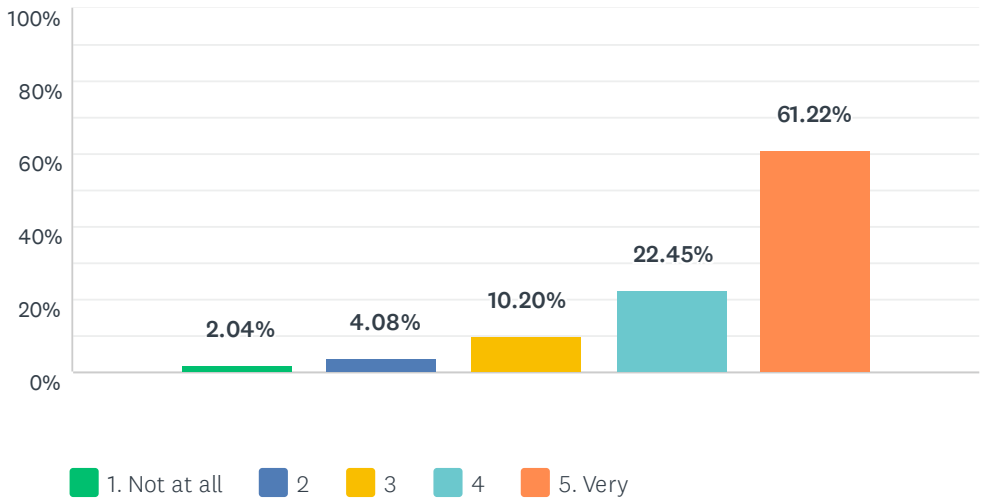
Answered: 49 Skipped: 57



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
	2.04% 1	0.00% 0	16.33% 8	40.82% 20	40.82% 20	49	4.18

Q7 The workshop helped me meet people with similar scientific interests

Answered: 49 Skipped: 57



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
	2.04% 1	4.08% 2	10.20% 5	22.45% 11	61.22% 30	49	4.37

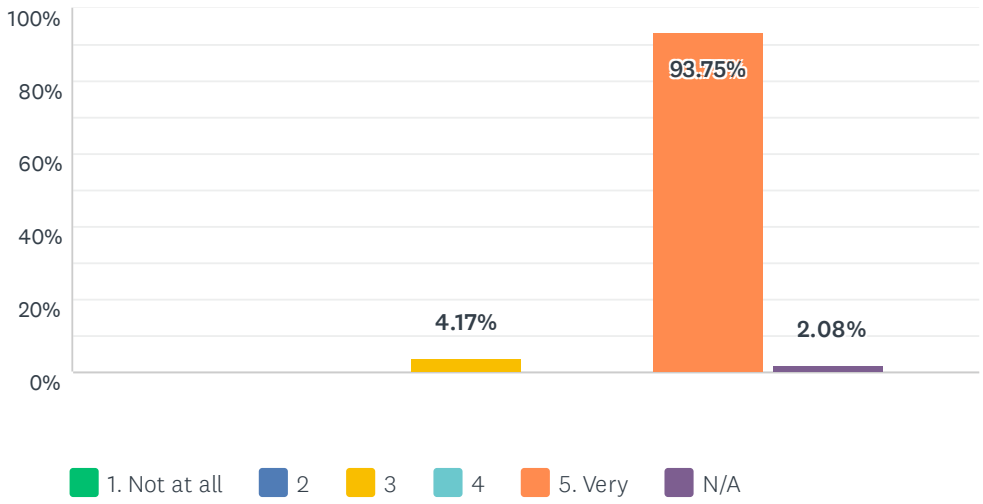
Q8 Additional comments

Answered: 5 Skipped: 101

#	RESPONSES	DATE
1	I think it was about as good as it could have been, all things considered	9/10/2021 9:43 AM
2	I was not sure if the workshop was aimed to be introductory or more like a conference, as I found all but a few talks to be rather advanced for an introductory workshop.	9/1/2021 9:14 AM
3	MSRI is great, and Workshop was great!	8/29/2021 11:22 AM
4	Great talks for the most part	8/27/2021 5:23 PM
5	congrats to the organizers	8/27/2021 2:35 PM

Q9 I found the MSRI staff helpful

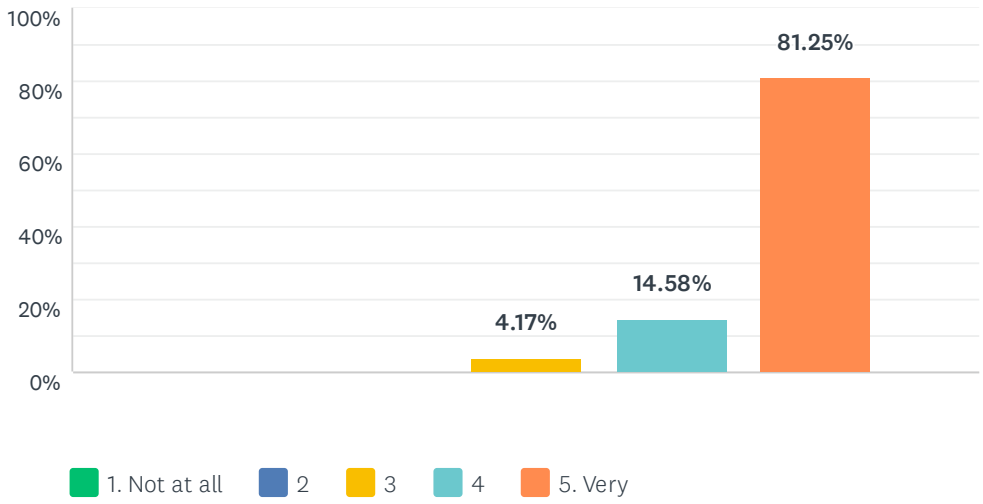
Answered: 48 Skipped: 58



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
	0.00% 0	0.00% 0	4.17% 2	0.00% 0	93.75% 45	2.08% 1	48	4.91

Q10 The MSRI facilities were conducive for such a workshop

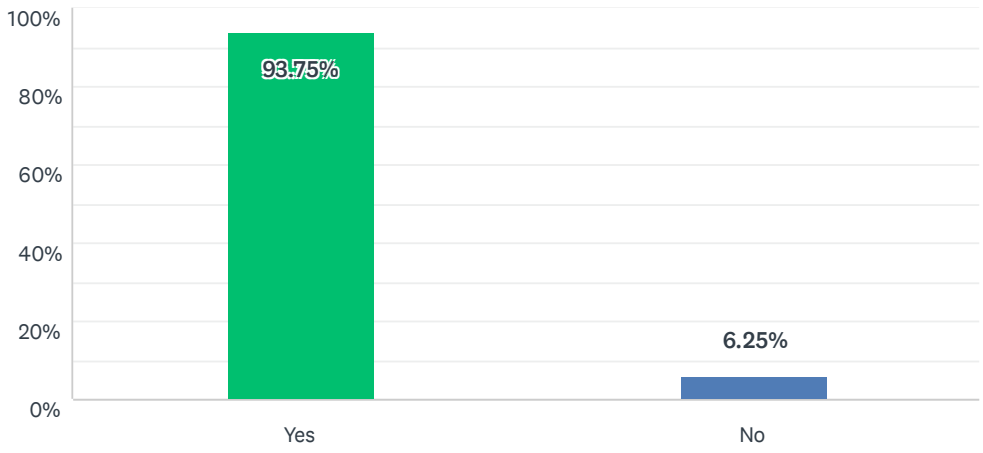
Answered: 48 Skipped: 58



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
	0.00% 0	0.00% 0	4.17% 2	14.58% 7	81.25% 39	48	4.77

Q11 Did you use MSRI's wireless network?

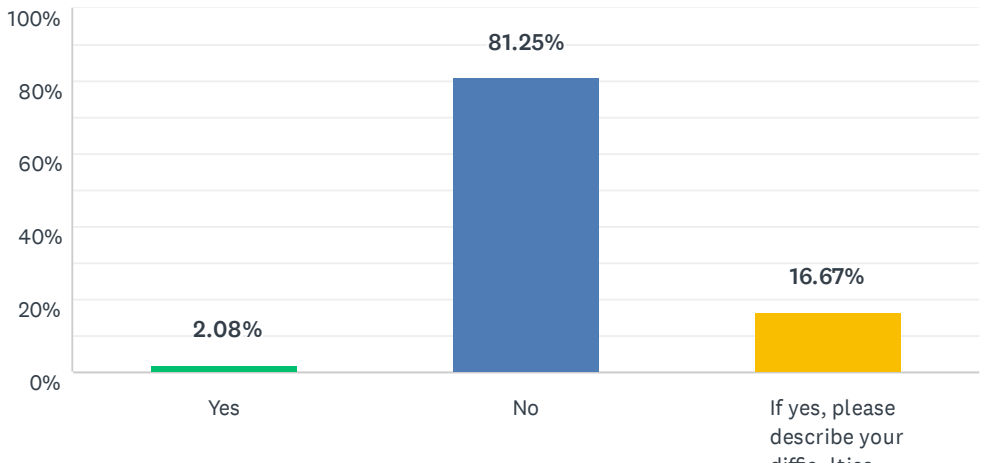
Answered: 48 Skipped: 58



ANSWER CHOICES	RESPONSES	
Yes	93.75%	45
No	6.25%	3
TOTAL		48

Q12 Did you experience any difficulties with the network?

Answered: 48 Skipped: 58

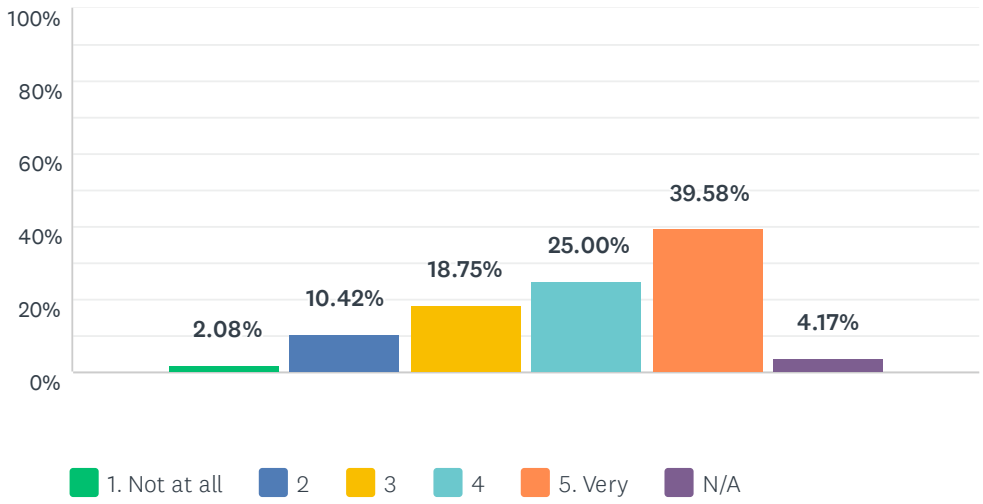


ANSWER CHOICES	RESPONSES	
Yes	2.08%	1
No	81.25%	39
If yes, please describe your difficulties	16.67%	8
TOTAL		48

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	I had problem connecting to the printer.	9/9/2021 8:39 PM
2	It disconnects frequently	9/9/2021 4:00 PM
3	Occasionally, my internet connection would cut out. This has mostly stopped.	9/1/2021 5:33 PM
4	Sometime is unstable	9/1/2021 8:48 AM
5	unstable wireless connection, both with eduroam and with MSRI-members ,both in office and in lecture hall	8/29/2021 11:25 AM
6	Sometimes It just goes down, randomly!	8/27/2021 2:48 PM
7	Sometimes the wifi connection was unstable.	8/27/2021 2:27 PM
8	I had to request an ethernet--usb cable as the wifi went down intermittently	8/27/2021 2:24 PM

Q13 The MSRI lunch arrangements were satisfactory

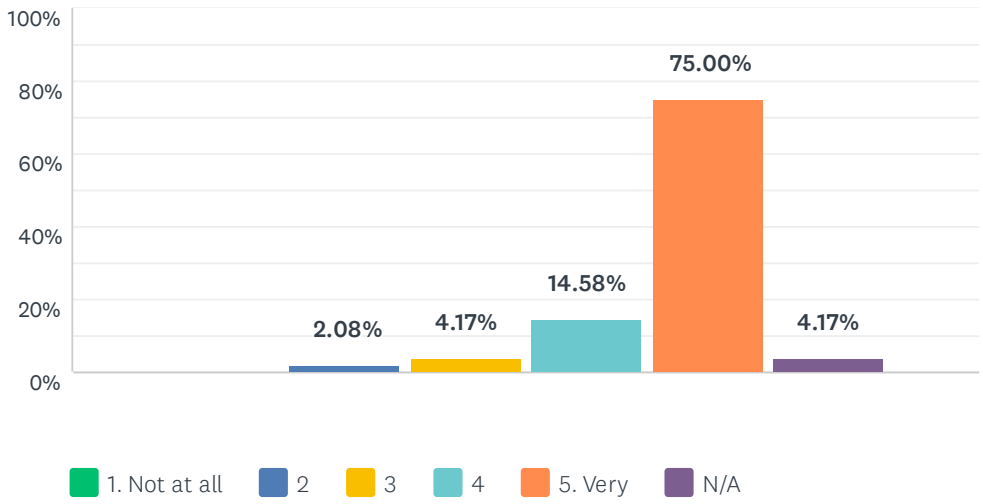
Answered: 48 Skipped: 58



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
	2.08% 1	10.42% 5	18.75% 9	25.00% 12	39.58% 19	4.17% 2	48	3.93

Q14 The MSRI tea arrangements were satisfactory

Answered: 48 Skipped: 58



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
	0.00% 0	2.08% 1	4.17% 2	14.58% 7	75.00% 36	4.17% 2	48	4.70

Q15 Additional comments about the MSRI staff, facilities and food

Answered: 6 Skipped: 100

#	RESPONSES	DATE
1	Maybe we could have had a tea break or breakfasat as part of the workshop to facilitate networking	9/10/2021 9:44 AM
2	I find the food from "stuffed in" much less tasteful than the other restaurants.	9/9/2021 3:42 PM
3	It would be great to have healthy food options in the MSRI fridge at all times, and perhaps a more substantial tea.	9/1/2021 5:33 PM
4	Everything was excellent. Issues with food are not related to staff or organization, but only to the location of MSRI, far from everything.	8/29/2021 11:25 AM
5	I would like to suggest to move the afternoon tea at 4pm instead of 3pm, at least during the conference week, since talks ended at 1pm and there is little time to get some work done before the tea. Thanks!	8/27/2021 3:42 PM
6	I would have preferred to have more time between lunches and tea breaks	8/27/2021 2:40 PM

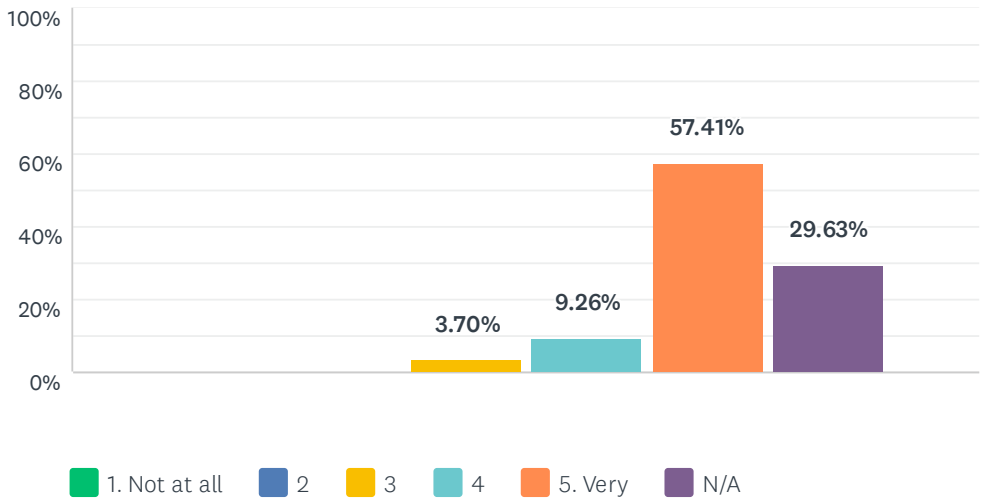
Q16 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 0 Skipped: 106

#	RESPONSES	DATE
	There are no responses.	

Q17 I found the MSRI staff helpful

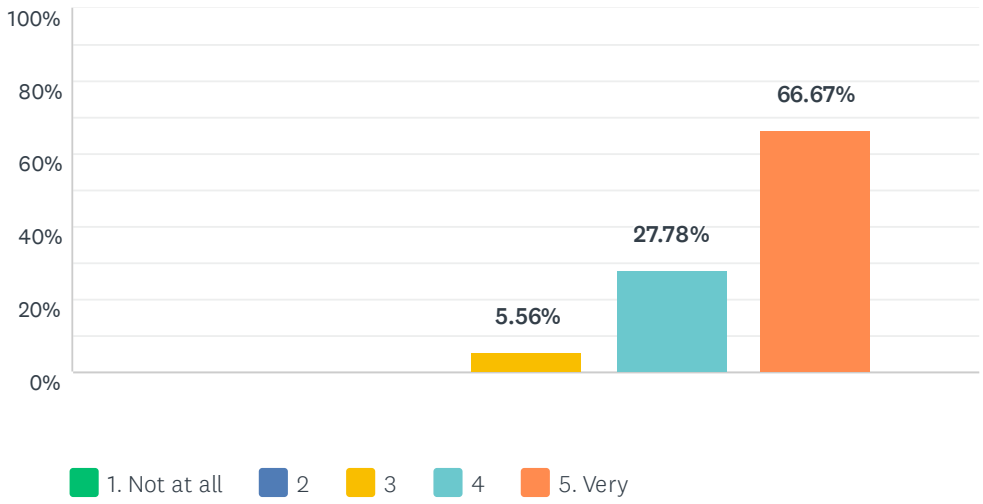
Answered: 54 Skipped: 52



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
	0.00% 0	0.00% 0	3.70% 2	9.26% 5	57.41% 31	29.63% 16	54	4.76

Q18 The workshop was intellectually stimulating

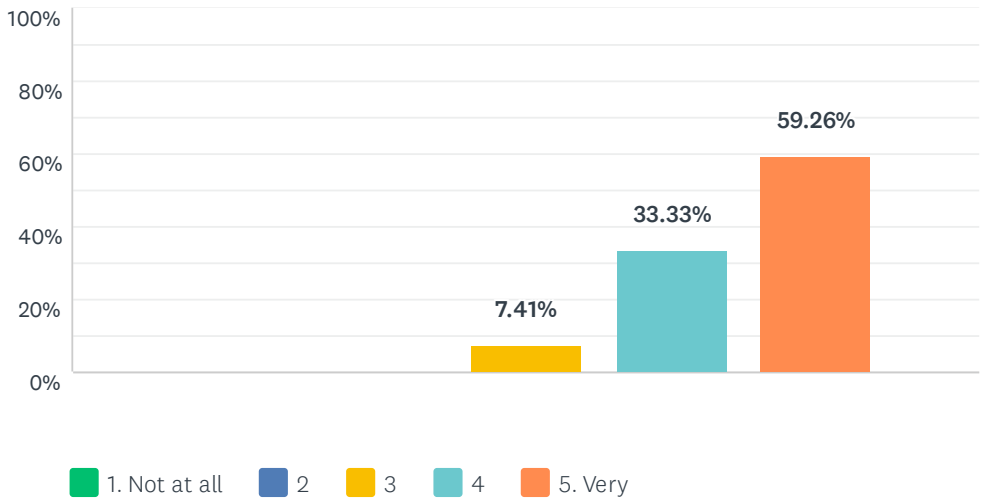
Answered: 54 Skipped: 52



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
	0.00% 0	0.00% 0	5.56% 3	27.78% 15	66.67% 36	54	4.61

Q19 The overall experience of the workshop was worthwhile

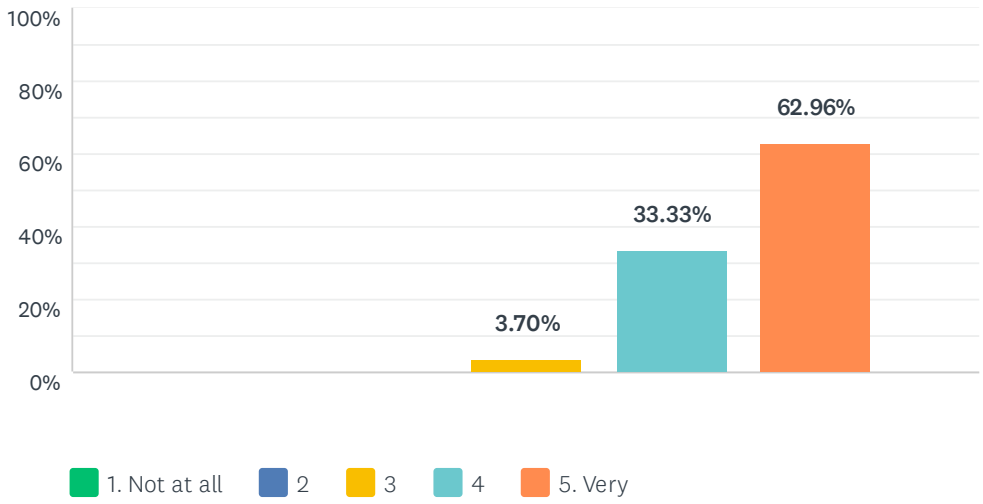
Answered: 54 Skipped: 52



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
	0.00% 0	0.00% 0	7.41% 4	33.33% 18	59.26% 32	54	4.52

Q20 The lectures were at at an appropriate level

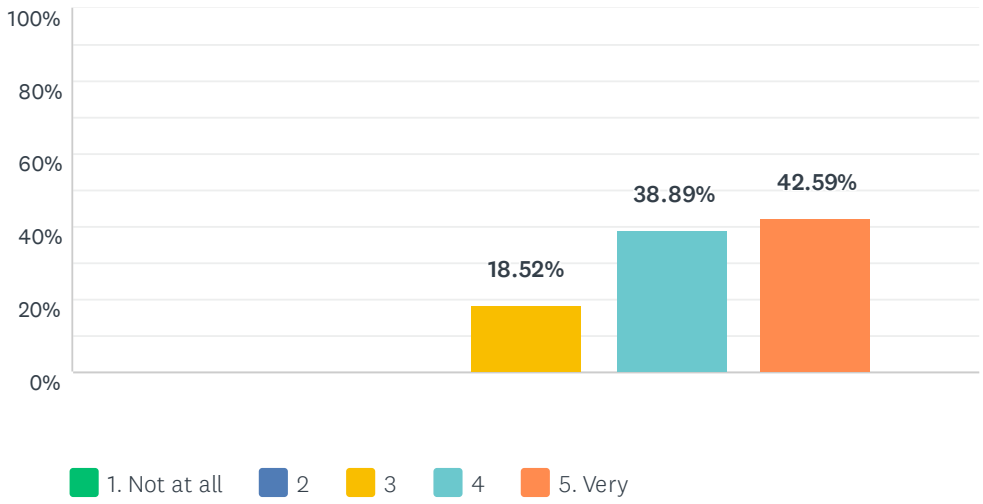
Answered: 54 Skipped: 52



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
	0.00% 0	0.00% 0	3.70% 2	33.33% 18	62.96% 34	54	4.59

Q21 I was well prepared to benefit from the lectures

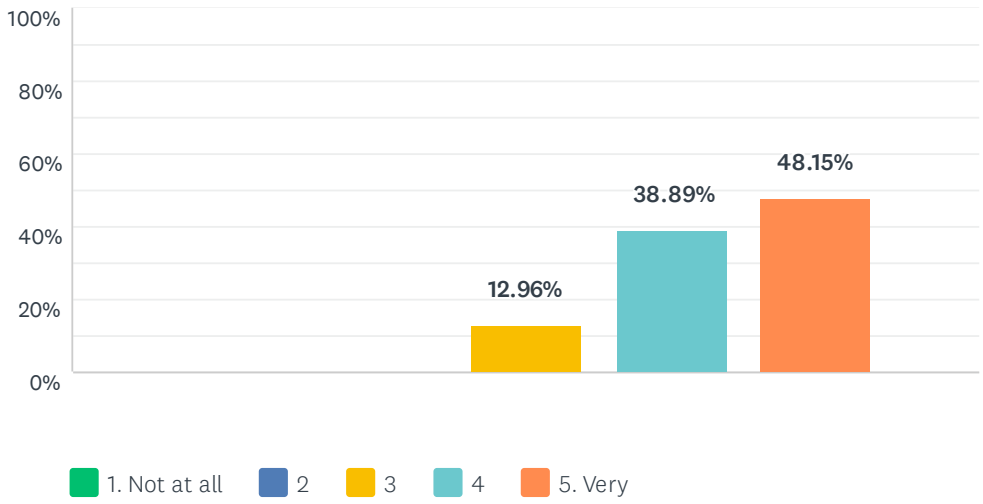
Answered: 54 Skipped: 52



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
	0.00% 0	0.00% 0	18.52% 10	38.89% 21	42.59% 23	54	4.24

Q22 My interest in the subject matter was increased by the workshop

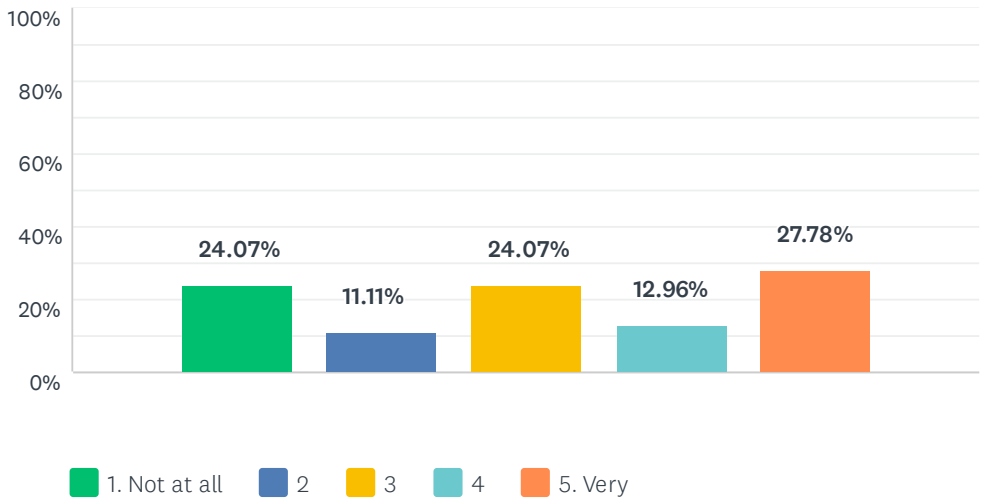
Answered: 54 Skipped: 52



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
	0.00% 0	0.00% 0	12.96% 7	38.89% 21	48.15% 26	54	4.35

Q23 The workshop helped me meet people with similar scientific interests

Answered: 54 Skipped: 52



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
	24.07% 13	11.11% 6	24.07% 13	12.96% 7	27.78% 15	54	3.09

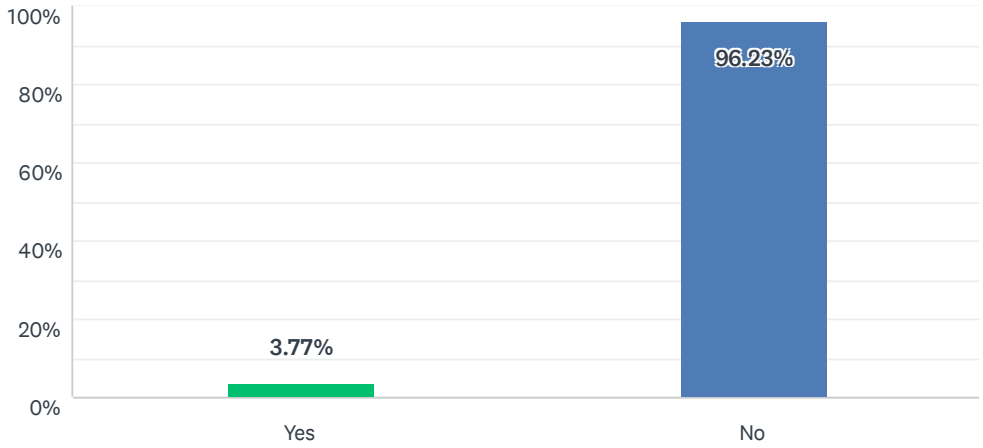
Q24 Additional comments

Answered: 11 Skipped: 95

#	RESPONSES	DATE
1	It’s tough doing an online workshop. Thanks for your work.	9/9/2021 6:17 PM
2	I found the lectures fantastic and engaging!! Thank you so much for organizing it! It might be helpful to have a wiki page or blog with the materials.. for benefit of intro people as well as advanced people. Thank you again!	9/1/2021 10:53 AM
3	I am in Europe, and I did follow only two days: the first and the last. I am very happy with what I saw, but I did not interact t all with the speakers nor participants.	9/1/2021 9:28 AM
4	Attending remotely, I did not meet anyone unfortunately.	8/28/2021 11:55 PM
5	This was an outstanding workshop with first rate speakers. I regret not being able to attend in person.	8/28/2021 6:17 PM
6	It was very informative	8/28/2021 2:10 AM
7	The hybrid workshop and presence of live audience give near in person workshop experience. I want participate in more such hybrid workshop in future.	8/27/2021 10:08 PM
8	With remote-only attendance, there is no "small-talk" in the corridors, and networking with other people becomes a bigger challenge	8/27/2021 4:19 PM
9	Holding the workshop at the beginning of my semester meant that it was at a time which was maximally busy for me and I couldn't get away to attend in person.	8/27/2021 3:33 PM
10	I regret I was not able to meet directly people taking part in the workshop, but I enjoyed very much the lectures and discussions.	8/27/2021 3:17 PM
11	Some kind of option for a break-out room coffee to talk to other remote people would have been nice.	8/27/2021 2:24 PM

Q25 Did you experience any technical difficulties accessing the workshop online?

Answered: 53 Skipped: 53



ANSWER CHOICES	RESPONSES	
Yes	3.77%	2
No	96.23%	51
TOTAL		53

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
1	It turns out that there is time conflict with my schedule in the department. I need to both teach and take courses since I'm graduate student.	8/29/2021 9:06 PM
2	There was an issue with the sound in one of the lectures, that took long to resolve.	8/28/2021 11:57 PM

Q26 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 53 Skipped: 53

#	RESPONSES	DATE
1	timezone difference was difficult	9/14/2021 5:57 AM
2	there was a negative effect of time difference	9/13/2021 12:25 PM
3	The time zone wasn't an issue. Having the workshop over Zoom makes it quite difficult to talk to the in-person participants who are not speakers.	9/11/2021 7:20 PM
4	The schedule is nice for me so I could attend most talks on MWF days that I am interested (I have full day teaching on TH days). Occasionally I cannot attend the last talk of the day due to the time zone difference.	9/10/2021 8:02 AM
5	Not at all	9/10/2021 6:26 AM
6	No	9/10/2021 5:42 AM
7	Time zone differences make it harder to participate in some events, but that is unavoidable and in my case it was mitigated by the way the workshop was organised.	9/10/2021 2:36 AM
8	Some talks were late at night in my time zone.	9/10/2021 1:31 AM
9	Yes. I could not come so the online form of the workshop allowed me to follow some lectures.	9/9/2021 11:56 PM
10	The online workshop is good -- I can actually see the screen more clearly.	9/9/2021 10:39 PM
11	There was a slight problem associated with the time difference, but it wasn't a significant factor.	9/9/2021 10:24 PM
12	Hard to talk to people	9/9/2021 6:17 PM
13	Only difficulties were due to time differences.	9/9/2021 3:57 PM
14	Asking questions online is not always convenient	9/9/2021 3:33 PM
15	a little bit less opportunity for follow up discussion	9/9/2021 3:33 PM
16	If the workshop had not been held online, I would not have been able to register so close to the date of the workshop. There is only 3 hours difference, which not a barrier for me.	9/4/2021 6:31 AM
17	I could not listen to some talks live but this is not a problem at all. I intend to view these at a later convenient time.	9/3/2021 11:53 PM
18	Good to have a chance to join remotely.	9/2/2021 7:35 AM
19	No difference.	9/1/2021 5:18 PM
20	The experience of meeting the participants via online format is very practical for persons who cannot travel or having visa to USA. It is very good for my opinion and I have appreciated it well.	9/1/2021 1:21 PM
21	I didn't engage with as many talks since they were online. I feel I missed many opportunities to connect with peers because it was online.	9/1/2021 12:03 PM
22	The online was fantastic! There's no way I could have attended in person. With online, at least I was able to attend the lectures.	9/1/2021 10:56 AM
23	some personal conflicting schedules hampered my ability to attend as much as I would have	9/1/2021 10:52 AM

	liked. Also, I could not be engaged as I would have been if I had attended in person.	
24	Did not talk to people	9/1/2021 10:18 AM
25	I will not be able to participate if not for the online portion	9/1/2021 9:38 AM
26	I answered previously; a barrier for me was the time zone difference, although I appreciated that the schedule was appropriate for me to be able to follow the talks.	9/1/2021 9:30 AM
27	I was planning to come in person but due to the pandemic I did not come. But the online participation turned out to be as successful as in person participation that I had in the past workshops.	9/1/2021 9:10 AM
28	The schedule of the talks was very good for participation throughout US time zones. I am in Chicago and it worked very well for me.	9/1/2021 8:52 AM
29	Time zone is not a problem. Personal circumstances due to the pandemic took a lot of time from me that would otherwise go to a more engaged participation.	9/1/2021 8:51 AM
30	The online workshop helped with my participation.	9/1/2021 8:49 AM
31	Everything went very well	8/31/2021 8:00 AM
32	I would have loved to be there, but having the option to listen to the talks online works very nicely for me. I missed the interactions that are natural over breaks, but I really appreciate the flexibility of being abe to participate to a large degree in the whole program even if I'm not going to be there the whole time.	8/30/2021 5:45 PM
33	Having the workshop held online allowed me to participate. Otherwise, I would have to miss the workshop altogether because my semester started on August 23 and I have to teach.	8/30/2021 8:41 AM
34	I would not have been able to participate if it where not held online.	8/30/2021 12:50 AM
35	No	8/29/2021 9:06 PM
36	I did not attend all lectures, mainly due to the time zone difference.	8/28/2021 11:57 PM
37	No problem with online, although in-person attendance would have been better.	8/28/2021 6:19 PM
38	When the presenter was writing on the chalkboard, I sometimes wished that I could look back at previous boards, but that is not possible in the online format (unfortunately, slides have the same problem unless the presenter posts the slides in advance).	8/28/2021 7:19 AM
39	Not so much	8/28/2021 4:48 AM
40	It was fine for me	8/28/2021 4:05 AM
41	Time zone difference. There is 18-hour difference but I can see the recored video.	8/28/2021 3:24 AM
42	This workshop was good online, but if it is in person then it will be more impactful.	8/28/2021 2:11 AM
43	Not at all, it is coordinated very well.	8/28/2021 12:29 AM
44	Time zone difference was not a big issue and Had this workshop been solely in person one (instead of a hybrid one) I could not attend it.	8/27/2021 10:30 PM
45	On the first day, it was not easy to find seats in the Simons auditorium due to social distancing. So I thought I'd attend the talks from my office using the Zoom link, and it was very convenient.	8/27/2021 5:47 PM
46	It was very convenient!	8/27/2021 4:55 PM
47	When attending in-site events, it is much easier to leave behind small daily issues that arise at home/home institution. With remote-only attendance, these little things impact the ability to focus solely on the event.	8/27/2021 4:28 PM
48	It was helpful. Otherwise, I could not attend.	8/27/2021 3:48 PM
49	It meant that I couldn't have meaningful informal contact with other participants.	8/27/2021 3:35 PM
50	The hours of lectures allowed me to attend them in evenings of European time. I really appreciate the kindness of the organizers in preparing such a schedule.	8/27/2021 3:22 PM

51	I generally had to miss the third talk each day due to time zone difference and extra childcare obligations due to the pandemic.	8/27/2021 2:40 PM
52	The online form doesn't impact my participation.	8/27/2021 2:30 PM
53	No, I couldn't have made the conference because of teaching, so being able to watch online was nice.	8/27/2021 2:26 PM

Q27 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 23 Skipped: 83

#	RESPONSES	DATE
1	hard to say, this can be rather random	9/13/2021 12:25 PM
2	Giving the possibility to present short talks (3 min long, for example) to a wider audience, including PhD's, postdocs and even Senior. After that we know better each other.	9/10/2021 6:26 AM
3	Slides should be uploaded before lectures or at least some relevant notes, we have Internet issues sometimes so it would better to have some idea before attending the workshop online. Overall it was good experience thanks for my registration.	9/10/2021 5:42 AM
4	Interaction online is complicated during the workshop because of the tight schedule. Perhaps it would be useful for remote participants to be able to submit comments/questions on a webpage open to everyone, for the speakers to see afterwards, and/or having a session for this.	9/10/2021 2:36 AM
5	I haven't yet experienced a system that works well in this respect.	9/9/2021 10:24 PM
6	GatherMe? Discord? Slack?	9/9/2021 6:17 PM
7	no suggestions	9/9/2021 3:33 PM
8	Perhaps you could try wonder.me? I have not used this application personally but I hear that nice things about it. My institution has been using it as a substitute for social gathering during the pandemic.	9/3/2021 11:53 PM
9	Not really.	9/2/2021 7:35 AM
10	For me, the organisation was very good, so if you want interaction between participants we can create chatroom .	9/1/2021 1:21 PM
11	No, I think this is a very difficult topic, and hard to replace this engagement through online platforms.	9/1/2021 12:03 PM
12	One thing I've seen in tech conferences is a live blog (where people post their thoughts and ideas) and breakout rooms. I think it might be nice to have virtual breakout rooms.. they might help facilitate interaction.	9/1/2021 10:56 AM
13	I am learning to use Gather Town, and I really appreciate it.	9/1/2021 9:30 AM
14	Not really sure.	9/1/2021 8:52 AM
15	Perhaps an interactive poster session (with a breakout room for each poster) would stimulate contact.	8/28/2021 11:57 PM
16	I'm not aware of any really good alternatives to in-person attendance.	8/28/2021 6:19 PM
17	When pandemic will over really wish to attend the workshop in person.	8/28/2021 2:11 AM
18	I understand that building interaction among those participating virtually is an issue. It has been same in all the previous conferences I attended. Having a small whatsapp or telegram group where anyone can pose any question, may be an option (vaguely speaking although). The group may be created 7 days ahead of the workshop and may be deleted 7 days after the workshop.	8/27/2021 10:30 PM
19	We could try Gather.	8/27/2021 4:55 PM
20	It could be helpful to encourage more senior people to actively become available for ocasional online chat. Sococo seems to be underestimated for that matter. For instance, encouraging a	8/27/2021 4:28 PM

	moment where some senior people are explicitly available for some "online coffee chat" (rather than having to write an email to setup a time just for some small questions) could be of help.	
21	No.	8/27/2021 3:35 PM
22	It seems almost nobody else uses sococo so perhaps some event to get people using it would help.	8/27/2021 2:40 PM
23	Leaving the Zoom rooms open afterwards, or during a coffee break would be nice. I think participants can create their own breakout rooms, for people to talk in.	8/27/2021 2:26 PM

Q28 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 12 Skipped: 94

#	RESPONSES	DATE
1	The schedule of the program did not specify the time zone (or it was not evident).	9/10/2021 6:32 AM
2	I think that general organisation was very good given the circumstances, and having the material from the talks (recording and/or slides) available is really useful.	9/10/2021 2:39 AM
3	It was a great event. I would like to thank the organizers. I have no further suggestions.	9/3/2021 11:54 PM
4	None.	9/2/2021 7:36 AM
5	If possible to speak carefully because there are people who don't speak English well.	9/1/2021 1:24 PM
6	I think it might be nice to have a community of participants.. maybe a slack channel or something.. so that it's possible to get in touch with others and get to know them and keep in touch with them afterwards. It would be nice to know if people might be interested in the problems I'm working on (applications of RMT in medicine/ genomics.)	9/1/2021 10:59 AM
7	I'd just like to mention that it may be worth considering hybrid versions even after the pandemic, to allow program members to attend seminars and workshops even while they are not at MSRI	8/30/2021 5:46 PM
8	Noting comes to mind. I enjoyed the conference enormously and learned much.	8/28/2021 6:20 PM
9	For talks with slides, if the presenter is willing to upload their slides before the talk begins, it makes it easier for participants to follow along (because we can look back at definitions or things that may have gone too fast).	8/28/2021 7:22 AM
10	Every thing was well planned, wish to participate and attend the coming workshops also.	8/28/2021 2:12 AM
11	Not as such....to me it was a good experience and I have already stated my suggestions.	8/27/2021 10:31 PM
12	Thank you, the conference was extremely well organized under the circumstances!	8/27/2021 4:55 PM

Connections and Introductory Workshop: Universality and Integrability in Random Matrix Theory and Interacting Particle Systems, Part 2

September 20, 2021 – September 24, 2021

Hybrid Workshop

Organizers:

Gérard Ben Arous (New York University, Courant Institute)
Ioana Dumitriu (University of California, San Diego)
Alice Guionnet (École Normale Supérieure de Lyon)
Alisa Knizel (University of Chicago)
Sylvia Serfaty (New York University, Courant Institute)
Horng-Tzer Yau (Harvard University)

REPORT ON THE MSRI WORKSHOP
"Connections and Introductory Workshop: Universality and Integrability in Random Matrix Theory and Interacting Particle Systems, Part 2 (Hybrid Workshop)"
September 20 – September 24, 2021

Organizers

- Gérard Ben Arous (New York University, Courant Institute),
- Ioana Dumitriu (University of California, San Diego),
- Alice Guionnet (École Normale Supérieure de Lyon),
- Alisa Knizel (The University of Chicago),
- Sylvia Serfaty (New York University, Courant Institute),
- Horng-Tzer Yau (Harvard University)

Scientific Description

This workshop aimed at providing participants with an overview of some of the recent developments in the topics of the semester, with a particular emphasis on universality and applications. This included universality for Wigner matrices and band matrices and quantum unique ergodicity, universality for beta ensembles and log/coulomb gases, KPZ universality class, universality in interacting particle systems, the connection between random matrices and number theory.

In addition, this workshop explored connections with other branches of mathematics and applications to sciences and engineering. The workshop featured presentations by both leading researchers and promising newcomers. There was some special activities originally planned for the Connections Workshop: a panel discussion of topics relevant to junior researchers, women, and minorities; a poster session for students and recent PhDs; and other social events.

Highlights of the Workshop

The workshop was hybrid in nature, with remote participants logging in (up to 80-90 at a time) in addition to in-person attendees. The special activities pertaining to the Connections workshop were very well-attended; the panel was lively and the poster presentation allowed many beginning and junior researchers (postdocs and graduate students) a chance to showcase their work and interact, even though not physically present.

Alice Guionnet kicked off the workshop with an excellent talk on rare events in random matrix theory which was followed by Fanny Augeri speaking on the fluctuations of characteristic polynomials of Jacobi matrices and Diane Holcomb's lecture on the Stochastic Airy operator. The last talk of the day was given by Evita Nestoridi, on the simple exclusion process, and the day was closed by the very well-attended panel on discussion on work and life issues.

The second day continued with talks by prominent women researchers presenting their most recent work: Sylvia Serfaty (log-Coulomb gases), Liza Rebrova (random matrices in iterative linear solvers), Manuela Girotti (Fredholm determinants and determinantal point processes), and Ke Wang (PCA in spiked covariance matrices). The talks were interspersed with two one-hour poster session presentations where a total of twelve junior researchers got a chance to talk about their work and receive feedback from more senior colleagues.

Day three consisted of a mix of talks: Roland Bauerschmidt showcased a connection between random forests, nonlinear sigma models, and random matrices; Thomas Leble talked about counting points in boxes, Mariya Shcherbina gave a presentation on rank-one imaginary perturbations for Hermitian band matrices, and Emma Bailey spoke about the generalized moments of classical compact groups. There was ample discussion time after the talks, which the in-person participants took advantage of.

On Thursday, Balint Virag spoke about three postulates in the random geometry known as the directed landscape; Amol Aggarwal presented universality results in random lozenge tilings, Ivan Corwin showed the existence of a certain stationary measure connected to the KPZ equation, and Alan Hammond talked about stability and chaos in dynamical last passage percolation. Finally, on Friday, Paul Bourgade presented a proof (up to tightness) for the Fyodorov-Hiary-Keating conjecture, Ioana Dumitriu delivered a presentation on the spectral gap of random regular graphs and hypergraphs, and Antti Knowles closed the workshop with a lecture on the localization and delocalization in various degree regimes for Erdos-Renyi random graphs.

The workshop maintained a highly interactive format, despite the challenges presented by its hybrid nature. Attendance, both online and in-person, was quite high, and the special events were a welcome addition to the lectures, as were the discussion times; we should not forget to mention the invaluable help of the MSRI staff, who ran things very smoothly. Overall, we are pleased to say that the workshop was very successful.

Organizers		
First Name	**Last Name**	**Institution**
Gérard	Ben Arous	New York University, Courant Institute
Ioana	Dumitriu	University of California, San Diego
Alice	Guionnet	École Normale Supérieure de Lyon
Alisa	Knizel	University of Chicago
Sylvia	Serfaty	New York University, Courant Institute
Horng-Tzer	Yau	Harvard University
Speakers		
First Name	**Last Name**	**Institution**
Amol	Aggarwal	Columbia University
Fanny	Augeri	Weizmann Institute of Science
Emma	Bailey	City University of New York (CUNY)
Roland	Bauerschmidt	University of Cambridge
Paul	Bourgade	New York University, Courant Institute
Ivan	Corwin	Columbia University
Ioana	Dumitriu	University of California, San Diego
Manuela	Girotti	Saint Mary's University
Alice	Guionnet	École Normale Supérieure de Lyon
Alan	Hammond	University of California, Berkeley
Diane	Holcomb	Royal Institute of Technology
Antti	Knowles	University of Geneva
Thomas	Leblé	Université de Paris V (René Descartes)
Evita	Nestoridi	Princeton University
Liza	Rebrova	Princeton University
Sylvia	Serfaty	New York University, Courant Institute
Mariya	Shcherbina	B. Verkin Institute for Low Temperature Physics
Balint	Virag	University of Toronto
Ke	Wang	Hong Kong University of Science and Technology

Mathematical Sciences Research Institute

Connections and Introductory Workshop: Universality and Integrability in Random Matrix Theory and Interacting Particle Systems, Part 2

September 20 to September 24, 2021

Monday, September 20, 2021		
09:15 AM - 09:30 AM		Introduction
09:30 AM - 10:20 AM	Alice Guionnet	Rare Events in RMT and Spherical Integrals
10:35 AM - 11:25 AM	Fanny Augeri	Fluctuations of the Characteristic Polynomial of Random Jacobi Matrices
11:40 AM - 12:30 PM	Diane Holcomb	The Stochastic Airy Operator and an Interesting Eigenvalue Process
01:30 PM - 02:10 PM		Random Zoom Rooms
02:10 PM - 03:00 PM	Evita Nestoridi	Mixing Times for the Simple Exclusion Process with Open Boundaries
03:30 PM - 05:00 PM		Panel Discussion on Work/Life

Tuesday, September 21, 2021		
08:40 AM - 09:30 AM		Random Zoom Rooms
09:30 AM - 10:20 AM	Sylvia Serfaty	Topics on Log and Coulomb Gases
10:30 AM - 11:30 AM		Participant Presentation Session
11:30 AM - 12:20 PM	Liza Rebrova	Random Matrices in Iterative Linear Solvers: Corruption Removal and Sketching
01:30 PM - 02:30 PM		Participant Presentation Session
02:30 PM - 03:20 PM	Manuela Girotti	Fredholm Determinant Solutions of the Painlevé II Hierarchy and Gap Probabilities of Determinantal Point Processes
04:00 PM - 04:50 PM	Ke Wang	Principal Components of Spiked Covariance Matrices

Wednesday, September 22, 2021		
09:00 AM - 09:50 AM	Roland Bauerschmidt	Random Forests and Nonlinear Sigma Models (and What These Have to Do with Random Matrices)
10:05 AM - 10:55 AM	Thomas Leblé	Counting Points in Boxes: the Riesz Family & Friends
11:10 AM - 12:00 PM	Mariya Shcherbina	Rank One Imaginary Perturbation for Hermitian Random Matrices in the Case of Band Matrices
12:15 PM - 01:05 PM	Emma Bailey	Generalized Moments of the Classical Compact Groups

Thursday, September 23, 2021		
09:00 AM - 09:50 AM	Balint Virag	Three Recipes for the Directed Landscape
10:05 AM - 10:55 AM	Amol Aggarwal	Universality Results in Random Lozenge Tilings
11:10 AM - 12:00 PM	Ivan Corwin	Stationary Measure for the Open KPZ Equation
12:15 PM - 01:05 PM	Alan Hammond	Stability and Chaos in Dynamical Last Passage Percolation

Friday, September 24, 2021		
09:00 AM - 09:50 AM	Paul Bourgade	The Fyodorov-Hiary-Keating Conjecture
10:05 AM - 10:55 AM	Ioana Dumitriu	Spectral Gap in Regular Graphs and Hypergraphs
11:10 AM - 12:00 PM	Antti Knowles	Localization and Delocalization in Erdös-Rényi Graphs

Participants

First Name	Last Name	Institution
Amol	Aggarwal	Columbia University
Gernot	Akemann	Universität Bielefeld
Johannes	Alt	University of Geneva
Fanny	Augeri	Weizmann Institute of Science
Jinho	Baik	University of Michigan
Emma	Bailey	City University of New York (CUNY)
Guillaume	Barraquand	Centre National de la Recherche Scientifique (CNRS)
Nicholas	Baskerville	University of Bristol
Estelle	Basor	American Institute of Mathematics (AIM)
Riddhipratim	Basu	International Centre for Theoretical Sciences
Roland	Bauerschmidt	University of Cambridge
Gérard	Ben Arous	New York University, Courant Institute
Manan	Bhatia	Massachusetts Institute of Technology
Natasha	Blitvic	University of Lancaster
Paul	Bourgade	New York University, Courant Institute
Sandra	Cerrai	University of Maryland
Andrew	Chee	Cornell University
Elizabeth	Collins-Woodfin	University of Michigan
Nicholas	Cook	Duke University
Sylvie	Corteel	University of California, Berkeley
Ivan	Corwin	Columbia University
Sayan	Das	Columbia University
Harini	Desiraju	University of Birmingham
Philippe	Di Francesco	University of Illinois at Urbana-Champaign
Hindy	Drillick	Columbia University
Ioana	Dumitriu	University of California, San Diego
Torsten	Ehrhardt	University of California, Santa Cruz
Chiara	Franceschini	Instituto Superior Técnico
Jacob	Fronk	University of Copenhagen
Roozbeh	Gharakhloo	Colorado State University
Manuela	Girotti	Saint Mary's University
Tamara	Grava	University of Bristol
Alice	Guionnet	École Normale Supérieure de Lyon
Aaron	Hale	Mathematical Sciences Research Institute (MSRI)
Alan	Hammond	University of California, Berkeley
Milind	Hegde	University of California, Berkeley
Ella	Hiesmayr	University of California, Berkeley
Zoe	Himwich	Columbia University
Diane	Holcomb	Royal Institute of Technology
Jiaoyang	Huang	New York University, Courant Institute
Jonathan	Husson	École Normale Supérieure de Lyon
Rinat	Kedem	University of Illinois at Urbana-Champaign
Alisa	Knizel	University of Chicago
Antti	Knowles	University of Geneva
Karol	Kozlowski	École Normale Supérieure de Lyon
Alexandre	Krajenbrink	International School for Advanced Studies (SISSA/ISAS)
Igor	Krasovsky	Imperial College, London
Thomas	Kriecherbauer	Universität Bayreuth
Torben	Krüger	University of Copenhagen
Gaultier	Lambert	Universität Zürich
Benjamin	Landon	University of Toronto
Han	Le	University of Michigan
Jaehun	Lee	Korea Advanced Institute of Science and Technology (KAIST)
Zhongyang	Li	University of Connecticut
Yuchen	Liao	University of Warwick
Karl	Liechty	DePaul University
Yier	Lin	Columbia University
Milivoje	Lukic	Rice University

Participants		
First Name	**Last Name**	**Institution**
Benjamin	McKenna	New York University, Courant Institute
Theo	McKenzie	University of California, Berkeley
Ken	McLaughlin	Colorado State University
Patrik	Nabelek	Oregon State University
Evita	Nestoridi	Princeton University
Christian	Noack	Cornell University
Alessandra	Occelli	Instituto Superior Técnico
Daniel	Ofner	Hebrew University of Jerusalem
Jeffrey	Oregero	University at Buffalo (SUNY)
Greta	Panova	University of Southern California
Shalin	Parekh	Columbia University
Iván	Parra	Katholieke Universiteit Leuven
Leonid	Petrov	University of Virginia
Mateusz	Piorkowski	Mathematical Sciences Research Institute (MSRI)
Istvan	Prause	University of Eastern Finland
Andrei	Prokhorov	University of Michigan
Dhanusshya	R	Ethiraj College for Women
Firas	Rassoul-Agha	University of Utah
Liza	Rebrova	Princeton University
Rohan	Sarkar	Cornell University
Sylvia	Serfaty	New York University, Courant Institute
Mariya	Shcherbina	B. Verkin Institute for Low Temperature Physics
Guilherme	Silva	Universidade de São Paulo
Philippe	Sosoe	Cornell University
Herbert	Spohn	Technische Universität München
Nikhil	Srivastava	University of California, Berkeley
Li-Cheng	Tsai	Stanford University
Benedek	Valko	University of Wisconsin-Madison
Roger	Van Peski	Massachusetts Institute of Technology
Andrés	Vindas Meléndez	University of California, Berkeley
Balint	Virag	University of Toronto
Mirjana	Vuletic	University of Massachusetts
Ke	Wang	Hong Kong University of Science and Technology
Zhichao	Wang	University of California, San Diego
Haixiao	Wang	University of California, San Diego
Xuan	Wu	University of Chicago
Qiang	Wu	University of Illinois at Urbana-Champaign
Kevin	Yang	Stanford University
Cong	Zhou	Indiana University
Zhengye	Zhou	Texas A & M University
Yizhe	Zhu	University of California, San Diego
Weitao	Zhu	Columbia University
Xinyun	Zhu	University of Texas-Permian Basin

Identifiable Participant Information

Participants		100

Gender		100
Male	64.00%	64
Female	34.00%	34
Declined to state	2.00%	2

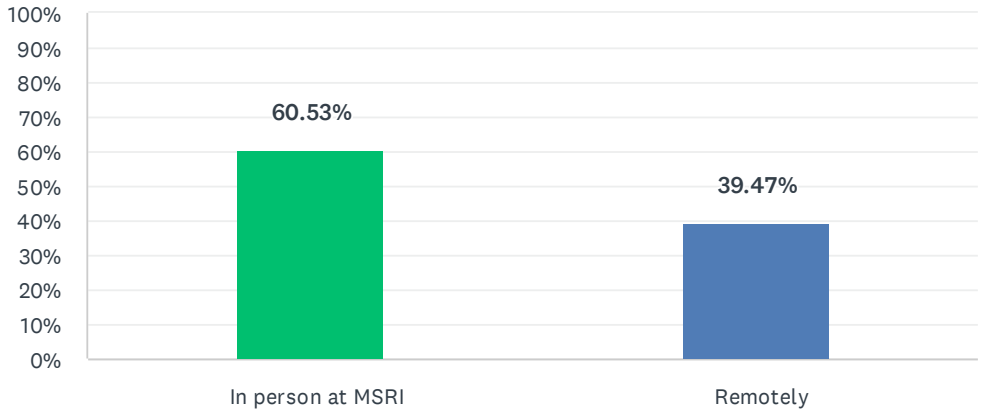
Ethnicity*		104
White	60.58%	63
Asian	25.96%	27
Hispanic	2.88%	3
Pacific Islander	0.00%	0
Black	1.92%	2
Native American	0.00%	0
Mixed	1.92%	2
Declined to state	6.73%	7

* ethnicity specifications are not exclusive

There were 86 unidentifiable participants.

Q1 I primarily participated in the workshop:

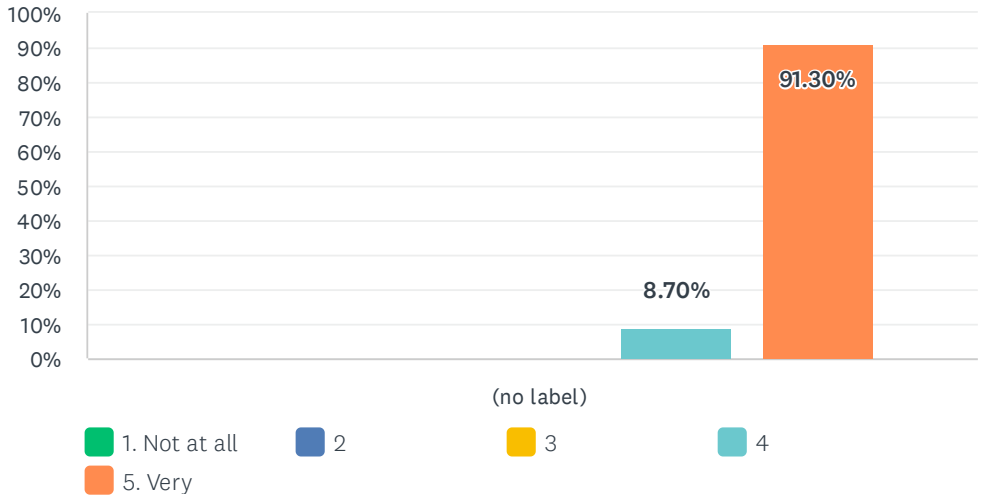
Answered: 38 Skipped: 0



ANSWER CHOICES	RESPONSES	
In person at MSRI	60.53%	23
Remotely	39.47%	15
TOTAL		38

Q2 The workshop was intellectually stimulating

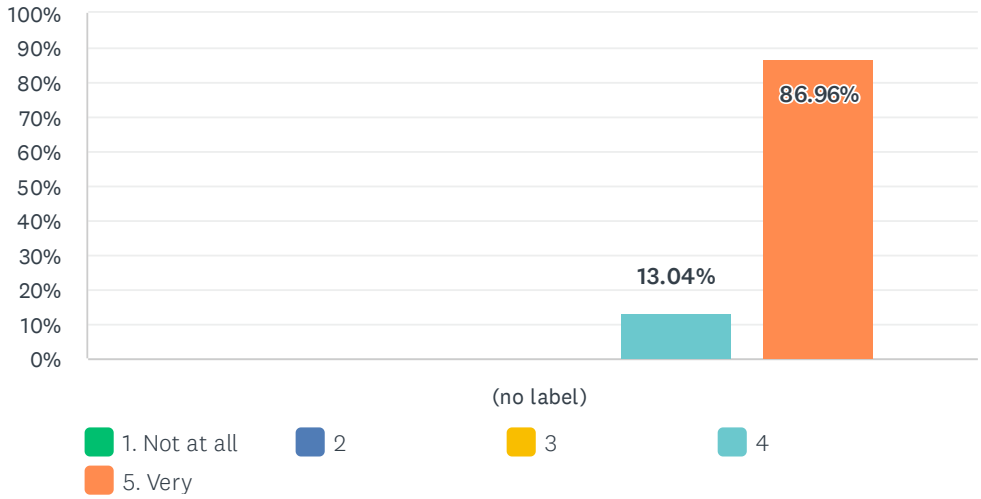
Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	8.70% 2	91.30% 21	23	4.91

Q3 The overall experience of the workshop was worthwhile

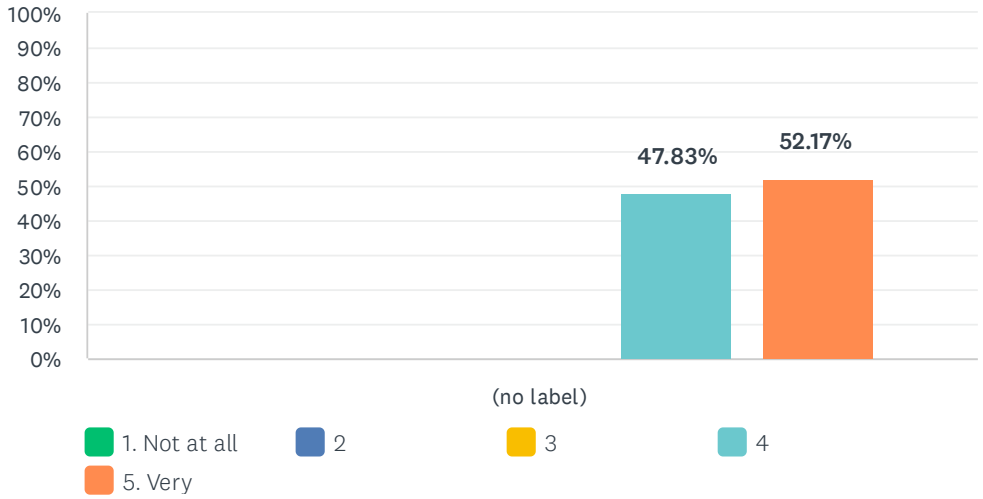
Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	13.04% 3	86.96% 20	23	4.87

Q4 The lectures were at at an appropriate level

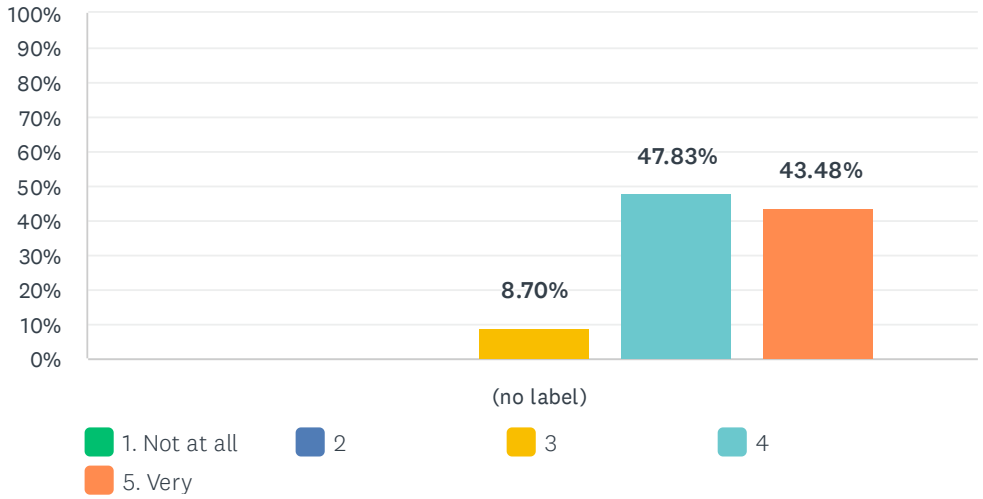
Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	47.83% 11	52.17% 12	23	4.52

Q5 I was well prepared to benefit from the lectures

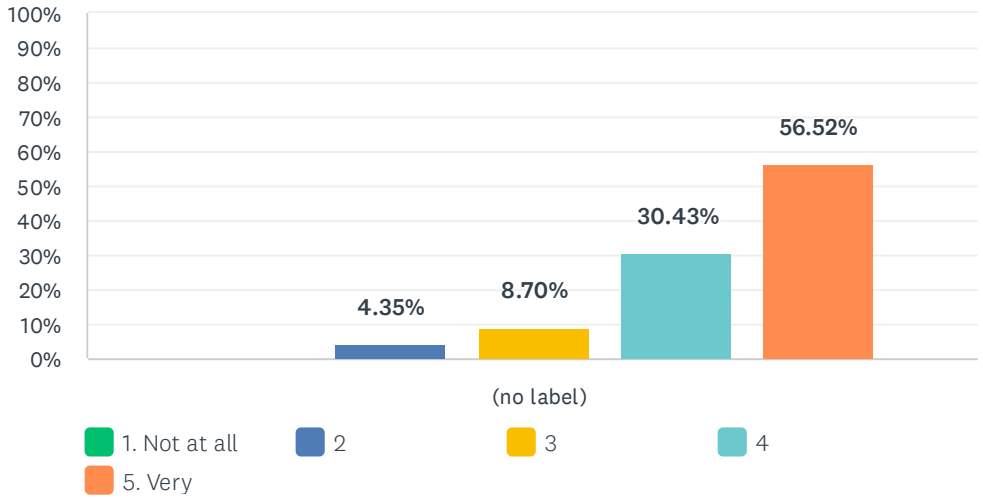
Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.70% 2	47.83% 11	43.48% 10	23	4.35

Q6 My interest in the subject matter was increased by the workshop

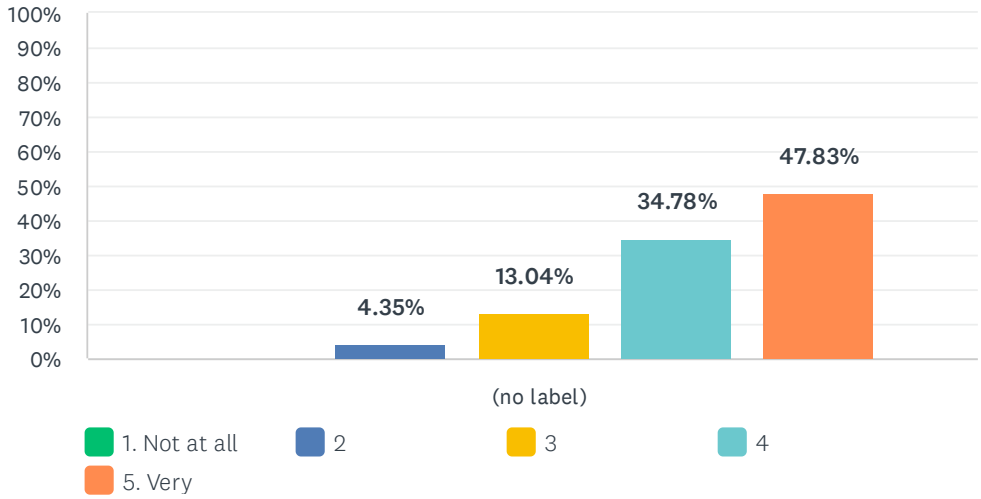
Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.35% 1	8.70% 2	30.43% 7	56.52% 13	23	4.39

Q7 The workshop helped me meet people with similar scientific interests

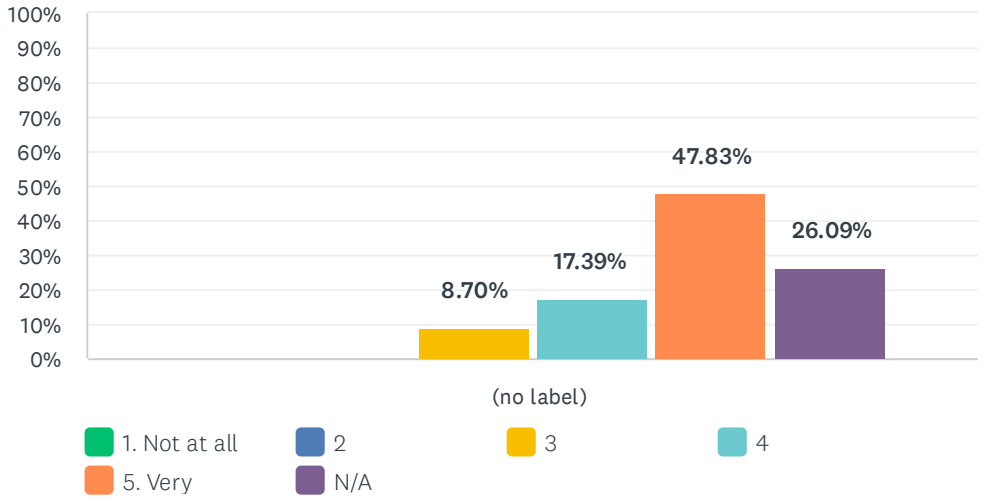
Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.35% 1	13.04% 3	34.78% 8	47.83% 11	23	4.26

Q8 Did you find the panel discussion worthwhile?

Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.70% 2	17.39% 4	47.83% 11	26.09% 6	23	4.53

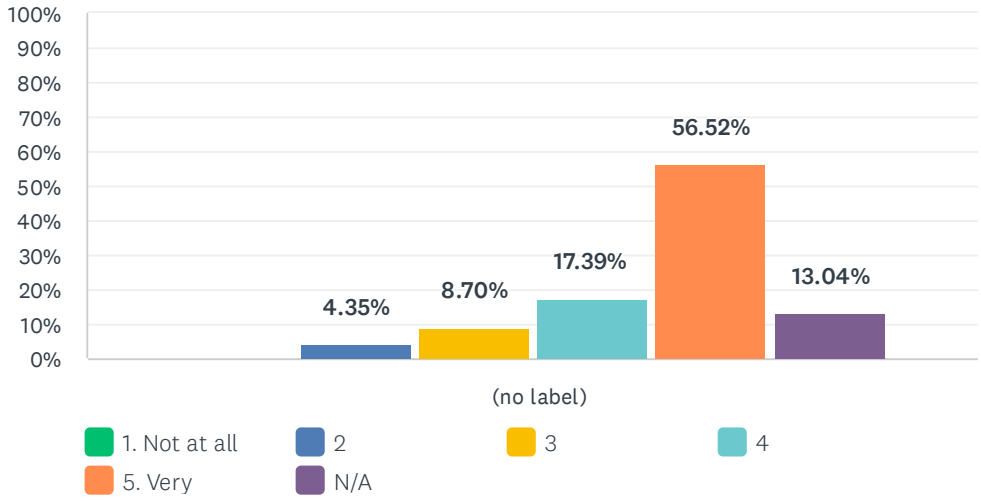
Q9 What other subjects should be discussed in future panel discussions?

Answered: 3 Skipped: 35

#	RESPONSES	DATE
1	Integrating teaching and research.	10/12/2021 12:33 PM
2	Pressure due to publications Minorities in math	9/24/2021 4:13 PM
3	How to write a diversity statement	9/24/2021 3:39 PM

Q10 Did you find the participant presentations worthwhile?

Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.35% 1	8.70% 2	17.39% 4	56.52% 13	13.04% 3	23	4.45

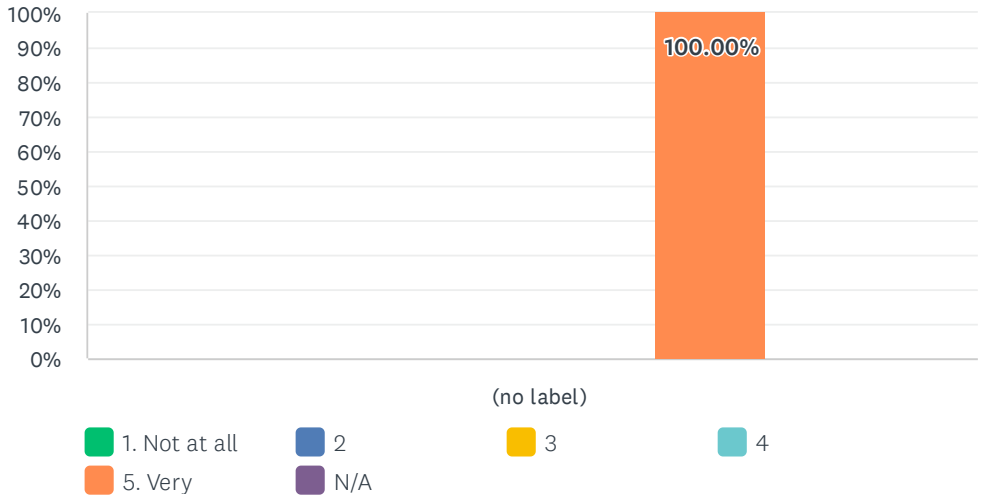
Q11 Additional comments

Answered: 3 Skipped: 35

#	RESPONSES	DATE
1	A page limit as in the 5 minute presentations could have been beneficial, e.g. to 5 slides	9/25/2021 4:01 PM
2	I really like the idea of the random rooms but I would suggest to make sure in advanced that people would actually participate and if that is not the case to advertise it. I think I was the only one to connect on Tuesday at 8:40 am	9/24/2021 4:13 PM
3	I think it would be better not to have them make the videos upfront (it seems few people watched them before) but give them more time (e.g 15 minute slots)	9/24/2021 3:36 PM

Q12 I found the MSRI staff helpful

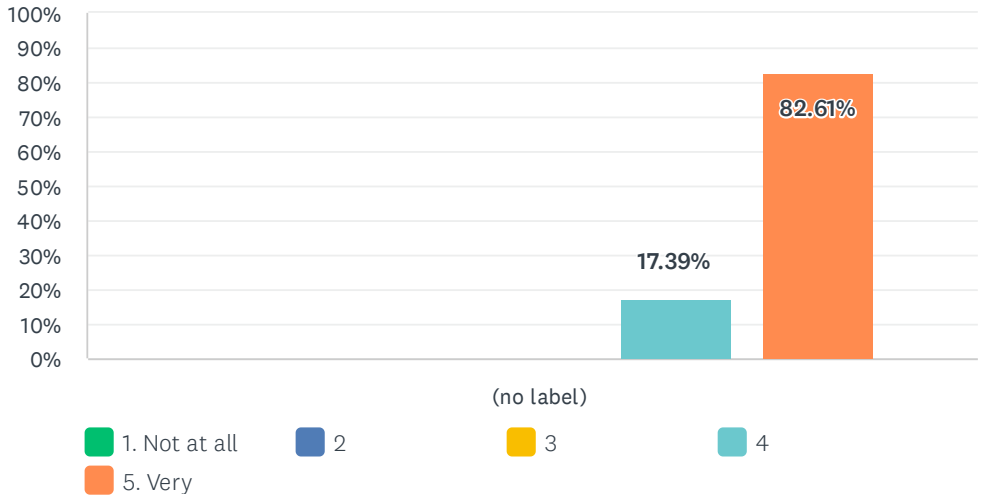
Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	0.00% 0	100.00% 23	0.00% 0	23	5.00

Q13 The MSRI facilities were conducive for such a workshop

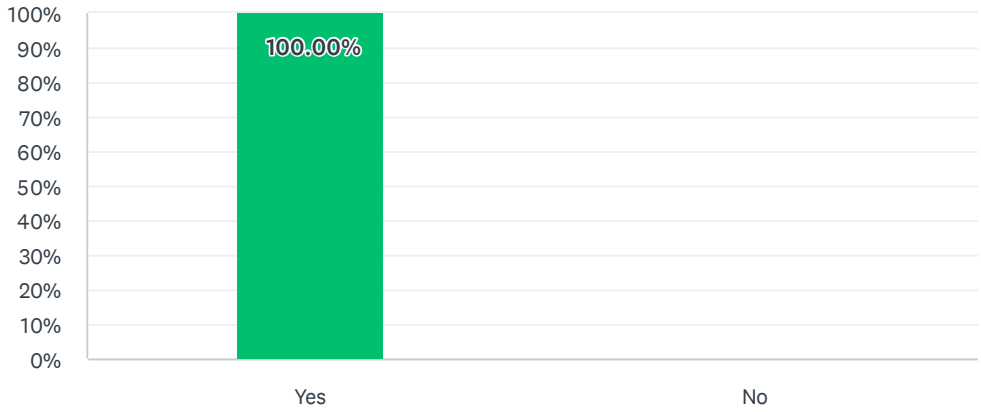
Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	17.39% 4	82.61% 19	23	4.83

Q14 Did you use MSRI's wireless network?

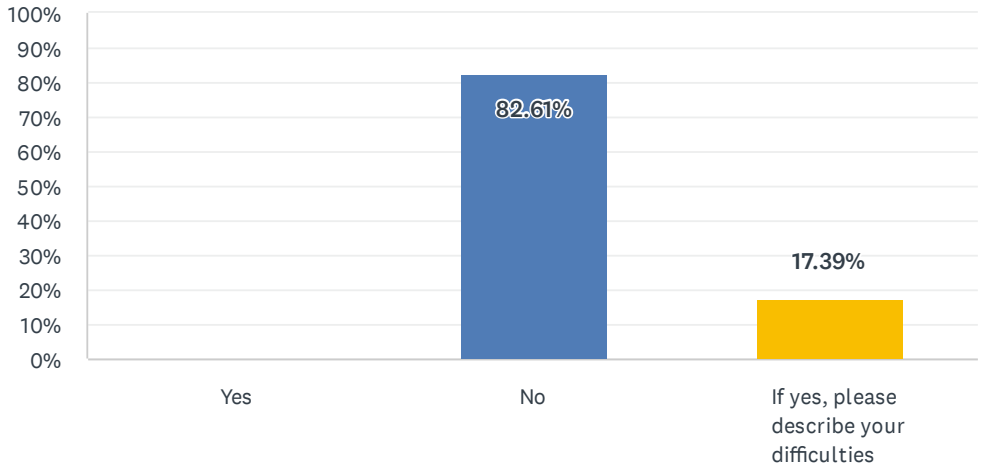
Answered: 23 Skipped: 15



ANSWER CHOICES	RESPONSES	
Yes	100.00%	23
No	0.00%	0
TOTAL		23

Q15 Did you experience any difficulties with the network?

Answered: 23 Skipped: 15

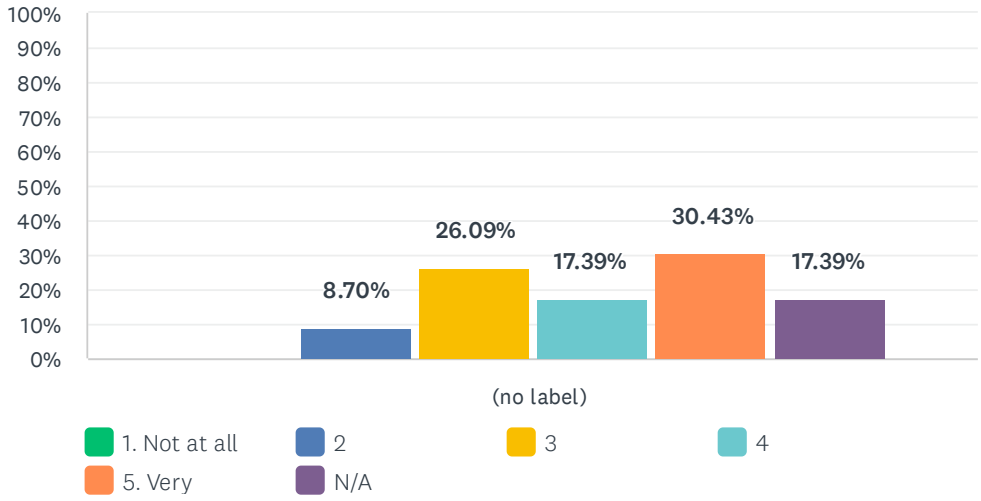


ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	82.61%	19
If yes, please describe your difficulties	17.39%	4
TOTAL		23

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	occasionally I would lose connection for a minute or two	10/12/2021 1:48 PM
2	in my office, the wifi signal was unstable occasionally.	10/12/2021 1:04 PM
3	the network would sometimes disconnect, the same problem occured with eduroam	9/25/2021 4:04 PM
4	The signal is weak sometimes, especially from some offices on third floor	9/24/2021 4:16 PM

Q16 The MSRI lunch arrangements were satisfactory

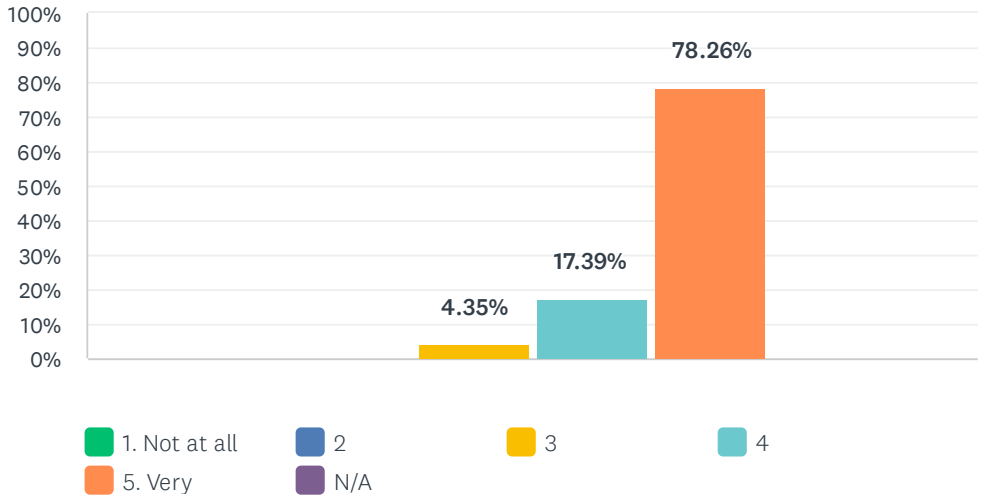
Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	8.70% 2	26.09% 6	17.39% 4	30.43% 7	17.39% 4	23	3.84

Q17 The MSRI tea arrangements were satisfactory

Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
	0.00% 0	0.00% 0	4.35% 1	17.39% 4	78.26% 18	0.00% 0	23	4.74

Q18 Additional comments about the MSRI staff, facilities and food

Answered: 6 Skipped: 32

#	RESPONSES	DATE
1	would be nice to have a tea or breakfast in the morning	10/12/2021 12:40 PM
2	The lunch was pretty bad and the tea was mediocre. It did not ruin the total experience, but the quality of the food was disappointing especially given how expensive it was.	9/25/2021 5:50 PM
3	I would have preferred to have tea a bit later than 3pm but understand the constraints due to working hours of staff	9/25/2021 4:04 PM
4	I wish we had more restaurants options	9/24/2021 4:16 PM
5	all the staff people are awesome! Thank you!	9/24/2021 4:03 PM
6	MSRI staff is doing a great job. I am particularly impressed how well the recording of the lectures is done so that one can follow the lectures easily on zoom	9/24/2021 3:38 PM

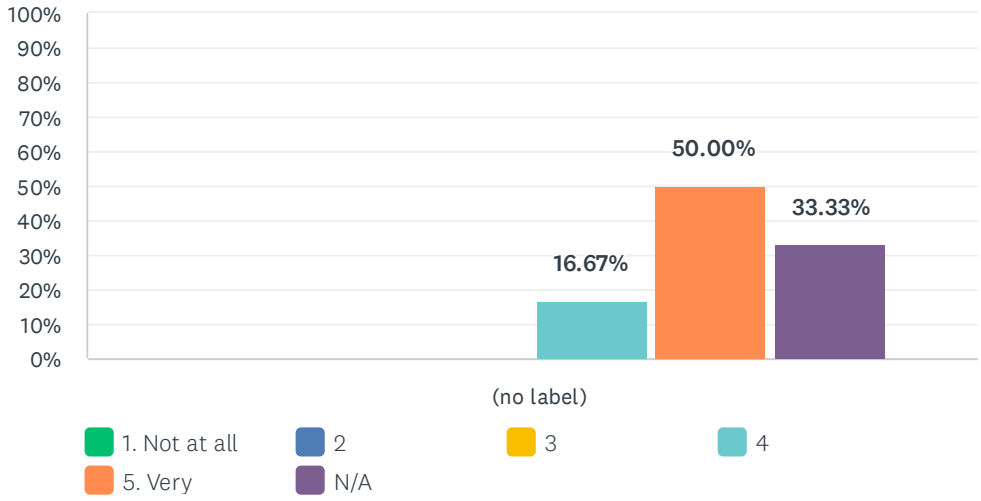
Q19 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 1 Skipped: 37

#	RESPONSES	DATE
1	A small improvement really, in the Simons auditorium only the middle blackboard has a board where to put chalk and eraser, I would find it beneficial if all 3 blackboards would have such a board.	9/25/2021 4:05 PM

Q20 I found the MSRI staff helpful

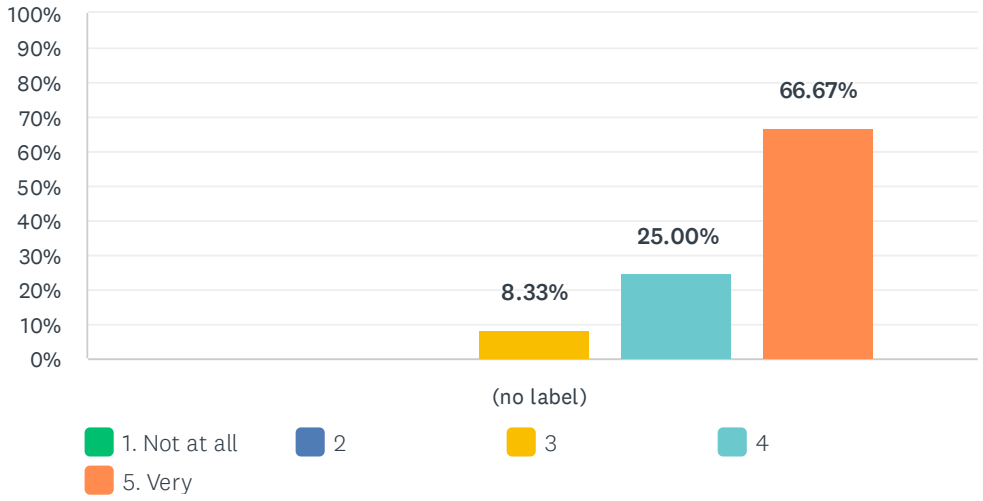
Answered: 12 Skipped: 26



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	16.67% 2	50.00% 6	33.33% 4	12	4.75

Q21 The workshop was intellectually stimulating

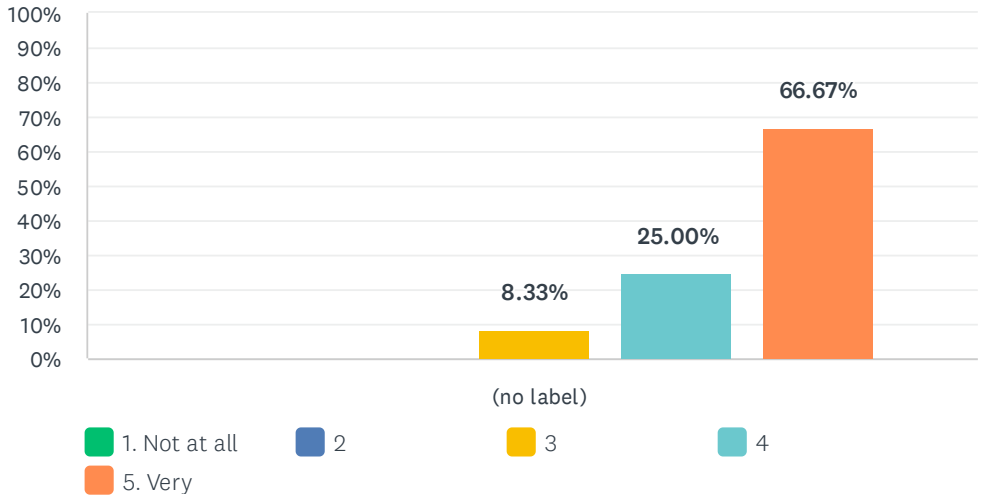
Answered: 12 Skipped: 26



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.33% 1	25.00% 3	66.67% 8	12	4.58

Q22 The overall experience of the workshop was worthwhile

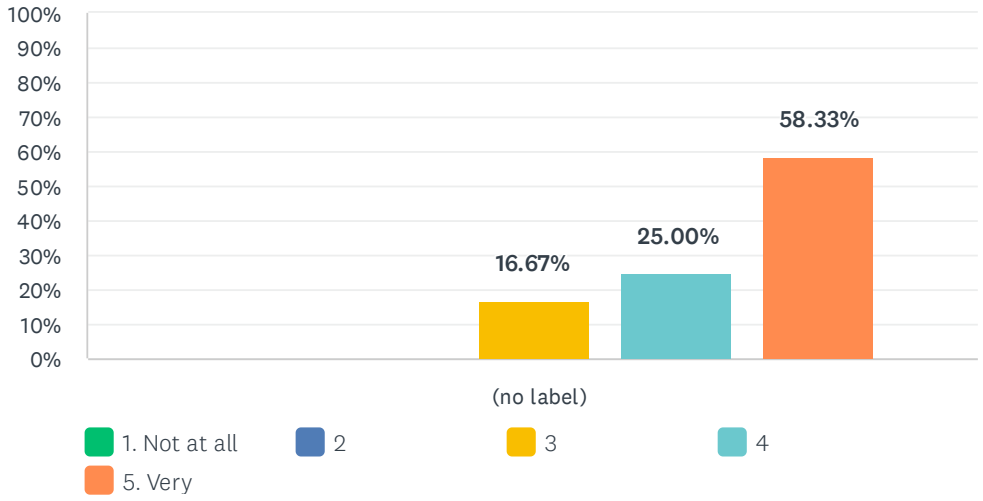
Answered: 12 Skipped: 26



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.33% 1	25.00% 3	66.67% 8	12	4.58

Q23 The lectures were at at an appropriate level

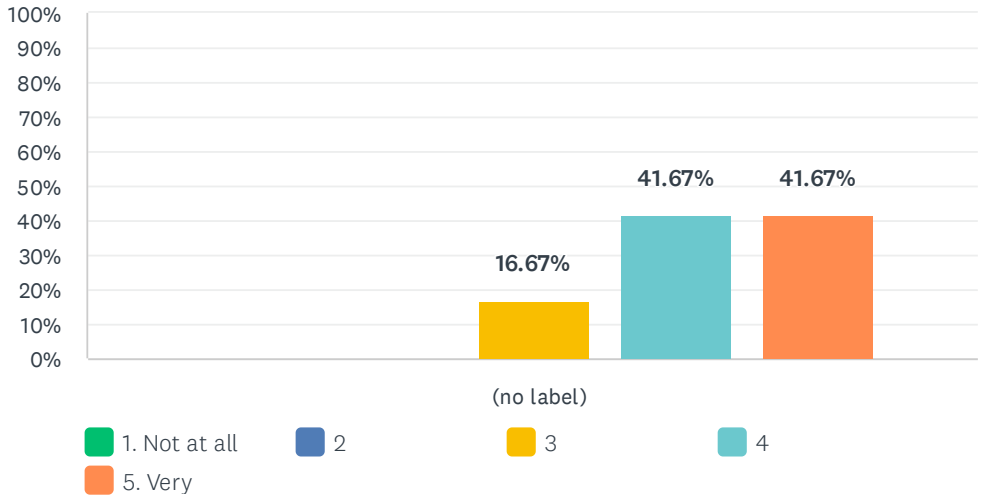
Answered: 12 Skipped: 26



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	16.67% 2	25.00% 3	58.33% 7	12	4.42

Q24 I was well prepared to benefit from the lectures

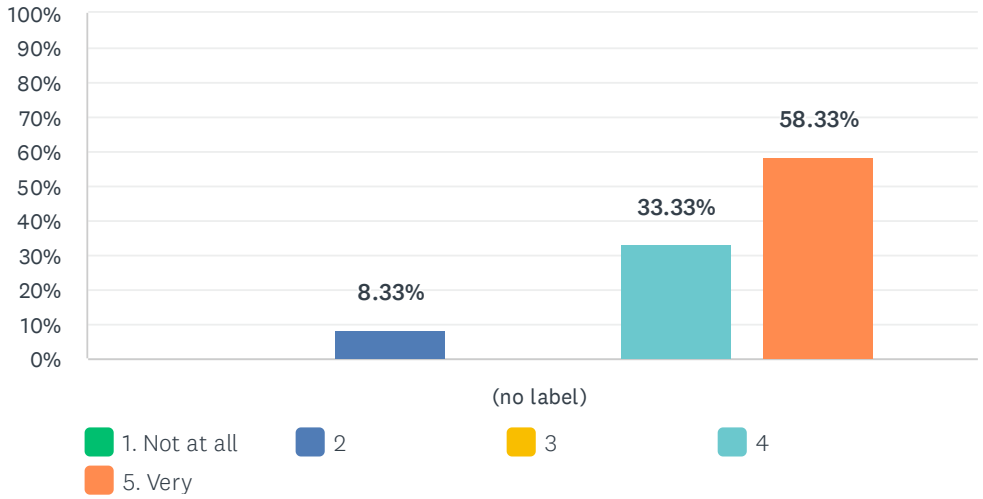
Answered: 12 Skipped: 26



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	16.67% 2	41.67% 5	41.67% 5	12	4.25

Q25 My interest in the subject matter was increased by the workshop

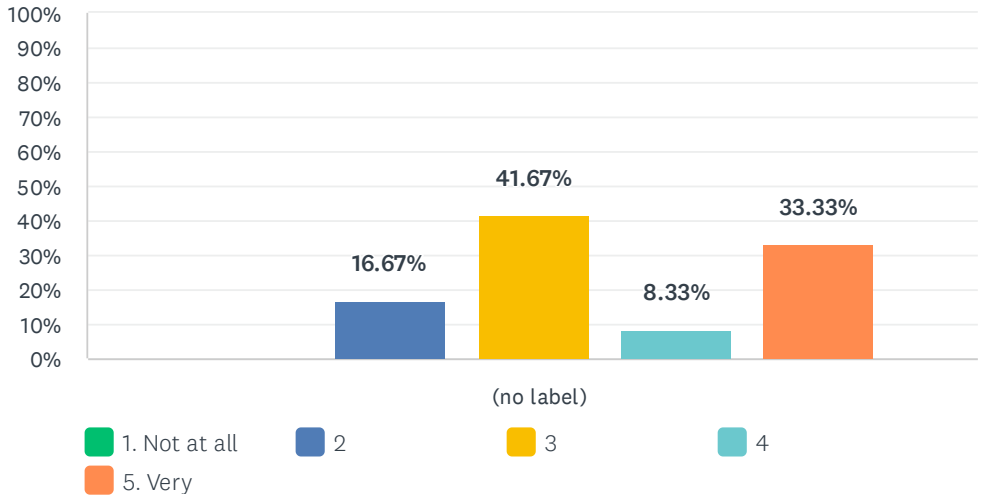
Answered: 12 Skipped: 26



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	8.33% 1	0.00% 0	33.33% 4	58.33% 7	12	4.42

Q26 The workshop helped me meet people with similar scientific interests

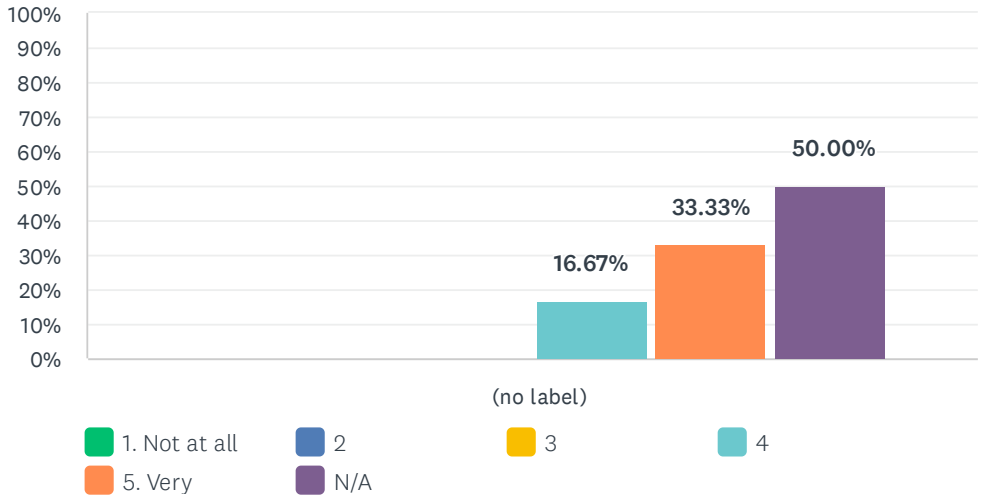
Answered: 12 Skipped: 26



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	16.67% 2	41.67% 5	8.33% 1	33.33% 4	12	3.58

Q27 Did you find the panel discussion worthwhile?

Answered: 12 Skipped: 26



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	16.67% 2	33.33% 4	50.00% 6	12	4.67

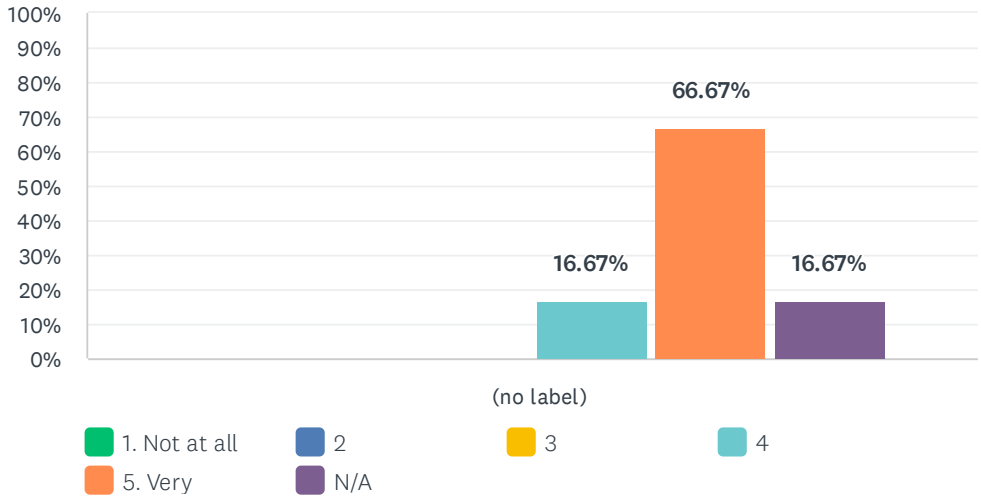
Q28 What other subjects should be discussed in future panel discussions?

Answered: 1 Skipped: 37

#	RESPONSES	DATE
1	Algebraic structures and number theory	9/24/2021 11:57 PM

Q29 Did you find the participant presentations worthwhile?

Answered: 12 Skipped: 26



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	16.67% 2	66.67% 8	16.67% 2	12	4.80

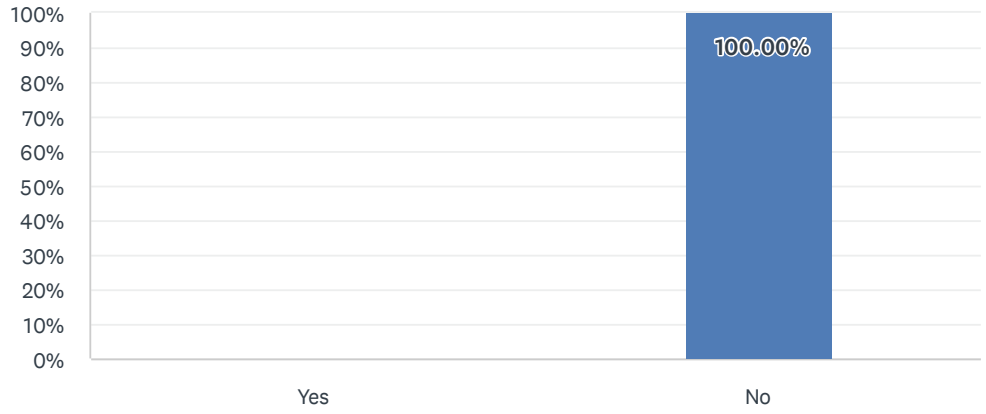
Q30 Additional comments

Answered: 1 Skipped: 37

#	RESPONSES	DATE
1	Based on the questions asked, it seemed that very few people watched the videos (which, as a presenter was frustrating). In future sessions with this format, I think it would be helpful to send out the titles of the talks (and possibly also abstracts) along with the video links. That would encourage more people to watch the videos, since it would be easy to pick and choose based on interest, rather than having to watch each video in order to find out the topic.	9/24/2021 5:41 PM

Q31 Did you experience any technical difficulties accessing the workshop online?

Answered: 11 Skipped: 27



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	100.00%	11
TOTAL		11

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
	There are no responses.	

Q32 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 11 Skipped: 27

#	RESPONSES	DATE
1	no	10/29/2021 10:38 AM
2	I had some othert commitments during the same time, but I could watch the presentations afterwards, which is helpful.	9/26/2021 4:20 PM
3	In my case, there are many time differences but I can view the recorded video and materials.	9/25/2021 9:10 PM
4	For me, the only barrier for participation is due to time zone differences (15 hours ahead). The good thing is that I could watch the recorded talks.	9/25/2021 6:37 AM
5	Online is hard when participants use slides.	9/25/2021 1:39 AM
6	Yes, it would be good if workshops held at morning only.	9/24/2021 11:58 PM
7	No	9/24/2021 6:25 PM
8	When people in the auditorium asked me questions during my zoom presentation, I often couldn't see them and had no idea who was asking the question (whereas at an in-person conference, they would be wearing a name tag). This makes it difficult to network or follow up with people who had interesting questions about my research. Perhaps it would be helpful to ask people to identify themselves when asking questions of a zoom presenter.	9/24/2021 5:47 PM
9	no	9/24/2021 4:26 PM
10	It actually made it easier since it was the first week of my classes.	9/24/2021 4:12 PM
11	Participating online is harder because you don't get to meet anyone, and since it was online I had to still attend to all my other duties. If it had been in person it might have been easier to reduce the workload for that week a bit.	9/24/2021 3:45 PM

Q33 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 2 Skipped: 36

#	RESPONSES	DATE
1	No	9/24/2021 6:25 PM
2	I thought it was good.	9/24/2021 4:12 PM

Q34 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 0 Skipped: 38

#	RESPONSES	DATE
	There are no responses.	

Workshop: Integrable Structures in Random Matrix Theory and Beyond

October 18, 2021 – October 22, 2021

Hybrid Workshop

Organizers:

Jinho Baik (University of Michigan)

Alexei Borodin (Massachusetts Institute of Technology)

Tamara Grava (University of Bristol; International School for Advanced Studies (SISSA/ISAS))

Alexander Its (Indiana University--Purdue University)

Sandrine Peche (Université de Paris VII (Denis Diderot))

REPORT ON THE MSRI WORKSHOP
"Integrable Structures in Random Matrix Theory and Beyond (Hybrid Workshop)"
October 18 – October 22, 2021

Organizers

- Jinho Baik (University of Michigan)
- Alexei Borodin (Massachusetts Institute of Technology)
- Tamara Grava (University of Bristol; International School for Advanced Studies (SISSA/ISAS))
- Alexander Its (Indiana University--Purdue University)
- Sandrine Peche (Université de Paris VII (Denis Diderot))

Scientific Description

This workshop focused on the integrable aspect of random matrix theory and other related probability models such as random tilings, directed polymers, and interacting particle systems. The emphasis was on communicating diverse algebraic structures in these areas which allowed the asymptotic analysis possible. Some of such structures are determinantal point processes, Toeplitz and Hankel determinants, Bethe ansatz, Yang-Baxter equation, Karlin-McGregor formula, Macdonald process, and stochastic six vertex model.

Highlights of the Workshop

The workshop featured nineteen talks on various topics related to random matrix theory, integrable probability, and other related fields. The talks illustrated recent important progress in integrable structures and methods as well as other asymptotic results. Specific areas covered are:

Random matrix theory: Akemann, Bothner, Claeys, Fyodorov, Lambert

Integrable systems and Riemann-Hilbert method: Bertola, Guionnet, McLaughlin

KPZ university and integrable probability: Dimitrov, Ferrari, Ghosal, Liu, Occelli, O'Connell, Remenik,

Combinatorics and tiling: Corteel, Kuijlaars, Russkikh,

Szego strong limit theorem: Johansson

The speakers were diverse in terms of gender (4 female speakers – Corteel, Guionnet, Occelli, Russkikh). The list of speakers included several young rising researchers (5 postdocs - Lambert, Dimitrov, Ghosal, Occelli, Russkikh) and two physicists (Akemann, Fyodorov).
The talks are given in a hybrid fashion. Some speakers gave in-person talks, while others gave online talks. All talks were broadcast online for those who could not participate in person due to the Covid pandemic. Typically, 30-60 people, in addition to those in the auditorium, attended talks online. Thanks to the fine work by the MSRI staff, the hybrid format worked seamlessly, and remote attendants could ask questions and participate in lively discussions.

Organizers		
First name	**Last Name**	**Institution**
Jinho	Baik	University of Michigan
Alexei	Borodin	Massachusetts Institute of Technology
Tamara	Grava	University of Bristol
Alexander	Its	Indiana University--Purdue University
Sandrine	Peche	Université de Paris VII (Denis Diderot)
Speaker		
First Name	**Last Name**	**Institution**
Gernot	Akemann	Universität Bielefeld
Marco	Bertola	Concordia University and SISSA
Thomas	Bothner	University of Bristol
Tom	Claeys	Université Catholique de Louvain
Sylvie	Corteel	University of California, Berkeley
Evgeni	Dimitrov	Columbia University
Patrik	Ferrari	Rheinische Friedrich-Wilhelms-Universität Bonn
Yan	Fyodorov	King's College London
Promit	Ghosal	Massachusetts Institute of Technology
Alice	Guionnet	École Normale Supérieure de Lyon
Kurt	Johansson	Royal Institute of Technology (KTH)
Arno	Kuijlaars	Katholieke Universiteit Leuven
Gaultier	Lambert	Universität Zürich
Zhipeng	Liu	University of Kansas
Ken	McLaughlin	Colorado State University
Neil	O'Connell	University College Dublin
Alessandra	Occelli	Instituto Superior Técnico
Daniel	Remenik	Universidad de Chile
Marianna	Russkikh	Massachusetts Institute of Technology

Mathematical Sciences Research Institute

Integrable Structures in Random Matrix Theory and Beyond

October 18 to October 22, 2021

Monday, October 18, 2021		
08:30 AM - 09:00 AM		Welcome Tea
09:00 AM - 09:10 AM		Introduction
09:10 AM - 10:00 AM	Kurt Johansson	Strong Szego Theorem on a Jordan Curve
10:20 AM - 11:10 AM	Alice Guionnet	Large Deviations for Generalized Gibbs Ensembles of the Classical Toda Chain
11:30 AM - 12:20 PM	Daniel Remenik	Exact Solution of TASEP and Generalizations
12:20 PM - 01:30 PM		Lunch
01:30 PM - 02:20 PM	Evgeni Dimitrov	Gibbsian Line Ensembles and Beta-Corners Processes
03:00 PM - 03:30 PM		Afternoon Tea

Tuesday, October 19, 2021		
09:10 AM - 10:00 AM	Yan Fyodorov	On Finite-Rank Non-Hermitian Deformations of Random Matrix Ensembles
10:20 AM - 11:10 AM	Neil O'Connell	Interacting Diffusions on Positive Definite Matrices
11:30 AM - 12:20 PM	Sylvie Corteel	Lecture Hall Tableaux, Non Intersecting Paths and Tilings
12:20 PM - 01:30 PM		Lunch
01:30 PM - 02:20 PM	Zhipeng Liu	Random Melting Skew Young Diagram
03:00 PM - 03:30 PM		Afternoon Tea

Wednesday, October 20, 2021		
09:10 AM - 10:00 AM	Arno Kuijlaars	The Two-Periodic Aztec Diamond and Matrix Valued Orthogonality
10:20 AM - 11:10 AM	Patrik Ferrari	Local Universality of the Time-Time Covariance and of the Geodesic Tree for Last Passage Percolation
11:30 AM - 12:20 PM	Marianna Russkikh	Lozenge Tilings and the Gaussian Free Field on a Cylinder
12:20 PM - 01:30 PM		Lunch
03:00 PM - 03:30 PM		Afternoon Tea

Thursday, October 21, 2021		
09:10 AM - 10:00 AM	Thomas Bothner	Hankel Composition Structures in Random Matrix Theory and Beyond
10:20 AM - 11:10 AM	Gernot Akemann	Properties of the chGUE at the Hard Edge: Spacing Distributions and Universality with External Field
11:30 AM - 12:20 PM	Alessandra Occelli	Stationary Half-Space Last Passage Percolation
12:20 PM - 01:30 PM		Lunch
01:30 PM - 02:20 PM	Promit Ghosal	Fractal Geometry of the KPZ Equation
03:00 PM - 03:30 PM		Afternoon Tea

Friday, October 22, 2021		
09:10 AM - 10:00 AM	Marco Bertola	The Riemann Hilbert Problem in Higher Genus and Some Applications
10:20 AM - 11:10 AM	Tom Claeys	Marked and Conditional Determinantal Point Processes
11:30 AM - 12:20 PM	Ken McLaughlin	Asymptotic Analysis of the Interaction Between a Soliton and a Regular Gas of Solitons
12:20 PM - 01:30 PM		Lunch
01:30 PM - 02:20 PM	Gaultier Lambert	The Edge Scaling Limit of the Characteristic Polynomial of the Gaussian β-Ensembles
03:00 PM - 03:30 PM		Afternoon Tea

Participants

First Name	Last Name	Institution
Amol	Aggarwal	Columbia University
Gernot	Akemann	Universität Bielefeld
Johannes	Alt	Université de Genève
Luisa	Andreis	Università di Firenze
Jonas	Arista	Universität Bielefeld
Jinho	Baik	University of Michigan
Emma	Bailey	City University of New York (CUNY)
Guillaume	Barraquand	Centre National de la Recherche Scientifique (CNRS)
Riddhipratim	Basu	International Centre for Theoretical Sciences
Sergey	Berezin	The Hebrew University of Jerusalem
Tomas	Berggren	University of Michigan
Marco	Bertola	Concordia University and SISSA
Manan	Bhatia	Massachusetts Institute of Technology
Sandipan	Bahattacherjee	Birla Institute of Technology, Mesra, Ranchi, India
Elia	Bisi	Technische Universität Wien
Pavel	Bleher	Indiana University--Purdue University
Natasha	Blitvic	University of Lancaster
Alexei	Borodin	Massachusetts Institute of Technology
Thomas	Bothner	University of Bristol
Paul	Bourgade	New York University, Courant Institute
Alexey	Bufetov	Universität Leipzig
Sung-Soo	Byun	Korea Institute for Advanced Study (KIAS)
Sandra	Cerrai	University of Maryland
Christophe	Charlier	University of Copenhagen
Yu-Ting	Chen	University of Victoria
Yang	Chen	University of Macau
Kailun	Chen	Institute of Applied Mathematics, Academy of Mathematics and Systems Science, Chinese Academy of Sciences
Tom	Claeys	Université Catholique de Louvain
Elizabeth	Collins-Woodfin	University of Michigan
Sylvie	Corteel	University of California, Berkeley
Ivan	Corwin	Columbia University
Joakim	Cronvall	Lund University
Cesar	Cuenca	Harvard University
Dan	Dai	City University of Hong Kong
Sayan	Das	Columbia University
Alfredo	Deaño	Universidad Carlos III de Madrid
Harini	Desiraju	University of Birmingham
Philippe	Di Francesco	University of Illinois at Urbana-Champaign
Korina	Digalaki	Massachusetts Institute of Technology
Evgeni	Dimitrov	Columbia University
Devon	Ding	Chinese University of Hong Kong
Arcelino	do Nascimento	Institute of Mathematics and Statistics (IME)
Hindy	Drillick	Columbia University
Torsten	Ehrhardt	University of California, Santa Cruz
Saleh	Elmohamed	University of California, Berkeley
Nicholas	Ercolani	University of Arizona
Kobra	Esmaeili	Ardakan University
Steven	Evans	University of California, Berkeley
Damir	Ferizović	Katholieke Universiteit Leuven
Patrik	Ferrari	Rheinische Friedrich-Wilhelms-Universität Bonn
Will	FitzGerald	University of Sussex
Yan	Fyodorov	King's College London
Aniruddhan	Ganesaraman	Chennai Mathematical Institute
Roozbeh	Gharakhloo	Colorado State University
Promit	Ghosal	Massachusetts Institute of Technology
Manuela	Girotti	St. Mary's University
Cleverson	Goulart	University of São Paulo
Tamara	Grava	University of Bristol
Sean	Groathouse	University of Utah

Participants

First Name	Last Name	Institution
Suman	Guha	Presidency University
Alice	Guionnet	École Normale Supérieure de Lyon
Alan	Hammond	University of California, Berkeley
Milind	Hegde	University of California, Berkeley
Ella	Hiesmayr	University of California, Berkeley
Zoe	Himwich	Columbia University
Jonathan	Husson	École Normale Supérieure de Lyon
Alexander	Its	Indiana University--Purdue University
Kurt	Johansson	Royal Institute of Technology (KTH)
Sharada	Kalanidhi	Stanford University School of Medicine
Rinat	Kedem	University of Illinois at Urbana-Champaign
Anna	Kis	University of Waterloo
Antti	Knowles	Université de Genève
Karol	Kozlowski	École Normale Supérieure de Lyon
Alexandre	Krajenbrink	International School for Advanced Studies (SISSA/ISAS)
Igor	Krasovsky	Imperial College, London
Thomas	Kriecherbauer	Universität Bayreuth
Arno	Kuijlaars	Katholieke Universiteit Leuven
Gaultier	Lambert	Universität Zürich
Han	Le	University of Michigan
Carlos	León	National University of Colombia
Jaehun	Lee	Korea Advanced Institute of Science and Technology (KAIST)
Matthew	Lerner-Brecher	Massachusetts Institute of Technology
Luen-Chau	Li	Pennsylvania State University
Zhongyang	Li	University of Connecticut
Xiaobin	Li	Southwest (Xinan) Jiaotong University
Yuchen	Liao	University of Warwick
Karl	Liechty	DePaul University
Yier	Lin	Columbia University
Zhipeng	Liu	University of Kansas
Patrick	Lopatto	Brown University
Tuto	LopezGonzalez	University of California, San Francisco
Milivoje	Lukic	Rice University
Chenyang	Ma	University of Kansas
Benjamin	McKenna	New York University, Courant Institute
Ken	McLaughlin	Colorado State University
Hector	Montiel	National Autonomous University of Mexico (UNAM)
Matteo	Mucciconi	Tokyo Institute Of Technology
Patrik	Nabelek	Oregon State University
Evangelos	Nastas	University at Albany (SUNY)
Hoi	Nguyen	Ohio State University
Matthew	Nicoletti	Massachusetts Institute of Technology
Christian	Noack	Cornell University
Alessandra	Occelli	Instituto Superior Técnico
Neil	O'Connell	University College Dublin
Jeffrey	Oregero	University at Buffalo (SUNY)
Hirofumi	Osada	Kyushu University
Mehdi	Ouaki	University of California, Berkeley
Aaradhya	Pandey	Indian Institute of Science
Greta	Panova	University of Southern California
Iván	Parra	Katholieke Universiteit Leuven
Sandrine	Peche	Université de Paris VII (Denis Diderot)
Leonid	Petrov	University of Virginia
Vanessa	Piccolo	École Normale Supérieure de Lyon
Mateusz	Piorkowski	MSRI - Mathematical Sciences Research Institute
Istvan	Prause	University of Eastern Finland
Andrei	Prokhorov	University of Michigan
Jeremy	Quastel	University of Toronto
Dhanusshya	Raghu	Ethiraj College for Women

Participants

First Name	Last Name	Institution
Jonathan	Ramalheira-Tsu	University of Arizona
Firas	Rassoul-Agha	University of Utah
Daniel	Remenik	Universidad de Chile
Brian	Rider	Temple University
Antonio	Rieser	Cimat
Pieter	Roffelsen	University of Sydney
Marianna	Russkikh	Massachusetts Institute of Technology
Mark	Rychnovsky	University of California, Santa Barbara
Gregory	Schehr	Sorbonne Université
Lakhdar	Sek	University of Biskra
Sylvia	Serfaty	New York University, Courant Institute
Mariya	Shcherbina	B. Verkin Institute for Low Temperature Physics
Meredith	Shea	University of California, Berkeley
Guilherme	Silva	Universidade de São Paulo
Sudhir	Singh	National Institute of Technology
Susanna	Spektor	Sheridan College
Reena	Tandon	Lovely Professional University
Mikhail	Tikhonov	University of Virginia
Mayank	Totloor	New York University
Craig	Tracy	University of California, Davis
Tejaswi	Tripathi	University of Michigan
Benedek	Valko	University of Wisconsin-Madison
Roger	Van Peski	Massachusetts Institute of Technology
Andrés	Vindas Meléndez	University of California, Berkeley
Jani	Virtanen	University of Reading
Dan-Virgil	Voiculescu	University of California, Berkeley
Mirjana	Vuletic	University of Massachusetts
Harriet	Walsh	Laboratoire de Physique, ENS de Lyon
Zhichao	Wang	Texas A & M University
Dasheng	Wang	Northern Illinois University
Lu	Wei	Texas Tech University
Bin	Xie	Shinshu University
Yamit	Yalanda	Universidad de Chile
Kevin	Yang	Stanford University
Meng	Yang	University of Copenhagen
Wang	Yanhui	Henan University
Maxim	Yattselev	Indiana University--Purdue University
Wang	Yilin	Massachusetts Institute of Technology
Takato	Yoshimura	All Souls College, University of Oxford
Ray	Zhang	University of Kansas
Chenyang	Zhong	Stanford University
Cong	Zhou	Indiana University
Yizhe	Zhu	University of California, San Diego
Weitao	Zhu	Columbia University
Xinyun	Zhu	University of Texas-Permian Basin
Andrzej	Zuk	Université de Paris

Identifiable Participants' Information

Participants		164

Gender		164
Male	75.61%	124
Female	21.95%	36
Other	0.00%	0
Declined to state	2.44%	4

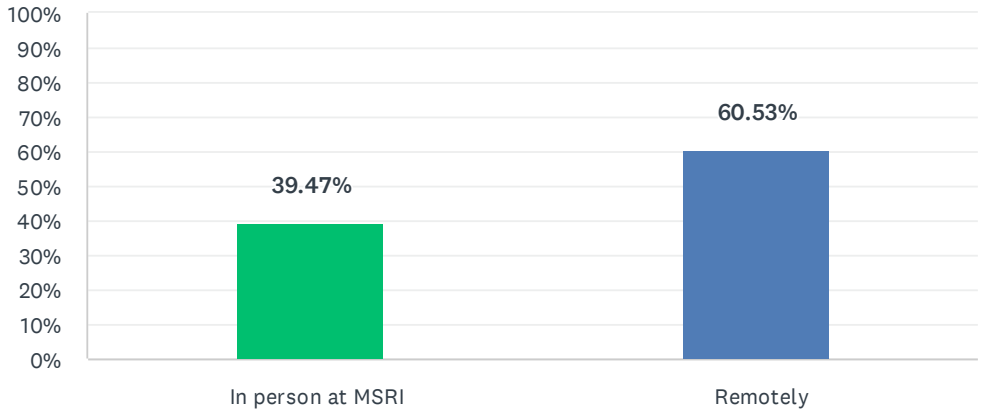
Ethnicity*		174
White	54.02%	94
Asian	29.31%	51
Hispanic	5.17%	9
Pacific Islander	0.00%	0
Black	0.57%	1
Native American	0.57%	1
Mixed	2.87%	5
Declined to state	7.47%	13

* ethnicity specifications are not exclusive

There were 28 unidentifiable participants.

Q1 I primarily participated in the workshop:

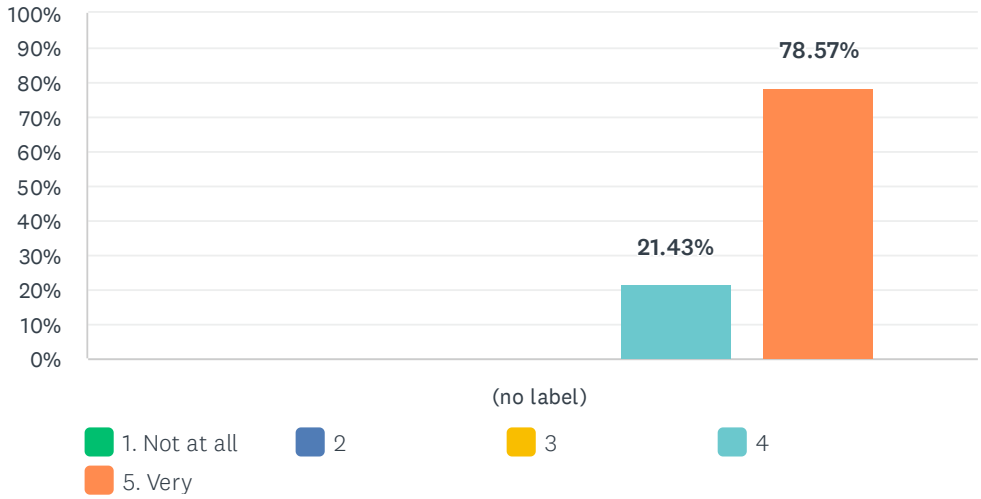
Answered: 38 Skipped: 0



ANSWER CHOICES	RESPONSES	
In person at MSRI	39.47%	15
Remotely	60.53%	23
TOTAL		38

Q2 The workshop was intellectually stimulating

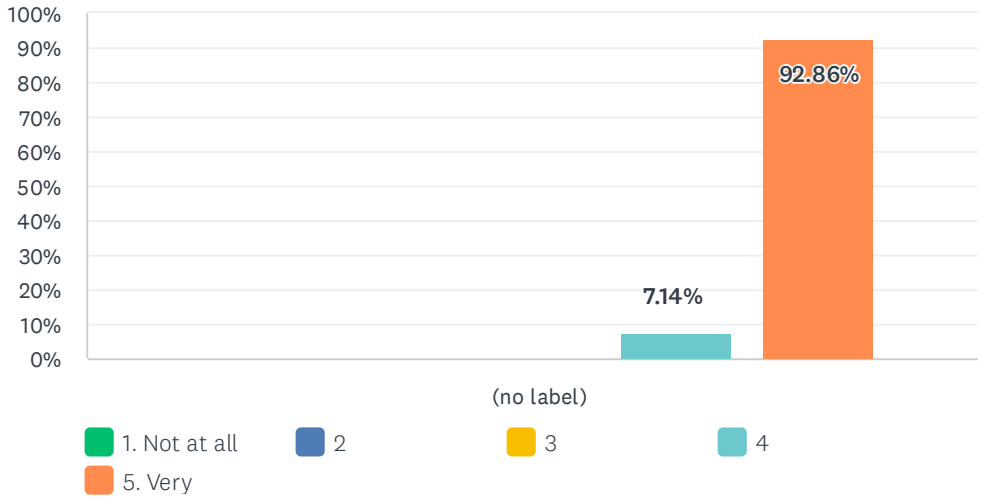
Answered: 14 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	21.43% 3	78.57% 11	14	4.79

Q3 The overall experience of the workshop was worthwhile

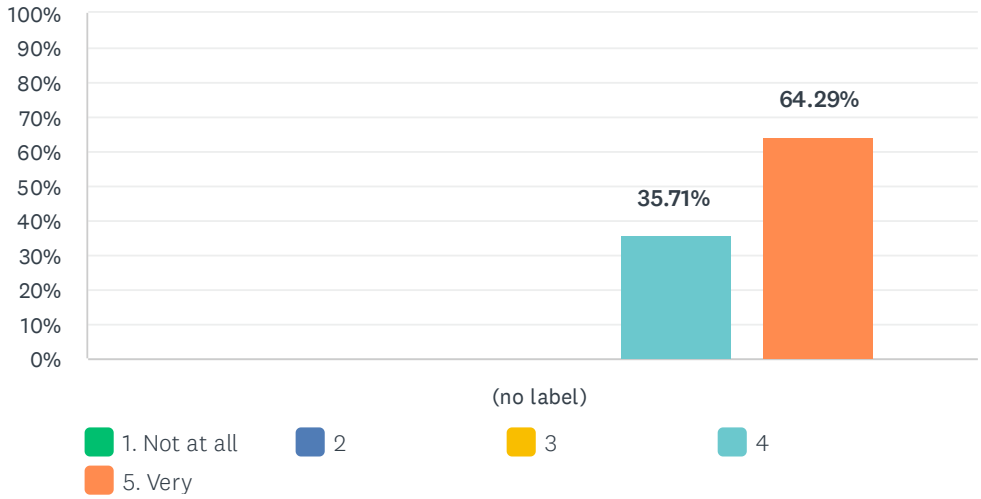
Answered: 14 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	7.14% 1	92.86% 13	14	4.93

Q4 The lectures were at at an appropriate level

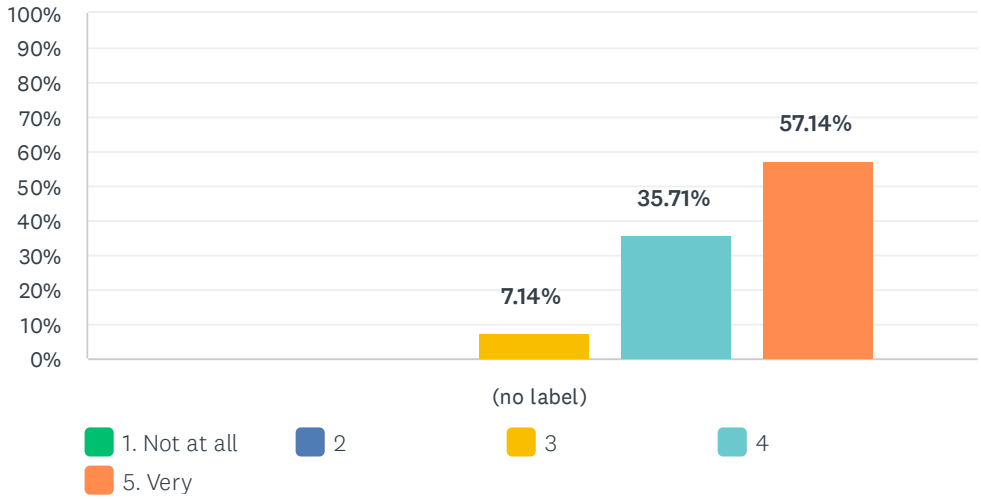
Answered: 14 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	35.71% 5	64.29% 9	14	4.64

Q5 I was well prepared to benefit from the lectures

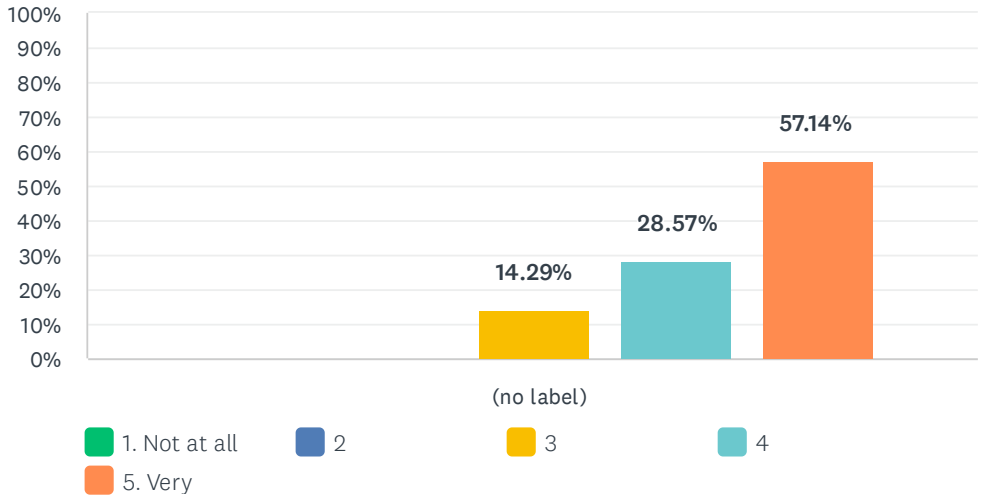
Answered: 14 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	7.14% 1	35.71% 5	57.14% 8	14	4.50

Q6 My interest in the subject matter was increased by the workshop

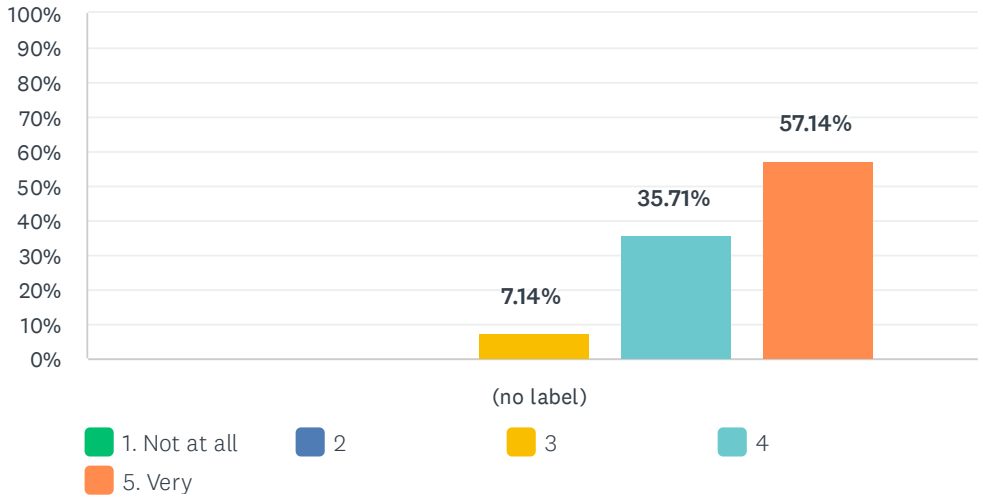
Answered: 14 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	14.29% 2	28.57% 4	57.14% 8	14	4.43

Q7 The workshop helped me meet people with similar scientific interests

Answered: 14 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	7.14% 1	35.71% 5	57.14% 8	14	4.50

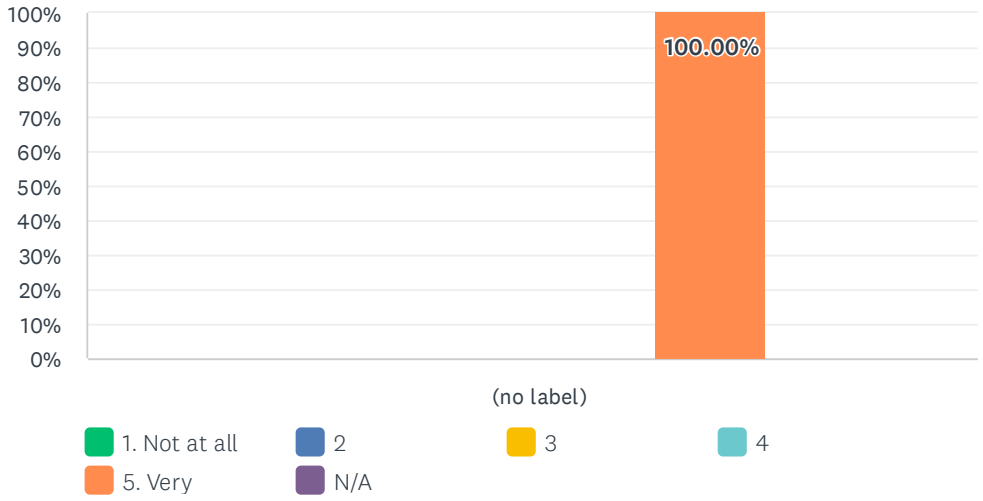
Q8 Additional comments

Answered: 0 Skipped: 38

#	RESPONSES	DATE
	There are no responses.	

Q9 I found the MSRI staff helpful

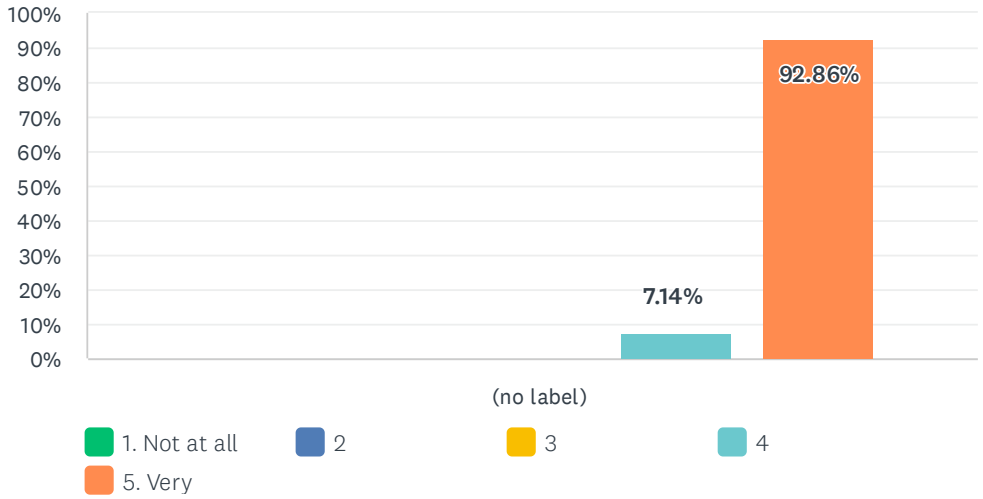
Answered: 14 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	0.00% 0	100.00% 14	0.00% 0	14	5.00

Q10 The MSRI facilities were conducive for such a workshop

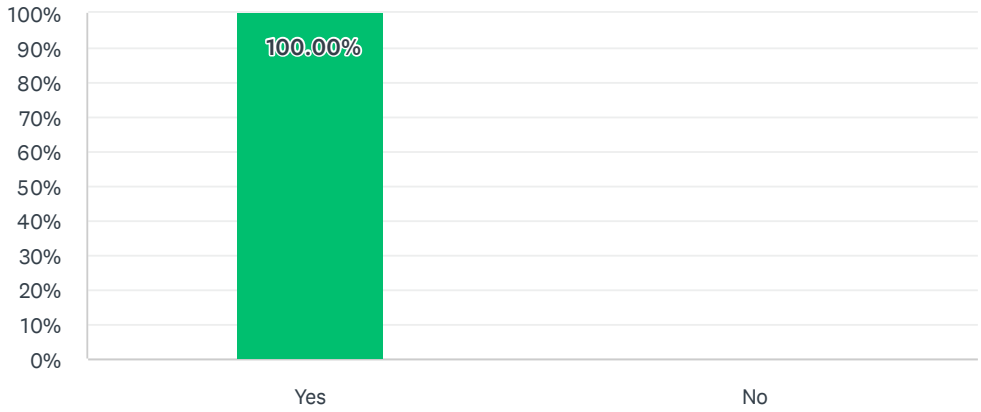
Answered: 14 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	7.14% 1	92.86% 13	14	4.93

Q11 Did you use MSRI's wireless network?

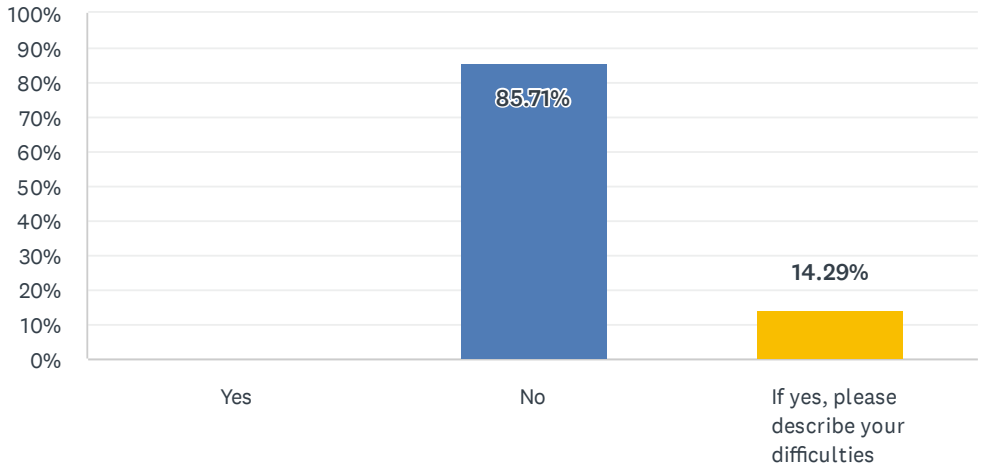
Answered: 14 Skipped: 24



ANSWER CHOICES	RESPONSES	
Yes	100.00%	14
No	0.00%	0
TOTAL		14

Q12 Did you experience any difficulties with the network?

Answered: 14 Skipped: 24

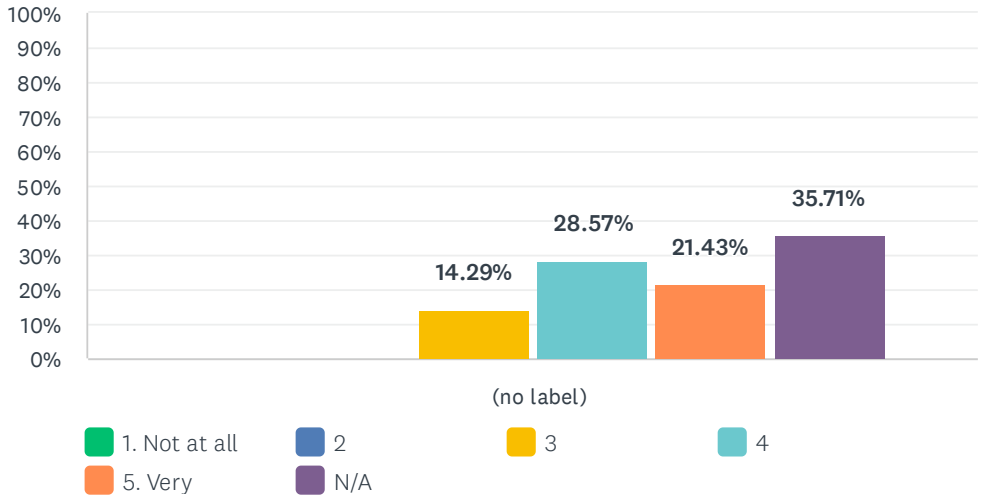


ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	85.71%	12
If yes, please describe your difficulties	14.29%	2
TOTAL		14

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	There are times when the network shows that it is connected, but I am unable to connect to the web.	10/27/2021 9:08 AM
2	In my assigned office the wireless connection would randomly disconnect and reconnect again (this didn't happen elsewhere)	10/22/2021 7:09 PM

Q13 The MSRI lunch arrangements were satisfactory

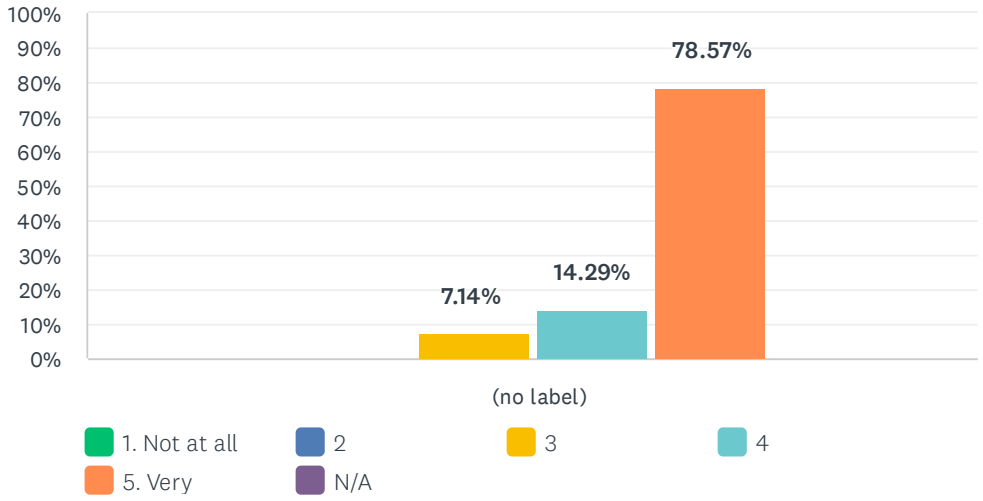
Answered: 14 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	14.29% 2	28.57% 4	21.43% 3	35.71% 5	14	4.11

Q14 The MSRI tea arrangements were satisfactory

Answered: 14 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	7.14% 1	14.29% 2	78.57% 11	0.00% 0	14	4.71

Q15 Additional comments about the MSRI staff, facilities and food

Answered: 0 Skipped: 38

#	RESPONSES	DATE
	There are no responses.	

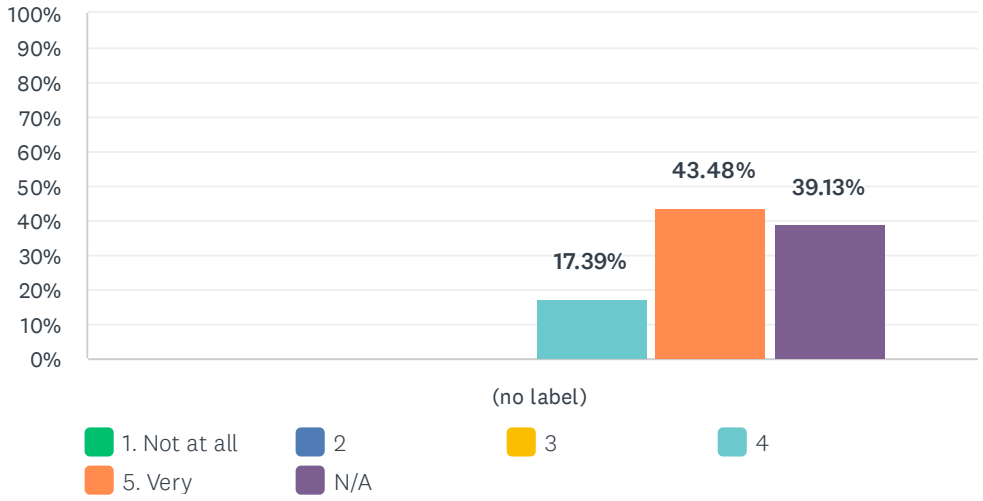
Q16 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 0 Skipped: 38

#	RESPONSES	DATE
	There are no responses.	

Q17 I found the MSRI staff helpful

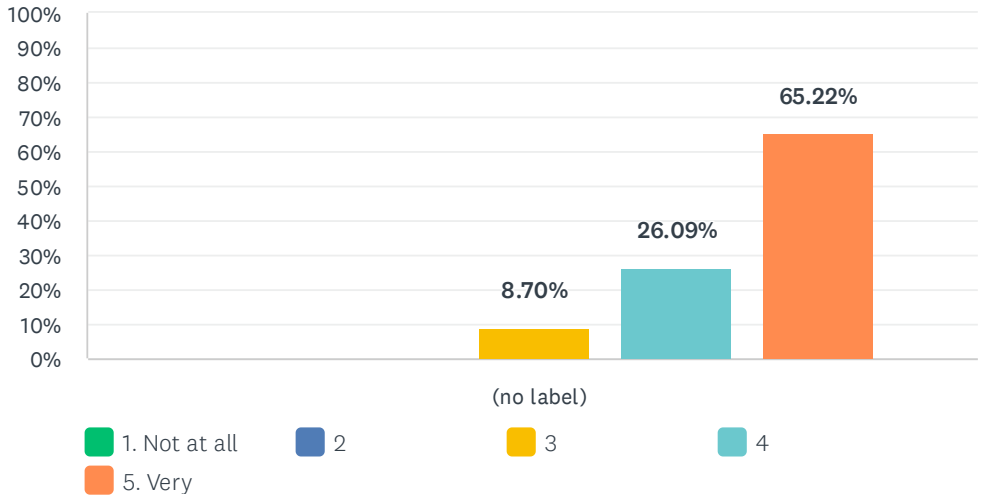
Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	17.39% 4	43.48% 10	39.13% 9	23	4.71

Q18 The workshop was intellectually stimulating

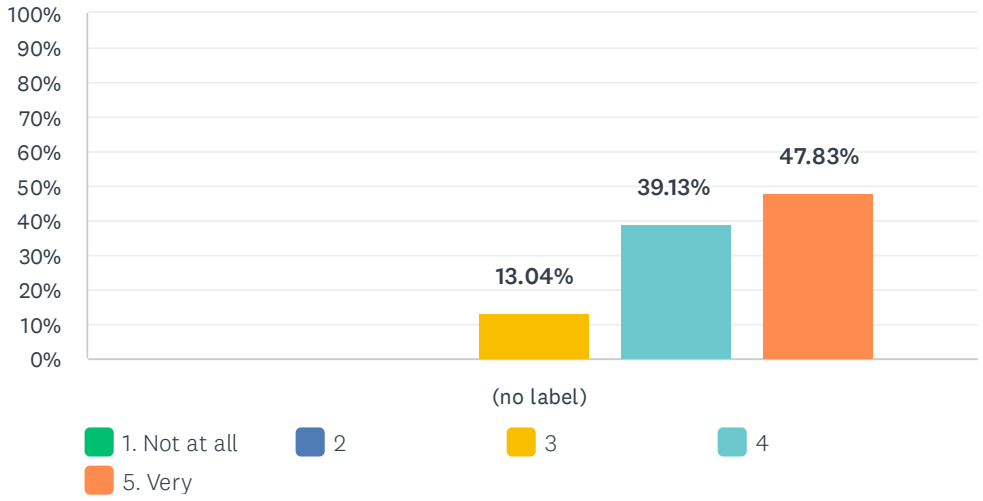
Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.70% 2	26.09% 6	65.22% 15	23	4.57

Q19 The overall experience of the workshop was worthwhile

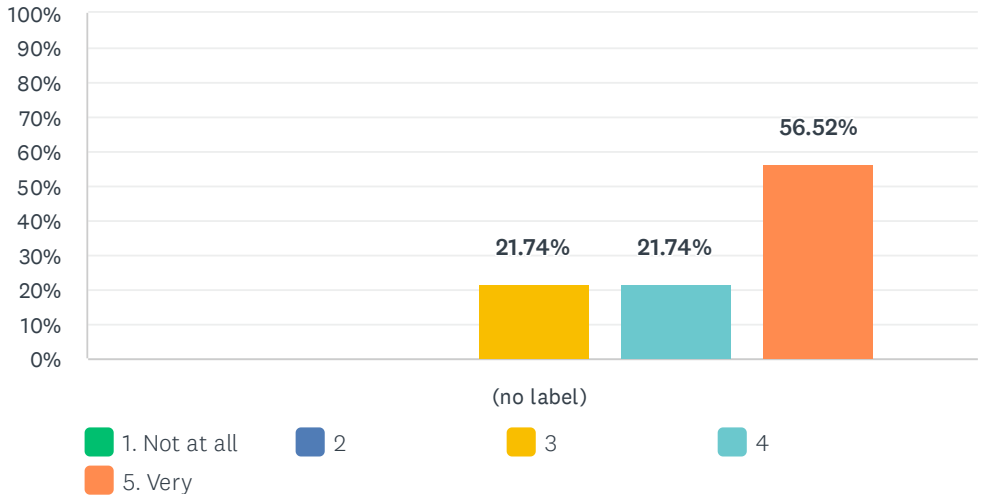
Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	13.04% 3	39.13% 9	47.83% 11	23	4.35

Q20 The lectures were at at an appropriate level

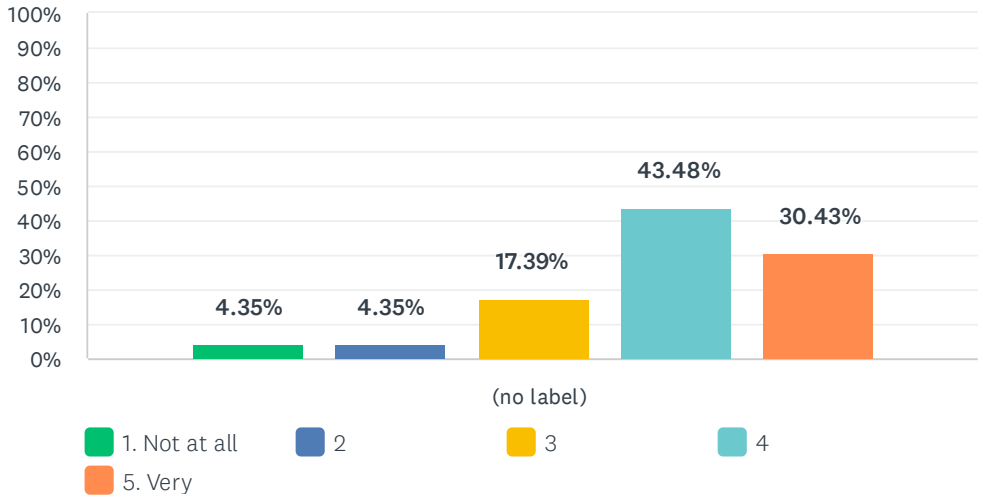
Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	21.74% 5	21.74% 5	56.52% 13	23	4.35

Q21 I was well prepared to benefit from the lectures

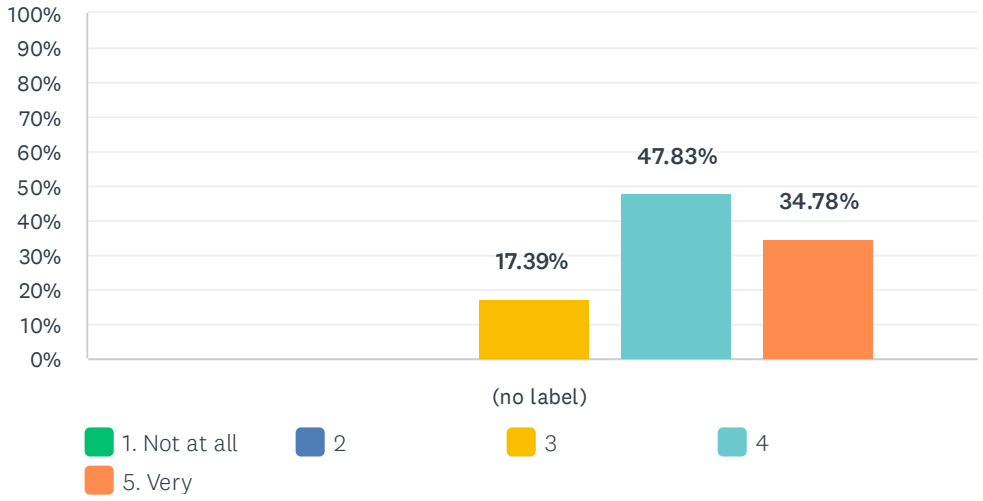
Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	4.35% 1	4.35% 1	17.39% 4	43.48% 10	30.43% 7	23	3.91

Q22 My interest in the subject matter was increased by the workshop

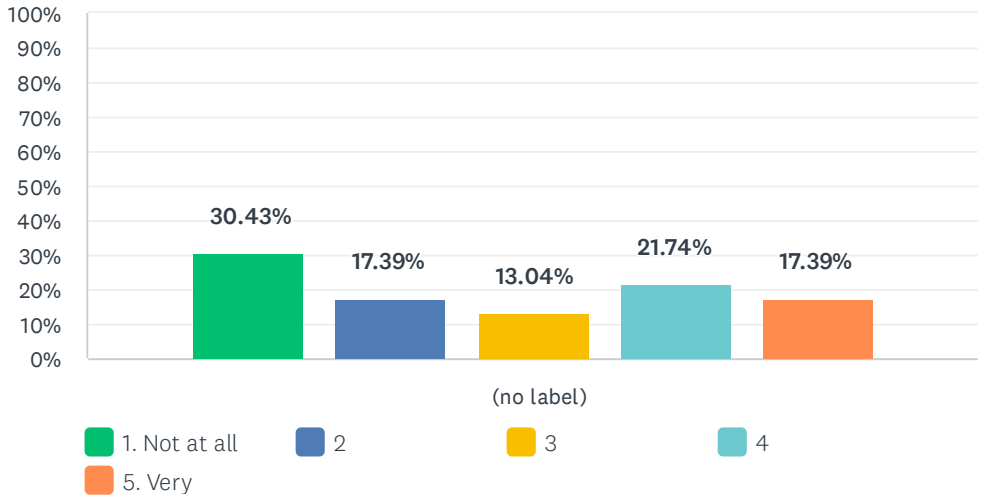
Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	17.39% 4	47.83% 11	34.78% 8	23	4.17

Q23 The workshop helped me meet people with similar scientific interests

Answered: 23 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	30.43% 7	17.39% 4	13.04% 3	21.74% 5	17.39% 4	23	2.78

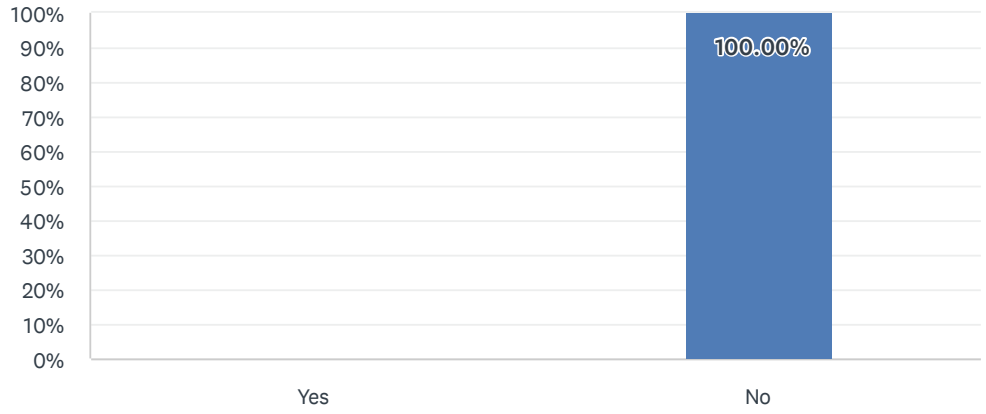
Q24 Additional comments

Answered: 5 Skipped: 33

#	RESPONSES	DATE
1	I was juggling my teaching load with attending some talks, so I unfortunately didn't have an opportunity to mingle (hence my answer to the last question). If it weren't for my schedule, I think I would have been able to meet people through the programme. Great workshop and I really appreciate having the talks recorded for later viewing :)	11/1/2021 3:11 PM
2	It has been a challenge to keep up with all the activities working remotely. First off, because of unavoidable commitments that arise when staying at home institution. And second, because a great deal of the scientific interactions happen normally at informal conversations, which do not occur when attending remotely.	10/26/2021 10:21 AM
3	Unfortunately the workshop did not allow me to really meet peoples because: 1) I was attending remotely; 2) due to the time shift I could follow live only part of it. It was however useful to be able to see the talks afterwards.	10/23/2021 12:24 AM
4	Online participation is not very stimulating.	10/22/2021 10:23 PM
5	Nicely organized and useful workshop with a good selection of speakers	10/22/2021 3:38 PM

Q25 Did you experience any technical difficulties accessing the workshop online?

Answered: 23 Skipped: 15



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	100.00%	23
TOTAL		23

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
	There are no responses.	

Q26 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 23 Skipped: 15

#	RESPONSES	DATE
1	I only participated to the morning sessions because of the time zone difference. Besides that, the main disadvantage of remote participation is the lack of informal coffee-break discussions.	11/5/2021 9:12 AM
2	It actually made it easier to participate!	11/1/2021 3:12 PM
3	Childcare needs kept me from coming to all talks.	11/1/2021 10:51 AM
4	One comment is that the questions asked by audience often not get picked by the audio, so speaker repeating the questions would be much appreciated. One good point is that a lot of the talks are given using beamer, and making the file available in advance helps me follow the talk better. The recordings are uploaded very quickly, which I'm very happy with.	10/29/2021 1:25 PM
5	I had no problem at all. In fact, the online workshop enabled me to participate. Otherwise, there is a possibility that I might not be able to participate if I could not find a colleague to substitute for my teaching.	10/29/2021 12:42 PM
6	The time zone difference does impose some minor difficulties, but the major impact when attending from distance was because it was hard to remain focused only on the event, due to other commitments that arise.	10/26/2021 10:24 AM
7	of course time zone difference affected participation	10/25/2021 2:55 AM
8	The time difference and the lack of meeting peoples in person made the workshop less inspiring.	10/25/2021 1:45 AM
9	Time zone difference made it difficult to participate fully.	10/25/2021 12:00 AM
10	I would have preferred to be there in person to interact with other participants, but I think it worked as well as possible, given the constraints.	10/24/2021 4:41 AM
11	Time zone differences were problematic, since I was already tired when MSRI started. But participating online is much better than not at all (I couldn't join in person unrelated to the pandemic).	10/23/2021 8:21 AM
12	Given the circumstances, it was great to be able to participate online. Time zone was not a major problem (evening here).	10/23/2021 2:30 AM
13	The main problem was the time shift, but also the fact that not participating in person implies also that the daily task (teaching, ...) are still running as usual. The recording however have been useful.	10/23/2021 12:26 AM
14	There was no opportunity for informal contacts, which is just as important as the official program. I could not join the lunches and coffee breaks.	10/22/2021 10:25 PM
15	Yes.	10/22/2021 9:33 PM
16	Since the letures was giving in the mid night in my time zone, the online vedios are helpful.	10/22/2021 8:46 PM
17	the pandemic prevented me from participating in person, but there were no issues otherwise	10/22/2021 4:11 PM
18	Time difference of course made some late talks less accessible due to family constraints	10/22/2021 3:40 PM
19	There was no change in the number of talks I attended compared to in-person participation. However, I was missing the social interaction compared to in-person participation.	10/22/2021 3:03 PM

20	I felt it would be better in view of the pandemic to have less people in the Auditorium. As the streaming is done so well one can participate remotely without loss of information	10/22/2021 2:46 PM
21	Couldn't attend in person because of pandemic, but got a lot out of lectures. Of course, personal interaction was lost.	10/22/2021 2:43 PM
22	I attended all the talks remotely and I do not think online is an issue.	10/22/2021 2:26 PM
23	Given my teaching commitments, without the hybrid option, I would not have been able to participate, so it was an excellent opportunity.	10/22/2021 2:23 PM

Q27 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 10 Skipped: 28

#	RESPONSES	DATE
1	No idea how to create more interaction online.	11/5/2021 9:12 AM
2	Not too sure -- I think that's a tricky thing to implement. Perhaps a separate chatroom or forum could help with this?	11/1/2021 3:12 PM
3	One might try a model of the sort 4+2 (a group of six people: where 4 of them know each other are joined by two participants, and hopefully the 4 will try to get the 2 into a conversation....).	10/23/2021 8:21 AM
4	There was some time to discuss between talks. It was difficult to make out people in the lecture hall, maybe would be better if each was connected directly on their laptop also.	10/23/2021 2:30 AM
5	Unfortunately I do not see how to improve much this aspect.	10/23/2021 12:26 AM
6	I do not know.	10/22/2021 10:25 PM
7	One option might be to set aside time for hybrid interactions/discussions related to the day's lectures	10/22/2021 4:11 PM
8	I have also been involved with trying to figure this out in other contexts. We never found anything that worked.	10/22/2021 2:43 PM
9	There is one thing which might be improved about the interaction. For remote speaker, it is hard to see the person who asks questions. I do not know how this can be improved. Probably it would be great if there is a remote camera?	10/22/2021 2:26 PM
10	schedule zoom coffee breaks and don't close the zoom feed once a physical coffee break is held at the MSRI	10/22/2021 2:23 PM

Q28 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 3 Skipped: 35

#	RESPONSES	DATE
1	/	11/5/2021 9:12 AM
2	As an online participant I could see the names of the other online people, and I could see some of the participants that are in the room at MSRI. But I had no idea who else was there.	10/22/2021 10:27 PM
3	Maybe to have a few introductory lectures at a less technical level preceding original talks would be helpful.	10/22/2021 3:41 PM

Chern-Simons Conference

November 16, 2021 – November 18, 2021

MSRI, Berkeley, CA, USA

Organizers:

Stephon Alexander (Brown University)

Fiona Burnell (University of Minnesota)

David Eisenbud (MSRI - Mathematical Sciences Research Institute)

Dan Freed (University of Texas, Austin)

Joel Moore (University of California, Berkeley)

John Morgan (Columbia University)

Workshop on Chern-Simons and Other Topological Field Theories
MSRI, November 16 to November 18, 2021

Summary of Scientific Activities

This workshop covered the current state of the manifold areas in mathematics and physics in which Chern-Simons and other topological field theories have had, or are having, a major impact. Scientific talks took place over three days at MSRI (day 2) and the Claremont Hotel and Spa (days 1 and 3), with a banquet dinner on day 2. In order to convey the scope of the meeting, and how Chern-Simons theoriest continue to find new applications, here are summaries of a few of the 17 talks.

At the interface between mathematics and physics, Mina Aganagic spoke about how the concept of mirror symmetry, a duality or correspondence between two seemingly different manifolds that emerged from the study of string theories, provides insight into knot homology. One of knot homology's creators, Mikhail Khovanov, explained how the recent introduction of the concept of "foams" leads to a way to generalize the understanding of knots via categorification, using the Kuperberg bracket as an example. Kevin Costello (Perimeter) explained how a dimensional reduction of unusual Chern-Simons theories in four dimensions leads to new families of integrable models in two dimensions.

Applications of Chern-Simons and related theories to physics were discussed by several speakers, including Nicolas Yunes, who explained how the signatures of general relativity, now explored in experiments like the Laser Interferometer Gravitational-Wave Observatory (LIGO), would be modified by the presence of a Chern-Simons term in addition to conventional Einstein gravity, and how these modifications might become observable in the next generation of experiments. Xie Chen and Nathan Seiberg talked about how theories with large numbers of symmetries show unexpected features including fractional particles described by Chern-Simons theory, and such particles also appeared in the discussion of topological phases by Xiao-Gang Wen.

In order to help make this broad range of topics accessible, two of the conference organizers, Dan Freed and Stephon Alexander, kicked off the meeting with short tutorials on Chern-Simons theories in mathematics and physics, respectively. While some talks explained how such theories are finding relevance in new areas, such as number theory (Minhyong Kim) and electrical transport in metals (Charles Kane), other talks were a chance to see how Chern-Simons theory reached its current centrality, as in Jim Simons's account of the origins of his work with Chern and Simon Donaldson's discussion of the role the Chern-Simons functional plays in Floer homology. The workshop served as a reminder of the continuing impact of mathematical discoveries across physics, making it an appropriate note on which to resume MSRI's in-person workshop program.

Organizers

First Name	Last Name	Institution
Stephon	Alexander	Brown University
Fiona	Burnell	University of Minnesota
David	Eisenbud	MSRI - Mathematical Sciences Research Institute
Dan	Freed	University of Texas, Austin
Joel	Moore	University of California, Berkeley
John	Morgan	Columbia University

Speakers

First Name	Last Name	Institution
Mina	Aganagic	University of California, Berkeley
Stephon	Alexander	Brown University
Xie	Chen	California Institute of Technology
Kevin	Costello	Perimeter Institute of Theoretical Physics
Simon	Donaldson	State University of New York, Stony Brook
Dan	Freed	University of Texas, Austin
Michael	Freedman	Microsoft Research Station Q
Sylvester	Gates	Brown University
Charles	Kane	University of Pennsylvania
Mikhail	Khovanov	Columbia University
Minhyong	Kim	International Centre for Mathematical Sciences
John	Lott	University of California, Berkeley
Nathan	Seiberg	Institute for Advanced Study
James	Simons	Simons Foundation
Cumrun	Vafa	Harvard University
Xiao-Gang	Wen	Massachusetts Institute of Technology
Nicolas	Yunes	University of Illinois Urbana-Champaign

Mathematical Sciences Research Institute

Chern-Simons Conference

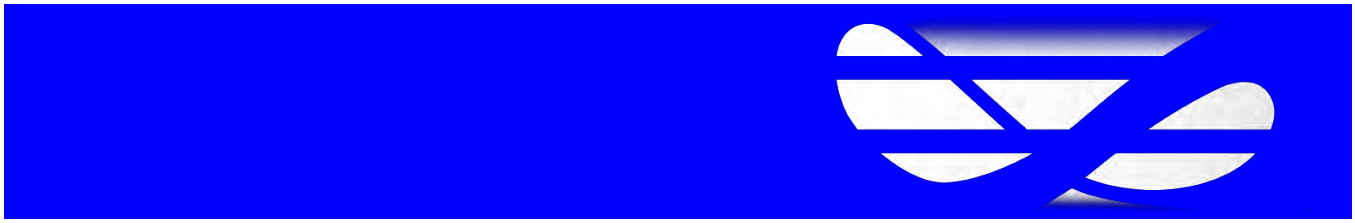
November 16 - 18, 2021

Tuesday, November 16, 2021			
08:00 AM - 09:00 AM	Meritage Room		Breakfast
09:00 AM - 09:30 AM	Skyline Room	Dan Freed	Introduction to Chern-Simons
09:30 AM - 10:00 AM	Skyline Room	Stephon Alexander	Chern-Simons and the Matter-Anti Matter Asymmetry in the Universe
10:00 AM - 10:30 AM	Meritage Room		Coffee Break
10:30 AM - 11:30 AM	Skyline Room	Mina Aganagic	(Homological) Knot Invariants from Mirror Symmetry
11:45 AM - 12:45 PM	Skyline Room	Xie Chen	Chern-Simons Theory and Fracton
12:45 PM - 02:30 PM	Meritage Room		Lunch
02:30 PM - 03:30 PM	Skyline Room	Simon Donaldson	The Chern-Simons Functional and Floer Homology
03:30 PM - 04:30 PM	Meritage Room		Afternoon Tea
04:30 PM - 05:30 PM	Skyline Room	Sylvester Gates	How SUSY & Topology led from Chern-Simons Theory to Solving a Forty Year Old Mathematical Puzzle

Wednesday, November 17, 2021			
08:00 AM - 08:30 AM	Claremont Club & Spa		Bus departs Claremont Club & Spa for MSRI
08:15 AM - 09:00 AM	Atrium & Commons		Breakfast
09:00 AM - 10:00 AM	Simons Auditorium	Charles Kane	Quantized Nonlinear Response in Ballistic Metals
10:00 AM - 10:30 AM	Atrium & Commons		Coffee Break
10:30 AM - 11:30 AM	Simons Auditorium	John Lott	Chern-Simons, Differential K-Theory and Operator Theory
11:45 AM - 12:45 PM	Simons Auditorium	Nathan Seiberg	Comments on Lattice vs. Continuum Quantum Field Theory
12:45 PM - 02:30 PM	Atrium & Decks		Lunch
02:30 PM - 03:30 PM	Simons Auditorium	Xiao-Gang Wen	Chern-Simons Theory and Non-Abelian Topological Order
03:30 PM - 04:30 PM	Atrium & Decks		Afternoon Tea
04:30 PM - 05:30 PM	Simons Auditorium	James Simons	Origins of the Chern-Simons Theory
06:00 PM - 06:30 PM	Front Courtyard		Bus departs MSRI for Hong Kong East Ocean Restaurant
06:30 PM - 09:00 PM	Hong Kong East Ocean Restaurant	Cumrun Vafa	Banquet
08:30 PM - 09:00 PM	Hong Kong East Ocean Restaurant		Buses depart for Claremont Club & Spa, MSRI and UC Berkeley Mining Circle

Thursday, November 18, 2021			
08:00 AM - 09:00 AM	Meritage Room		Breakfast
09:00 AM - 10:00 AM	Skyline Room	Nicolas Yunes	Astrophysical Observational Signatures of Dynamical Chern-Simons Gravity

10:00 AM - 10:30 AM	Meritage Room		Coffee Break
10:30 AM - 11:30 AM	Skyline Room	Kevin Costello	Chern-Simons Theories in Dimensions Four, Five and Six
11:45 AM - 12:45 PM	Skyline Room	Minhyong Kim	Arithmetic Field Theories and Arithmetic Invariants
12:45 PM - 02:30 PM	Meritage Room		Lunch
02:30 PM - 03:30 PM	Skyline Room	Mikhail Khovanov	Categorification
03:30 PM - 04:30 PM	Meritage Room		Afternoon Tea
04:30 PM - 05:30 PM	Skyline Room	Michael Freedman	The Universe from a Single Particle
06:00 PM - 06:30 PM	Claremont Club & Spa		Bus departs Claremont Club & Spa for David Brower Center
07:00 PM - 08:00 PM	David Brower Center	Stephon Alexander	Public Lecture: "Jazz of the Spheres"
08:15 PM - 08:45 PM	David Brower Center		Buses depart for Claremont Club & Spa, MSRI and UC Berkeley Mining Circle



Participants

First Name	Last Name	Institution
Mark	Adler	Brandeis University
Mina	Aganagic	University of California, Berkeley
Ian	Agol	University of California, Berkeley
Stephon	Alexander	Brown University
Federico	Ardila	San Francisco State University
Chan	Bae	University of California, Berkeley
Christopher	Bailey	University of Pennsylvania
Scott	Baldridge	Louisiana State University
Brenno	Barbosa	Federal University of Sao Carlos
Sandipan	Bhattacherjee	Birla Institute of Technology, Mesra, Ranchi, India
Pavel	Bleher	Indiana University--Purdue University
Hans	Boden	McMaster University
Jeffrey	Bohn	University of California, Berkeley
Norman	Bookstein	Lawrence Berkeley Laboratory
Gregory	Brumfiel	Stanford University
Milo	Buitrago Casas	University of California, Berkeley
Ivan Mauricio	Burbano Aldana	University of California, Berkeley
Fiona	Burnell	University of Minnesota
Jorge	Castaño-Yepes	Universidad de Colima
Sun-Yung	Chang	Princeton University
Xie	Chen	California Institute of Technology
Suh Young	Choi	Korea Advanced Institute of Science and Technology (KAIST)
Ralph	Cohen	Stanford University
Kevin	Costello	Perimeter Institute of Theoretical Physics
John	Cruz Morales	Universidad Nacional de Colombia
Hailong	Dao	University of Kansas
James	Davis	Indiana University
Arun	Debray	Purdue University
Percy	Deift	New York University, Courant Institute
Fabrizio	Del Monte	CRM - Centre de Recherches Mathématiques
Harini	Desiraju	University of Birmingham
Philippe	Di Francesco	University of Illinois at Urbana-Champaign
Arcelino	Do Nascimento	Institute of Mathematics and Statistics (IME)
Simon	Donaldson	State University of New York, Stony Brook
Arpit	Dua	California Institute of Technology
Robert	Edwards	University of California, Los Angeles
David	Eisenbud	MSRI - Mathematical Sciences Research Institute
Saleh	Elmohamed	University of California, Berkeley
Sarah	Ernst	Ludwig-Maximilians-Universität München
Paul	Feehan	Rutgers University
Alexander	Felshtyn	Uniwersytet Szczecinski
Liam	Fox	State University of New York, Stony Brook
Dan	Freed	University of Texas, Austin
Michael	Freedman	Microsoft Research Station Q
Daniel	Garza	University of Georgia
Sylvester	Gates	Brown University
Promit	Ghosal	Massachusetts Institute of Technology
Manuela	Girotti	Saint Mary's University
Nicolle	Gonzalez	University of California, Los Angeles
Jin-Cheng	Guu	State University of New York, Stony Brook
Araminta	Gwynne	Massachusetts Institute of Technology
Saman	Habibi Esfahani	Stony Brook University
Peter	Haine	Massachusetts Institute of Technology
Kangjin	Han	Daegu-Gyeongbuk Institute of Science & Technology (DGIST)

Participants

First Name	Last Name	Institution
Jenny	Harrison	University of California, Berkeley
Zichen	He	University of California, San Diego
Zheng	Huang	CUNY, Graduate Center
Steven	Hurder	University of Illinois at Chicago
Michael	Hutchings	University of California, Berkeley
Dionne	Ibarra	George Washington University
Jerry	Kaminker	University of California, Davis
Charles	Kane	University of Pennsylvania
Rinat	Kedem	University of Illinois at Urbana-Champaign
Benjamin	Keigwin	University of Pennsylvania
Mikhail	Khovanov	Columbia University
Minhyong	Kim	International Centre for Mathematical Sciences
Sungwoon	Kim	Jeju National University
Nayeong	Kim	San Francisco State University
Robion	Kirby	University of California, Berkeley
Philippe	LeFloch	Sorbonne University
Elise	LePage	University of California, Berkeley
Zhongyang	Li	University of Connecticut
Xiaobin	Li	Southwest (Xinan) Jiaotong University
Bencheng	Li	Georgia Institute of Technology
Chris	Li	University of California, Berkeley
Larsen	Linov	University of California, Berkeley
Tuto	LopezGonzalez	University of California, San Francisco
John	Lott	University of California, Berkeley
José	Marín Guzmán	University of Maryland, College Park
Kishore	Marathe	Brooklyn College, CUNY
Aaron	Mazel-Gee	California Institute of Technology
Rafe	Mazzeo	Stanford University
Joel	Moore	University of California, Berkeley
John	Morgan	Columbia University
Marc	Muhleisen	University of Pennsylvania
Motohico	Mulase	University of California, Davis
Ameth	Ndiaye	Faculté des Sciences et Technologies de L'éducation et de la Formation (FASTEF)
Ilia	Nekrasov	University of Michigan
Tristan	Nguyen	Air Force Office of Scientific Research
Juan Carlos	Nunez Maldonado	Federal University of São Carlos - UFSCar
Pablo	Ocal	University of California, Los Angeles
Yong-Geun	Oh	Institute for Basic Science
Jeffrey	Oregero	University at Buffalo (SUNY)
Sunghyuk	Park	California Institute of Technology
Leonid	Petrov	University of Virginia
Daniel	Pollack	University of Washington
Andrei	Prokhorov	University of Michigan
Dhanusshya	R	Ethiraj College for Women
Jorge	Robinson Arrieta	University of Arkansas
Ilan	Roth	University of California, Berkeley
Nathan	Seiberg	Institute for Advanced Study
James	Simons	Simons Foundation
Jim	stasheff	University of Pennsylvania
Bankteshwar	Tiwari	Banaras Hindu University
Tatiana	Toro	University of Washington
Siddharth	Vadnerkar	University of California, Davis
Cumrun	Vafa	Harvard University
Pierre	van Moerbeke	Brandeis University

Participants		
First Name	**Last Name**	**Institution**
Monica	Vazirani	University of California, Davis
Chelsea	Walton	Rice University
Shuguang	Wang	University of Missouri
Dasheng	Wang	Northern Illinois University
Xiao-Gang	Wen	Massachusetts Institute of Technology
Peter	Woit	Columbia University
Xiangjin	Xu	Binghamton University (SUNY)
Bowen	Yang	California Institute of Technology
Lexing	Ying	Stanford University
Mingze	Yu	University of California, Berkeley
Nicolas	Yunes	University of Illinois Urbana-Champaign
Qingyun	Zeng	University of Pennsylvania
Ming	Zhang	University of California, San Diego
Yingchun	Zhang	University of Michigan
Alexander	Zuevsky	Institute of Mathematics, Czech Academy of Sciences

Identifiable Participants' Information

Participants		123

Gender		123
Male	78.05%	96
Female	16.26%	20
Declined to state	5.69%	7
Other	0.00%	0

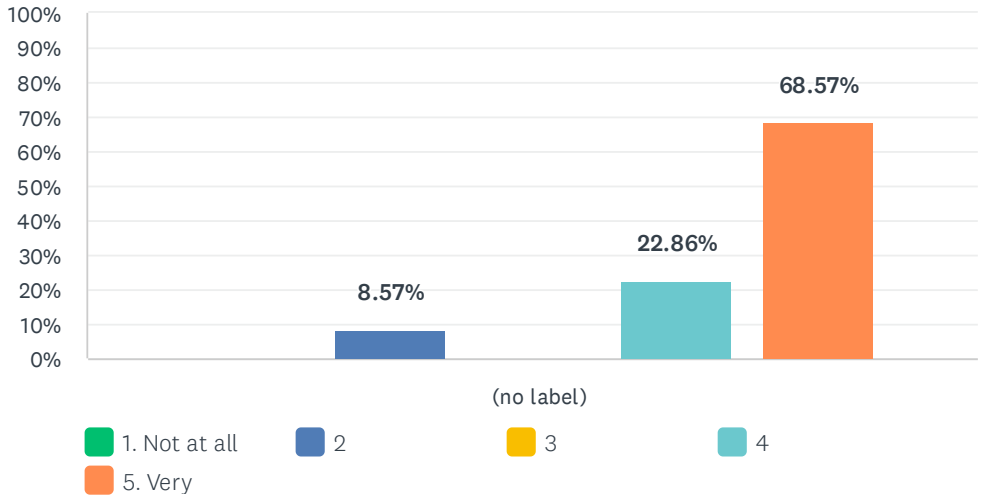
Ethnicity*		141
White	39.01%	55
Asian	27.66%	39
Hispanic	9.22%	13
Pacific Islander	0.00%	0
Black	4.26%	6
Native American	0.71%	1
Mixed	6.38%	9
Declined to state	12.77%	18

* ethnicity specifications are not exclusive

There were 5 unidentifiable participants.

Q1 The workshop was intellectually stimulating

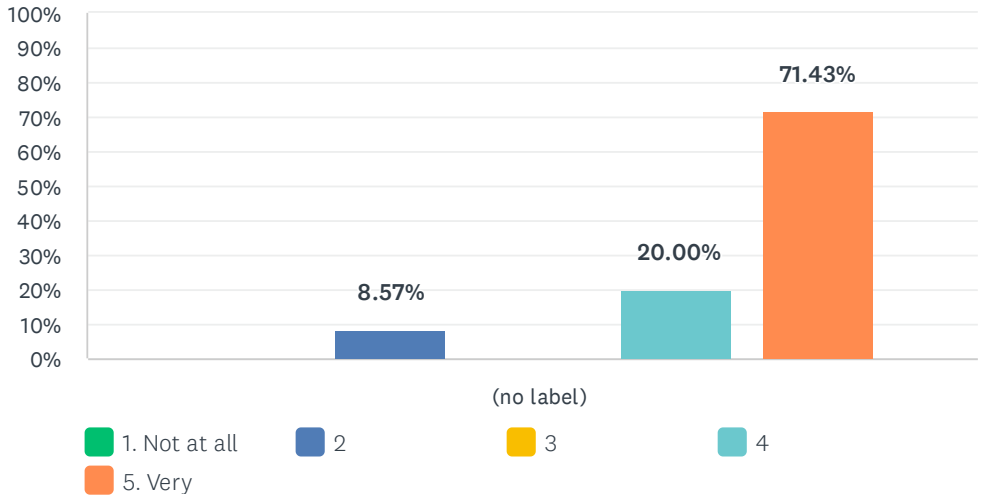
Answered: 35 Skipped: 0



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	8.57% 3	0.00% 0	22.86% 8	68.57% 24	35	4.51

Q2 The overall experience of the workshop was worthwhile

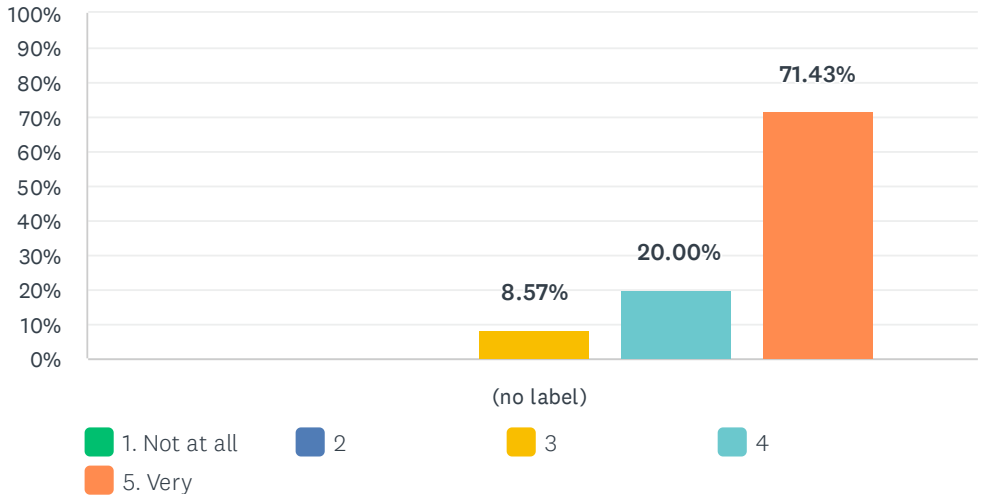
Answered: 35 Skipped: 0



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	8.57% 3	0.00% 0	20.00% 7	71.43% 25	35	4.54

Q3 The time between lectures was adequate for discussion

Answered: 35 Skipped: 0



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.57% 3	20.00% 7	71.43% 25	35	4.63

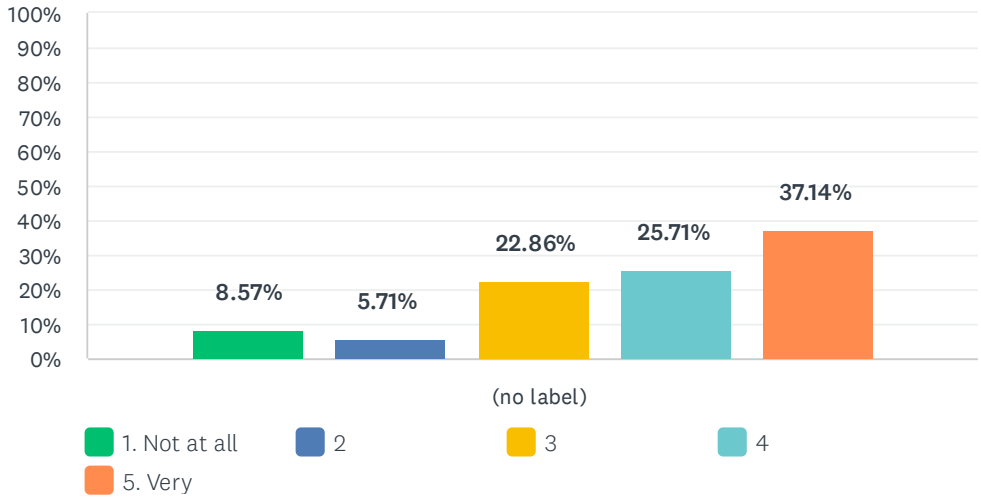
Q4 Additional comments

Answered: 11 Skipped: 24

#	RESPONSES	DATE
1	Thank you to MSRI, the organizers, and the speakers for a wonderful conference!	12/6/2021 1:32 PM
2	Since this event was advertised as a workshop, I was disappointed that (1) the talks were forbidding or even inaccessible to younger grad students/newcomers, (2) there were no suggested exercises or readings posted in advance, and (3) there were very few introductory talks (if they could even be called this) and they were squeezed into shorter time slots which made them feel rushed and devalued. If I had known this, I would not have registered for the conference.	12/3/2021 2:27 PM
3	I only attended one day (Wednesday) so my impression is limited. I was very disappointed in Seiberg's talk.The issue of a rigorous quantum field theory has been a challenge for almost 100 years, and what emerged from Seiberg's report is that very little has been achieved. The models he described were artificial and contrived. More precisely, I thought Seiberg gave a good talk, but my disappointment was that so little has been achieved.	11/25/2021 11:55 AM
4	There was a good overlap between math and physics , beneficial to both..,	11/23/2021 11:18 AM
5	This workshop wasn't at all what I thought it would be. I learned almost nothing because the talks were in too diverse a set of fields, and because there were so many of them.	11/22/2021 4:59 PM
6	Thank you very much! It was extremely mathematically stimulating!	11/22/2021 4:40 PM
7	I was able to learn a lot of new ideas with great excitement. Thank you so much for your opportunity! I would never have thought about how naturally the Chern-Simons terms could be incorporated into the metric consideration of a manifold. To me, metric geometry, such as Kaehler-Einstein geometry, and topology based on Chern-Simons forms, are two unrelated subjects. Now they indeed form one object, and algebraic geometry of string theory should provide a control over it. It was a conference to show us a glimpse of the future yet to come.	11/22/2021 1:18 PM
8	Nice format, and a very well-put-together workshop. Thank you.	11/22/2021 1:08 PM
9	The food was too good; pity my waist line	11/22/2021 1:00 PM
10	Great to see people in person.	11/22/2021 11:32 AM
11	It is a nice conference that helped my academic career in several ways.	11/22/2021 11:18 AM

Q5 I was well prepared to benefit from the lectures

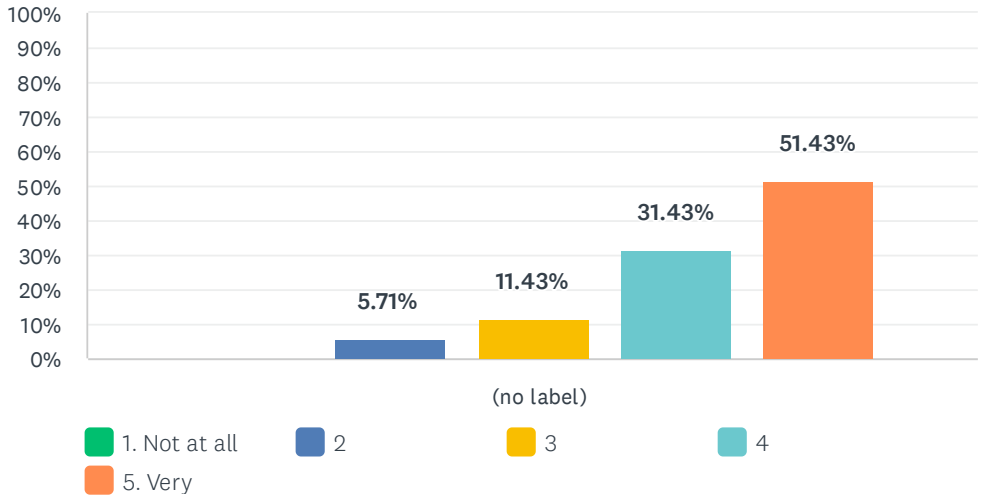
Answered: 35 Skipped: 0



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	8.57% 3	5.71% 2	22.86% 8	25.71% 9	37.14% 13	35	3.77

Q6 My interest in the subject matter was increased by the workshop

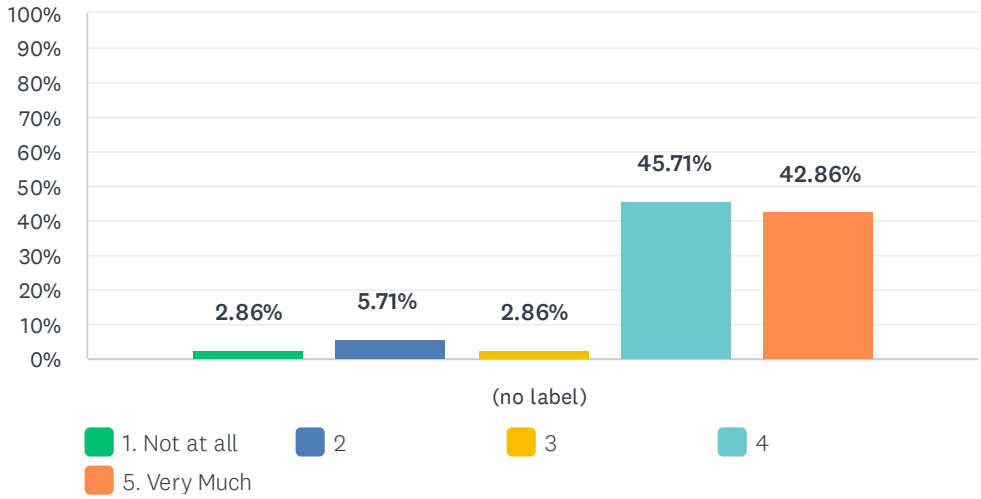
Answered: 35 Skipped: 0



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.71% 2	11.43% 4	31.43% 11	51.43% 18	35	4.29

Q7 The workshop helped me meet people with similar scientific interests

Answered: 35 Skipped: 0



	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	2.86% 1	5.71% 2	2.86% 1	45.71% 16	42.86% 15	35	4.20

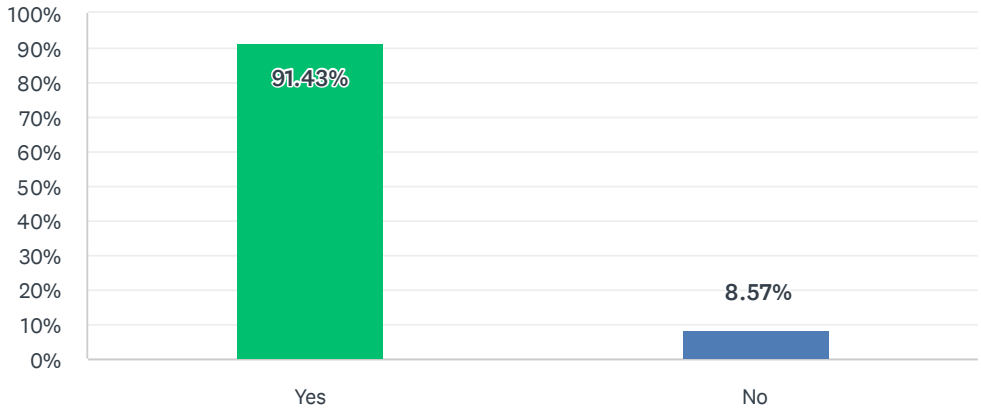
Q8 Additional comments on your personal assessment

Answered: 7 Skipped: 28

#	RESPONSES	DATE
1	Since this event was advertised as a workshop, I was disappointed that (1) the talks were forbidding or even inaccessible to younger grad students/newcomers, (2) there were no suggested exercises or readings posted in advance, and (3) there were very few introductory talks (if they could even be called this) and they were squeezed into shorter time slots which made them feel rushed and devalued. If I had known this, I would not have registered for the conference.	12/3/2021 2:27 PM
2	For young researchers, a positive addition might be some kind of structured social events or icebreakers.	11/29/2021 3:23 PM
3	This is not my area. I was hoping to learn more about it.	11/25/2021 11:56 AM
4	I was already interested...	11/23/2021 6:47 PM
5	I also had an ample chance to talk with my new collaborator, who traveled thousands of miles to participate in the conference. Talking to speakers also stimulated my thinking on the very current subject I am working on.	11/22/2021 1:21 PM
6	Some the physics was a strain fort me as a mathematician, but good to know what's out there	11/22/2021 1:01 PM
7	I had a couple of long discussions with grad students, a pleasant experience for an oldster	11/22/2021 11:33 AM

Q9 Did you attend the banquet at Hong Kong East Ocean Restaurant?

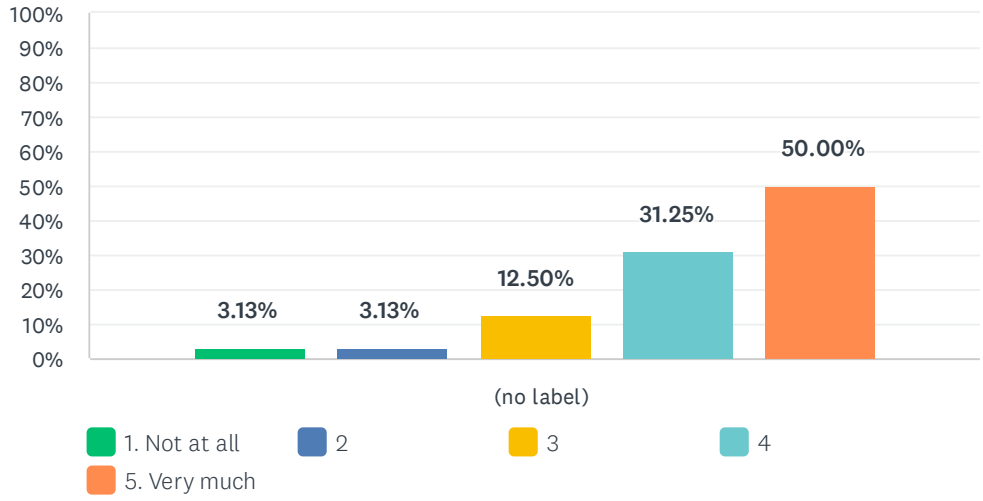
Answered: 35 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	91.43%	32
No	8.57%	3
TOTAL		35

Q10 Did the banquet help to solidify the contacts you made during the workshop?

Answered: 32 Skipped: 3



	1. NOT AT ALL	2	3	4	5. VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	3.13% 1	3.13% 1	12.50% 4	31.25% 10	50.00% 16	32	4.22

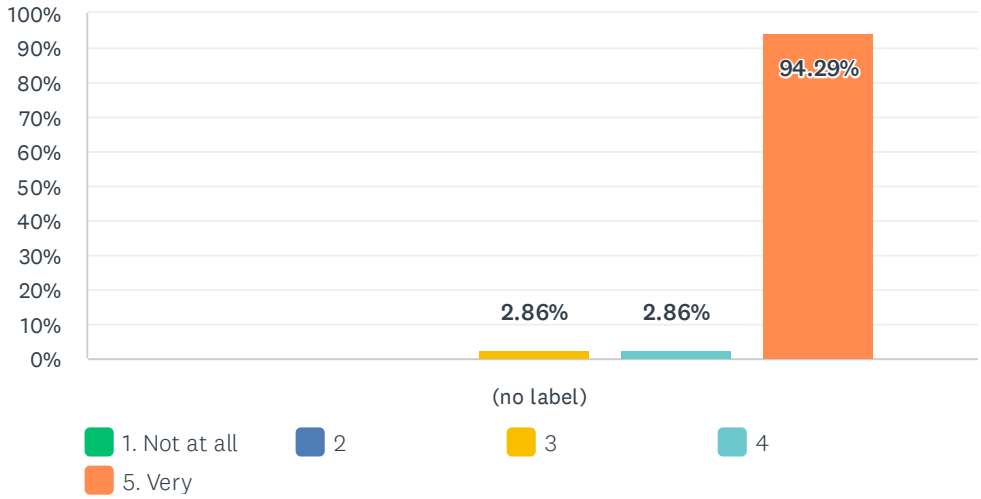
Q11 Please provide any comments about the banquet

Answered: 10 Skipped: 25

#	RESPONSES	DATE
1	The food was disappointing. The best dish was served at the very end after we were all full. But I appreciated you hosted the banquet. The speeches were great.	11/29/2021 10:57 PM
2	Absolutely wonderful!	11/29/2021 3:23 PM
3	Banquet was wonderful: food was great and I had a lot of fun!	11/24/2021 9:00 AM
4	Delicious!	11/23/2021 6:47 PM
5	Choice of the table determines the scientific benefits. Social benefits are always positive.	11/23/2021 11:20 AM
6	It was very pleasant to attend the banquet.	11/22/2021 4:41 PM
7	It was very unfortunate that their gluten free substitutes were not at the same quality of the main dishes! But the opportunity was great to talk to people: one speaker on my right and my new collaborator on my left. It was a fantastic dinner in this regard!	11/22/2021 1:23 PM
8	great place!	11/22/2021 1:08 PM
9	Kumar's talks a delight. I hope it was recorded or transcribed	11/22/2021 1:02 PM
10	Mostly I talked to old friends whom I hadn't seen in person for too long	11/22/2021 11:34 AM

Q12 I found the MSRI staff helpful

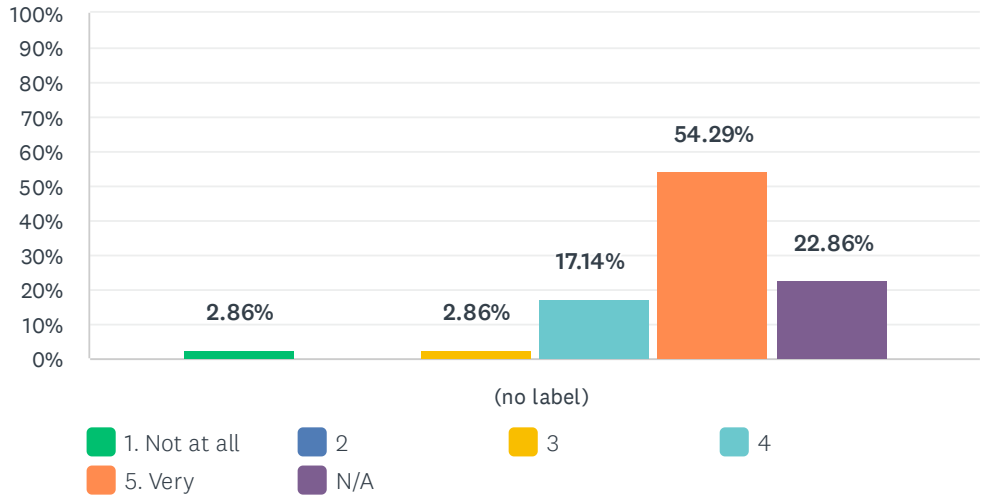
Answered: 35 Skipped: 0



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.86% 1	2.86% 1	94.29% 33	35	4.91

Q13 The Claremont Club & Spa facilities were conducive for such a workshop

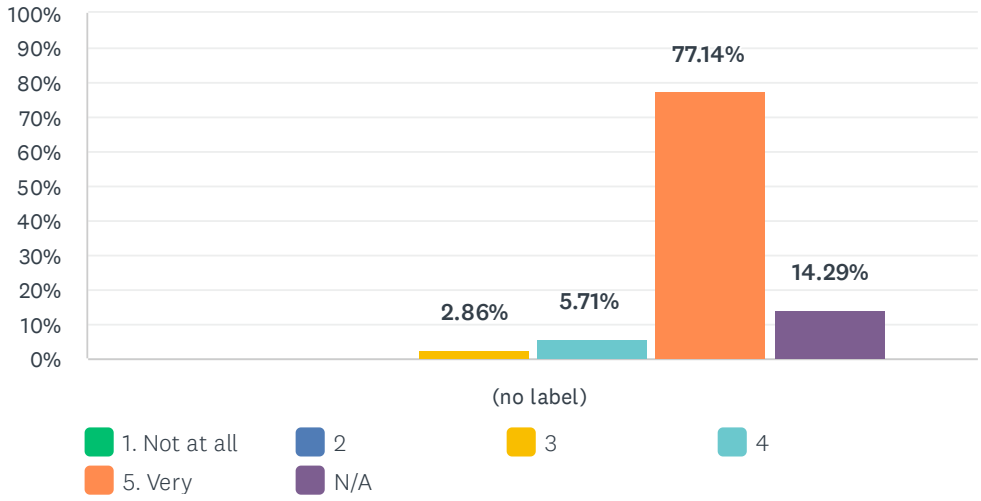
Answered: 35 Skipped: 0



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	2.86% 1	0.00% 0	2.86% 1	17.14% 6	54.29% 19	22.86% 8	35	4.56

Q14 The MSRI facilities were conducive for such a workshop

Answered: 35 Skipped: 0



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.86% 1	5.71% 2	77.14% 27	14.29% 5	35	4.87

Q15 Additional comments about the MSRI staff and the facilities

Answered: 9 Skipped: 26

#	RESPONSES	DATE
1	MSRI is always a delight to visit.	12/6/2021 1:33 PM
2	The room for talks at the Claremont is not at all as good as the MSRI lecture hall. The tea and lunch set up was great for networking.	11/29/2021 10:58 PM
3	Two thumbs up !!	11/25/2021 2:06 PM
4	The staff and the facilities are truly excellent!	11/25/2021 11:57 AM
5	I was an online participant so the correct response would be "not applicable'	11/24/2021 6:30 PM
6	They worked so hard for the success of the conference and happiness of the participants! Tracy is a gem. She deserves our standing ovation.	11/22/2021 1:26 PM
7	MSRI staffers extremely helpful	11/22/2021 1:03 PM
8	The staff, including the Director, couldn't have been nicer.	11/22/2021 11:35 AM
9	Lovely place!	11/22/2021 11:26 AM

Q16 We welcome any additional comments or suggestions you may have to improve the overall experience for future participants.

Answered: 11 Skipped: 24

#	RESPONSES	DATE
1	More in-person events now that COVID is waning.	12/6/2021 1:34 PM
2	Since this event was advertised as a workshop, I was disappointed that (1) the talks were forbidding or even inaccessible to younger grad students/newcomers, (2) there were no suggested exercises or readings posted in advance, and (3) there were very few introductory talks (if they could even be called this) and they were squeezed into shorter time slots which made them feel rushed and devalued. If I had known this, I would not have registered for the conference.	12/3/2021 2:28 PM
3	I got some mixed information about parking. The schedule said to pay $20, but later (too late) I found out it was possible to get a voucher.	11/29/2021 10:59 PM
4	I thought it was really phenomenal, very well-organized and executed. The only addition that I think could be helpful would be some structured interactions between various groups that attend (in addition to e.g. less structured tea times and meals).	11/29/2021 3:25 PM
5	This was a great conference. Thank you for all the work you put into it!	11/24/2021 9:01 AM
6	Please make slides and notes available for reference.	11/23/2021 6:17 PM
7	Thank you to everyone who helped put the workshop together. I know that it really helped a lot of people, and I am very appreciative of the time and effort you all spent into organizing everything.	11/22/2021 7:07 PM
8	I wish you were clearer in the advertisement about what this "workshop" actually consisted of.	11/22/2021 5:01 PM
9	This experience was amazing. I am grateful To MSRI that let me be there.	11/22/2021 3:36 PM
10	Thank you, David!	11/22/2021 1:27 PM
11	I stayed at the Shattuck plaza hotel - checked the MSRI rate and found the day I asked the hotel did better!	11/22/2021 1:04 PM

Blackwell Tapia Conference

November 18, 2021 – November 20, 2021

MSRI, Berkeley, CA, USA

Organizers:

David Banks (Duke University)

Hélène Barcelo (MSRI - Mathematical Sciences Research Institute)

Lloyd Douglas (UNC Greensboro)

Robert Megginson (University of Michigan)

Mariel Vazquez (University of California, Davis)

Ulrica Wilson (Morehouse College; Institute for Computational and Experimental Research in Mathematics (ICERM))

REPORT ON THE MSRI WORKSHOP
Blackwell-Tapia Conference 2021
November 18 – 20, 2021

Organizers

- David Banks (Duke University)
- Hélène Barcelo (MSRI - Mathematical Sciences Research Institute)
- Lloyd Douglas (UNC Greensboro)
- Robert Megginson (University of Michigan)
- Mariel Vazquez (University of California, Davis)
- Ulrica Wilson (Morehouse College; Institute for Computational and Experimental Research in Mathematics (ICERM)

Scientific Description

Held biennially, the Blackwell-Tapia Conference honors David Blackwell, the first African-American member of the National Academy of Science, and Richard Tapia, 2010 recipient of the National Medal of Science. These two seminal figures inspired a generation of African-American, Native American, and Latinx students to pursue careers in mathematics. The Blackwell-Tapia Prize recognizes a mathematician who has contributed significantly to research in his or her area of expertise, served as a role model for mathematical scientists from underrepresented minority groups, and contributed in other significant ways to addressing the problem of underrepresentation of minorities in mathematics.

The 2021 Blackwell-Tapia Conference (rescheduled from fall 2020), celebrated prize recipient Tatiana Toro (University of Washington), who had recently been announced as the next Director of MSRI effective August 2022. The conference was held simultaneously at four locations nationwide as well as online. The Mathematical Sciences Research Institute (MSRI, Berkeley) served as the primary hub, with the Institute for Advanced Studies (IAS, Princeton), the Institute for Mathematical and Statistical Innovation (iMSi, Chicago), and the Institute for Pure and Applied Mathematics (IPAM, Los Angeles) serving as satellite sites. Researchers had the choice to attend the conference in person at any of the satellite locations or virtually. Each institute had in-person speakers as well as a representative of the MSIDI team present to facilitate networking activities.

The conference drew more than 140 participants, approximately 38 of whom were online. 43% of participants were women, 21% were Hispanic/Latinx, and 22% were Black.

Highlights of the Workshop

The 2-day workshop kicked off with a spectacular lecture/performance given by Stephon Alexander (Brown University) on the *Jazz of Spheres.* Prof. Alexander is a distinguished physicist and jazz saxophonist who wrote the 2016 book *The Jazz of Physics*.

Among the many awards he has received are the National Geographic Emerging Explorers' Award (2006); an NSF Career Award (2008); the AAAS John Wesley Powell Memorial Award (2010); and the American Physical Society's (APS) E. Bouchet Award (2013).

The following day began with Richard Tapia's talk on the remarkable “journey of the isoperimetric problem” given at MSRI. It was followed by additional research talks given by Carrie Diaz Eaton (at the IAS), Wilfrid Gangbo (MSRI), Federico Ardila (MSRI) and ended with a powerful talk by Jacqueline Hughes-Oliver on the life and work of David Blackwell given from iMSi. The second day was equally captivating, beginning with an online talk by Chelsea Walton on the Frobenius Algebras Galore. The day ended with a conversation between Tatiana Toro (at MSRI), this year’s Blackwell-Tapia Prize recipient, and Carlos Kenig (at iMSi), who had just delivered a talk on the significance of Toro’s work. Attendees very much enjoyed this charming conversation between two colleagues whose friendship and mentoring relationship began decades ago when Toro was a postdoctoral fellow at the University of Chicago.

The final discussion was followed by various activities across the satellite institutes. MSRI hosted a banquet for attendees at the nearby David Brower Center. As MSRI sits on the territory of xučyun (Huichin), the ancestral and unceded land of the Chochenyo speaking Ohlone people, the 10-course feast was prepared and presented by two notable Ohlone chefs using indigenous ingredients and methods.

All talks and activities may be found on the conference website.

Testimonials

Below is a selection of testimonials from the 2021 Blackwell-Tapia Conference exit survey.

> “I loved being in a space with so many mathematicians of color and seeing them share their amazing work. It made me feel like I can exist in math.”
>
> “The format worked really well [...] It'd be a good format even after COVID concerns die down. In particular, having portions hosted at multiple sites across the country will allow for more student participation and others who have travel support limitations.”
>
> “Getting to talk to other people about math and attend the assortment of talks was very enjoyable. In particular, the talk about David Blackwell was both inspiring and informative. In general, the talks were excellent and I am very glad to have attended.”
>
> “I enjoyed the conference and will attend again in the future. It is a terrific way to learn about the research of underrepresented groups of colleagues.”

Organizers		
First Name	**Last Name**	**Institution**
David	Banks	Duke University
Hélène	Barcelo	MSRI - Mathematical Sciences Research Institute
Lloyd	Douglas	
Robert	Megginson	University of Michigan
Mariel	Vazquez	University of California, Davis
Ulrica	Wilson	Morehouse College
Speakers		
First Name	**Last Name**	**Institution**
Stephon	Alexander	Brown University
Federico	Ardila	San Francisco State University
Carrie	Diaz Eaton	Bates College
David	Eisenbud	MSRI - Mathematical Sciences Research Institute
Wilfrid	Gangbo	University of California, Los Angeles
Jacqueline	Hughes-Oliver	North Carolina State University
Carlos	Kenig	University of Chicago
Omayra	Ortega	Sonoma State University
Juanita	Pinzón Caicedo	University of Notre Dame
Aaron	Pollack	University of California, San Diego
Richard	Tapia	Rice University
Tatiana	Toro	University of Washington
Chelsea	Walton	Rice University

Mathematical Sciences Research Institute

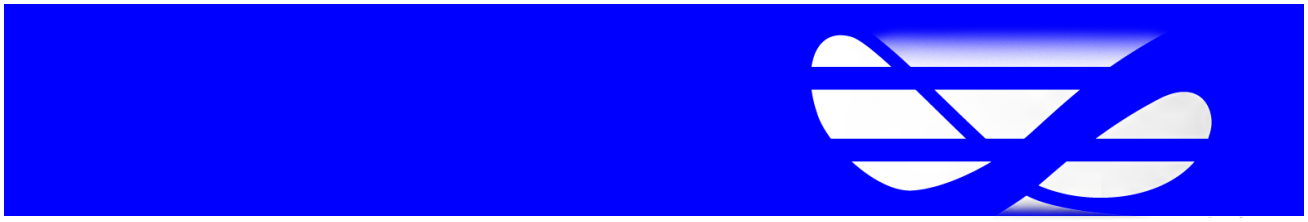
Blackwell-Tapia Conference

November 18 - 20, 2021

Thursday, November 18, 2021			
07:00 PM - 08:00 PM	David Brower Center	Stephon Alexander	The Jazz of the Spheres

Friday, November 19, 2021			
08:00 AM - 08:15 AM	Simons Auditorium	David Eisenbud & Richard Tapia	Welcome
08:15 AM - 09:05 AM	Simons Auditorium	Richard Tapia	The Remarkable Journey of the Isoperimetric Problem: a Completion of Euler's Approach
09:10 AM - 10:00 AM	Simons Auditorium	Carrie Diaz Eaton	Who Are We Centering in This?: Examining the Language of Equity and Inclusion in STEM Education Policy
10:05 AM - 11:05 AM	Atrium & Commons		Networking Activity
11:05 AM - 11:55 AM	Simons Auditorium	Wilfrid Gangbo	A Minimization Problem Involving a Polyconvex Integrand; an H1- Projection Problem
12:00 PM - 12:50 PM	Simons Auditorium	Federico Ardila	A Tale of Two Polytopes: the Bipermutahedron and the Harmonic Polytope
12:55 PM - 02:15 PM	Atrium & Decks		Lunch
02:15 PM - 03:05 PM	Simons Auditorium	Jacqueline Hughes-Oliver	On the Life and Work of David Blackwell
03:10 PM - 04:30 PM	Atrium & Commons		Networking Activity
04:30 PM - 06:00 PM	Atrium		Reception
05:00 PM - 06:30 PM			Dinner

Saturday, November 20, 2021			
08:00 AM - 08:50 AM	Simons Auditorium	Chelsea Walton	Frobenius Algebras Galore
08:55 AM - 09:45 AM	Simons Auditorium	Juanita Pinzón Caicedo	Instantons and Knot Concordance
09:50 AM - 10:50 AM	Atrium		Poster Session
10:50 AM - 11:40 AM	Simons Auditorium	Aaron Pollack	Modular Forms on Exceptional Groups
11:45 AM - 12:35 PM	Simons Auditorium	Omayra Ortega	Things that Used to be Strange Are Familiar Now: Reflections on the Inevitable Evolution of Pedagogy & Scholarship
12:40 PM - 01:50 PM	Atrium & Decks		Lunch
01:50 PM - 02:40 PM	Simons Auditorium	Carlos Kenig	On the Scientific Work of Tatiana Toro
02:45 PM - 03:35 PM	Simons Auditorium	Tatiana Toro	How to Describe a Domain in Euclidean Space
03:40 PM - 04:40 PM	Simons Auditorium	Carlos Kenig Tatiana Toro	A Conversation with Carlos Kenig and Tatiana Toro
05:30 PM - 06:15 PM	Atrium		Social Hour
06:15 PM - 08:30 PM	David Brower Center		Award Banquet



Participants		
First Name	**Last Name**	**Institution**
Ayomikun	Adeniran	Colby College
Jimmie	Adriazola	Bloomfield College
Stephon	Alexander	Brown University
Rachael	Alfant	Rice University
Ashley	Alfred	University of Texas
Areej	Alsafri	University of Toledo
Johnathan	Andres	University of Texas
Federico	Ardila	San Francisco State University
Rene	Ardila	Grand Valley State University
Caleb	Ashley	Boston College
Jayadev	Athreya	University of Washington
Angela	Avila	University of Texas
Bassam	Bamieh	University of California, Santa Barbara
David	Banks	Duke University
Selenne	Banuelos	California State University Channel Islands
Rodrigo	Bañuelos	Purdue University
Hélène	Barcelo	MSRI - Mathematical Sciences Research Institute
Ghanshyam	Bhatt	Tennessee State University
Marian	Bocea	National Science Foundation
Norman	Bookstein	Lawrence Berkeley Laboratory
Melkana	Brakalova	Fordham University
Ron	Buckmire	Occidental College
Ivan Mauricio	Burbano Aldana	University of California, Berkeley
Jan Tracy	Camacho	San Francisco State University
Naiomi	Cameron	Spelman College
Fei	Cao	Arizona State University
Jamylle	Carter	Diablo Valley college
Bem	Cayco	San Jose State University
Anastasia	Chavez	University of California, Davis
Yuguo	Chen	University of Illinois at Urbana-Champaign
Tamara	Christiani	University of California, Davis
Montse	Cordero	San Francisco State University
Kevin	Corlette	University of Chicago
Alvaro	Cornejo	San Francisco State University
marieMarie	Dahleh	Tulane University
Donatella	Danielli	Arizona State University
Percy	Deift	New York University, Courant Institute
Carrie	Diaz Eaton	Bates College
Alexander	Diaz-Lopez	Villanova University
Wandi	Ding	Middle Tennessee State University
Shanna	Dobson	University of California, Riverside
Hongjie	Dong	Brown University
Lloyd	Douglas	
Kossi	Edoh	North Carolina Agricultural and Technical State University
David	Eisenbud	MSRI - Mathematical Sciences Research Institute
Robert	Feinberg	NSA - National Security Agency
Dana	Ferranti	Tulane University
Andy	Fry	Pacific University
Wilfrid	Gangbo	University of California, Los Angeles
Raul	Garcia	Rice University
Mathilde	Gerbelli-Gauthier	Institute for Advanced Study
Alison	Gilbert	San Francisco State University
Edray	Goins	Pomona College
Nicolle	Gonzalez	University of California, Los Angeles
Helen	Grundman	Bryn Mawr College
Sean	Guidry Stanteen	University of Texas
Kevin	Harris	University of Texas
Brendan	Hassett	Brown University
Willy	Hereman	Colorado School of Mines
Jacqueline	Hughes-Oliver	North Carolina State University
Ron	Irving	University of Washington
Quindel	Jones	Virginia Commonwealth University
Vincent	Jones	Northwestern University
Dagan	Karp	Harvey Mudd College
Arshdeep	Kaur	University of California, Berkeley
Carlos	Kenig	University of Chicago
Lily	Khadjavi	Loyola Marymount University
Hana Jia	Kong	Institute for Advanced Study
Jeongsu	Kyeong	Temple University
Therese	Landry	University of California, Riverside
Addie	Ledbetter	Converse University

Participants		
First Name	**Last Name**	**Institution**
Emma	Lennen	University of Pennsylvania
Feynman	Liang	University of California, Berkeley
Chitaranjan	Mahapatra	University of California, San Francisco
Kishore	Marathe	Brooklyn College, CUNY
Leonardo	Marazzi	Rutgers University
Jonathan	Mattingly	Duke University
Reginald	McGee	College of the Holy Cross
Ken	McLaughlin	Colorado State University
Robert	Megginson	University of Michigan
Fabio	Milner	Arizona State University
Anastasiia	Minenkova	University of Mississippi
Gabriel	Montoya-Vega	George Washington University
Jean Pierre	Mutanguha	Institute for Advanced Study
Asamoah	Nkwanta	Morgan State University
Lauren	Nowak	San Francisco State University
Sylvia	Nwakanma	San Francisco State University
Sydney	Nwakanma	San Francisco State University
Pablo	Ocal	University of California, Los Angeles
Melkior	Ornik	University of Illinois Urbana-Champaign
Omayra	Ortega	Sonoma State University
Mayra	Ortiz Galarza	University of Texas Rio Grande Valley
Jose	Palacio	Rice University
Gyujin	Park	Georgia Institute of Technology
Juanita	Pinzón Caicedo	University of Notre Dame
Daniel	Pollack	University of Washington
Aaron	Pollack	University of California, San Diego
Joan	Ponce	Purdue University
Amy	Prager	Cornell University
Jessica	Radford	Temple University
Aswin	Rangasamy Venkatesan	San Francisco State University
Christian	Ratsch	University of California, Los Angeles
John	Rock	California State Polytechnic University, Pomona
Keri	Sather-Wagstaff	Clemson University
Jennifer	Schultens	University of California, Davis
Sherry	Scott	MSOE
David	Scott	Rice University
Josef	Sifuentes	University of Texas Rio Grande Valley
Anna	Sisk	University of Tennessee
Nathaniel	Slaman	
Mariana	Smit Vega Garcia	Western Washington University
Dorian	Smith	University of Minnesota
Stephanie	Somersille	Somersille Math Education Services
Idris	Stovall	Mathematical Sciences Institute (MSI)
Richard	Tapia	Rice University
Diane	Tchuindjo	University of Maryland
Morelle	Tchuindjo	University of Maryland
Tatiana	Toro	University of Washington
Olha	Trofymenko	Vasyl' Stus Donetsk National University
Bilyana	Tzolova	Rice University
Karen	Uhlenbeck	University of Texas, Austin
Victoria	Uribe	Arizona State University
John	Urschel	Institute for Advanced Study
Wencel	Valega-Mackenzie	University of Tennessee
Anthony	Várilly-Alvarado	Rice University
Mariel	Vazquez	University of California, Davis
Leticia	Velazquez	Rice University
Alejandro	Velez-Santiago	University of Puerto Rico
Cristina	Villalobos	University of Texas Rio Grande Valley
Andrés	Vindas Meléndez	University of California, Berkeley
Chelsea	Walton	Rice University
Talitha	Washington	Clark Atlanta University
Kimberly	Weems	North Carolina Central University
Dwight	Williams	Iowa State University
Ulrica	Wilson	Morehouse College
Robin	Wilson	California State Polytechnic University, Pomona
Christopher	Wu	College of Alameda
Tingting	Yang	University of Pennsylvania
Zihui	Zhao	University of Chicago
Alvis	Zhaodh	Rutgers University
Geigh	Zollicoffer	Georgia Institute of Technology

Officially Registered Participants' Information

Participants		141

Gender		141
Male	53.90%	76
Female	43.26%	61
Other	0.71%	1
Declined to state	2.13%	3

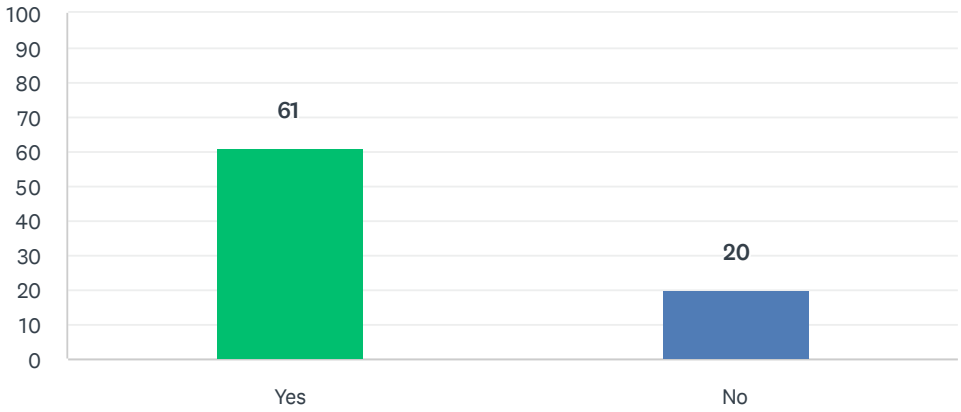
Ethnicity*		174
White	28.74%	50
Asian	12.64%	22
Hispanic	20.69%	36
Pacific Islander	0.57%	1
Black	21.84%	38
Native American	1.72%	3
Mixed	9.20%	16
Declined to state	4.60%	8

* ethnicity specifications are not exclusive

There were 4 unidetifiable participants.

Q1 Was this your first time attending the Blackwell-Tapia Conference?

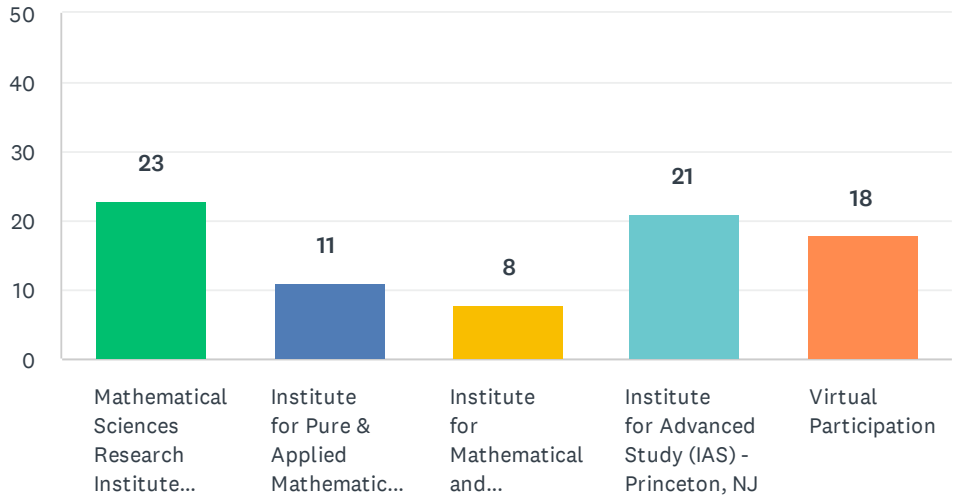
Answered: 81 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	75.31%	61
No	24.69%	20
TOTAL		81

Q2 Where did you attend?

Answered: 81 Skipped: 0



ANSWER CHOICES	RESPONSES	
Mathematical Sciences Research Institute (MSRI) - Berkeley, CA	28.40%	23
Institute for Pure & Applied Mathematics (IPAM) - Los Angeles, CA	13.58%	11
Institute for Mathematical and Statistical Innovation (IMSI) - Chicago, IL	9.88%	8
Institute for Advanced Study (IAS) - Princeton, NJ	25.93%	21
Virtual Participation	22.22%	18
TOTAL		81

Q3 This was the first conference held simultaneously at four institutes. Please provide your feedback on this format, including any suggestions for improvement.

Answered: 81 Skipped: 0

#	RESPONSES	DATE
1	It was sometimes hard to engage with the virtual streamed sessions.	1/16/2022 6:00 PM
2	It was a good format that allowed more speakers to participate.	12/15/2021 4:31 PM
3	I was happy with how the format for this conference worked.	12/8/2021 4:52 PM
4	I really liked it	12/6/2021 8:46 AM
5	I think this was a wonderful idea given the circumstances of a pandemic that is still in an issue. Of course, it's not ideal in general.	12/5/2021 3:12 PM
6	excellent	12/4/2021 7:39 PM
7	Maybe slides could be shared separately from the speak view on zoom!	12/4/2021 9:08 AM
8	Not enough talks at IAS	12/4/2021 9:03 AM
9	It would be great if funding is provided to the international students and researchers to come to the conference and learn things in-person.	12/3/2021 11:15 PM
10	I think the virtual format worked really well. This should definitely be kept.	12/3/2021 7:57 PM
11	I think it worked just fine.	12/3/2021 4:08 PM
12	I would have appreciated more in-person lectures at my institute.	12/3/2021 4:05 PM
13	It was very great and nice that the organizers came up with the idea	12/3/2021 3:37 PM
14	I thought it was such a wonderful event. To have all institutes participating at once. I really recommend continuing events like these, for those of us that cannot travel very far. It was nice to feel so locally connected and globally all at the same time :).	12/3/2021 3:23 PM
15	Very good	12/3/2021 2:01 PM
16	The truth is that it didn't really compare to the Blackwell-Tapia conferences where everyone was in the same location. For math research workshops I find this less important personally, but for a conference like this where a lot of personal mentoring takes place, I think the in-person component is key.	12/3/2021 1:55 PM
17	I don't have any critical suggestions for improvement. But perhaps one can get better visuals. For example, it would have been nice to have a camera on both the speaker and the person asking questions.	12/3/2021 1:18 PM
18	I think the option made attending the event much more accessible.	12/3/2021 1:17 PM
19	I thought it was done very conveniently	12/3/2021 1:12 PM
20	The one drawback of having attendees at different institutes is the lack of interactions between the groups. However, I don't know if there's a remedy for that.	12/2/2021 6:49 AM
21	The format when without many hitches. The only issue is that having the conference in four places made it really small in each place. Consequently, there was a much lower possibility of finding mathematicians with similar research interests. I found none.	11/30/2021 11:50 AM
22	This was a nice way to stay Covid-safe. Although as a speaker, I wasn't always sure of where I should be looking. Aside from this, I thought this was very well done.	11/29/2021 5:56 PM
23	I appreciated the interaction at my home site--the (smaller) size may have played a role. It	11/29/2021 12:38 PM

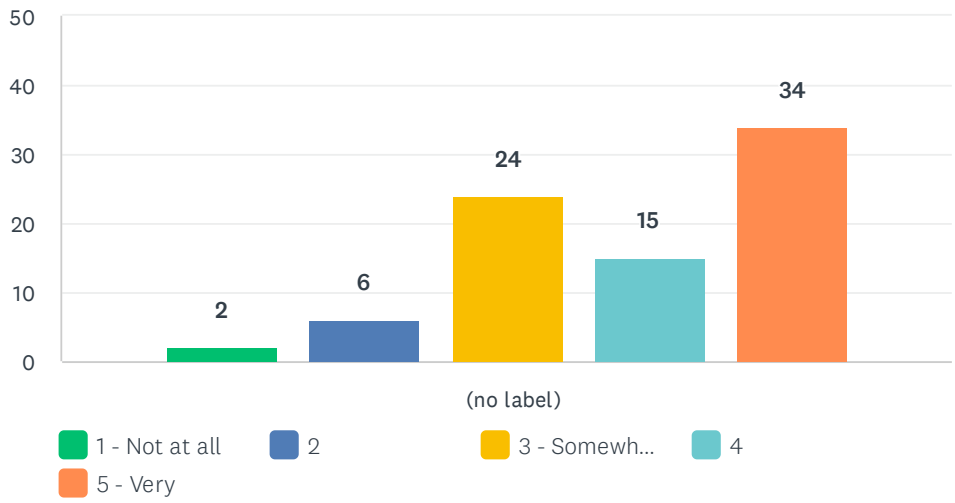
	would have been nice to have a participant list or a time to interact with those at other sites. Sometimes conferences are designated social times that replace phone calls, emails, messages.	
24	It was a great effort to allow some face-to-face interactions. However, my wish is that future conferences will go back to being held in a single location, to facilitate more interactions.	11/29/2021 11:57 AM
25	Creating more room for social interactions across different institutes.	11/29/2021 8:49 AM
26	I think that the conference was very well coordinated between the institutes and I really enjoyed how convenient it was in terms of traveling to a location. My only drawback is the inability to connect with other participants/speakers at different locations.	11/29/2021 6:58 AM
27	Great work.	11/28/2021 10:18 PM
28	.	11/27/2021 5:51 PM
29	The only thing I can suggest is the timing of getting back on the room. The attendees seemed to be confused when how quickly the next talks would occur.	11/27/2021 2:54 PM
30	I thought it worked well, though limited networking.	11/26/2021 7:15 AM
31	I thought it went great	11/26/2021 7:11 AM
32	It was perfect. Thank you.	11/25/2021 10:19 AM
33	It worked reasonably well, but in person interactions and talks are preferable	11/24/2021 3:09 PM
34	While the the conference was well organized, especially given the coordination required to host at four locations, I think it would be better if there were only one location. This would allow for all talks to be in-person and for more interaction among attendees.	11/24/2021 8:13 AM
35	It was a great idea to host it in four different locations. The only disadvantage is that we cannot interact directly with many of the attendees, as well as speakers, if they are at another institute.	11/24/2021 6:01 AM
36	This ran very smoothly. I appreciate the effort to promote small groups and social distancing during the pandemic.	11/24/2021 5:53 AM
37	I prefer when the conferences were held at one location. So much of the community building happens in the informal chats between talks when many people are gathered together in one location.	11/23/2021 8:57 PM
38	It would have been better if there were more time between talks.	11/23/2021 8:14 PM
39	It worked surprisingly well, I thought.	11/23/2021 5:59 PM
40	None. I participated virtually.	11/23/2021 4:36 PM
41	I love the format. The online part made things convenient and the in-person part provided real person interactions. It was very nice.	11/23/2021 3:07 PM
42	Worked very well from the perspective of a virtual attendee.	11/23/2021 3:01 PM
43	Didn’t like the impersonal aspects of the conference; most speakers were streamed.	11/23/2021 2:57 PM
44	It semed fine.	11/23/2021 2:45 PM
45	I thought it worked well for being the first time.	11/23/2021 2:08 PM
46	I think it worked really well.	11/23/2021 2:02 PM
47	I liked the format. Having a smaller group at a site allowed for more interaction.	11/23/2021 1:44 PM
48	I think technically it went well. Regarding low attendance at some of the institutes I am not sure how this affected the level of engagement of the participants.	11/23/2021 1:44 PM
49	.	11/23/2021 1:21 PM
50	N/A	11/23/2021 1:11 PM
51	Looks great. 11am - 5,6pm daily meeting could be extended from 11 am - 7, 8 pm	11/23/2021 12:52 PM

52	I thought the format worked really well, but under normal circumstance I would have appreciated the opportunity to interact with faculty and students from other geographic locations.	11/23/2021 12:49 PM
53	I think in general it worked well.	11/23/2021 12:49 PM
54	I was very happy to attend the Conference. It was very interesting convenient format. Thank you for your work!	11/23/2021 12:39 PM
55	It would be better to hold the conference at a single site, with remote participants accommodated via Zoom.	11/23/2021 12:34 PM
56	it was nice to be able to participate at all. but the idea of conferences only being virtual seems like a loss if the pandemic effect swings that way. (as far as expanding assess, I think virtual conferences can be used well. this platform seemed to be a statement that the institutes supported the conference, I think this is meaningful.) but as a virtual participant I was jealous of participants who were able to congregate and interact elbow to elbow.	11/23/2021 12:23 PM
57	The conference ran smoothly. The staff was very friendly and effective.	11/23/2021 11:55 AM
58	I think it worked great! I liked the small audience at my location meant I was able to get to know people a little better while we felt part of something bigger.	11/23/2021 11:55 AM
59	This was unique experience. The format was great based on the situation but otherwise the regular method is better as there is more interaction there with the participants.	11/23/2021 11:54 AM
60	The format worked really well, given the circumstances. It'd be a good format even after COVID concerns die down. In particular, having portions hosted at multiple sites across the country will allow for more student participation and others who have travel support limitations. It was nice to have a chunk of the participants at IPAM to meet with in person, network, and get to know.	11/23/2021 11:53 AM
61	Great format. It allows participants from different regions to connect and share ideas.	11/23/2021 11:51 AM
62	I think it went very well.	11/23/2021 11:42 AM
63	I really liked the virtual satellite format. The technology worked well -- we could interact with the speakers as though they were actually in the room. I appreciated being able to attend the conference by only driving 60 minutes away from home.	11/23/2021 11:36 AM
64	N/A	11/23/2021 11:32 AM
65	The lack of networking for virtual participants was unfortunate.	11/23/2021 11:31 AM
66	Very exciting to be able to be so many distinct places having a joint conference. The format was excellent as the timing of certain events was spot on with the locations time frame.	11/23/2021 11:28 AM
67	While the format provided the oppurtunity to interact with everyone in a more relaxed setting, I believe this can still be achieved if the conference was held in one location.	11/23/2021 11:28 AM
68	I feel that I was not able to benefit from the conference as much as if it had been in only one location.	11/23/2021 11:28 AM
69	I think the format is good. Although I think the number of participants at each four institutes should be roughly the same. From my experience, the number of participants at IPAM was lesser than the number of participants at the other three institutes.	11/23/2021 11:26 AM
70	It seemed to work well and I don't think we really experienced any technical issues watching the talks.	11/23/2021 11:25 AM
71	Honestly, I think the organization of the conference was really great. There were minimal technology issues considering the number of locations involved.	11/23/2021 11:24 AM
72	Impressive format. The setup in the lecture hall featured two large screens of the speaker and overhead material. A compelling layout.	11/23/2021 11:24 AM
73	It worked great. Hopefully more speakers at other locations	11/23/2021 11:23 AM
74	This is a wonderful format because it may possible the participation of many more people from different geographic regions. The technology could be improved, for example we could not see	11/23/2021 11:19 AM

	the participants from the different sites on the major screen, it would be nice to have some opportunities for interactions.	
75	It worked remarkably well!	11/23/2021 11:19 AM
76	I thought this was a great format which allowed for a small group at four different location	11/23/2021 11:19 AM
77	none	11/23/2021 11:19 AM
78	This was good and the most effective way to organize a conference during the pandemic. Moreover, participants from various institutions need not travel a long distance to attend the conference.	11/23/2021 11:17 AM
79	Maybe some feedback from attendees re: what speakers they are interested in hearing from? I thought the format was good	11/23/2021 11:16 AM
80	Great!! Except possibly more interaction	11/23/2021 11:15 AM
81	MSRI	11/23/2021 11:14 AM

Q4 This format was partially dictated by the constraints of the pandemic. We also wish to remain mindful of our carbon footprint. How interested would you be in future workshops held across multiple institutes?

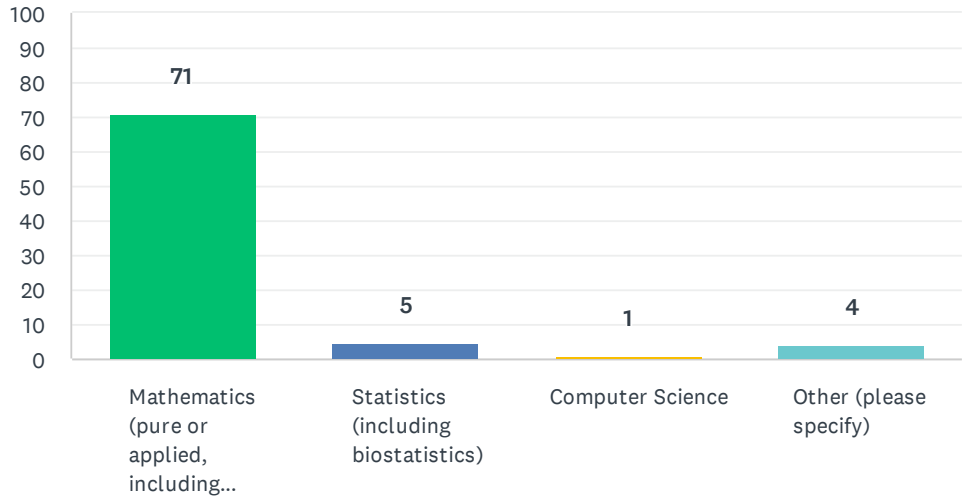
Answered: 81 Skipped: 0



	1 - NOT AT ALL	2	3 - SOMEWHAT	4	5 - VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.47% 2	7.41% 6	29.63% 24	18.52% 15	41.98% 34	81	3.90

Q5 What is your primary field or discipline? (choose one)

Answered: 81 Skipped: 0

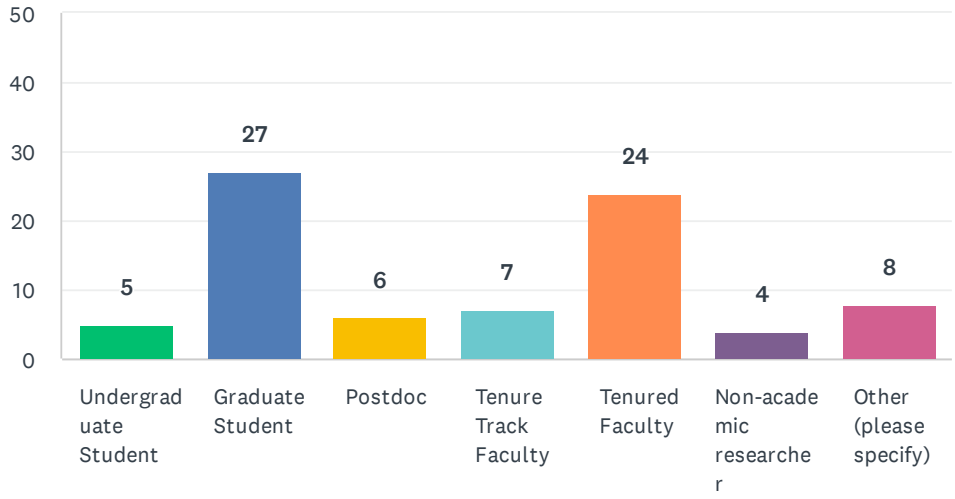


ANSWER CHOICES	RESPONSES	
Mathematics (pure or applied, including biomath)	87.65%	71
Statistics (including biostatistics)	6.17%	5
Computer Science	1.23%	1
Other (please specify)	4.94%	4
TOTAL		81

#	OTHER (PLEASE SPECIFY)	DATE
1	Theoretical Physics (String theory, Quantum Field Theory, 2D Quantum Gravity)	12/3/2021 11:15 PM
2	Youth development	11/23/2021 2:57 PM
3	Math Education and Teacher Preparation	11/23/2021 11:51 AM
4	Biology	11/23/2021 11:28 AM

Q6 Your status or position at the time of the conference:

Answered: 81 Skipped: 0

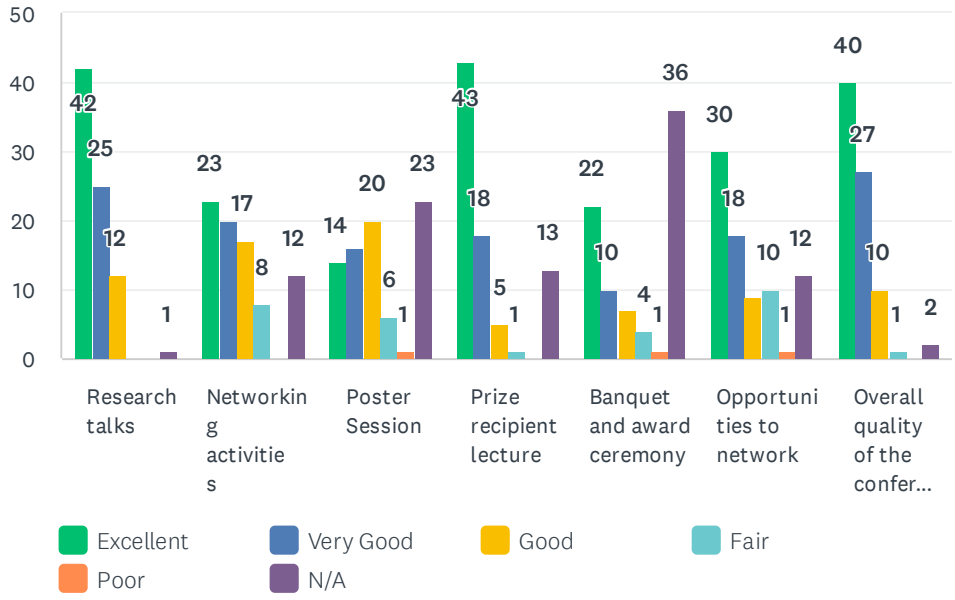


ANSWER CHOICES	RESPONSES	
Undergraduate Student	6.17%	5
Graduate Student	33.33%	27
Postdoc	7.41%	6
Tenure Track Faculty	8.64%	7
Tenured Faculty	29.63%	24
Non-academic researcher	4.94%	4
Other (please specify)	9.88%	8
TOTAL		81

#	OTHER (PLEASE SPECIFY)	DATE
1	RN - Math Degree	1/16/2022 6:00 PM
2	Professor emeritus	11/23/2021 5:59 PM
3	retiired	11/23/2021 4:36 PM
4	Retired	11/23/2021 2:57 PM
5	Emeritus professor	11/23/2021 2:45 PM
6	Assistant professor	11/23/2021 12:39 PM
7	Research professor & professor emeritus	11/23/2021 11:31 AM
8	teaching faculty and administrator	11/23/2021 11:19 AM

Q7 How would you rate the following features of the 2021 Blackwell-Tapia Conference? (if you did not attend the session, please select N/A)

Answered: 80 Skipped: 1



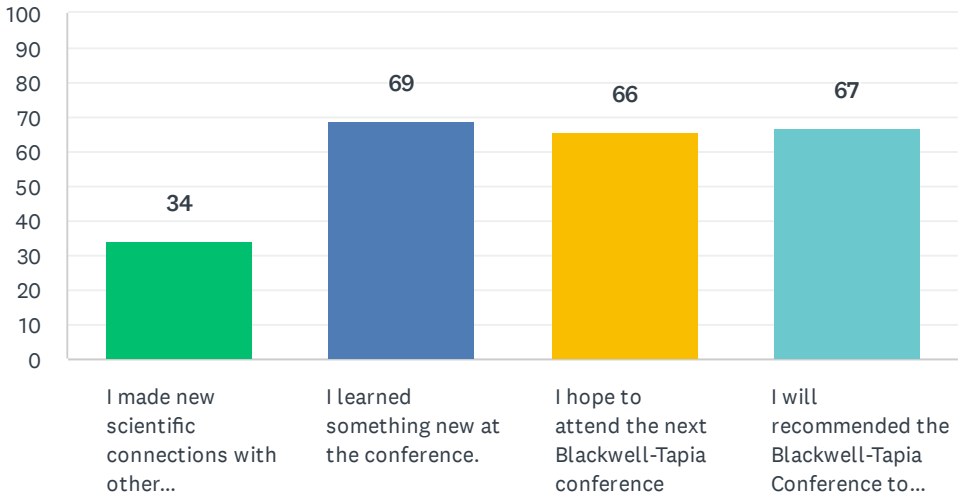
	EXCELLENT	VERY GOOD	GOOD	FAIR	POOR	N/A	TOTAL
Research talks	52.50% 42	31.25% 25	15.00% 12	0.00% 0	0.00% 0	1.25% 1	80
Networking activities	28.75% 23	25.00% 20	21.25% 17	10.00% 8	0.00% 0	15.00% 12	80
Poster Session	17.50% 14	20.00% 16	25.00% 20	7.50% 6	1.25% 1	28.75% 23	80
Prize recipient lecture	53.75% 43	22.50% 18	6.25% 5	1.25% 1	0.00% 0	16.25% 13	80
Banquet and award ceremony	27.50% 22	12.50% 10	8.75% 7	5.00% 4	1.25% 1	45.00% 36	80
Opportunities to network	37.50% 30	22.50% 18	11.25% 9	12.50% 10	1.25% 1	15.00% 12	80
Overall quality of the conference	50.00% 40	33.75% 27	12.50% 10	1.25% 1	0.00% 0	2.50% 2	80

#	COMMENTS:	DATE
1	At the IAS there was a conflict with Dr Ardila's lecture and poster session set up. This made me sad.	12/6/2021 8:48 AM
2	I believe that the underrepresentation of domestic Black and Brown students is a vital issue facing the country and discipline. It seems that this underrepresentation extends to the conference speakers as well. I know that there are high quality domestic mathematicians that could speak and I would encourage the program committee to consider such diversity amongst speakers.	12/5/2021 3:15 PM
3	While most of the speakers did a great job motivating their research, a couple of the talks were	12/2/2021 6:51 AM

	hard to follow.	
4	Poster session somehow seemed shorter than desired. I think the bus constraints made the award ceremony feel rushed, but that was a logistical mountain I imagine.	11/29/2021 12:40 PM
5	The number of people at MSRI seemed like a great amount to network with. But that could be a difficult thing for the other institutions if they don't have as large of a turnout.	11/27/2021 2:55 PM
6	Would be great if research talks could include more applied and computational mathematics, as well as mathematics for machine learning.	11/24/2021 8:14 AM
7	I attended only the Kenig talk, Toro talk, and Toro-Kenig conversation. Well done.	11/23/2021 6:00 PM
8	There were few posters.	11/23/2021 1:45 PM
9	This was a very good conference, considering the constraints from COVID-19 and the different locations.	11/23/2021 12:54 PM
10	The banquet was underwhelming - a shame given the award recipient and her contributions to the Institutes and MSRI in particular.	11/23/2021 12:37 PM
11	None	11/23/2021 11:54 AM
12	Great work, I look forward to the next one!	11/23/2021 11:54 AM
13	I felt the banquet was cut too short. I appreciate the use off a indigenous catering group.	11/23/2021 11:30 AM
14	Excellent conference!	11/23/2021 11:29 AM
15	Continue holding such creative conferences and make sure that more diverse groups are participating.	11/23/2021 11:20 AM

Q8 Check all the statements that you agree with:

Answered: 78 Skipped: 3

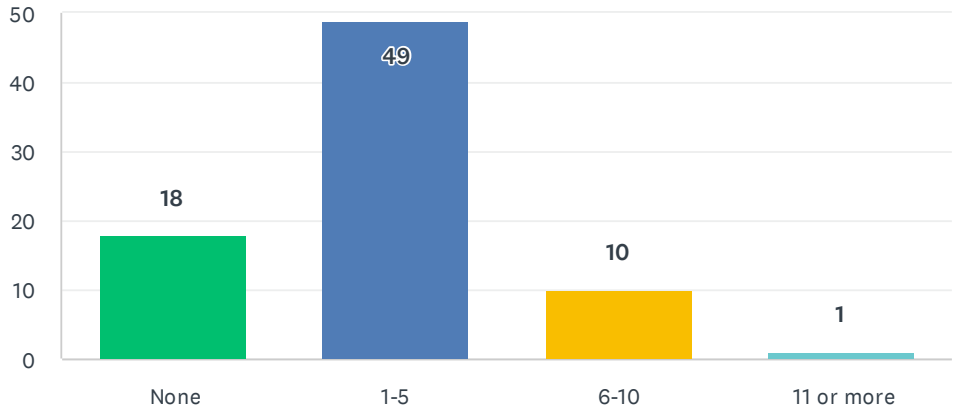


ANSWER CHOICES	RESPONSES	
I made new scientific connections with other participants that may lead to collaborations or other opportunities.	43.59%	34
I learned something new at the conference.	88.46%	69
I hope to attend the next Blackwell-Tapia conference	84.62%	66
I will recommended the Blackwell-Tapia Conference to others.	85.90%	67
Total Respondents: 78		

#	COMMENTS	DATE
1	I want to be at every Blackwell-Tapia conference and engaged!	11/29/2021 12:43 PM
2	I would base my recommendation on previous conferences.	11/23/2021 11:35 AM

Q9 How many new connections did you make during this conference?

Answered: 78 Skipped: 3

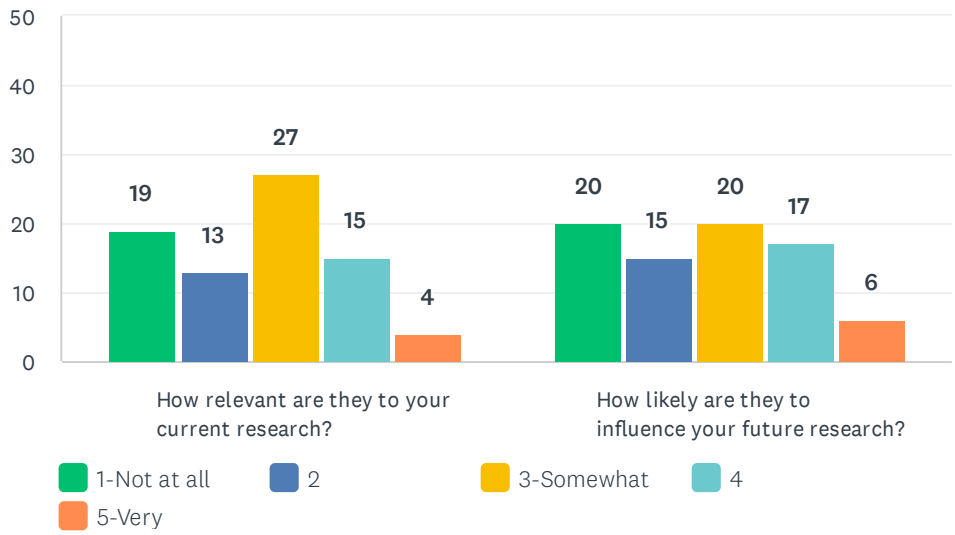


ANSWER CHOICES	RESPONSES	
None	23.08%	18
1-5	62.82%	49
6-10	12.82%	10
11 or more	1.28%	1
TOTAL		78

#	COMMENTS	DATE
1	I connected with a few people, but nothing that would lead to a significant project in the near term.	12/4/2021 9:13 AM
2	And a lot of re-connections!	11/29/2021 12:43 PM
3	To be fair, I attended as undergraduate student and this conference is more tailored towards graduate students and post docs, so for me, I was more focused about getting exposure to higher level mathematics which I was able to do.	11/29/2021 7:01 AM
4	It is good to see someone who comes from the same University as me.	11/23/2021 11:30 AM

Q10 On a scale of 1 to 5, please answer the following questions concerning the CONNECTIONS that you made during the Blackwell-Tapia Conference:

Answered: 78 Skipped: 3



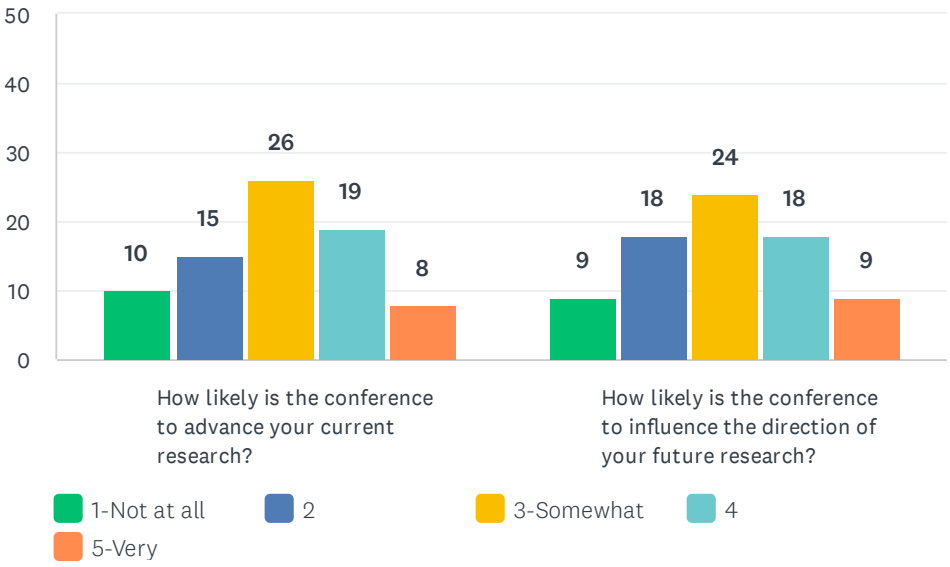
	1-NOT AT ALL	2	3-SOMEWHAT	4	5-VERY	TOTAL	WEIGHTED AVERAGE
How relevant are they to your current research?	24.36% 19	16.67% 13	34.62% 27	19.23% 15	5.13% 4	78	2.64
How likely are they to influence your future research?	25.64% 20	19.23% 15	25.64% 20	21.79% 17	7.69% 6	78	2.67

#	COMMENTS	DATE
1	Met someone who knew about H^p spaces where p is space-dependent (surprising). I spoke with someone else about their analysis of Fredholm equations in elasticity. I worked on these in the context of scattering for a side project once; nice to know there's some low-hanging fruit in elasticity in terms of numerics.	12/4/2021 9:13 AM
2	I can't really answer this since I participated virtually.	12/3/2021 1:20 PM
3	See comment from question 10	11/29/2021 7:01 AM
4	this question should only be required if the correct option was selected in q8	11/26/2021 7:13 AM
5	The focus should not be on research connections since this was not a field specific conference.	11/24/2021 3:11 PM
6	Math is not my discipline; attended with a friend.	11/23/2021 2:59 PM
7	Hard to know what my future research will be. If I stay in my area, then not at all likely.	11/23/2021 2:07 PM
8	I made new contacts and hence have already assisted them in their next career move by putting them in contact with others.	11/23/2021 1:47 PM
9	This question should not require answers as phrased.	11/23/2021 11:35 AM
10	did not make connections	11/23/2021 11:33 AM
11	I am doing probability & stochastic processes, so a lot of talks on algebra and geometry are	11/23/2021 11:30 AM

	not my type. The poster session on applications of machine learning interests me the most.	
12	The connections were not exactly in my research field.	11/23/2021 11:24 AM

Q11 On a scale of 1 to 5, please answer the following questions concerning the KNOWLEDGE you gained during the Blackwell-Tapia Conference:

Answered: 78 Skipped: 3



	1-NOT AT ALL	2	3-SOMEWHAT	4	5-VERY	TOTAL	WEIGHTED AVERAGE
How likely is the conference to advance your current research?	12.82% 10	19.23% 15	33.33% 26	24.36% 19	10.26% 8	78	3.00
How likely is the conference to influence the direction of your future research?	11.54% 9	23.08% 18	30.77% 24	23.08% 18	11.54% 9	78	3.00

#	COMMENTS	DATE
1	The talks that stood out to me were Tatiana's, Gangbo's, and the talk about Froebenius algebras. Strongly motivated to continue studying variational problems and geometric measure theory, optimal transport, etc. I also work with integrable systems in applied settings, and now I really want to know more about Froebenius algebras because of how broad their applications are.	12/4/2021 9:13 AM
2	Talks were not in my area. But they were interesting.	12/3/2021 1:20 PM
3	there weren't really any applied mathematicians there. I assumed that the research theme followed the research of the award recipient and that was why the majority of the talks were in Pure Mathematics	11/29/2021 5:58 PM
4	this question should only be required if the correct option was selected in q8	11/26/2021 7:13 AM
5	This was my first time visiting IMSI, so I look forward to learning about future programs that will advance my research. I greatly enjoyed the excellent talks. However, one suggestion is to have more variety among subdisciplines. For instance, I would have appreciated a statistics research talk.	11/24/2021 6:04 AM
6	Hard to know what my future research will be. If I stay in my area, then not at all likely.	11/23/2021 2:07 PM
7	None	11/23/2021 12:56 PM
8	I gained some knowledge/understanding of diverse research fields through the keynote talks	11/23/2021 11:24 AM

	(which were great) and some of the topics that were discussed have the potential to influence my research.	

Q12 If applicable, please provide feedback on the hotel accommodations and transportation provided.

Answered: 31 Skipped: 50

#	RESPONSES	DATE
1	The hotel was not walkable to many things including the conference and food.	1/16/2022 6:02 PM
2	I wish there was a shuttle from the hotel to the IAS provided. The hotel in general was good.	12/8/2021 4:57 PM
3	Both were good	12/5/2021 3:18 PM
4	hotel accommodations were excellent!	12/4/2021 9:17 AM
5	They were fine.	12/3/2021 4:11 PM
6	The hotel was very nice, but I wish they had had breakfast.	12/3/2021 4:06 PM
7	na	12/3/2021 1:20 PM
8	The hotel and IAS were far away from each other and Princeton doesn't have robust uber/lyft services. Consequently, it made traveling to and from the conference very expensive ($20-25 one way). A shuttle throughout the duration of the conference would have been immensely helpful.	11/30/2021 11:56 AM
9	The Double Tree itself was great. Great service, great accomodations, beautiful view. However the traffic on the single poorly maintained road to get to the hotel was terrible.	11/29/2021 6:00 PM
10	The hotel staff was very professional. The wifi seemed a bit sketchy (as usual with hotels)	11/27/2021 3:02 PM
11	Great	11/24/2021 8:19 AM
12	Excellent. Thanks for arranging transportation to the conference site from the hotel.	11/24/2021 6:31 AM
13	The hotel was a little far and there was no transportation to the conference	11/24/2021 6:07 AM
14	Hyatt Regency was not convenient to the conference site. It was not walker friendly; had to take a cab ride everywhere. Located off the hwy and no sidewalks. $45 on cabs daily.	11/23/2021 3:03 PM
15	Good.	11/23/2021 2:50 PM
16	Both were good. Clean hotel. Bus on time.	11/23/2021 1:54 PM
17	Was great	11/23/2021 1:00 PM
18	Excellent	11/23/2021 12:51 PM
19	The location was suboptimal - isolated from Berkeley and unpleasant to get to. The contrast with the property used for the Chern-Simons meeting is dramatic. MSRI staff (Traci Huang) did an excellent job supporting the participants.	11/23/2021 12:43 PM
20	Great hotel, and great transportation	11/23/2021 12:27 PM
21	Excellent	11/23/2021 11:56 AM
22	Excellent	11/23/2021 11:54 AM
23	Hotel accommodations & transportation were excellent	11/23/2021 11:35 AM
24	N/A	11/23/2021 11:34 AM
25	Excellent!	11/23/2021 11:33 AM
26	The hotel accommodations and transportation provided are both EXCELLENT!	11/23/2021 11:33 AM
27	Hotel and Transportation accommodations were good quality and time efficient.	11/23/2021 11:33 AM

28	Very nice hotel	11/23/2021 11:27 AM
29	no transportation from the Hyatt to IAS, I think some people struggled in securing it.	11/23/2021 11:26 AM
30	very good	11/23/2021 11:21 AM
31	Great	11/23/2021 11:16 AM

Q13 What aspect(s) of the Blackwell-Tapia Conference did you like the most?

Answered: 49 Skipped: 32

#	RESPONSES	DATE
1	I liked the talk the woman did on Mathematics education.	1/16/2022 6:02 PM
2	The people. Getting to talk to other people about math and attend the assortment of talks was very enjoyable. In particular, the talk about David Blackwell was both inspiring and informative. In general, the talks were excellent and I am very glad to have attended.	12/8/2021 4:57 PM
3	I think I got the most out of the poster session. Some professors made some very useful comments on my work.	12/6/2021 8:50 AM
4	The networking and venue	12/5/2021 3:18 PM
5	Being directly and indirectly exposed to the type of environment at NSF funded institutes. I want to apply to work at one after I finish my first post doc.	12/4/2021 9:17 AM
6	The opportunity to meet new people interested in diversity.	12/3/2021 4:11 PM
7	I liked the networking opportunities.	12/3/2021 4:06 PM
8	The IPAM staff was so helpful and curteous. I also liked being connected to 4 amazing institutes all at once. Please host more multi modal conferences :).	12/3/2021 3:24 PM
9	the banquet	12/3/2021 1:57 PM
10	I liked meeting mathematicians outside my main field of study.	12/3/2021 1:22 PM
11	na	12/3/2021 1:20 PM
12	I loved the intimate nature of it. Everyone seemed to care about each other. Even though I didn't network, it was nice to put names to faces that I always saw in an article or behind a zoom profile	12/3/2021 1:17 PM
13	N/A	11/30/2021 11:56 AM
14	This was my first in-person meeting and I felt very safe. I am glad that this was my introduction back into this format.	11/29/2021 6:00 PM
15	The new perspectives I gained from discussing with mathematicians of different cultures.	11/27/2021 3:02 PM
16	Was easy to meet people. Organization was good. Some talks were very engaging or of interest to me.	11/24/2021 8:19 AM
17	Collegiality among the participants. I was happy to see education included among the talks.	11/24/2021 6:31 AM
18	The opportunity to interact and work on areas other than math.	11/24/2021 6:07 AM
19	Award winner talk.	11/23/2021 9:00 PM
20	Virtual	11/23/2021 4:38 PM
21	The interview/conversation with Carlos Kenig and TatianaToro and the talks by Frederico Ardila, Jacqueline Hughes-Oliver, Tatiana Toro, and Richard Tapia.	11/23/2021 3:12 PM
22	Speakers and other attendees.	11/23/2021 3:03 PM
23	Everyting.	11/23/2021 2:50 PM
24	Getting to meet the students	11/23/2021 2:10 PM
25	Poster session, the presenters were friendly and patient with me.	11/23/2021 2:09 PM
26	few number of participants; networking; excellent talks that led the audience from introducing a	11/23/2021 1:54 PM

	field to more advanced topics in the field---keep this aspect. The staff were marvelous and attentive to needs of the participants.	
27	Jazz of Spheres	11/23/2021 1:13 PM
28	The different locations.	11/23/2021 1:00 PM
29	Networking opportunities, lectures by Kenig and Toro, and the following discussion.	11/23/2021 12:51 PM
30	Online organization, scientific level	11/23/2021 12:43 PM
31	Meeting the students and leaders in diversifying mathematics.	11/23/2021 12:43 PM
32	Networking, conversation between Dr. Toro and Dr. Carlos, etc.	11/23/2021 12:27 PM
33	I loved being in a space with so many mathematicians of color and seeing them share their amazing work. It made me feel like I can exist in math.	11/23/2021 11:57 AM
34	Poster presentation	11/23/2021 11:56 AM
35	Meeting with people in person! It was my first time doing so since 2019.	11/23/2021 11:55 AM
36	Relevance of the talks and organization.	11/23/2021 11:54 AM
37	Various talks.	11/23/2021 11:36 AM
38	Network	11/23/2021 11:35 AM
39	I appreciate the option to attend virtually	11/23/2021 11:34 AM
40	The location of the Blackwell-Tapia Conference.	11/23/2021 11:33 AM
41	The networking possibility and opportunity	11/23/2021 11:33 AM
42	I really liked being able to be around fellow young and mature math/stats people.	11/23/2021 11:33 AM
43	Networking and food	11/23/2021 11:27 AM
44	The talks were great!	11/23/2021 11:26 AM
45	Lectures introducing and by the prize recipient.	11/23/2021 11:25 AM
46	Location and some of the lectures	11/23/2021 11:23 AM
47	the talks on education and access	11/23/2021 11:21 AM
48	Networking	11/23/2021 11:19 AM
49	Networking	11/23/2021 11:16 AM

Q14 What aspect(s) of the Blackwell-Tapia Conference did you like the least?

Answered: 36 Skipped: 45

#	RESPONSES	DATE
1	Some of the research involving math problems had no connection with me anymore as an RN.	1/16/2022 6:02 PM
2	I wish that there had been a bit more direction on where to go next. Sometimes it was unclear where, for example the poster session would be held or what location was next.	12/8/2021 4:57 PM
3	Missing Dr Ardila's talk	12/6/2021 8:50 AM
4	The lack of diversity, especially amongst Latino/a/x speakers.	12/5/2021 3:18 PM
5	Lack of talks at IAS, lack of opportunities to interact with established researchers.	12/4/2021 9:17 AM
6	The shut-in feeling that went along with the pandemic, but there was little that could be done to fix that.	12/3/2021 4:11 PM
7	the lack of communication with other sites	12/3/2021 1:57 PM
8	I would have preferred longer breaks, both for networking and for getting a fresh air break from wearing a mask.	12/3/2021 1:22 PM
9	na	12/3/2021 1:20 PM
10	N/A	11/30/2021 11:56 AM
11	I wish there were a way to have more cross-institute networking. I felt that I knew my local people very well and was hoping to meet more new people.	11/29/2021 6:00 PM
12	Back-to-back 55-minute presentations were a bit difficult to pay attention to as the day progresses. Some breaks would have been beneficial.	11/24/2021 8:19 AM
13	N/A	11/24/2021 6:31 AM
14	I prefer to have all talks at the same place, but I understand the current situation of the pandemic.	11/24/2021 6:07 AM
15	Assigned seating for the networking break outs.	11/23/2021 9:00 PM
16	Hotel not convenient to anything, dining, Princeton university, shopping, etc.	11/23/2021 3:03 PM
17	Travel time from hotel to conference a bit long.	11/23/2021 2:50 PM
18	Some research talks got very technical.	11/23/2021 2:09 PM
19	For networking activities, different groups were placed within a foot of each other and it was difficult to hear what participants were discussing within one's group. So place more separation between the different groups.	11/23/2021 1:54 PM
20	No lodging funding	11/23/2021 1:13 PM
21	The talks do not cover the broad area of the attendees expertise.	11/23/2021 1:00 PM
22	Research talks.	11/23/2021 12:27 PM
23	I struggled getting to the site so early since it’s not easily transit accessible.	11/23/2021 11:57 AM
24	Online setting	11/23/2021 11:56 AM
25	Everything was good or great.	11/23/2021 11:55 AM
26	Very few posters	11/23/2021 11:54 AM
27	I wished more people came to attend the conference at IPAM. We had maybe 16 people in	11/23/2021 11:37 AM

	attendance?	
28	The lack of opportunities to interact with people informally (for the virtual attendees).	11/23/2021 11:36 AM
29	N/A	11/23/2021 11:34 AM
30	N/A	11/23/2021 11:33 AM
31	I would prefer mathematicians who share more-or-less the same research taste to attend the conference at the same location	11/23/2021 11:33 AM
32	I didn't like the lack of networking activities among all the institutes.	11/23/2021 11:33 AM
33	I think the meals provided could have been spread out better over the 2 days instead of having all the meals provided on just the first day	11/23/2021 11:27 AM
34	I am not sure, maybe people can get connected better	11/23/2021 11:26 AM
35	Needed more time at the poster session and networking activities were too static and not structured	11/23/2021 11:23 AM
36	detailed technical talks	11/23/2021 11:21 AM

Q15 How can we improve the quality of the Blackwell-Tapia Conference? We welcome your suggestions!

Answered: 26 Skipped: 55

#	RESPONSES	DATE
1	Include math as it relates to the outside world or research on education and math or even heatlhcare and math.	1/16/2022 6:02 PM
2	Shuttle from hotel to IAS and more direction on where to go in between talks, poster session, and food.	12/8/2021 4:57 PM
3	It was great!!	12/6/2021 8:50 AM
4	As mentioned previously - increased participation amongst domestic, underrepresented minorities among speakers.	12/5/2021 3:18 PM
5	Fix whatever was in 14 :)	12/4/2021 9:17 AM
6	I think it was fine.	12/3/2021 4:11 PM
7	Please host more multi modal conferences like this :).	12/3/2021 3:24 PM
8	I would remove the poster session.	12/3/2021 1:22 PM
9	N/A	11/30/2021 11:56 AM
10	An MSRI conference is THE standard for conference quality so this is tough to give feedback. Great job to the staff and organizers.	11/27/2021 3:02 PM
11	Maybe alternating talks between mathematics presentations and issues in representation. One location would also be ideal.	11/24/2021 8:19 AM
12	Please have more time between talks.	11/23/2021 8:15 PM
13	I enjoyed the conference and will attend again in the future. It is a terrific way to learn about the research of underrepresented groups of colleagues.	11/23/2021 3:12 PM
14	Overall it was professional, informative, and very organized.	11/23/2021 3:03 PM
15	It would be great to get a tour of the university where the institute is located. I would have liked to spend a couple of hours at UC-Berkeley. Also in the past, I recall senior grad students also giving talks, perhaps reconsider.	11/23/2021 1:54 PM
16	Talks need to cover both applied and theory of matheamtics.	11/23/2021 1:00 PM
17	Maybe make research talks more active with the audience, or more relatable, and have deeper research conversations during poster session or oral presentations. Oral presentations could be chosen to attend based on which research talk one wanted to hear more about.	11/23/2021 12:27 PM
18	Meet together and have a discusdion	11/23/2021 11:56 AM
19	Get more students involved.	11/23/2021 11:55 AM
20	Create a student talks slot; lightening talks would provided students with a great opportunity to enhance their communication skills [they could be selected by past Blackwell Tapia award recipients]	11/23/2021 11:35 AM
21	More widespread allocation of speakers. For example having the same amount of speakers at every location in person	11/23/2021 11:33 AM
22	See my answer to question #14	11/23/2021 11:33 AM
23	It would have been interesting to have a hybrid round table connecting students and faculty from different locations to hear about available opportunities.	11/23/2021 11:33 AM

24	providing for better ways to connect participants, if possible. The group I met was very different from the people I usually meet.	11/23/2021 11:26 AM
25	Have the sessions during the week (not a Saturday), try to make it empowering and informative to the groups we are celebrating	11/23/2021 11:23 AM
26	make the talks more accessible. not experts in the specific areas	11/23/2021 11:21 AM

Connections Workshop: The Analysis and Geometry of Random Spaces

January 19, 2022 – January 21, 2022

Hybrid Workshop

Organizers:

Mario Bonk (University of California, Los Angeles)

Joan Lind (University of Tennessee)

Eero Saksman (University of Helsinki)

Jang-Mei Wu (University of Illinois at Urbana-Champaign)

REPORT ON THE MSRI WORKSHOP
"Connections Workshop: The Analysis and Geometry of Random Spaces (Hybrid Workshop)"
January 19 – January 21, 2022

Organizers

- Mario Bonk (University of California, Los Angeles)
- Joan Lind (University of Tennessee)
- Eero Saksman (University of Helsinki)
- Jang-Mei Wu (University of Illinois at Urbana-Champaign)

Scientific Description

The Connections Workshop featured talks on a variety of topics related to the analysis and geometry of random spaces. It previewed the research themes of the semester program and highlighted the work of women in the field, and it included a panel discussion. This workshop was directly prior to the Introductory Workshop, and participants were encouraged to participate in both workshops. This workshop was open to all mathematicians.

Highlights of the Workshop

The work of six female mathematicians was showcased during the Connections Workshop. These talks, which received many compliments, featured both the analytic side and probabilistic side of this field, as well as the interplay between these two. On the analytic side, Nages Shanmugalingam led off the workshop with a beautiful talk showing how to use modulus to be able to do analysis in metric spaces where there is not a differential structure. Next, we saw the probabilistic side with a talk by Vivian Healey about using Brownian loop measures to define multiple radial SLE. This was followed by Hao Wu's talk about crossing probabilities and related topics in several 2-dimensional models such as the Ising model and the Gaussian Free Field (GFF). The GFF appeared again later as the focus in Ellen Powell's talk, where she discussed a result that characterized the GFF. Amanda Turner gave a beautiful talk about Laplacian Growth models, where along with her results, she put a variety of models into a coherent context and showed several simulations. On the last day, Maria Gordina took us into the infinite-dimensional world, talking about how to do stochastic analysis in infinite dimensional curved spaces. This talk prepared us for her talk in the following workshop on Diff(S^1). The last speaker, Eveliina Peltola, wrapped up the workshop beautifully in her talk on large deviations of SLE. During this talk, she pointed out connection points to each of the previous speakers, helping to highlight the interconnectivity of all the topics.

In addition to these six superb talks, there was a panel discussion about concrete ways to support broader participation of under-represented groups in mathematics. Panelist Jayadev Athreya commented that for many, it can be hard to know how to do our part, and he recommended getting involved with groups that are already established, such as the Math Alliance. Panelist Mario Bonk spoke from his vantage point as department chair about the challenges his department faces. Panelist Moon Duchin spoke about some of the programs that she has started, such as the Directed Reading Program where pairs of undergraduate and graduate students read a math paper together, and she highlighted the importance of building community. Panelist Nages Shanmugalingam warned that providing access is not enough, but that we need to make sure that we paying attention to whether individuals from under-represented groups feel welcomed and supported.

Organizers		
First Name	**Last Name**	**Institution**
Mario	Bonk	University of California, Los Angeles
Joan	Lind	University of Tennessee
Eero	Saksman	University of Helsinki
Jang-Mei	Wu	University of Illinois at Urbana-Champaign
Speaker		
First Name	**Last Name**	**Institution**
Jayadev	Athreya	University of Washington
Mario	Bonk	University of California, Los Angeles
Moon	Duchin	Tufts University
Maria	Gordina	University of Connecticut
Vivian	Healey	Texas State University
Eveliina	Peltola	Rheinische Friedrich-Wilhelms-Universität Bonn
Ellen	Powell	University of Durham
Nageswari	Shanmugalingam	University of Cincinnati
Amanda	Turner	University of Lancaster
Hao	Wu	Tsinghua University

Mathematical Sciences Research Institute

Connections Workshop: The Analysis and Geometry of Random Spaces [Hybrid Workshop]

January 19 to January 21, 2022

Wednesday, January 19, 2022		
08:50 AM - 09:00 AM		Welcome
09:00 AM - 09:50 AM	Nageswari Shanmugalingam	Sobolev Spaces via Upper Gradients in Non-Smooth Setting
11:00 AM - 11:50 AM	Vivian Healey	Multiple SLE from a Loop Measure Perspective
04:00 PM - 04:50 PM	Hao Wu	Crossing Probabilities in 2D Critical Lattice Models

Thursday, January 20, 2022		
08:30 AM - 09:20 AM	Amanda Turner	Scaling Limits of Laplacian Random Growth Models
09:50 AM - 10:40 AM	Ellen Powell	Characterising the Gaussian Free Field
11:10 AM - 12:00 PM	Jayadev Arthreya, Mario Bonk, Moon Duchin & Nageswari Shanmugalingam	Panel Discussion

Friday, January 21, 2022		
09:00 AM - 09:50 AM	Maria Gordina	Stochastic Analysis on Infinite-Dimensional Curved Spaces
11:00 AM - 11:50 AM	Eveliina Peltola	On Large Deviations of SLEs, Real Rational Functions, and Zeta-Regularized Determinants of Laplacians

Participants		
First Name	**Last Name**	**Institution**
Osama	Abuzaid	Aalto University
Tom	Alberts	University of Utah
Awais	Asif	University of Alberta
Jayadev	Athreya	University of Washington
Tahmineh	Azizi	Florida State University
Eric	Babson	University of California, Davis
Manan	Bhatia	Massachusetts Institute of Technology
Sandipan	Bhattacherjee	Birla Institute of Technology, Mesra, Ranchi, India
Ilia	Binder	University of Toronto
Christopher	Bishop	Stony Brook University
Mario	Bonk	University of California, Los Angeles
Jack	Burkart	University of Wisconsin-Madison
Mandela	Butu	Institut Superieure des Techniques Appliquees
Marco	Carfagnini	University of Connecticut
Zhen-Qing	Chen	University of Washington
Li	Chen	University of the District of Columbia
Hailong	Dao	University of Kansas
Guy	David	Ball State University
Devon	Ding	University of California, Berkeley
George	Dragomir	Columbia University
David	Drasin	Purdue University
Moon	Duchin	Tufts University
Bertrand	Duplantier	Paris-Saclay University
David	Eisenbud	MSRI - Mathematical Sciences Research Institute
Saleh	Elmohamed	University of California, Berkeley
kobra	Esmaeili	Ardakan University
Joseph	Fu	University of Georgia
Aygul	Galimova	Duke University
Aniruddhan	Ganesaraman	Chennai Mathematical Institute
Fabian	Germ	University of Edinburgh
Ryan	Gibara	University of Cincinnati
Adi	Glucksam	Northwestern University
Maria	Gordina	University of Connecticut
Francisco	Gozzi	UFABC
Suman	Guha	Presidency University
Vladislav	Guskov	Royal Institute of Technology
Vivian	Healey	Texas State University
Susanna	Heikkilä	University of Helsinki
Wade	Hindes	Texas State University
Eriko	Hironaka	Florida State University
Mikhail	Hlushchanka	Universiteit Utrecht
Nina	Holden	ETH Zurich
Kukkeprasanna	J	Bengaluru City University
Antoine	Jego	MSRI - Mathematical Sciences Research Institute
Fushuai	Jiang	University of California, Davis
Janne	Junnila	École Polytechnique Fédérale de Lausanne (EPFL)
Sharada	Kalanidhi	Stanford University School of Medicine
Alex	Kapiamba	University of Michigan
Sungwoon	Kim	Jeju National University

Participants		
First Name	**Last Name**	**Institution**
Yujin	Kim	New York University, Courant Institute
Joshua	Kline	University of Cincinnati
Aleksandra	Korzhenkova	École Polytechnique Fédérale de Lausanne (EPFL)
Sefika	Kuzgun	University of Kansas
Therese	Landry	University of California, Riverside
Nan	Li	New York City Technical College, CUNY
Zhiqiang	Li	Peking University
wenbo	Li	University of Toronto
Joan	Lind	University of Tennessee
Issam	Louhichi	American University of Sharjah
Liangbing	Luo	University of Connecticut
Víctor	Maciá	Autonomous University of Madrid
Sid	Maibach	Rheinische Friedrich-Wilhelms-Universität Bonn
Nikolai	Makarov	California Institute of Technology
Aditya	Makkar	Columbia University
Keivan	Mallahi Karai	Jacobs University Bremen
Christopher	McKay	Montana State University
Curtis	McMullen	Harvard University
Xiangqian	Meng	University of Washington
Tim	Mesikepp	Peking University
Mathav	Murugan	University of British Columbia
Evangelos	Nastas	University at Albany (SUNY)
James	Norris	University of Cambridge
Byung-Geun	Oh	Hanyang University
Kshitij	Pandey	Indian Institute of Technology
Pekka	Pankka	University of Helsinki
Leonie	Papon	University of Durham
José Juan	Peña Leal	Universidad Nacional Autónoma de México
David	Pechersky	University of Toronto
Eveliina	Peltola	Rheinische Friedrich-Wilhelms-Universität Bonn
Pietro	Poggi-Corradini	Kansas State University
Ellen	Powell	University of Durham
Istvan	Prause	University of Eastern Finland
Nikolai	Prochorov	Université d'Aix-Marseille I (Université de Provence)
Wei	Qian	Université Paris-Saclay
Dhanusshya	R	Ethiraj College for Women
Jasmin	Raissy	Institut de Mathématiques de Bordeaux
Rohini	Ramadas	University of Warwick
Sukhwinder	Rawat	Doon University
Gabriele	Rembado	Hausdorff Research Institute for Mathematics, University of Bonn
Larissa	Richards	University of Lancaster
Antonio	Rieser	Cimat
Steffen	Rohde	University of Washington
Miguel Angel	Rosas	Universidad del Bío-Bío
Noussiba	Saadoudi	Universite M'hammed Bouguerra de Boumerdes (UMBB)
Afshan	Sadiq	Government College
Eero	Saksman	University of Helsinki
Anne	Schreuder	Center for Mathematical Sciences
Nageswari	Shanmugalingam	University of Cincinnati

Participants		
First Name	**Last Name**	**Institution**
Alan	Sola	Stockholm University
Susanna	Spektor	Sheridan College
Jeff	Steif	Chalmers University of Technology/University of Göteborg
Danny	Stoll	University of Michigan
Xin	Sun	University of Pennsylvania
Jinwoo	Sung	University of Chicago
Emanuel	Sygal	Tel Aviv University
Joseph	Taban	University of Northern Philippines
Hassan	Tahir	Ocean University of China
Mayank	Totloor	New York University
Sascha	Troscheit	University of Vienna
Amanda	Turner	University of Lancaster
Diederik	van Engelenburg	University of Vienna
Fredrik	Viklund	Royal Institute of Technology
Yilin	Wang	Massachusetts Institute of Technology
Rebecca	Winarski	College of the Holy Cross
Jang-Mei	Wu	University of Illinois at Urbana-Champaign
Hao	Wu	Tsinghua University
Xiangjin	Xu	Binghamton University (SUNY)
Jonguk	Yang	Stony Brook University
Liding	Yao	University of Wisconsin-Madison
Malik	Younsi	University of Hawaii at Manoa
Yang	Yu	University of Washington
Yizheng	Yuan	TU Berlin
Evgeny	Zelenov	Steklov Mathematical Institute
Jiaxin	Zhang	California Institute of Technology
Hui	Zhu	University of Michigan
Michel	Zinsmeister	Université d'Orléans

Identifiable Participants' Information

Participants		126

Gender		126
Male	72.22%	91
Female	26.98%	34
Other	0.79%	1
Declined to state	0.00%	0

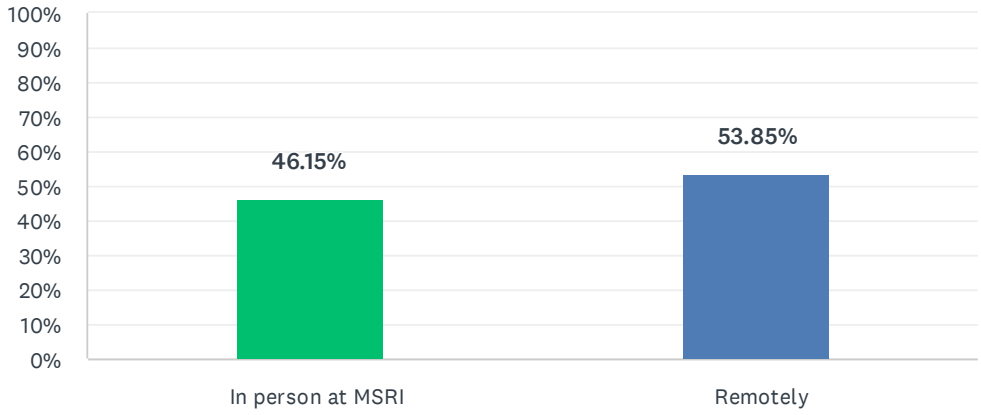
Ethnicity*		133
White	48.87%	65
Asian	36.09%	48
Hispanic	2.26%	3
Pacific Islander	0.75%	1
Black	1.50%	2
Native American	0.00%	0
Mixed	2.26%	3
Declined to state	8.27%	11

* ethnicity specifications are not exclusive

There were 10 unidentifiable participants.

Q1 I primarily participated in the workshop:

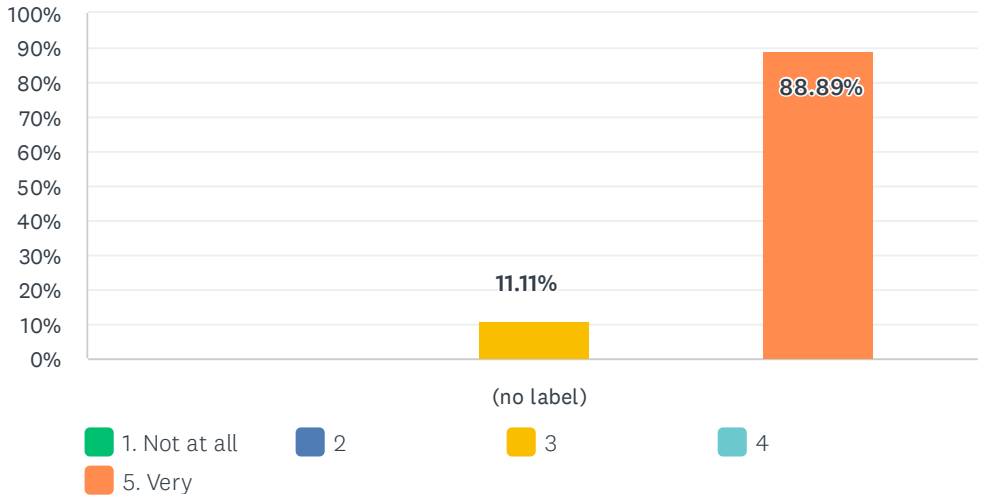
Answered: 39 Skipped: 0



ANSWER CHOICES	RESPONSES	
In person at MSRI	46.15%	18
Remotely	53.85%	21
TOTAL		39

Q2 The workshop was intellectually stimulating

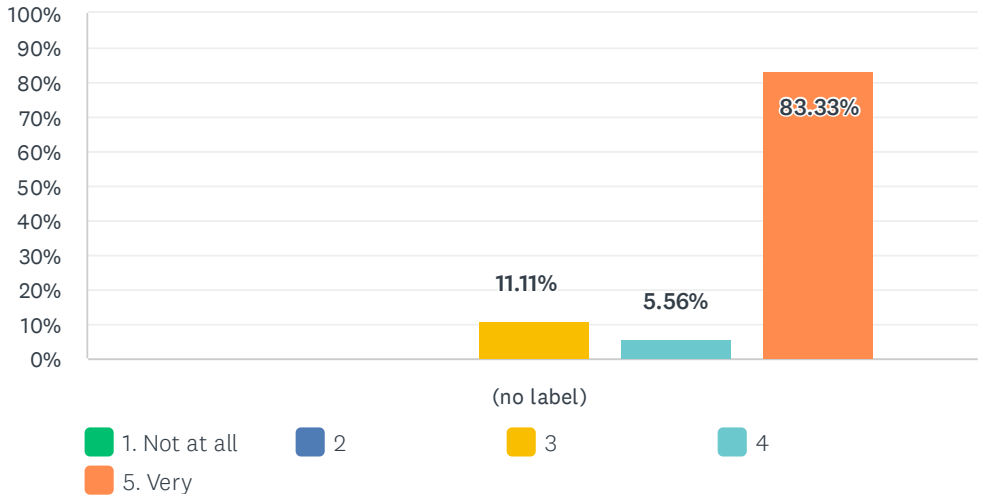
Answered: 18 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	11.11% 2	0.00% 0	88.89% 16	18	4.78

Q3 The overall experience of the workshop was worthwhile

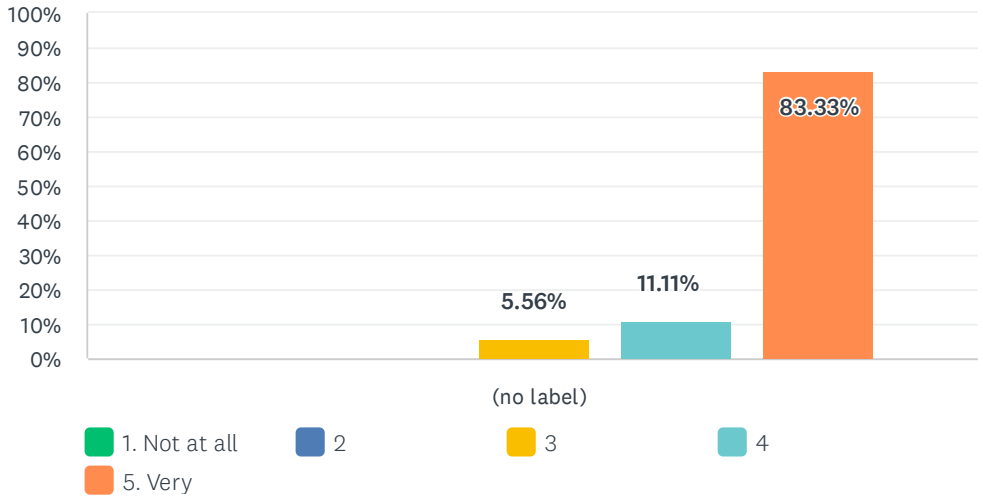
Answered: 18 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	11.11% 2	5.56% 1	83.33% 15	18	4.72

Q4 The lectures were at an appropriate level

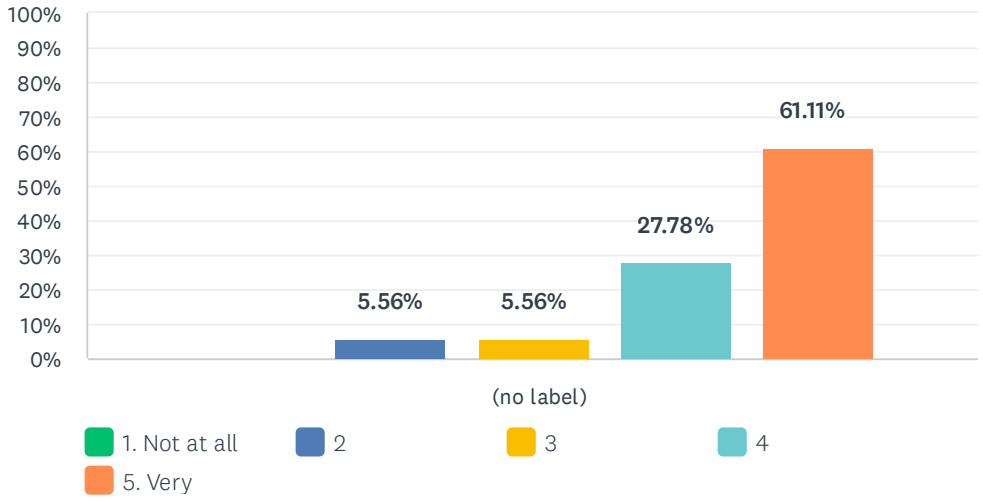
Answered: 18 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.56% 1	11.11% 2	83.33% 15	18	4.78

Q5 I was well prepared to benefit from the lectures

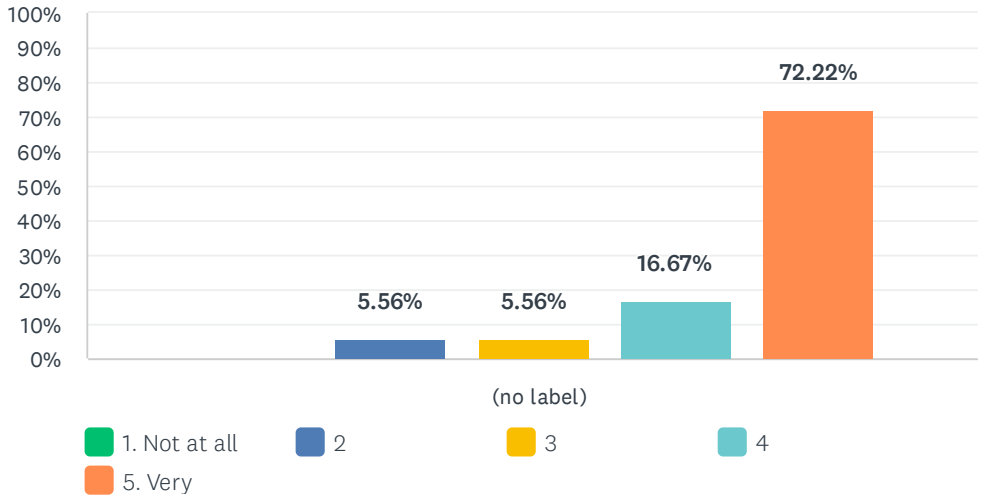
Answered: 18 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.56% 1	5.56% 1	27.78% 5	61.11% 11	18	4.44

Q6 My interest in the subject matter was increased by the workshop

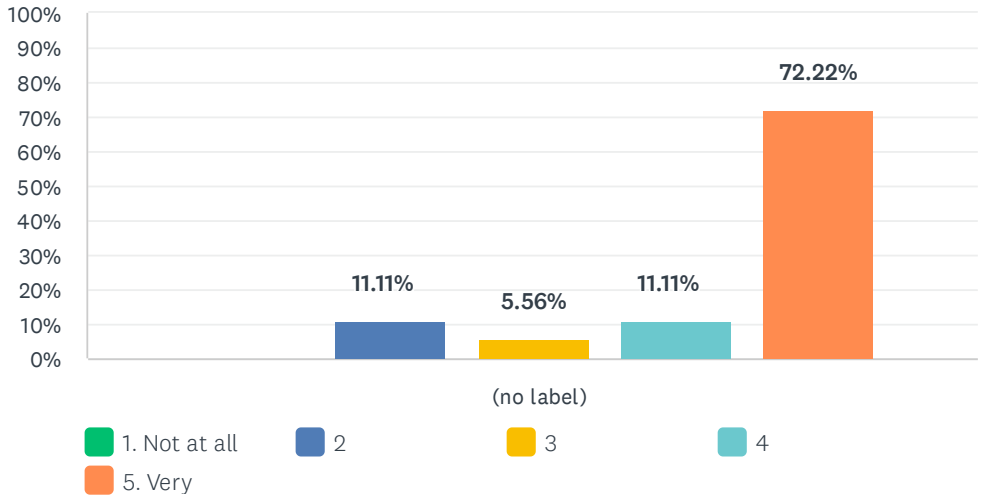
Answered: 18 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.56% 1	5.56% 1	16.67% 3	72.22% 13	18	4.56

Q7 The workshop helped me meet people with similar scientific interests

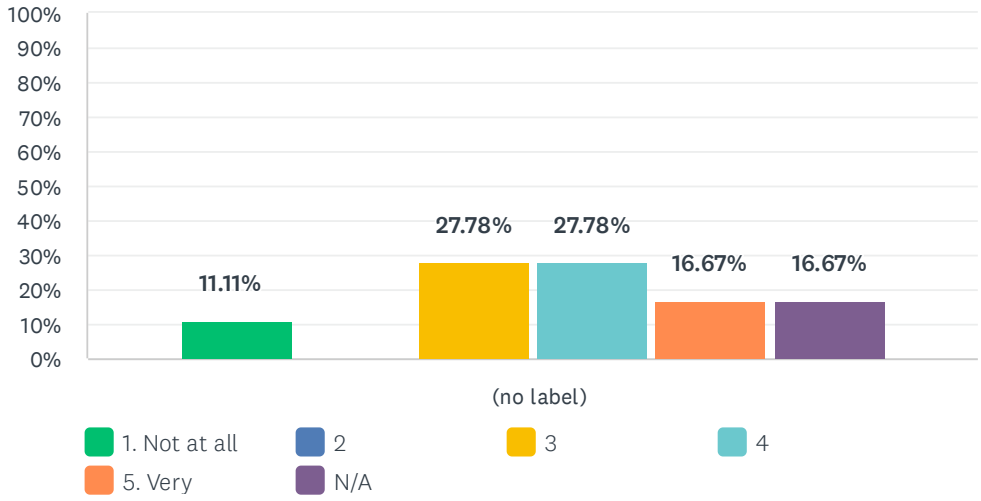
Answered: 18 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	11.11% 2	5.56% 1	11.11% 2	72.22% 13	18	4.44

Q8 Did you find the panel discussion worthwhile?

Answered: 18 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	11.11% 2	0.00% 0	27.78% 5	27.78% 5	16.67% 3	16.67% 3	18	3.47

Q9 What other subjects should be discussed in future panel discussions?

Answered: 3 Skipped: 36

#	RESPONSES	DATE
1	How to conduct job searches with diversity in mind — many experts in this, but the idea being that *before the search* you need to write into your job criteria what kinds of things you actually value about candidates from diverse backgrounds, for example: ability to support students from underrepresented groups, candidates who can relate to/have shared experience with the students, candidates who have already demonstrated resilience in their career, etc. This requires actual thinking about what the committee/department positively values about diversity, rather than an outlook that “diversity candidates” were less qualified but skipped to the head of the class because of “affirmative action.”	1/28/2022 5:37 AM
2	I think that a broader panel, like "ask a mathematician" with people in different stages of their career would be more interesting and inclusive for everyone.	1/24/2022 10:01 AM
3	I think a panel discussion should be less of lecturing the audience than a discussion. Participants might be asked to submit questions either ahead of time or during the event. Many people outside of the US had no idea what it was about.	1/21/2022 4:45 PM

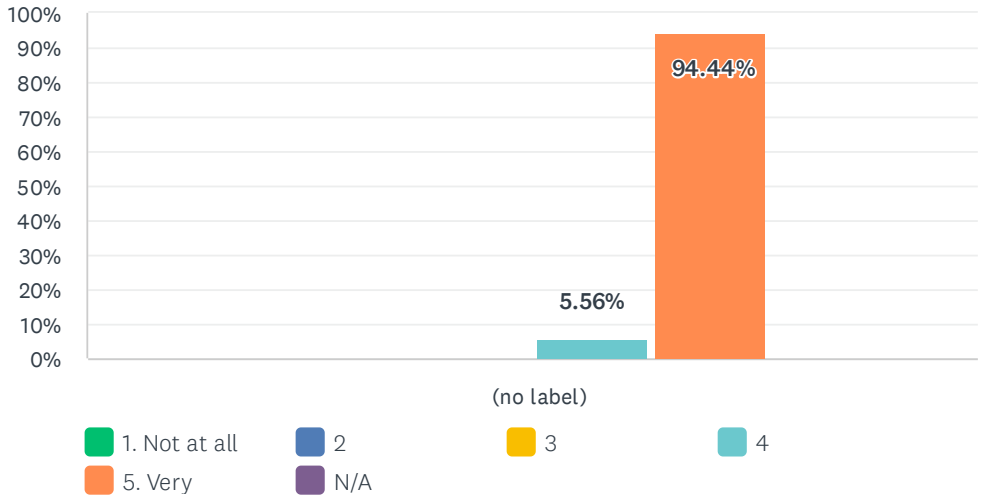
Q10 Additional comments

Answered: 2 Skipped: 37

#	RESPONSES	DATE
1	I only attended to few talks.	1/24/2022 10:01 AM
2	It would be good to have some goals set for such events. I always feels being patronized by such an experience. Maybe it is good for people holding leadership positions to learn why mathematicians from the groups under-represented in STEM feel so isolated at times. From such people.	1/21/2022 4:45 PM

Q11 I found the MSRI staff helpful

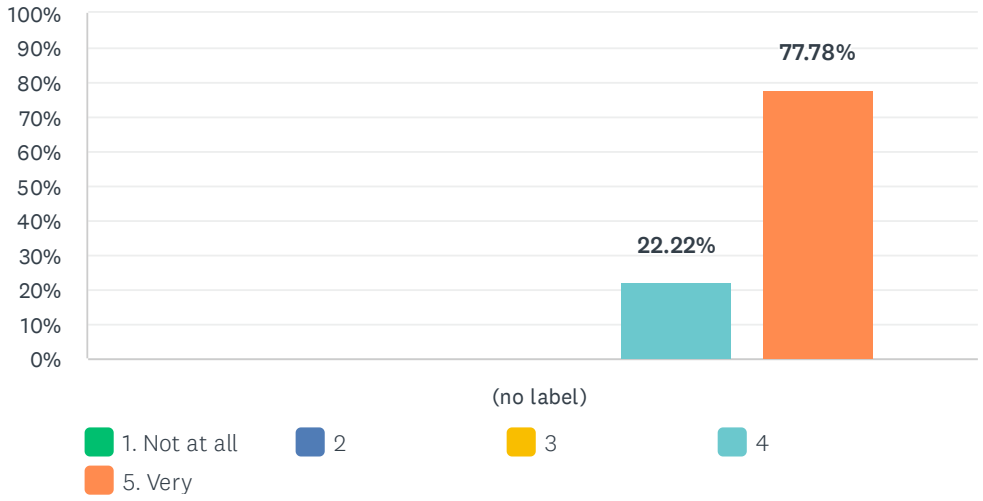
Answered: 18 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	5.56% 1	94.44% 17	0.00% 0	18	4.94

Q12 The MSRI facilities were conducive for such a workshop

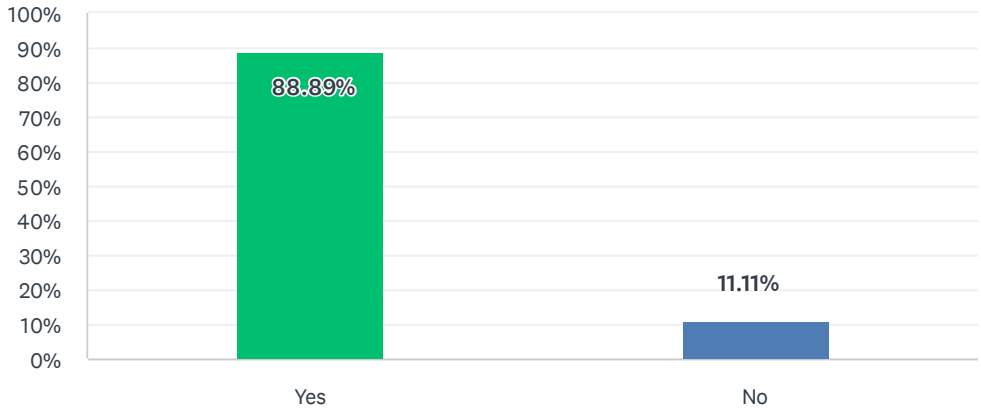
Answered: 18 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	22.22% 4	77.78% 14	18	4.78

Q13 Did you use MSRI's wireless network?

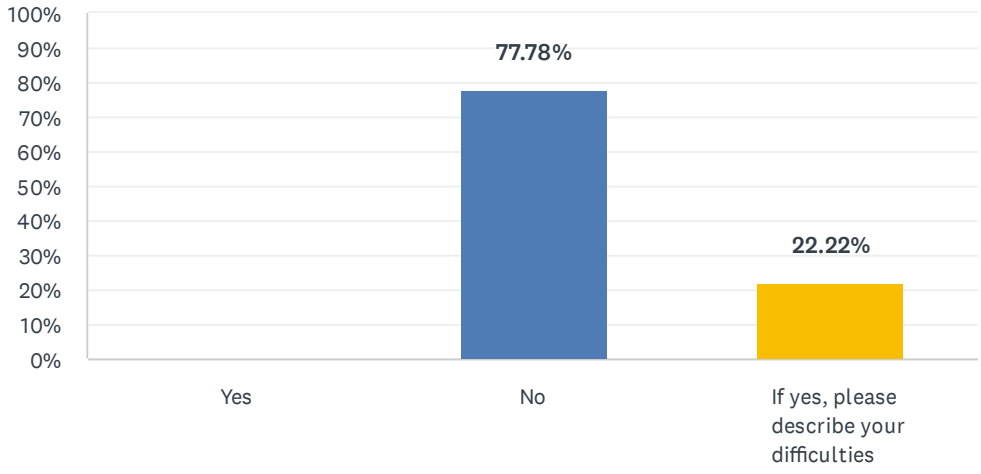
Answered: 18 Skipped: 21



ANSWER CHOICES	RESPONSES	
Yes	88.89%	16
No	11.11%	2
TOTAL		18

Q14 Did you experience any difficulties with the network?

Answered: 18 Skipped: 21

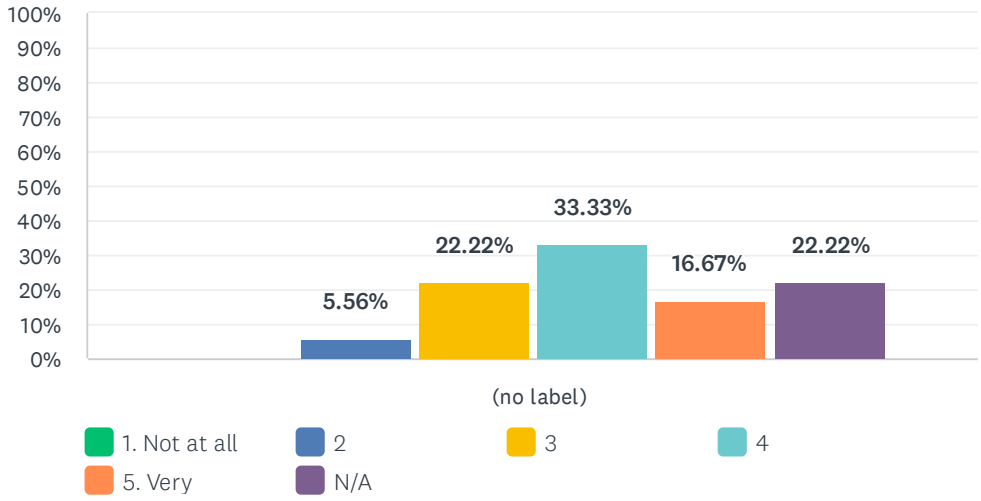


ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	77.78%	14
If yes, please describe your difficulties	22.22%	4
TOTAL		18

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	The wifi was not working so well	2/20/2022 8:59 PM
2	Connecting issues, that got resolved at the end of the week.	1/24/2022 10:01 AM
3	connectivity issues	1/21/2022 4:46 PM
4	sometimes in my room	1/21/2022 4:40 PM

Q15 The MSRI lunch arrangements were satisfactory

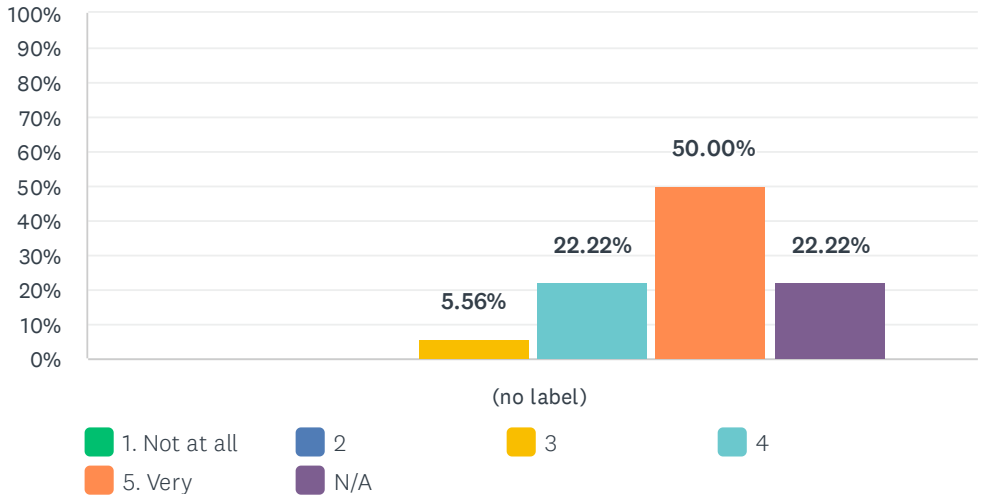
Answered: 18 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.56% 1	22.22% 4	33.33% 6	16.67% 3	22.22% 4	18	3.79

Q16 The MSRI tea arrangements were satisfactory

Answered: 18 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.56% 1	22.22% 4	50.00% 9	22.22% 4	18	4.57

Q17 Additional comments about the MSRI staff, facilities and food

Answered: 5 Skipped: 34

#	RESPONSES	DATE
1	The quality of the food one can order was not that good.	1/28/2022 6:08 PM
2	The MSRI staff did an amazing job with the technology, allowing it to feel almost as if the remote speakers were present.	1/22/2022 9:49 AM
3	Thank you for managing the COVID-related matters so efficiently!	1/21/2022 9:55 PM
4	I think the special circumstances have been extremely well managed: testing, masks, restrictions, symptoms screening, etc. The MSRI staff has been doing a remarkable job of crucial importance to the success of the program, and I as a participant have enjoyed the week very much.	1/21/2022 4:42 PM
5	it would be even better if there would be a projector with clear piecture that would project a substantially bigger image in the middle.	1/21/2022 4:40 PM

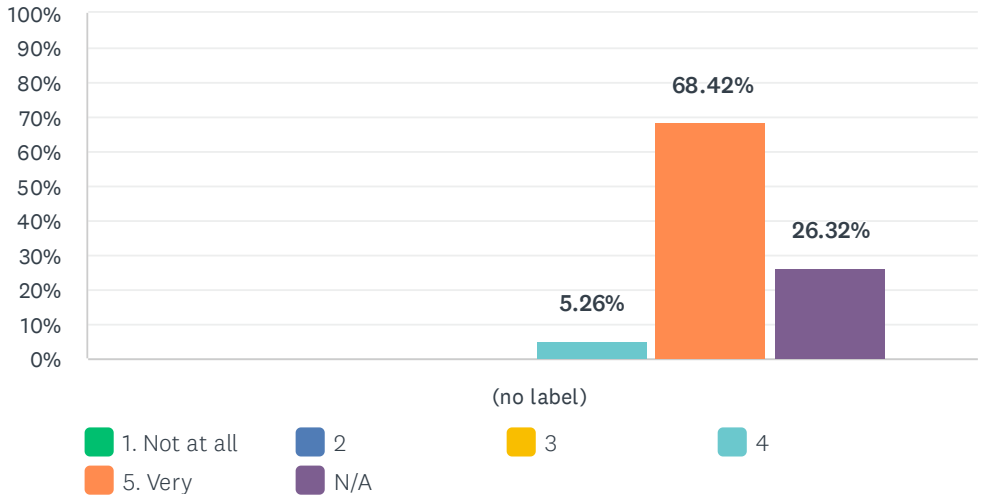
Q18 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 3 Skipped: 36

#	RESPONSES	DATE
1	Access for disabled participants is limited and requires special requests. It should be made clear upfront (via a mass email, say) that MSRI is committed to access, and participants should be given the name/email address of the person who will help them with any accommodations that can support their full participation in the program.	1/28/2022 5:41 AM
2	It is clear that MSRI worked hard to make the hybrid workshop as successful as possible. Although I wished all participants could have been able to attend in person, MSRI provided the best possible situation during these covid times.	1/22/2022 9:51 AM
3	The hybrid format is a good find from the pandemic. It can include more participants while still having an element of an in-person event. Some people found the slide screen too small, hopefully this can be addressed.	1/21/2022 4:48 PM

Q19 I found the MSRI staff helpful

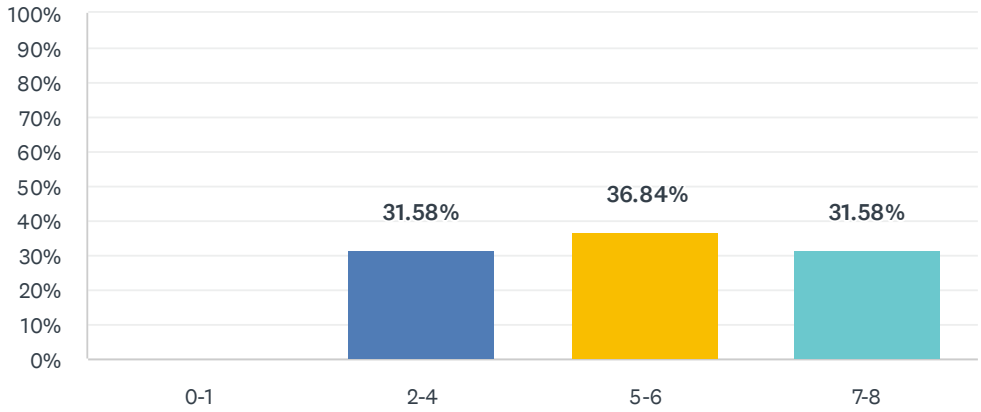
Answered: 19 Skipped: 20



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	5.26% 1	68.42% 13	26.32% 5	19	4.93

Q20 How many talks did you watch live?

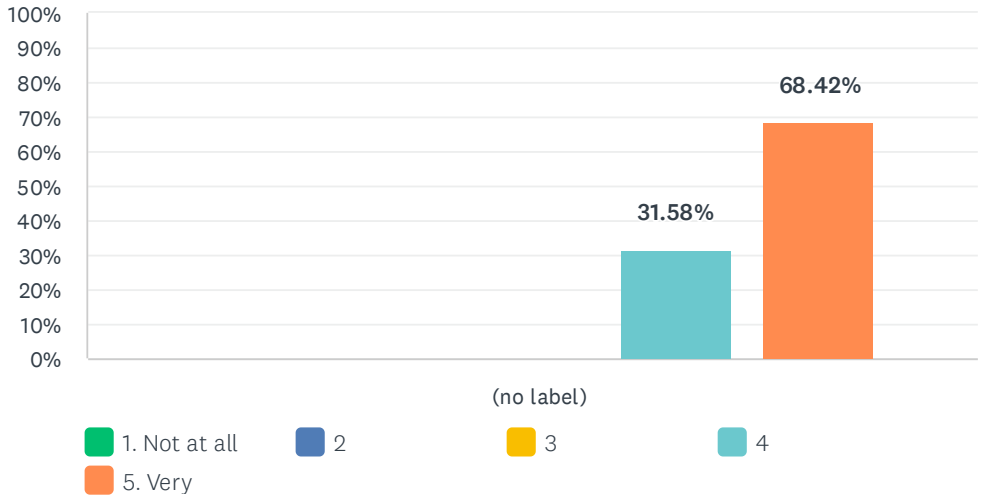
Answered: 19 Skipped: 20



ANSWER CHOICES	RESPONSES	
0-1	0.00%	0
2-4	31.58%	6
5-6	36.84%	7
7-8	31.58%	6
TOTAL		19

Q21 The workshop was intellectually stimulating

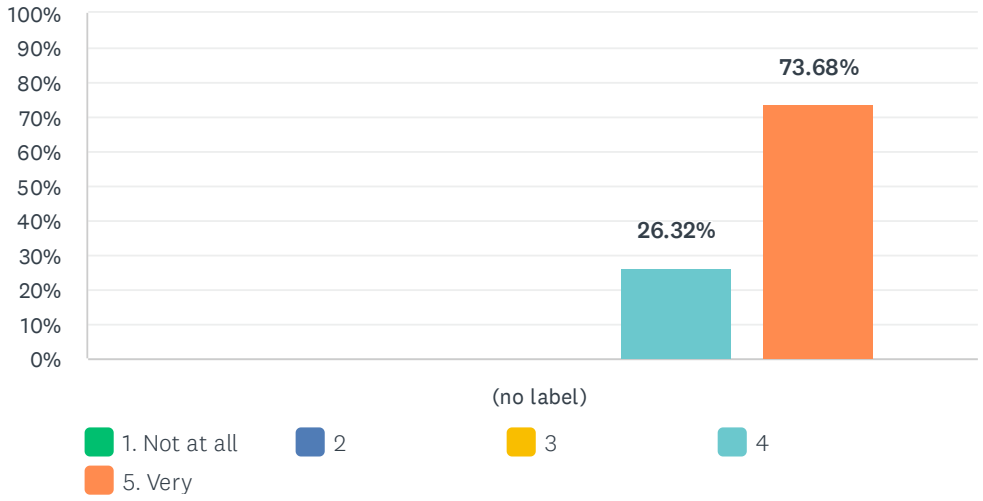
Answered: 19 Skipped: 20



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	31.58% 6	68.42% 13	19	4.68

Q22 The overall experience of the workshop was worthwhile

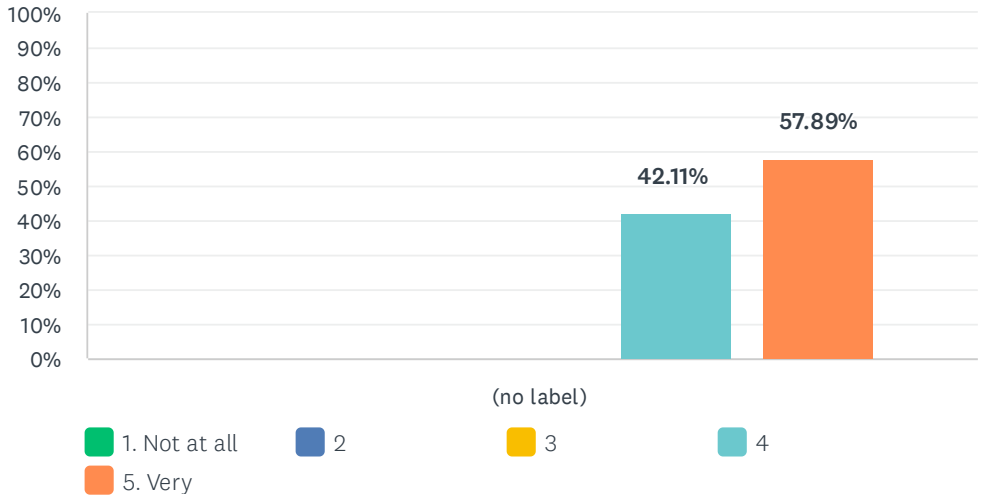
Answered: 19 Skipped: 20



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	26.32% 5	73.68% 14	19	4.74

Q23 The lectures were at an appropriate level

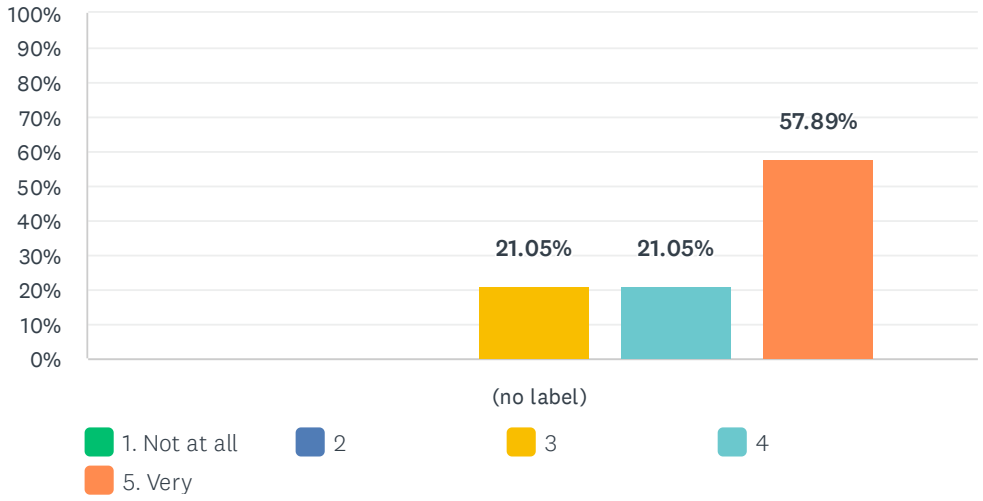
Answered: 19 Skipped: 20



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	42.11% 8	57.89% 11	19	4.58

Q24 I was well prepared to benefit from the lectures

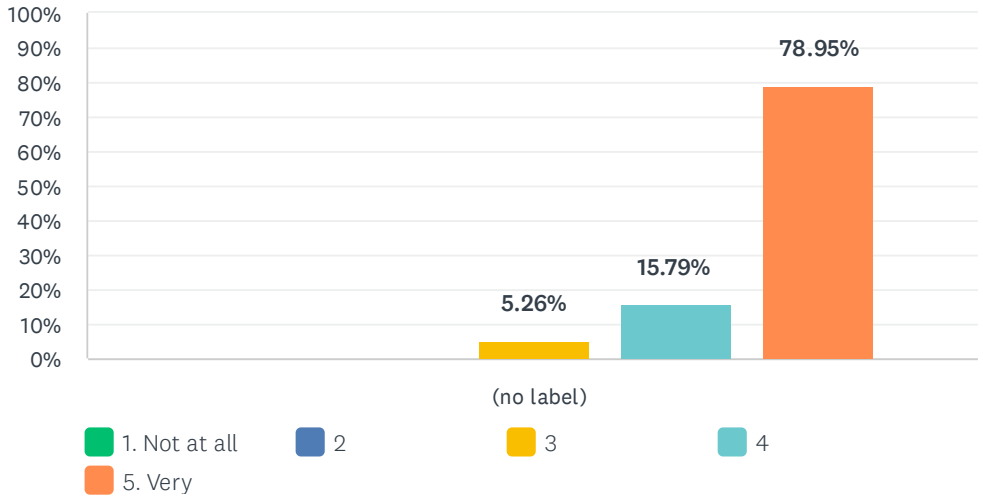
Answered: 19 Skipped: 20



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	21.05% 4	21.05% 4	57.89% 11	19	4.37

Q25 My interest in the subject matter was increased by the workshop

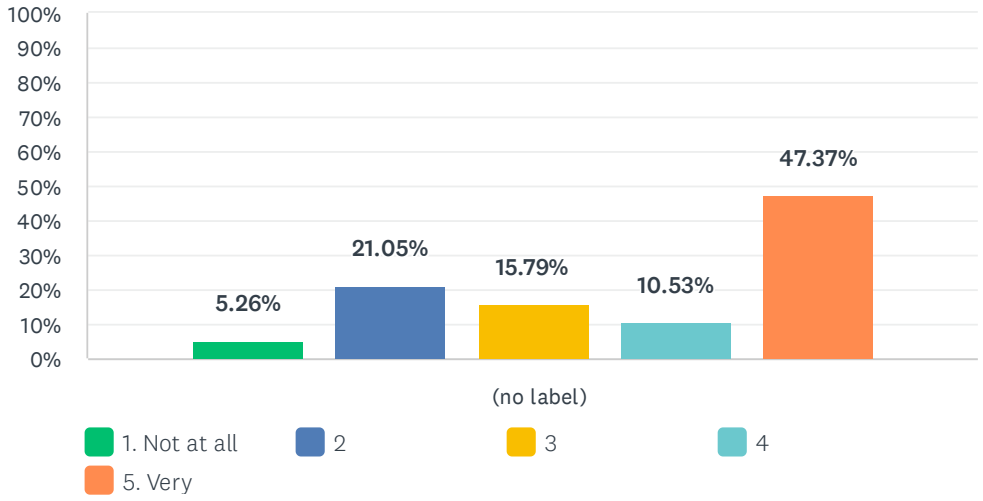
Answered: 19 Skipped: 20



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.26% 1	15.79% 3	78.95% 15	19	4.74

Q26 The workshop helped me meet people with similar scientific interests

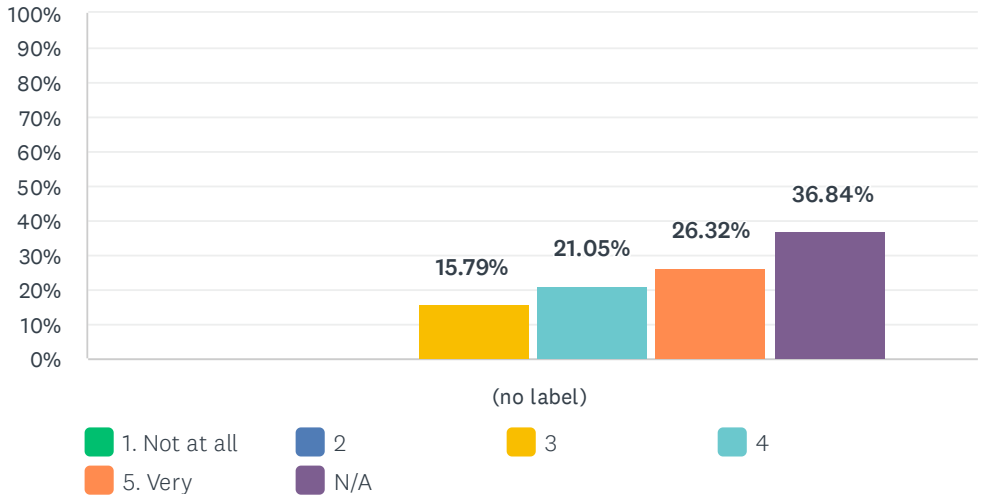
Answered: 19 Skipped: 20



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	5.26% 1	21.05% 4	15.79% 3	10.53% 2	47.37% 9	19	3.74

Q27 Did you find the panel discussion worthwhile?

Answered: 19 Skipped: 20



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	15.79% 3	21.05% 4	26.32% 5	36.84% 7	19	4.17

Q28 What other subjects should be discussed in future panel discussions?

Answered: 4 Skipped: 35

#	RESPONSES	DATE
1	To be honest, I didn't know how these sessions will look like, and what will be discussed in them. So, I didn't attend.	1/24/2022 7:08 AM
2	How to ensure the sustainability of what we are doing.	1/21/2022 11:26 PM
3	Generalized measures, Fuzzy topology.	1/21/2022 7:32 PM
4	I would personally prefer more about research discussion related to the previous talks.	1/21/2022 6:33 PM

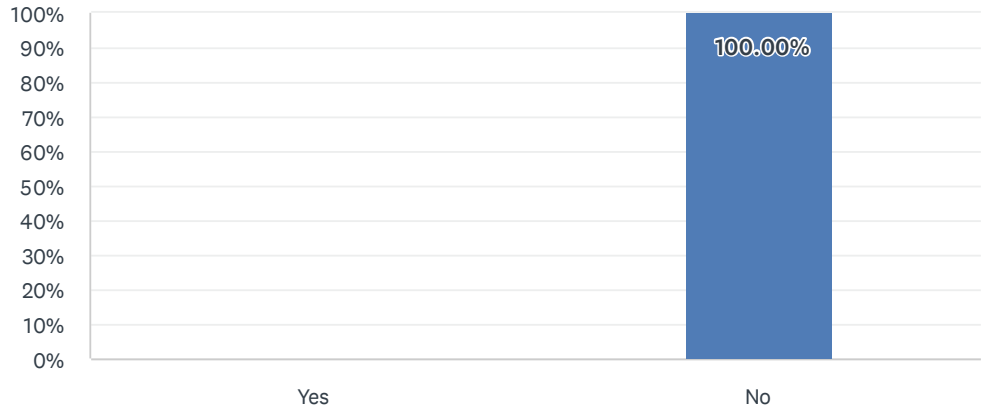
Q29 Additional comments

Answered: 4 Skipped: 35

#	RESPONSES	DATE
1	Participants should always use the mobile microphone when asking questions during the talks.	1/27/2022 10:38 AM
2	I wish there are also introductory level classes in the workshop so that I can get a deeper understanding. This way many talks were in the level of a research talk which might be what is aimed but I guess it would be more appropriate for graduate students if there are one or two introductory lectures in the beginning of the workshops.	1/24/2022 7:08 AM
3	The hybrid arrangements generally worked well. However, for remote participants, it wasn't very easy to see who was speaking in the auditorium during the questions. It might help remote participants in future hybrid meetings if participants could introduce themselves when asking questions.	1/21/2022 11:26 PM
4	If possible please organize a workshop regarding Matroid theory concepts. Thanking you KukkePrasanna J	1/21/2022 6:35 PM

Q30 Did you experience any technical difficulties accessing the workshop online?

Answered: 18 Skipped: 21



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	100.00%	18
TOTAL		18

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
	There are no responses.	

Q31 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 18 Skipped: 21

#	RESPONSES	DATE
1	It's actually easier for me to attend romotely.	2/6/2022 5:09 PM
2	no	1/30/2022 3:55 PM
3	It did not	1/29/2022 12:39 PM
4	I think the talks themselves work very well online, but what is of course missing are the informal after-talk coffee discussions. Hard to say how one could improve this, however.	1/28/2022 4:57 PM
5	Yes, the schedule is in principle ok for Europe, but there were often long delays to start the talks, which led to sessions ending late by 45 minutes.	1/27/2022 10:41 AM
6	saving time	1/24/2022 2:27 PM
7	It is good and nothing stoped communication.	1/24/2022 10:09 AM
8	Having the workshop online made it easy to access. I did not have any trouble participating.	1/24/2022 12:20 AM
9	It made it possible for me to attend the lectures, because I could not participate in per.	1/22/2022 9:08 AM
10	There was one talk that starting for me at midnight, so I had some trouble concetrating. Otherwise it worked fine.	1/22/2022 2:31 AM
11	If the workshop hadn't been online then I wouldn't have been able to participate at all, as I am unable to travel due to the pandemic! I had to miss a couple of talks due to time-zone differences, but intend to watch them online later.	1/21/2022 11:33 PM
12	It is only possible for me to join this workshop as it is on online mode. So for me it is a great way to learn high-end research topic through such webinar or workshop. Yes there is always a challenge due to time zone difference but it can be manageable.	1/21/2022 8:08 PM
13	It will be better if whole workshop is held on only mornings.	1/21/2022 7:05 PM
14	Yes, time zone difference was a barrier, I was not able to attend the last part of day one.	1/21/2022 6:38 PM
15	There is some small impact. Indeed I am more ``motived'' to skip the talks which I am not that familiar with.	1/21/2022 6:35 PM
16	I was only 3hrs ahead, so it was not a problem.	1/21/2022 5:36 PM
17	Greatly improved ability to participate.	1/21/2022 5:27 PM
18	I wouldn't be able to attend in person due to current travel difficulties, so the online format was great.	1/21/2022 4:36 PM

Q32 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 5 Skipped: 34

#	RESPONSES	DATE
1	The remote participants should be invited to ask questions by the chair. That did not happen.	1/27/2022 10:41 AM
2	Maybe having zoom breakout sessions or using platforms like gathertown.	1/22/2022 2:31 AM
3	Perhaps there could be a chance to meet the speakers in informal breakout rooms at the end of the workshop.	1/21/2022 11:33 PM
4	Maybe provide more than one cameras in the room, and allow us to switch views, especially if we want to take note from the blackboard talk	1/21/2022 6:35 PM
5	I have been at conferences where participants could join different small groups by moving an avatar around on the computer screen while seeing where different people were located. This allowed one to converse in small groups which is a lot less intimidating and to seek out particular people.	1/21/2022 5:27 PM

Q33 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 2 Skipped: 37

#	RESPONSES	DATE
1	More online and hybrid sessions. Thanks.	1/24/2022 2:31 PM
2	Is there any certificate of participation provided for the workshop participants? If there is any it will be helpful for our institution records.	1/21/2022 6:40 PM

Introductory Workshop: The Analysis and Geometry of Random Spaces

January 24 - January 28, 2022

Hybrid Workshop

Organizers:

Mario Bonk (University of California, Los Angeles)

Joan Lind (University of Tennessee)

Steffen Rohde (University of Washington)

Fredrik Viklund (Royal Institute of Technology)

REPORT ON THE MSRI WORKSHOP
"Introductory Workshop: The Analysis and Geometry of Random Spaces (Hybrid Workshop)"
January 24 – January 28, 2022

Organizers

- Mario Bonk (University of California, Los Angeles),
- Joan Lind (University of Tennessee),
- Steffen Rohde (University of Washington),
- Fredrik Viklund (Royal Institute of Technology)

Scientific Description

This workshop introduced some of the major themes in probability and geometric analysis that were relevant for the semester-long program. The workshop was in hybrid format with in-person participation by members of the program. There was a total of 18 talks devoted to topics near the intersection of probability and conformal analysis. Part of the workshop were four mini-courses (of two talks each) on topics of broader interest.

Highlights of the Workshop

The mini-courses covered the following subjects: Introductions to Multiplicative Chaos by E. Saksman (U. Helsinki), to the Gaussian Free Field by N. Berestycki (U. Vienna), to Liouville Conformal Field Theory by Rémi Rhodes (U. d'Aix-Marseille), to Critical Percolation by T. Hutchcroft (Caltech), and a survey on Removability of Planar Sets by M. Younsi (U. Hawaii at Manoa).

The 10 other talks were stand-alone presentations, often touching upon subjects that were studied in more detail during the program. For example, in her talk, M. Gordina (U. Connecticut) raised questions about the diffeomorphism group of the circle. Later this evolved in a study seminar that took place weekly for the full duration of the program.

Another highlight was the talk of S. Sheffield on Random Surfaces, where he outlined his unique perspective of the subject from four different angles. This touched upon many themes such as random quadrangulations, scaling limits, conformal matings of trees, Liouville Quantum Gravity, etc. His vision was very thought-provoking and gave promising starting points for a deeper understanding of this area.

The last talk (via Zoom) was given by R. Kenyon (U. Yale). He presented some of his work on chromatic polynomials and conductances on graphs. His topics was right at the interface of probability and (discrete) conformal analysis. This aligned nicely with the general theme of the workshop, bringing it to a fitting conclusion.

Organizers		
First Name	**Last Name**	**Institution**
Mario	Bonk	University of California, Los Angeles
Joan	Lind	University of Tennessee
Steffen	Rohde	University of Washington
Fredrik	Viklund	Royal Institute of Technology
Speakers		
First Name	**Last Name**	**Institution**
Tom	Alberts	University of Utah
Nathanael	Berestycki	University of Vienna
Maria	Gordina	University of Connecticut
Nina	Holden	ETH Zürich
Tom	Hutchcroft	California Institute of Technology
Richard	Kenyon	Brown University
Gregory	Lawler	University of Chicago
Nikolai	Makarov	California Institute of Technology
Wei	Qian	Université Paris-Saclay
Rémi	Rhodes	Université d'Aix-Marseille (AMU)
Eero	Saksman	University of Helsinki
Scott	Sheffield	Massachusetts Institute of Technology
Yilin	Wang	Massachusetts Institute of Technology
Malik	Younsi	University of Hawaii at Manoa

Mathematical Sciences Research Institute

Introductory Workshop: The Analysis and Geometry of Random Spaces [Hybrid Workshop]

January 24 to January 28, 2022

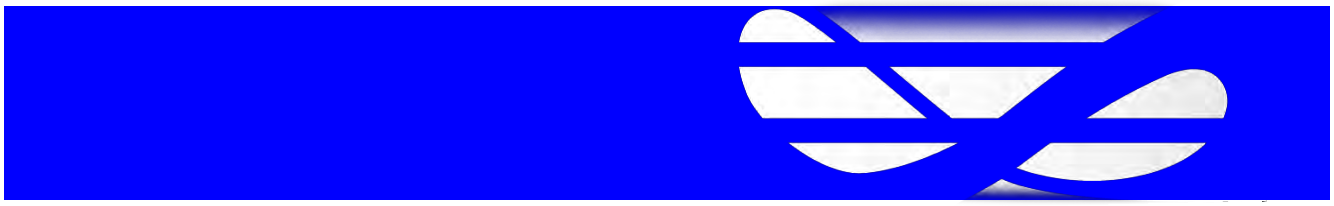
Monday, January 24, 2022		
08:00 AM - 08:10 AM		Welcome
08:10 AM - 09:00 AM	Eero Saksman	An Elementary Introduction to Multiplicative Chaos
09:10 AM - 10:00 AM	Marisa Gordina	Stochastic Analysis on Diff(S^1) Revisited
10:20 AM - 11:10 AM	Yilin Wang	Loewner Energy, SLE and Weil-Petersson Quasicircles
11:40 AM - 12:30 PM	Wei Qian	Geodesics in the Brownian Map: Strong Confluence and Geometric Structure

Tuesday, January 25, 2022		
08:00 AM - 08:50 AM	Tom Alberts	Loewner Dynamics for Real Rational Functions and the Multiple SLE(0) Process
09:00 AM - 09:50 AM	Nina Holden	Conformal Welding in Liouville Quantum Gravity
10:20 AM - 11:10 AM	Nathanael Berestycki	Gaussian Free Field: An Introduction
11:40 AM - 12:30 PM	Eero Saksman	An Elementary Introduction to Multiplicative Chaos Pt II

Wednesday, January 26, 2022		
08:30 AM - 09:20 AM	Gregory Lawler	Fractal Measures
09:50 AM - 10:40 AM	Nathanael Berestycki	Gaussian Free Field: An Introduction Pt II
11:10 AM - 12:00 PM	Tom Hutchcroft	A Pedagogical Introduction to Critical Percolation via the Hierarchical Lattice

Thursday, January 27, 2022		
08:00 AM - 08:50 AM	Scott Sheffield	Random Surfaces
09:00 AM - 09:50 AM	Tom Hutchcroft	A Pedagogical Introduction to Critical Percolation via the Hierarchical Lattice Pt II
10:20 AM - 11:10 AM	Malik Younsi	Removability of Planar Sets
11:40 AM - 12:30 PM	Rémi Rhodes	Introduction to Liouville Conformal Field Theory

Friday, January 28, 2022		
08:30 AM - 09:20 AM	Rémi Rhodes	Introduction to Liouville Conformal Field Theory Pt II
09:50 AM - 10:40 AM	Malik Younsi	Removability of Planar Sets Pt II
11:10 AM - 12:00 PM	Richard Kenyon	Random Conductances and the Chromatic Polynomial



Participants

First Name	Last Name	Institution
Osama	Abuzaid	Aalto University
Rafly	Aditya Darmawan	Federal Reserve Bank of Chicago
Tom	Alberts	University of Utah
Morris	Ang	Massachusetts Institute of Technology
Kwame	Appiah	Ghana Atomic Energy Commission
Shrey	Aryan	ETH Zürich
Jayadev	Athreya	University of Washington
Tahmineh	Azizi	Florida State University
Eric	Babson	University of California, Davis
Nathanael	Berestycki	University of Vienna
Sandipan	Bhattacherjee	Birla Institute of Technology, Mesra, Ranchi, India
Ilia	Binder	University of Toronto
Christopher	Bishop	Stony Brook University
Mario	Bonk	University of California, Los Angeles
Paul	Bourgade	New York University, Courant Institute
Jack	Burkart	University of Wisconsin-Madison
Marco	Carfagnini	University of Connecticut
Ajay Kumar	Chaudhary	Tribhuvan University
Zhen-Qing	Chen	University of Washington
Li	Chen	University of the District of Columbia
Li	Chen	Louisiana State University
Hailong	Dao	University of Kansas
Guy	David	Ball State University
André	de Carvalho	University of São Paulo
Laura	DeMarco	Harvard University
Amir	Dembo	Stanford University
Devon	Ding	University of California, Berkeley
George	Dragomir	Columbia University
David	Drasin	Purdue University
Bertrand	Duplantier	Paris-Saclay University
David	Eisenbud	MSRI - Mathematical Sciences Research Institute
Saleh	Elmohamed	University of California, Berkeley
Sylvester	Eriksson-Bique	University of Oulu
Tanya	Firsova	Kansas State University
Aygul	Galimova	Duke University
Aniruddhan	Ganesaraman	Chennai Mathematical Institute
Fabian	Germ	University of Edinburgh
Lukas	Geyer	Montana State University
Ryan	Gibara	University of Cincinnati
Adi	Glucksam	Northwestern University
Miriam	Gordin	Princeton University
Maria	Gordina	University of Connecticut
Francisco	Gozzi	UFABC
Andrew	Graven	California Institute of Technology
Suman	Guha	Presidency University
Colin	Guillarmou	Université Paris-Saclay
Vladislav	Guskov	Royal Institute of Technology
Alan	Hammond	University of California, Berkeley
Vivian	Healey	Texas State University
Susanna	Heikkilä	University of Helsinki
Eriko	Hironaka	Florida State University
Mikhail	Hlushchanka	Universiteit Utrecht
Nina	Holden	ETH Zürich
Zheng	Huang	CUNY, Graduate Center

Participants

First Name	Last Name	Institution
Tom	Hutchcroft	California Institute of Technology
Annina	Iseli	University of California, Los Angeles
Kukkeprasanna	J	Bengaluru City University
Antoine	Jego	MSRI - Mathematical Sciences Research Institute
Fushuai	Jiang	University of California, Davis
Janne	Junnila	École Polytechnique Fédérale de Lausanne (EPFL)
Sharada	Kalanidhi	Stanford University School of Medicine
Alex	Kapiamba	University of Michigan
Richard	Kenyon	Brown University
Richard	Kenyon	Yale University
Sungwoon	Kim	Jeju National University
Yujin	Kim	New York University, Courant Institute
Joshua	Kline	University of Cincinnati
Aleksandra	Korzhenkova	École Polytechnique Fédérale de Lausanne (EPFL)
Jared	Krandel	State University of New York, Stony Brook
Ellen	Krusell	Royal Institute of Technology
Therese	Landry	University of California, Riverside
Gregory	Lawler	University of Chicago
Zhongyang	Li	University of Connecticut
Xiaobin	Li	Southwest (Xinan) Jiaotong University
Zhiqiang	Li	Peking University
Wenbo	Li	University of Toronto
Willie	Lim	State University of New York, Stony Brook
Peter	Lin	State University of New York, Stony Brook
Joan	Lind	University of Tennessee
Issam	Louhichi	American University of Sharjah
Liangbing	Luo	University of Connecticut
Jeetendrasingh	Maan	Indian School of Mines
Víctor	Maciá	Autonomous University of Madrid
Sid	Maibach	Rheinische Friedrich-Wilhelms-Universität Bonn
Nikolai	Makarov	California Institute of Technology
Aditya	Makkar	Columbia University
Firdous	Mala	University of Kashmir
Keivan	Mallahi Karai	Jacobs University Bremen
Didac	Martinez Granado	University of California, Davis
Christopher	McKay	Montana State University
Xiangqian	Meng	University of Washington
Chebbab	Mesbah	University of Science and Technology Houari Boumedienne (USTHB)
Tim	Mesikepp	Peking University
Daniel	Meyer	University of Liverpool
Sabyasachi	Mukherjee	Tata Institute of Fundamental Research
Evangelos	Nastas	University at Albany (SUNY)
Dimitrios	Ntalampekos	State University of New York, Stony Brook
Byung-Geun	Oh	Hanyang University
Pekka	Pankka	University of Helsinki
Leonie	Papon	University of Durham
David	Pechersky	University of Toronto
Eveliina	Peltola	Rheinische Friedrich-Wilhelms-Universität Bonn
Pietro	Poggi-Corradini	Kansas State University
Ellen	Powell	University of Durham
Istvan	Prause	University of Eastern Finland
Nikolai	Prochorov	Université d'Aix-Marseille I (Université de Provence)
Wei	Qian	Université Paris-Saclay
Jasmin	Raissy	Institut de Mathématiques de Bordeaux

Participants		
First Name	**Last Name**	**Institution**
Rohini	Ramadas	University of Warwick
Sukhwinder	Rawat	Doon University
Gabriele	Rembado	Hausdorff Research Institute for Mathematics, University of Bonn
Rémi	Rhodes	Université d'Aix-Marseille (AMU)
Larissa	Richards	University of Lancaster
Steffen	Rohde	University of Washington
Miguel Angel	Rosas	Universidad del Bío-Bío
Marianna	Russkikh	Massachusetts Institute of Technology
Afshan	Sadiq	Government College
Eero	Saksman	University of Helsinki
Anne	Schreuder	Center for Mathematical Sciences
Nageswari	Shanmugalingam	University of Cincinnati
Scott	Sheffield	Massachusetts Institute of Technology
Hyungeun	Shin	University of Victoria
Alan	Sola	Stockholm University
Aviral	Srivastava	University of Hyderabad
Jeff	Steif	Chalmers University of Technology/University of Göteborg
Danny	Stoll	University of Michigan
Xin	Sun	University of Pennsylvania
Jinwoo	Sung	University of Chicago
Emanuel	Sygal	Tel Aviv University
Hassan	Tahir	Ocean University of China
Mathav	Murugan	University of British Columbia
Dylan	Thurston	Indiana University
Mayank	Totloor	New York University
Sascha	Troscheit	University of Vienna
Amanda	Turner	University of Lancaster
Joonas	Vättö	ETH Zürich
Diederik	van Engelenburg	University of Vienna
Sebastian	van Strien	Imperial College, London
Vyron	Vellis	University of Tennessee
Fredrik	Viklund	Royal Institute of Technology
Jani	Virtanen	University of Reading
Dan-Virgil	Voiculescu	University of California, Berkeley
Yilin	Wang	Massachusetts Institute of Technology
Catherine	Wolfram	Massachusetts Institute of Technology
Jang-Mei	Wu	University of Illinois at Urbana-Champaign
William	Wylie	Syracuse University
Xiangjin	Xu	Binghamton University (SUNY)
Jonguk	Yang	Stony Brook University
Kevin	Yang	Stanford University
Liding	Yao	University of Wisconsin-Madison
Malik	Younsi	University of Hawaii at Manoa
Yang	Yu	University of Washington
Yizheng	Yuan	TU Berlin
Jiaxin	Zhang	California Institute of Technology
Hui	Zhu	University of Michigan
Michel	Zinsmeister	Université d'Orléans

Identifiable Participants' Information

Participants		156

Gender		156
Male	76.28%	119
Female	22.44%	35
Other	0.64%	1
Declined to state	0.64%	1

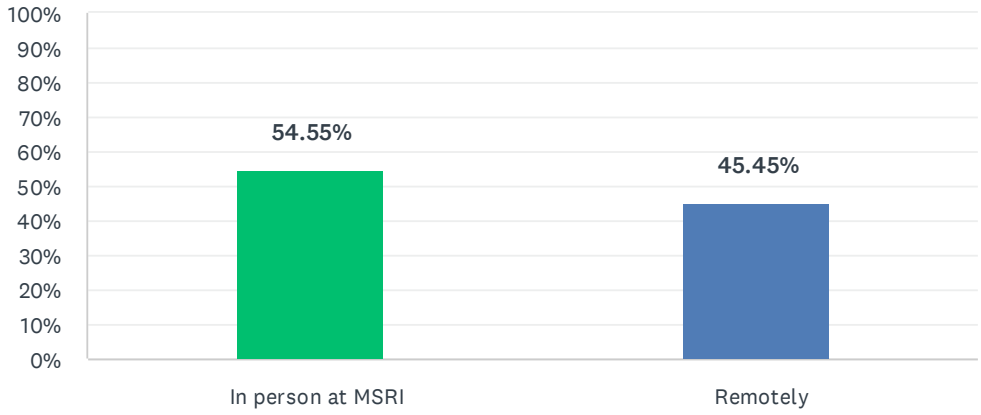
Ethnicity*		163
White	53.37%	87
Asian	33.74%	55
Hispanic	1.84%	3
Pacific Islander	0.61%	1
Black	1.23%	2
Native American	0.00%	0
Mixed	1.84%	3
Declined to state	7.36%	12

* ethnicity specifications are not exclusive

There were 13 unidentifiable participants.

Q1 I primarily participated in the workshop:

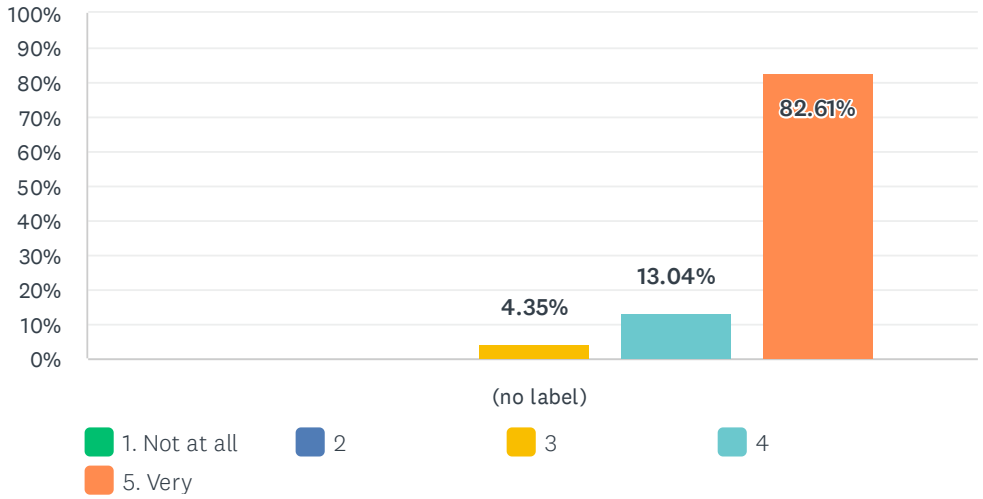
Answered: 44 Skipped: 0



ANSWER CHOICES	RESPONSES	
In person at MSRI	54.55%	24
Remotely	45.45%	20
TOTAL		44

Q2 The workshop was intellectually stimulating

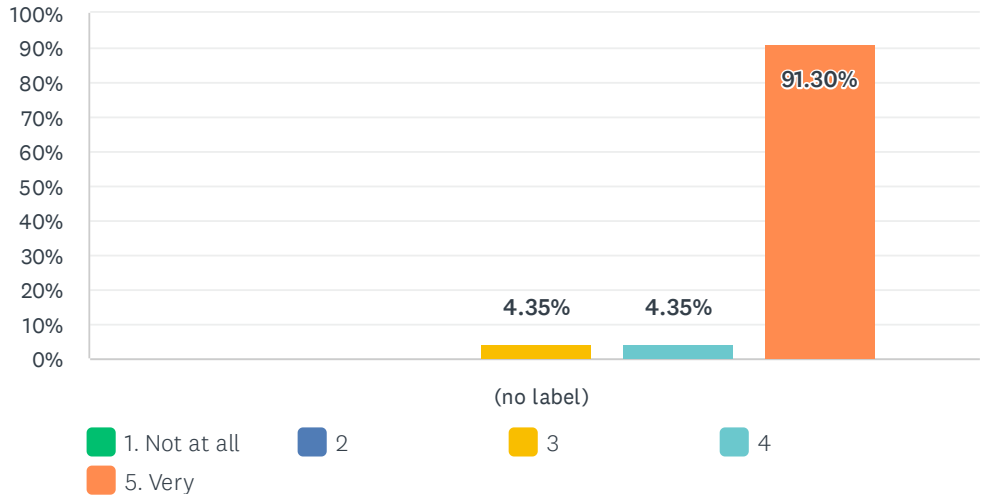
Answered: 23 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	4.35% 1	13.04% 3	82.61% 19	23	4.78

Q3 The overall experience of the workshop was worthwhile

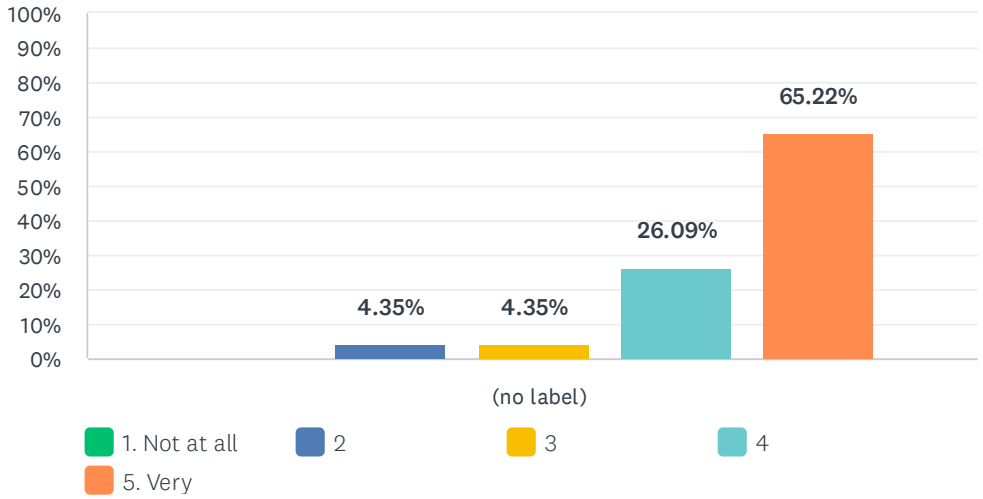
Answered: 23 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	4.35% 1	4.35% 1	91.30% 21	23	4.87

Q4 The lectures were at an appropriate level

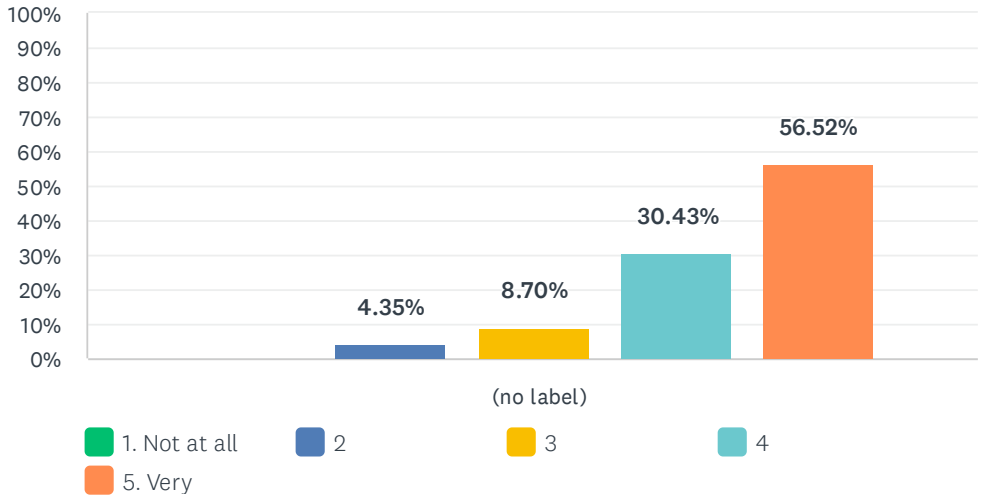
Answered: 23 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.35% 1	4.35% 1	26.09% 6	65.22% 15	23	4.52

Q5 I was well prepared to benefit from the lectures

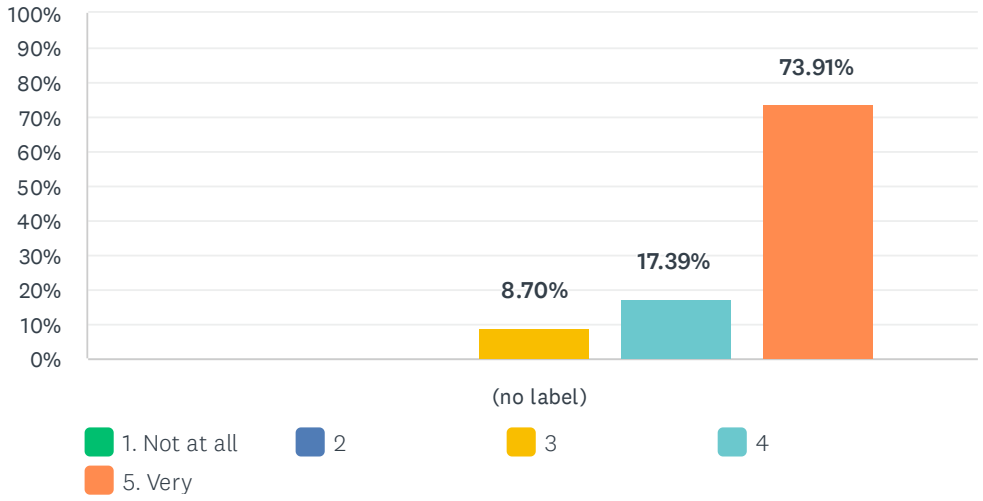
Answered: 23 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.35% 1	8.70% 2	30.43% 7	56.52% 13	23	4.39

Q6 My interest in the subject matter was increased by the workshop

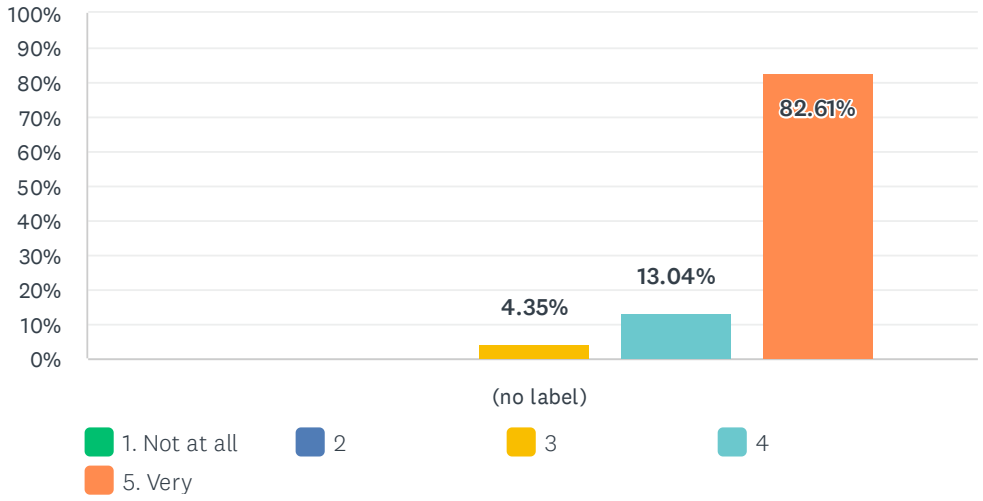
Answered: 23 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.70% 2	17.39% 4	73.91% 17	23	4.65

Q7 The workshop helped me meet people with similar scientific interests

Answered: 23 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	4.35% 1	13.04% 3	82.61% 19	23	4.78

Q8 What other subjects should be discussed in future panel discussions?

Answered: 1 Skipped: 43

#	RESPONSES	DATE
1	Mathematical integration worldwide.	2/3/2022 10:19 AM

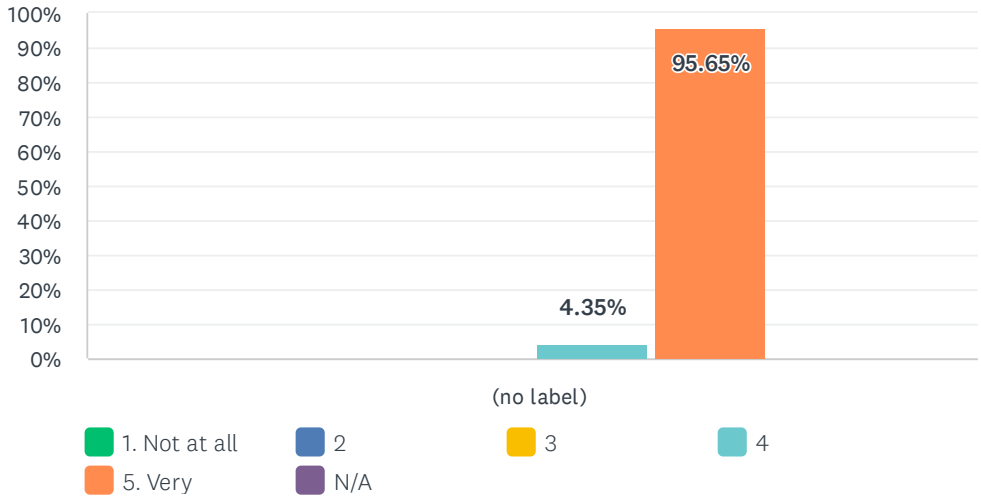
Q9 Additional comments

Answered: 2 Skipped: 42

#	RESPONSES	DATE
1	I think the panel discussion was about an important topic, it would just have been nicer if it was announced beforehand what the topic would be so one could be prepared.	2/3/2022 9:58 AM
2	Thank you very much!	1/29/2022 10:14 AM

Q10 I found the MSRI staff helpful

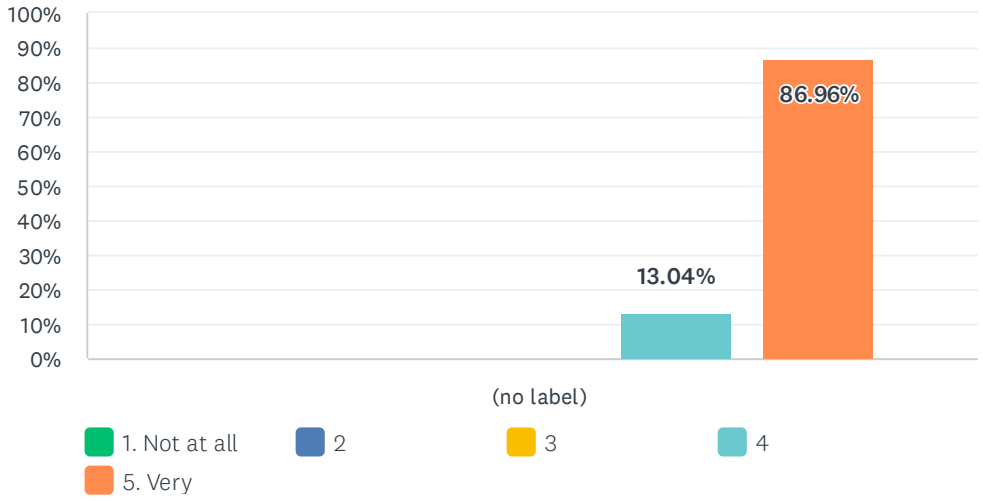
Answered: 23 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	4.35% 1	95.65% 22	0.00% 0	23	4.96

Q11 The MSRI facilities were conducive for such a workshop

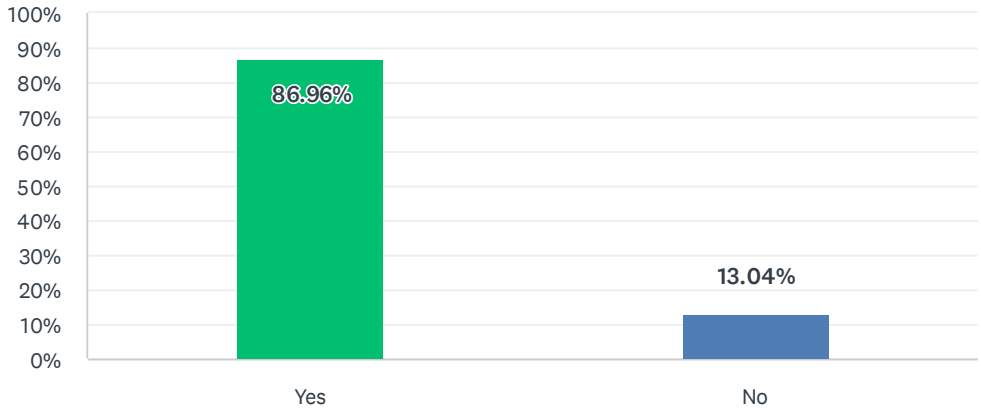
Answered: 23 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	13.04% 3	86.96% 20	23	4.87

Q12 Did you use MSRI's wireless network?

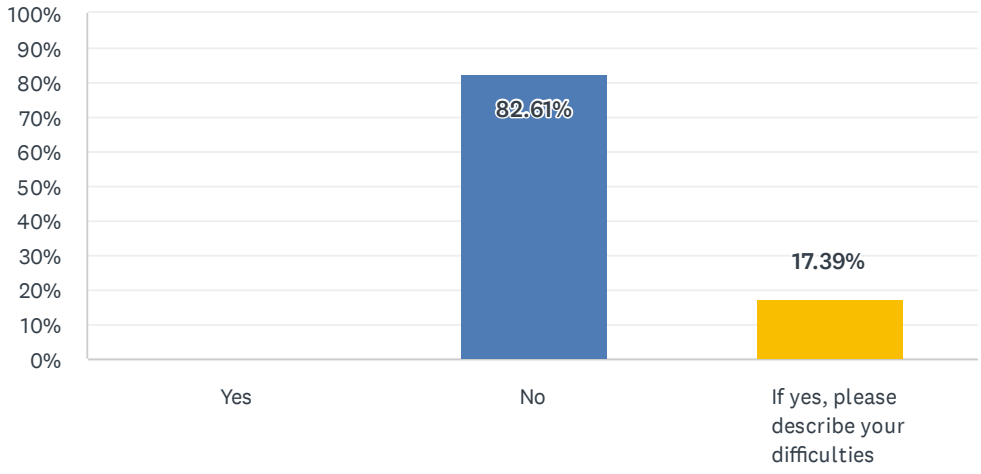
Answered: 23 Skipped: 21



ANSWER CHOICES	RESPONSES	
Yes	86.96%	20
No	13.04%	3
TOTAL		23

Q13 Did you experience any difficulties with the network?

Answered: 23 Skipped: 21

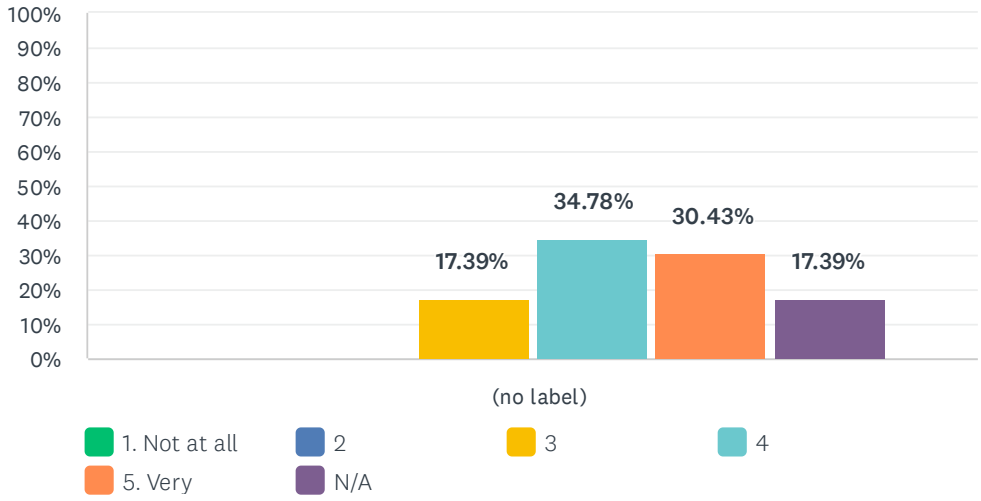


ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	82.61%	19
If yes, please describe your difficulties	17.39%	4
TOTAL		23

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	Some issues with the wifi	2/20/2022 9:00 PM
2	when trying to listen to lectures from my office, the internet connection was unstable.	1/28/2022 7:53 PM
3	Unreliable connection	1/28/2022 7:29 PM
4	Was sometimes slow	1/28/2022 4:34 PM

Q14 The MSRI lunch arrangements were satisfactory

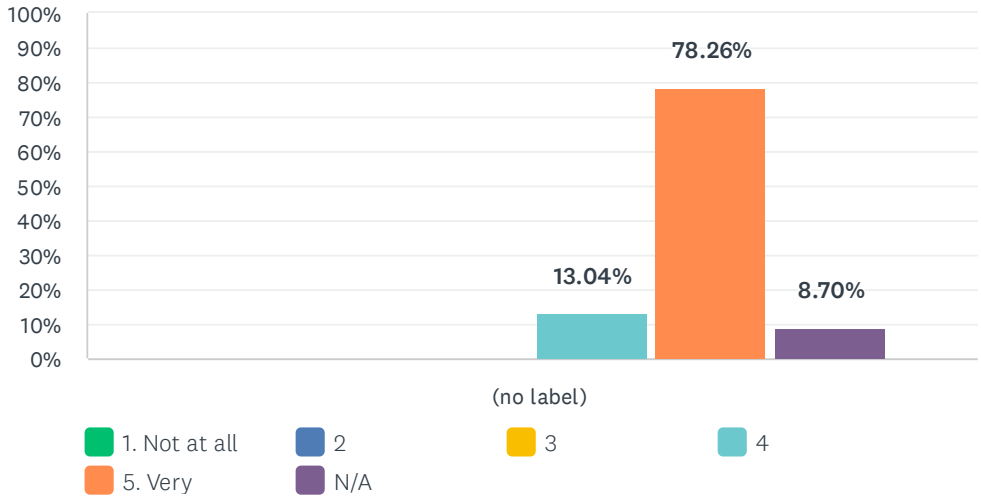
Answered: 23 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	17.39% 4	34.78% 8	30.43% 7	17.39% 4	23	4.16

Q15 The MSRI tea arrangements were satisfactory

Answered: 23 Skipped: 21



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	13.04% 3	78.26% 18	8.70% 2	23	4.86

Q16 Additional comments about the MSRI staff, facilities and food

Answered: 7 Skipped: 37

#	RESPONSES	DATE
1	Online access to MSRI library is not easy to use. Providing some detailed instruction and links may be helpful.	2/3/2022 11:15 AM
2	I like the system but I think the choice of restaurants could be improved. The Mexican place was good.	2/3/2022 9:54 AM
3	a non-dairy milk option would be great for tea	1/31/2022 9:09 AM
4	A bit frustrating that you can't take coffee into the auditorium, even if it is in a thermos or secure container.	1/29/2022 10:15 AM
5	Thank you so much to the staff at MSRI. You guys are always so patient and helpful.	1/29/2022 9:57 AM
6	Doing very well handling the constraints of the pandemic.	1/29/2022 9:41 AM
7	The staff are super friendly and helpful!	1/28/2022 5:21 PM

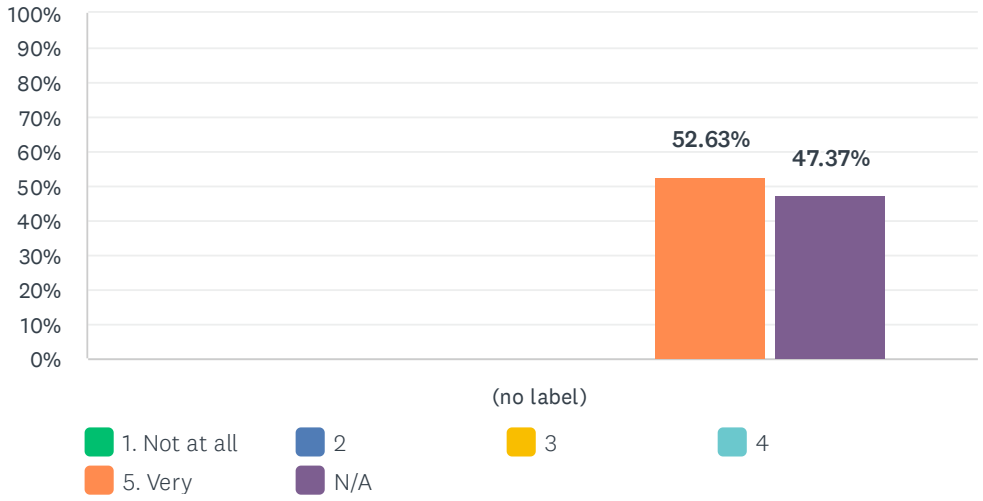
Q17 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 2 Skipped: 42

#	RESPONSES	DATE
1	Instructions on how to use equipment in the video room at the MSRI library will be helpful.	2/3/2022 11:16 AM
2	MSRI is a wonderful place and its staff is extremely helpful and friendly. Thank you very much.	2/3/2022 10:21 AM

Q18 I found the MSRI staff helpful

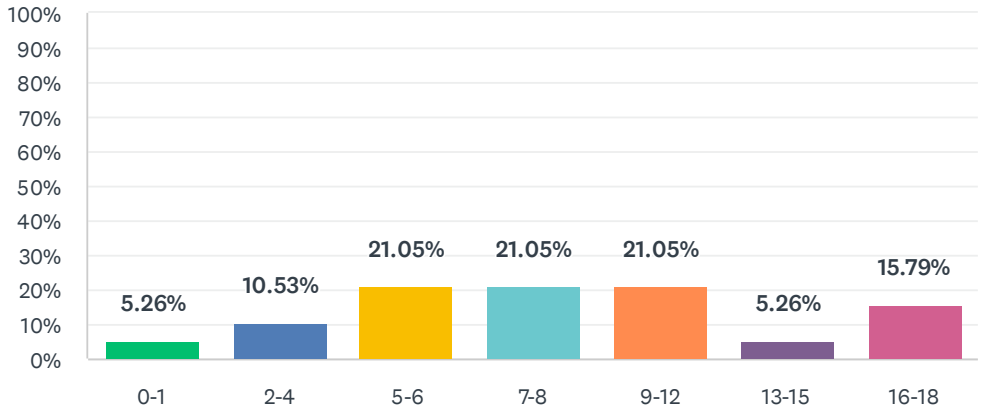
Answered: 19 Skipped: 25



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	0.00% 0	52.63% 10	47.37% 9	19	5.00

Q19 How many talks did you watch live?

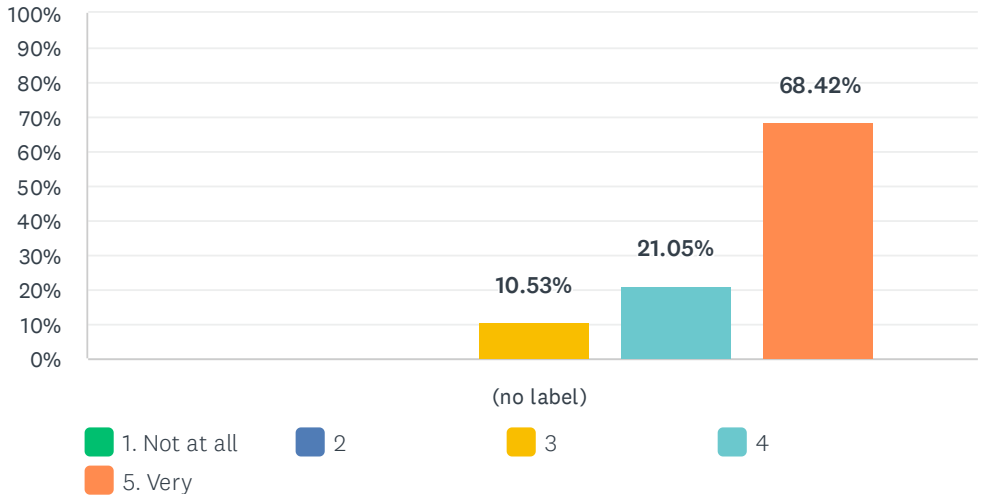
Answered: 19 Skipped: 25



ANSWER CHOICES	RESPONSES	
0-1	5.26%	1
2-4	10.53%	2
5-6	21.05%	4
7-8	21.05%	4
9-12	21.05%	4
13-15	5.26%	1
16-18	15.79%	3
TOTAL		19

Q20 The workshop was intellectually stimulating

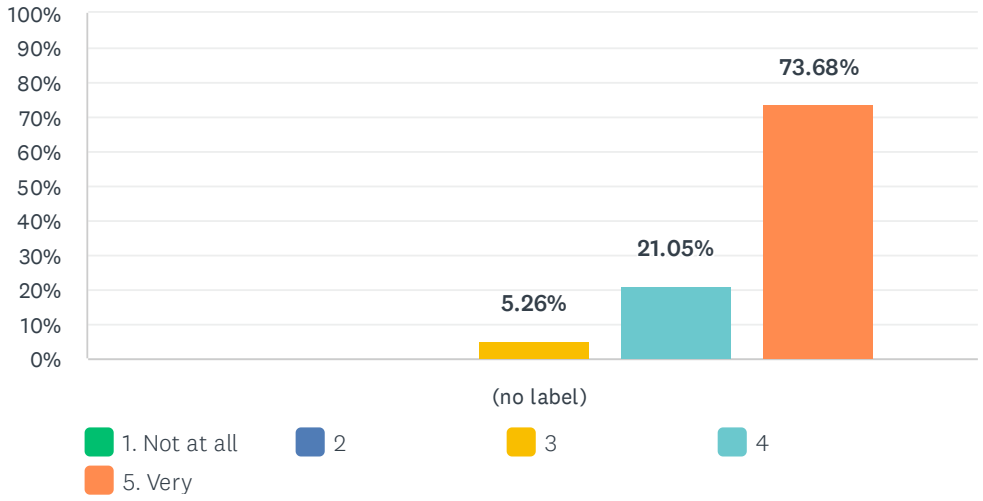
Answered: 19 Skipped: 25



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	10.53% 2	21.05% 4	68.42% 13	19	4.58

Q21 The overall experience of the workshop was worthwhile

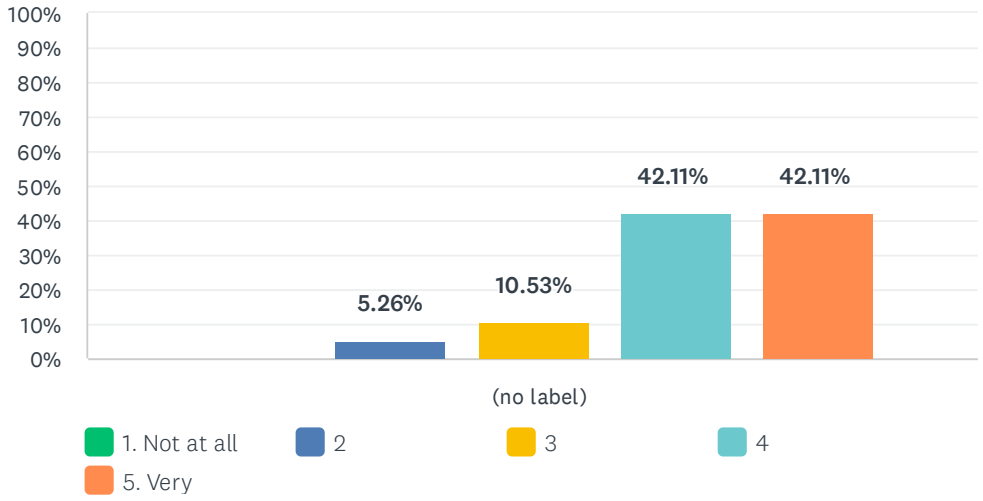
Answered: 19 Skipped: 25



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.26% 1	21.05% 4	73.68% 14	19	4.68

Q22 The lectures were at an appropriate level

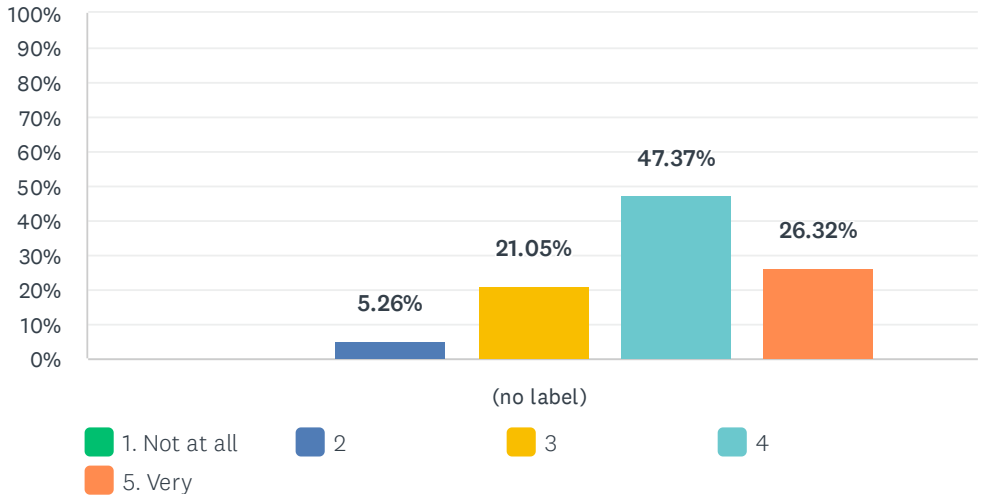
Answered: 19 Skipped: 25



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.26% 1	10.53% 2	42.11% 8	42.11% 8	19	4.21

Q23 I was well prepared to benefit from the lectures

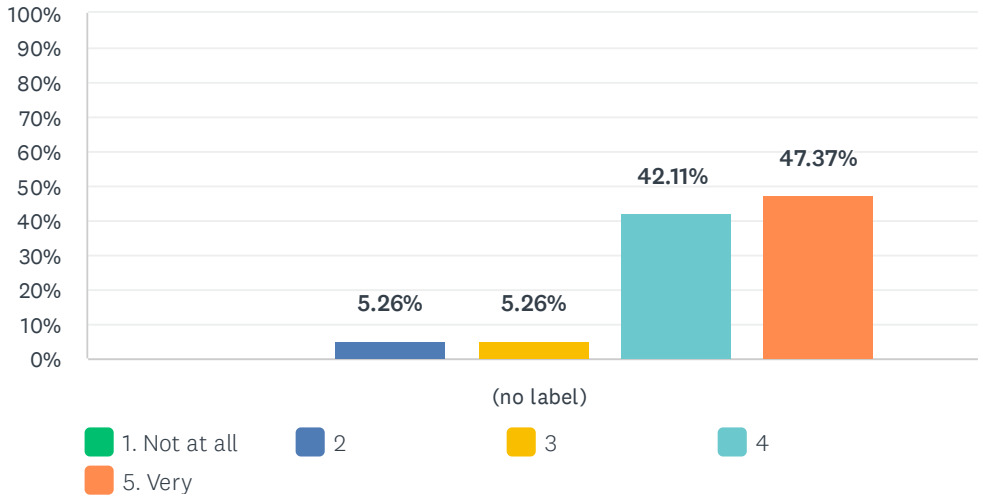
Answered: 19 Skipped: 25



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.26% 1	21.05% 4	47.37% 9	26.32% 5	19	3.95

Q24 My interest in the subject matter was increased by the workshop

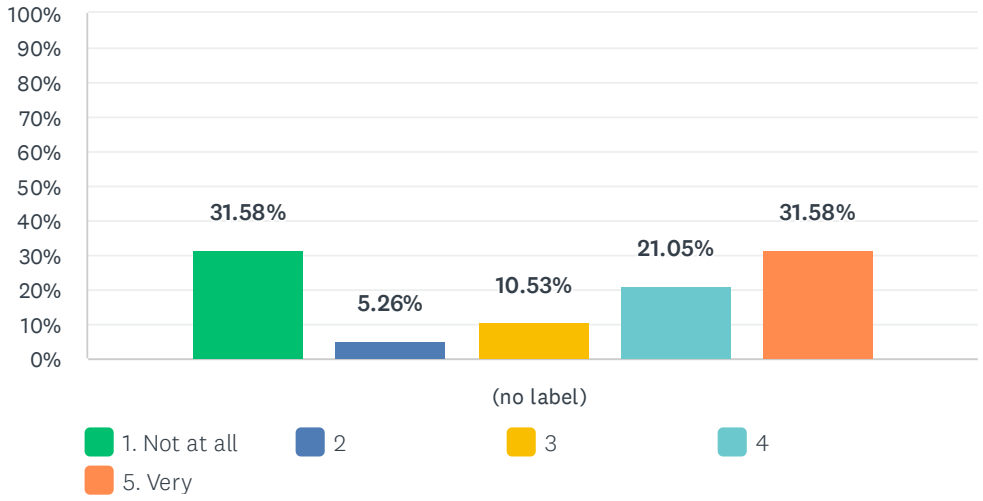
Answered: 19 Skipped: 25



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.26% 1	5.26% 1	42.11% 8	47.37% 9	19	4.32

Q25 The workshop helped me meet people with similar scientific interests

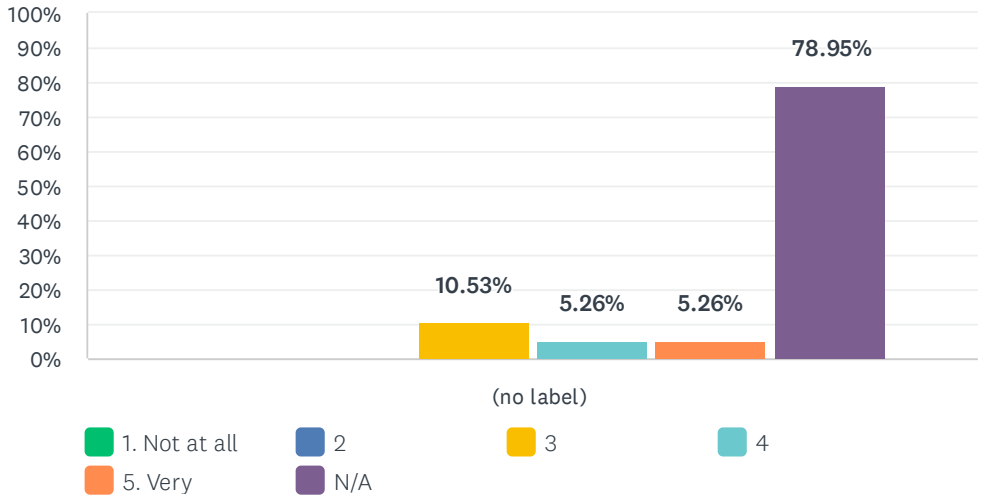
Answered: 19 Skipped: 25



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	31.58% 6	5.26% 1	10.53% 2	21.05% 4	31.58% 6	19	3.16

Q26 Did you find the panel discussion worthwhile?

Answered: 19 Skipped: 25



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	10.53% 2	5.26% 1	5.26% 1	78.95% 15	19	3.75

Q27 What other subjects should be discussed in future panel discussions?

Answered: 0 Skipped: 44

#	RESPONSES	DATE
	There are no responses.	

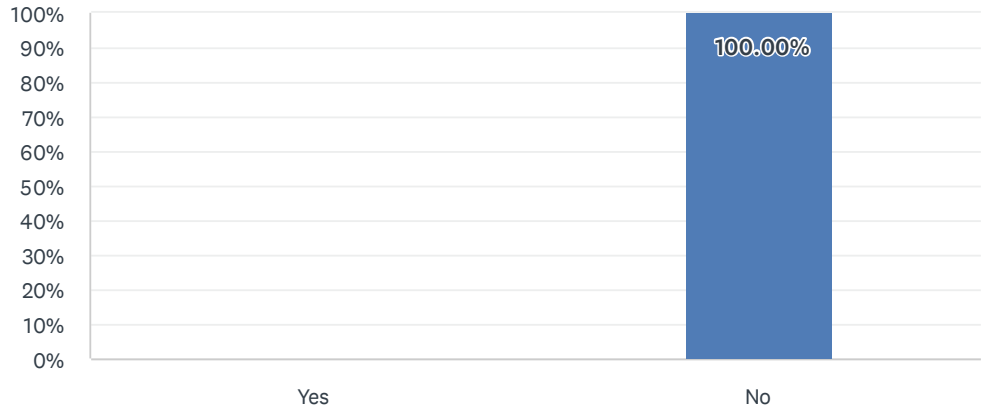
Q28 Additional comments

Answered: 4 Skipped: 40

#	RESPONSES	DATE
1	As far as I know, the "introductory workshop" did not have a panel discussion (the connections workshop did). Is there a conflation of the two workshops?	1/29/2022 1:25 PM
2	I would be good to try and stick to the schedule due to time zone differences for remote participants!	1/29/2022 12:19 AM
3	The virtual format is challenging. It may increase the interest in the talks to stream them as well. Perhaps the registration could have a streaming option in the future to which all are accepted. For steaming it is important to keep the schedule. At times this week it was annoying when the program was much delayed. Perhaps, and especially, for the introductory workshops, some form of forum for “stupid” questions and a teaching assistant a bit knowledgeable to answer them - or to give a reference, would be nice. Say a Slack channel monitored by an assistant.	1/28/2022 9:50 PM
4	I'm very happy for being a part of the workshop.	1/28/2022 5:48 PM

Q29 Did you experience any technical difficulties accessing the workshop online?

Answered: 18 Skipped: 26



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	100.00%	18
TOTAL		18

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
1	The talks being delayed some days was annoying.	1/28/2022 9:55 PM

Q30 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 18 Skipped: 26

#	RESPONSES	DATE
1	My personal circumstances and time zone differences limited my participation in the workshop. Certainly, it would be more active in person.	2/5/2022 10:55 PM
2	I don't know why, but I find it much harder to follow online talks, than in person talks. The time zone was all right for me. The talks were for me in the afternoon.	2/4/2022 2:12 AM
3	There was a barrier to participation due to time zone differences	2/3/2022 12:26 PM
4	I wasn't able to come in person, so I am grateful there was a remote option available to us!	2/3/2022 11:53 AM
5	Although I appreciate that the talks were scheduled in the mornings to be more compatible with European time zones, I struggled to benefit from the later talks as I found I was very tired by that point in the day. Also several talks coincided with when my family wanted to eat dinner. Making the recordings available at least means that I hope to be able to catch up soon.	2/1/2022 4:24 AM
6	It helped me attend more talks	1/31/2022 1:56 PM
7	I had no issues participating remotely.	1/30/2022 7:51 AM
8	Distractions at my departmental office, and not being able to ask questions in person (I am not comfortable asking questions via online platforms)	1/29/2022 1:26 PM
9	It seemed the schedule sometimes deviated from what was posted.	1/29/2022 12:38 PM
10	I appreciate having the opportunity to participate online.	1/29/2022 10:24 AM
11	NA	1/29/2022 2:02 AM
12	Yes, the time zone difference was a question, but only when the schedule drifted by 30/45 mins.	1/29/2022 12:22 AM
13	When there is a big time difference, such as my 10 hours, it’s obvious one can not attend all the time and some other circumstances will hamper the ability to focus.	1/28/2022 9:55 PM
14	Time zone difference prevented me from attending the early morning talks	1/28/2022 7:26 PM
15	Time zone difference was the main barrier.	1/28/2022 5:50 PM
16	I did not come in person due to family reasons. Participating online was very helpful and appreciated.	1/28/2022 5:04 PM
17	Talks started quite early (usually 8 am), and I was biking up to MSRI, so I would have had to leave home at 7 am. Furthermore, there were still COVID restrictions on office usage, and my office mate had the office in the morning.	1/28/2022 4:33 PM
18	Yes. It was a big help. Otherwise I would not have attended.	1/28/2022 4:33 PM

Q31 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 7 Skipped: 37

#	RESPONSES	DATE
1	Technologies like gathertown or similar allow people to meet in small groups online. I have had online coffee breaks like that before.	2/4/2022 2:12 AM
2	Can someone (for example, a postdoc that is there in person) monitor the chat in Zoom? Then we might be more engaged with the group.	2/3/2022 11:53 AM
3	The delayed start to some of the talks at the start of the week meant there was a chance for some enjoyable informal chats amonst remote participants while waiting. I'm not sure if there's a way to schedule this kind of interaction formally, though, as I suspect we were all only online because we were expecting the talks to start. The fact that the onversation was being recorded was a bit off-putting to contributing, so perhaps only the actual talks could be recorded in future, to encourage more informal discussion.	2/1/2022 4:24 AM
4	None.	1/29/2022 1:26 PM
5	The remote participant could be invited to ask questions via their microphone and video, rather than in the chat.	1/29/2022 12:22 AM
6	A Slack channel could encourage questions especially from junior members, or people new to the area. It may be say a forum to find good lecture notes on the topic. I think streaming the interesting talks is a good idea. I also really liked that the week sparked two virtual online courses by participants in the program. Perhaps in the future MSRI could encourage some remote - or partly remote - participation which would involve teaching a course on the topic which is online/hybrid and open to all. If participants are mixed online and in person, interaction is quite unlikely. Some gather.town or similar social interactions could help with junior participants.	1/28/2022 9:55 PM
7	I have been to other conferences that made use of software where participants could move avatars around a virtual room and have the ability to talk to people when they got close enough to them. Since you can see where every one is, it is easy to find people and form small conversation, somewhat like being in person. Nuria Fagella was one of the organizers of such a workshop in Barcelona last year and I think she is at MSRI for the holomorphic dynamics program this person (I am not sure if she is there in person).	1/28/2022 4:33 PM

Q32 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 4 Skipped: 40

#	RESPONSES	DATE
1	Temporarily no	2/3/2022 12:26 PM
2	Thank you!	2/3/2022 11:53 AM
3	Thanks to the MSRI staff for all their work making this run so smoothly for the virtual participants!	1/29/2022 10:25 AM
4	Start the talks a little later, maybe 9 am.	1/28/2022 4:33 PM

Connections Workshop: Complex Dynamics - From Special Families to Natural Generalizations in One and Several Variables

February 02 - February 04, 2022

Hybrid Workshop

Organizers:

Núria Fagella (University of Barcelona)

Tanya Firsova (Kansas State University)

Thomas Gauthier (Université Paris-Saclay)

Sarah Koch (University of Michigan)

REPORT ON THE MSRI WORKSHOP
"Connections Workshop: Complex Dynamics - from special families to natural generalizations in one and several variables (Hybrid Workshop)"
February 02 – February 04, 2022

Organizers

- Núria Fagella (University of Barcelona)
- Tanya Firsova (Kansas State University)
- Thomas Gauthier (Université Paris-Saclay)
- Sarah Koch (University of Michigan)

Scientific Description

This workshop featured lectures on a variety of topics in complex dynamics, given by prominent researchers in the field, as well as presentations by younger participants. It preceded the introductory workshop and previewed the major research themes of the semester program. There was a panel discussion focused on issues particularly relevant to junior researchers, women, and minorities, as well as other social events. This workshop was open to all mathematicians.

Highlights of the Workshop

The workshop was successfully conducted in the hybrid format. There were both in-person and online speakers, and there were both in-person and online audience members. The schedule featured 5 online talks and 6 in-person talks and a panel discussion.

Talks.

It was important for the organizers to highlight the work of female mathematicians. In particular, all of the talks were given by women. There were 7 talks given by junior researchers, which included 1 graduate student and several postdocs. There were also 4 talks given by senior researchers.
The topics of the workshop included dynamics and moduli spaces of rational maps, Thurston theory, dynamics in several complex variables, transcendental dynamics.

Panel.

The theme of the panel was "Ask a mathematician". It was important to the organizers that the panelists featured mathematicians in different career stages and from different types of universities and colleges. Our panelists were Jack Burkart (postdoctoral fellow, University of Wisconsin), Núria Fagella (professor, Universitat de Barcelona), Scott Kaschner (associate professor, Butler University), Becca Winarski (assistant professor, College of the Holy Cross). Our moderator was Rohini Ramadas, assistant professor at the University of Warwick. We solicited questions from all participants ahead of time. The panel generated a lot of discussion about the current job situation

for young mathematicians. In particular, many of the younger people found that getting jobs is especially challenging during the pandemic. They also expressed concern about the lack of guidance and mentorship available for those pursuing nonacademic paths.

Overall the organizers are very pleased with the workshop. There were a lot of mathematical discussion during the breaks, and we invited everyone to join us for a workshop "cookie walk" which was very well attended.

Organizers

First Name	Last Name	Institution
Núria	Fagella	University of Barcelona
Tanya	Firsova	Kansas State University
Thomas	Gauthier	Université Paris-Saclay
Sarah	Koch	University of Michigan

Speakers

First Name	Last Name	Institution
Anna Miriam	Benini	Università di Parma
Araceli	Bonifant	University of Rhode Island
Jack	Burkart	University of Wisconsin-Madison
Vasiliki	Evdoridou	Open University
Núria	Fagella	University of Barcelona
Nataliia	Goncharuk	University of Toronto, Mississauga
Yan Mary	He	University of Oklahoma
Scott	Kaschner	Butler University
Sarah	Koch	University of Michigan
Alexandra	Kuznetsova	École Polytechnique
Leticia	Pardo Simon	University of Manchester
Rohini	Ramadas	University of Warwick
Raluca	Tanase	Institute of Mathematics of the Romanian Academy
Rebecca	Winarski	College of the Holy Cross

Mathematical Sciences Research Institute

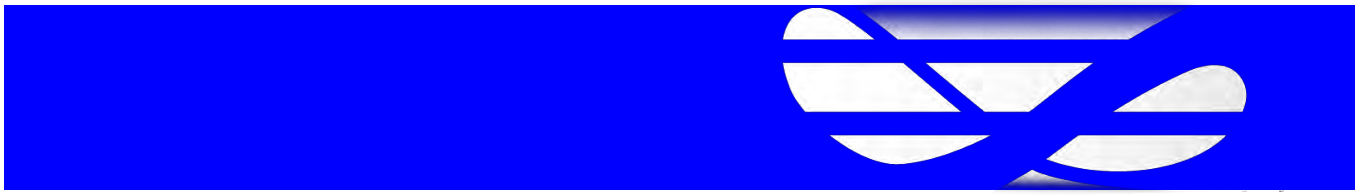
Connections Workshop: Complex Dynamics - From Special Families to Natural Generalizations in One and Several Variables [Hybrid Workshop]

February 02 to February 04, 2022

Wednesday, February 02		
08:50 AM - 09:00 AM		Welcome
09:00 AM - 09:50 AM	Sarah Koch	Dynamical Moduli Spaces
10:00 AM - 10:50 AM	Araceli Bonifant	Dynamic Tessellations Associated with Cubic Polynomials
11:30 AM - 11:55 AM	Rebecca Winarski	Thurston Theory: Connecting Geometry, Topology and Complex Dynamics
12:00 PM - 12:25 PM	Rohini Ramadas	Moduli Spaces and Dynamics

Thursday, February 03		
09:00 AM - 09:50 AM	Raluca Tanase	Dynamics of Complex Henon Maps
10:00 AM - 10:25 AM	Alexandra Kuznetsova	Regularizations of Birational Automorphisms
10:40 AM - 11:05 AM	Nataliia Goncharuk	Complex Rotation Numbers and Renormalization
11:20 AM - 12:20 PM	Jack Burkart, Núria Fagella, Scott Kaschner, Rohini Ramadas & Rebecca Winarski	Panel Discussion

Friday, February 04		
09:00 AM - 09:50 AM	Anna Miriam Benini	Birfurcations in Families of Meromorphic Maps
10:00 AM - 10:25 AM	Leticia Pardo Simon	Transcendental Entire Functions with Cantor Bouquet Julia Sets
11:00 AM - 11:25 AM	Vasiliki Evdoridou	Simply Connected Wandering Domains
11:30 AM - 11:55 AM	Yan Mary He	Ergodic Methods in Complex Dynamics



Participants

First Name	Last Name	Institution
Alejandro	Álvarez Araníbar	Universidad Mayor de San Andrés
Marco	Abate	Università di Pisa
Sepideh	Abdollahi	Sharif University of Technology
Rafly	Aditya Darmawan	Federal Reserve Bank of Chicago
Tom	Alberts	University of Utah
Mariam	Al-Hawaj	University of Toronto
Matthieu	Astorg	Université d'Orléans
Tahmineh	Azizi	Florida State University
Eric	Babson	University of California, Davis
Hyungryul	Baik	Cornell University
Juhun	Baik	Korea Advanced Institute of Science and Technology (KAIST)
Veronica	Beltrami	Università di Parma
Anna Miriam	Benini	Università di Parma
Tania G.	Benitez	University of Liverpool
Sebastien	Biebler	Institut de Mathematiques de Jussieu
Ilia	Binder	University of Toronto
Richard	Birkett	University of Notre Dame
Christopher	Bishop	Stony Brook University
Paul	Blanchard	Boston University
Araceli	Bonifant	University of Rhode Island
Andrew	Brown	University of Liverpool
Jack	Burkart	University of Wisconsin-Madison
Jordi	Canela Sánchez	Universitat Jaume I
Marco	Carfagnini	University of Connecticut
Melida	Carranza	Centro de Investigación en Matemáticas A.C.
Zhen-Qing	Chen	University of Washington
Tao	Chen	City University of New York (CUNY)
Scott	Crass	California State Univ, Long Beach
Caroline	Davis	Indiana University
André	de Carvalho	University of São Paulo
Robert	Devaney	Boston University
Jeff	Diller	University of Notre Dame
Devon	Ding	University of California, Berkeley
Arcelino	do Nascimento	Institute of Mathematics and Statistics (IME)
Schinella	D'Souza	University of Michigan
Dzmitry	Dudko	Stony Brook University
David	Eisenbud	MSRI - Mathematical Sciences Research Institute
Vasiliki	Evdoridou	The Open University
Núria	Fagella	University of Barcelona
Charles	Favre	École Polytechnique
Tanya	Firsova	Kansas State University
Robert	Florido-Llinàs	University of Barcelona
Hang	Fu	National Taiwan University
Joanna	Furno	University of South Alabama
Thomas	Gauthier	Université Paris-Saclay
Lukas	Geyer	Montana State University
Adi	Glucksam	Northwestern University
Nataliia	Goncharuk	University of Toronto, Mississauga
Igors	Gorbovickis	Jacobs University Bremen
Vesselin	Gueorguiev	Ronin Institute for Independent Scholarship
Funda	Gultepe	University of Toledo
Minsik	Han	Brown University
Yan Mary	He	University of Oklahoma
Susanna	Heikkilä	University of Helsinki

Participants

First Name	Last Name	Institution
Hafedh	Herichi	Santa Monica College
Wade	Hindes	Texas State University
Eriko	Hironaka	Florida State University
Mikhail	Hlushchanka	Universiteit Utrecht
Mi	Hu	Università di Parma
Valentin	Huguin	Jacobs University Bremen
Annina	Iseli	University of California, Los Angeles
Kukkeprasanna	J	Bengaluru City University
Xavier	Jarque	Universitat de Barcelona
Anna	Jové-Campabadal	University of Barcelona
Jeremy	Kahn	Brown University
Sharada	Kalanidhi	Stanford University School of Medicine
Alex	Kapiamba	University of Michigan
Scott	Kaschner	Butler University
Linda	Keen	CUNY, Graduate Center
Kyounghee	Kim	Florida State University
Sungwoon	Kim	Jeju National University
Sarah	Koch	University of Michigan
Ellen	Krusell	Royal Institute of Technology
Rishi	Kumar	Ben Gurion University of the Negev
Gaurav	Kumar	Indian Institute of Technology
Alexandra	Kuznetsova	École Polytechnique
Therese	Landry	University of California, Riverside
Kirill	Lazebnik	University of Toronto
Chifan	Leung	Oregon State University
Zhiqiang	Li	Peking University
Willie	Lim	State University of New York, Stony Brook
Peter	Lin	State University of New York, Stony Brook
Joan	Lind	University of Tennessee
Jessica	Liu	CUNY, Graduate Center
Yusheng	Luo	Stony Brook University
Liangbing	Luo	University of Connecticut
Víctor	Maciá	Autonomous University of Madrid
Firdous	Mala	University of Kashmir
David	Martí-Pete	University of Liverpool
Jacob	Mazor	State University of New York, Stony Brook
Christopher	McKay	Montana State University
Sergiy	Merenkov	City College, CUNY
Chebbab	Mesbah	University of Science and Technology Houari Boumedienne (USTHB)
Tim	Mesikepp	Peking University
Daniel	Meyer	University of Liverpool
John	Milnor	Institute for Mathematical Sciences
Sabyasachi	Mukherjee	Tata Institute of Fundamental Research
Malavika	Mukundan	University of Michigan
Hamid	Naderiyan	University of North Texas
Shizuo	Nakane	Tokyo Polytechnic University
Hongming	Nie	Stony Brook University
Leticia	Pardo Simon	University of Manchester
Eveliina	Peltola	Rheinische Friedrich-Wilhelms-Universität Bonn
Pietro	Poggi-Corradini	Kansas State University
Nikolai	Prochorov	Université d'Aix-Marseille I (Université de Provence)
Wei	Qian	Université Paris-Saclay
Remus	Radu	Institute of Mathematics of the Romanian Academy
Jasmin	Raissy	Institut de Mathématiques de Bordeaux

Participants		
First Name	**Last Name**	**Institution**
Rohini	Ramadas	University of Warwick
Bernhard	Reinke	Institut de Mathématiques de Jussieu
Lasse	Rempe	University of Liverpool
Thomas	Richards	University of Warwick
Larissa	Richards	University of Lancaster
Gustavo	Rodrigues Ferreira	The Open University
Pascale	Roesch	IMT
Steffen	Rohde	University of Washington
Mohammad	Sajid	Qassim University
Eero	Saksman	University of Helsinki
Tom	Sharland	University of Rhode Island
Alan	Sola	Stockholm University
Stan	Srednyak	Duke University
Leon	Staresinic	Imperial College, London
Margaret	Stawiska-Friedland	Mathematical Reviews
Danny	Stoll	University of Michigan
Pedro Iván	Suárez Navarro	Pontifical Catholic University of Peru
Emanuel	Sygal	Tel Aviv University
Raluca	Tanase	Institute of Mathematics of the Romanian Academy
Zhongkai	Tao	University of California, Berkeley
Dylan	Thurston	Indiana University
Vladlen	Timorin	HSE University
Giulio	Tiozzo	University of Toronto
Mayank	Totloor	New York University
Diederik	van Engelenburg	University of Vienna
Vyron	Vellis	University of Tennessee
Liz	Vivas	Ohio State University
Yilin	Wang	Massachusetts Institute of Technology
James	Waterman	State University of New York, Stony Brook
Max	Weinreich	Brown University
Rebecca	Winarski	College of the Holy Cross
Jang-Mei	Wu	University of Illinois at Urbana-Champaign
Chenxi	Wu	University of Wisconsin-Madison
Xiangjin	Xu	Binghamton University (SUNY)
Jonguk	Yang	Stony Brook University
Fei	Yang	Nanjing University
Yang	Yu	University of Washington
Runze	Zhang	Institut de Mathématiques de Toulouse
Michel	Zinsmeister	Université d'Orléans

Identifiable Participants' Information

Participants		147

Gender		147
Male	67.35%	99
Female	31.29%	46
Other	0.68%	1
Declined to state	0.68%	1

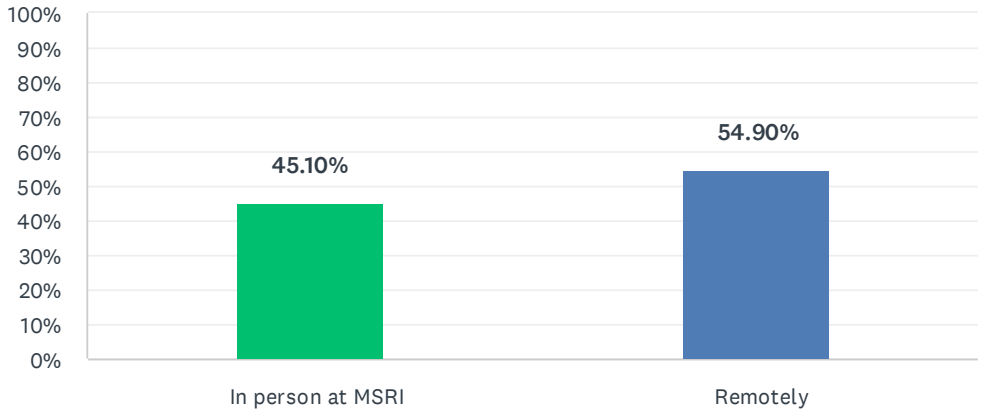
Ethnicity*		156
White	53.85%	84
Asian	27.56%	43
Hispanic	3.85%	6
Pacific Islander	0.64%	1
Black	1.28%	2
Native American	0.00%	0
Mixed	3.21%	5
Declined to state	9.62%	15

* ethnicity specifications are not exclusive

There were 10 unidentifiable participants.

Q1 I primarily participated in the workshop:

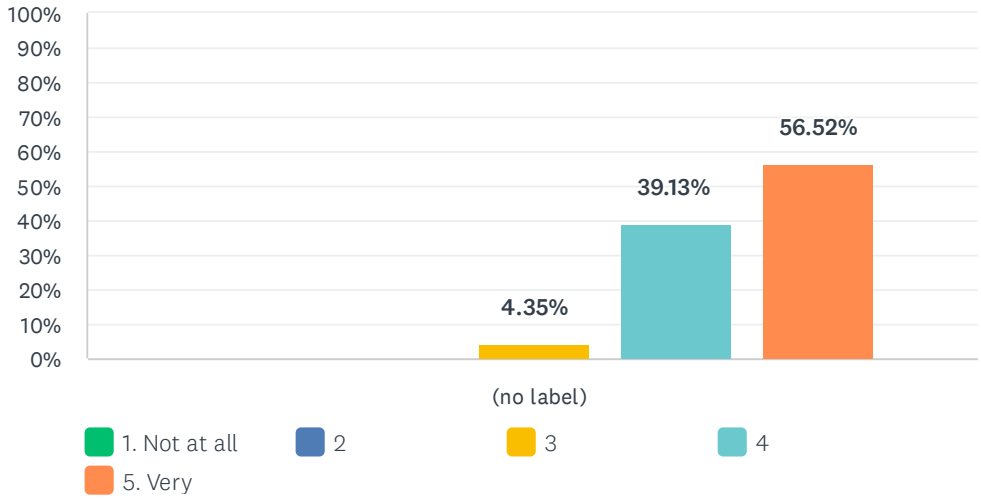
Answered: 51 Skipped: 0



ANSWER CHOICES	RESPONSES	
In person at MSRI	45.10%	23
Remotely	54.90%	28
TOTAL		51

Q2 The workshop was intellectually stimulating

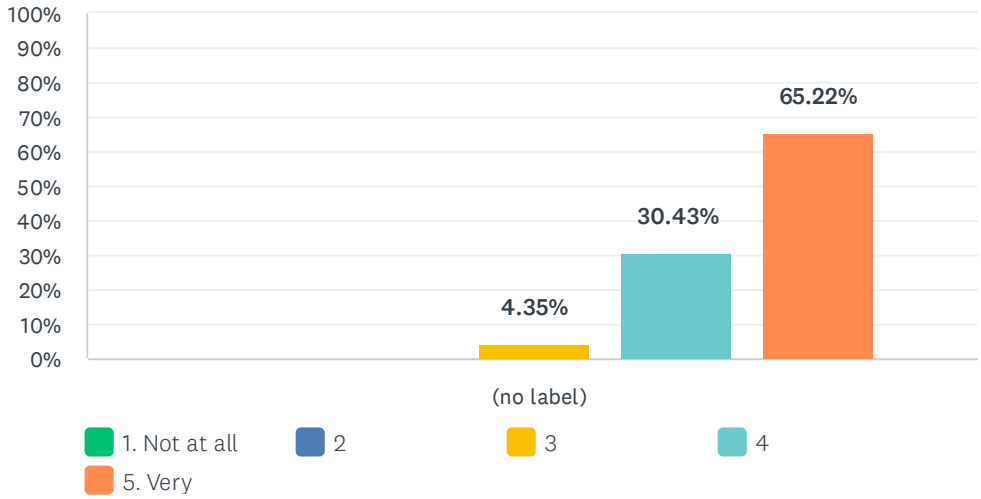
Answered: 23 Skipped: 28



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	4.35% 1	39.13% 9	56.52% 13	23	4.52

Q3 The overall experience of the workshop was worthwhile

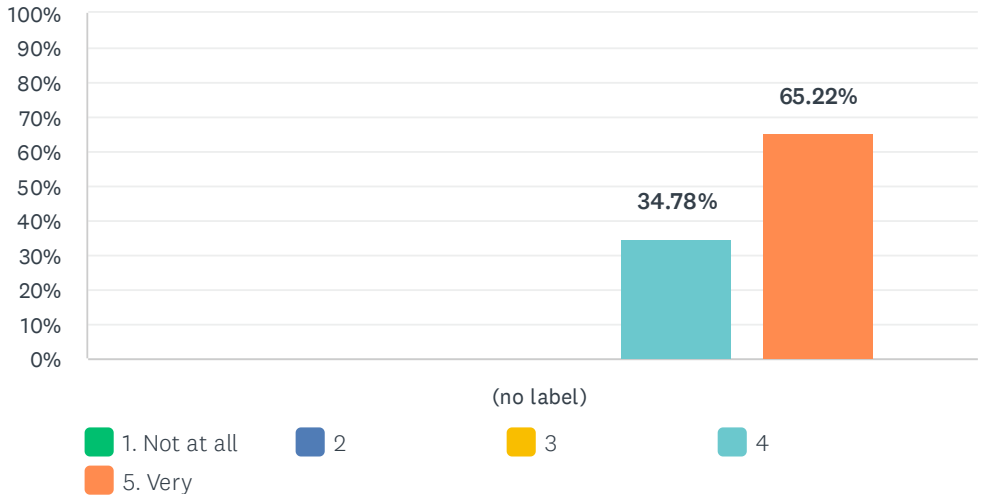
Answered: 23 Skipped: 28



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	4.35% 1	30.43% 7	65.22% 15	23	4.61

Q4 The lectures were at an appropriate level

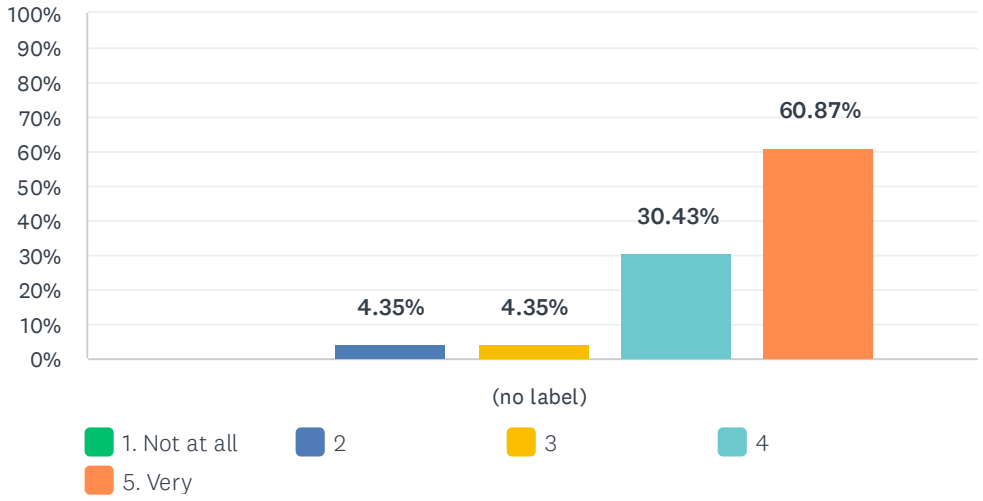
Answered: 23 Skipped: 28



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	34.78% 8	65.22% 15	23	4.65

Q5 I was well prepared to benefit from the lectures

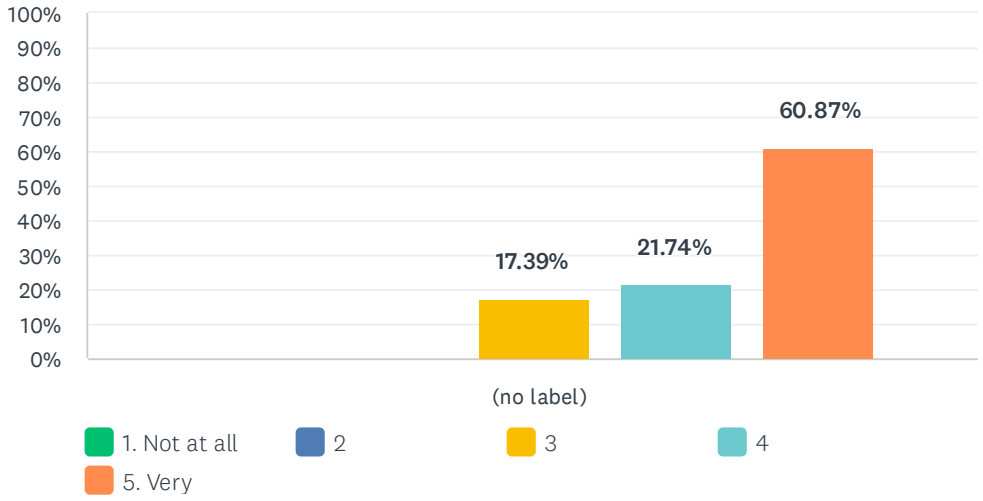
Answered: 23 Skipped: 28



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.35% 1	4.35% 1	30.43% 7	60.87% 14	23	4.48

Q6 My interest in the subject matter was increased by the workshop

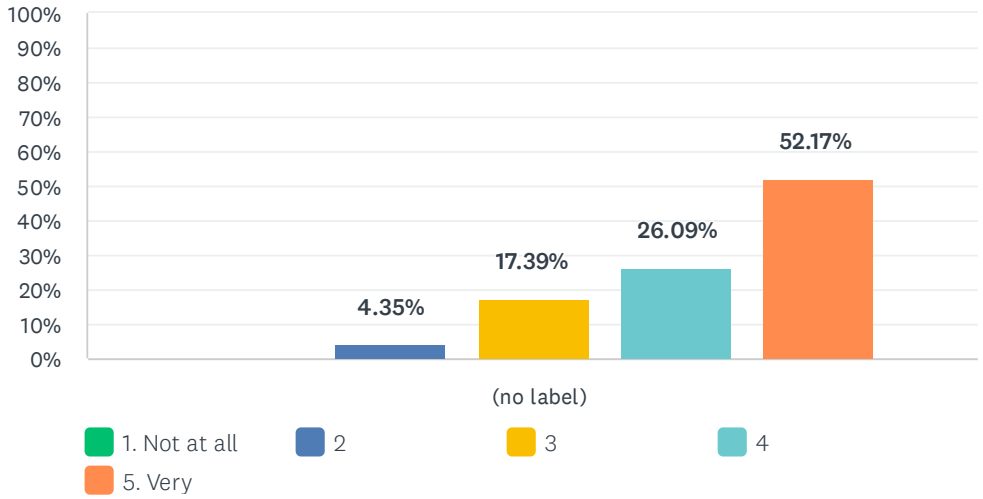
Answered: 23 Skipped: 28



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	17.39% 4	21.74% 5	60.87% 14	23	4.43

Q7 The workshop helped me meet people with similar scientific interests

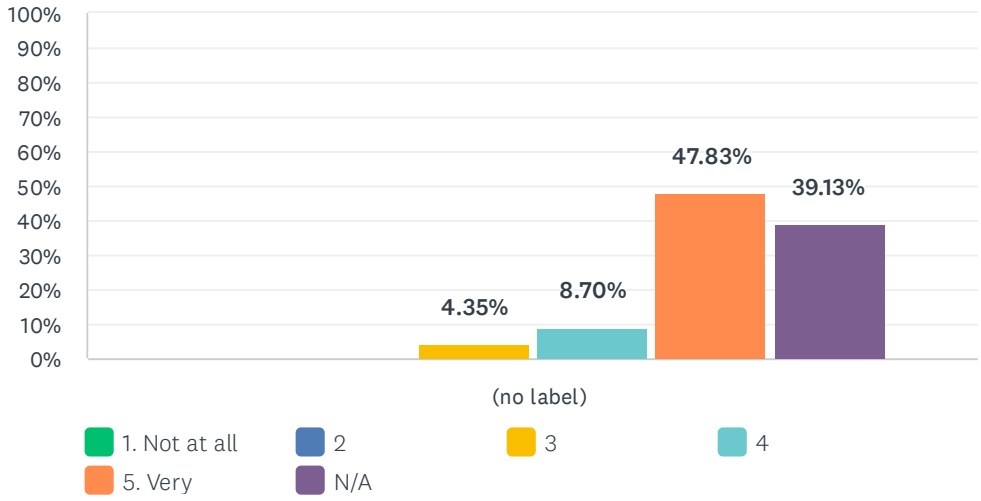
Answered: 23 Skipped: 28



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.35% 1	17.39% 4	26.09% 6	52.17% 12	23	4.26

Q8 Did you find the panel discussion worthwhile?

Answered: 23 Skipped: 28



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	4.35% 1	8.70% 2	47.83% 11	39.13% 9	23	4.71

Q9 What other subjects should be discussed in future panel discussions?

Answered: 1 Skipped: 50

#	RESPONSES	DATE
1	How to form collaborations in your early career; work-life balance; support communities for women and people of color	2/4/2022 3:37 PM

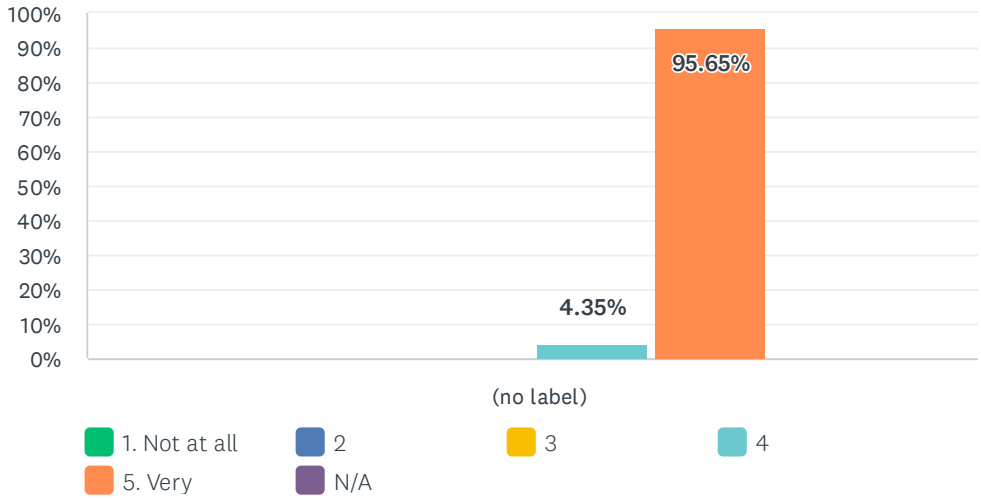
Q10 Additional comments

Answered: 2 Skipped: 49

#	RESPONSES	DATE
1	I'm part of the other program and don't really work on the field of this workshop. I however found it very interesting and could get an overview of the topics.	2/9/2022 9:39 AM
2	Thank you very much!	2/4/2022 7:32 PM

Q11 I found the MSRI staff helpful

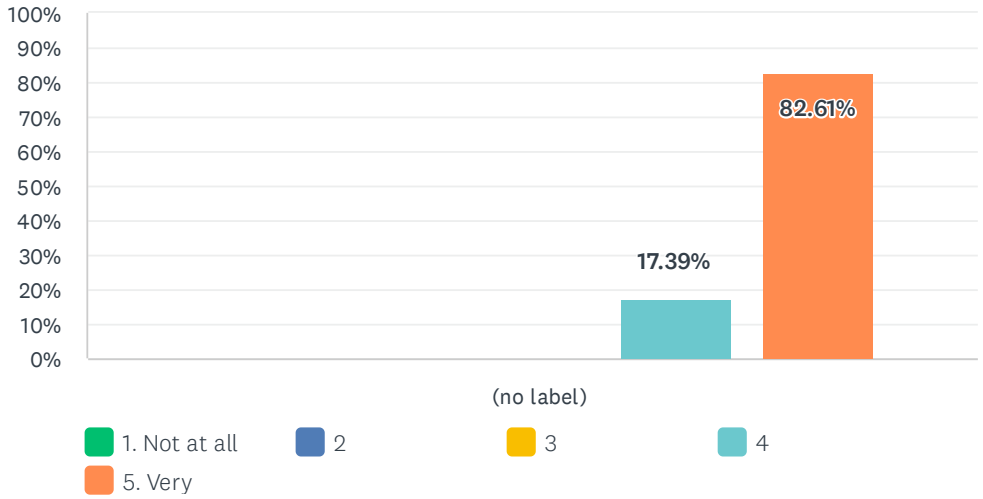
Answered: 23 Skipped: 28



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	4.35% 1	95.65% 22	0.00% 0	23	4.96

Q12 The MSRI facilities were conducive for such a workshop

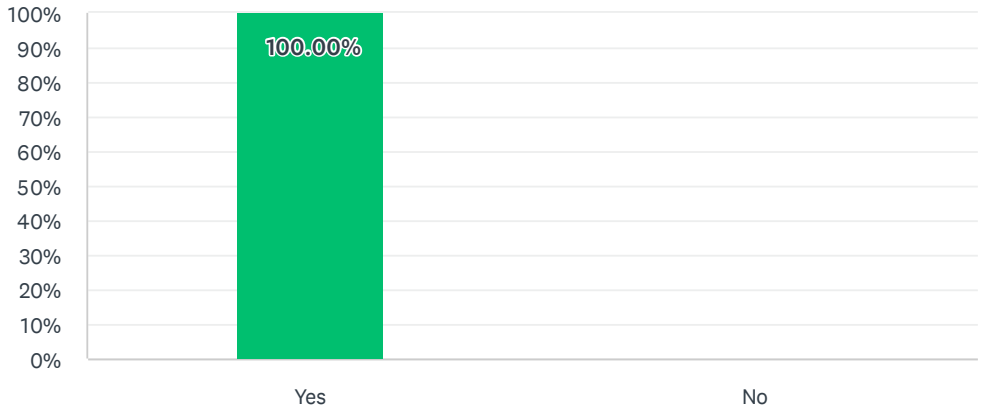
Answered: 23 Skipped: 28



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	17.39% 4	82.61% 19	23	4.83

Q13 Did you use MSRI's wireless network?

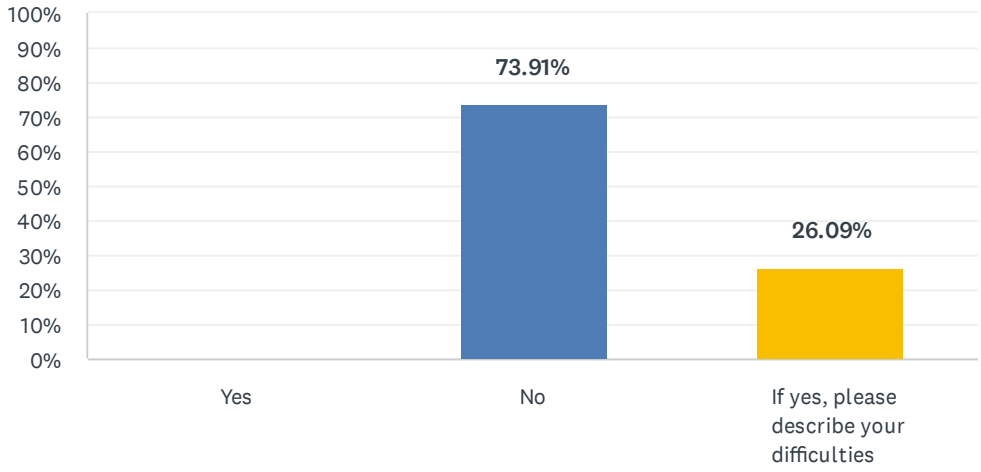
Answered: 23 Skipped: 28



ANSWER CHOICES	RESPONSES	
Yes	100.00%	23
No	0.00%	0
TOTAL		23

Q14 Did you experience any difficulties with the network?

Answered: 23 Skipped: 28

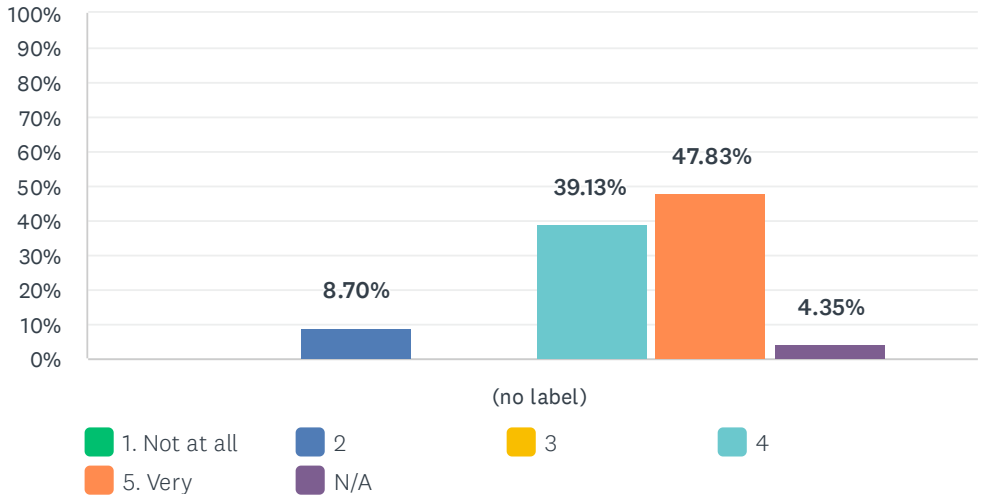


ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	73.91%	17
If yes, please describe your difficulties	26.09%	6
TOTAL		23

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	choppy at times	2/9/2022 9:14 AM
2	Overall great, but sometimes a little unstable and having difficulties connecting	2/9/2022 9:14 AM
3	The bandwidth available would sometimes drop all the way to 0.	2/7/2022 2:00 PM
4	Some difficulty with wifi, but it is being worked on!	2/4/2022 5:10 PM
5	It was unstable at times	2/4/2022 3:38 PM
6	slow connection	2/4/2022 3:16 PM

Q15 The MSRI lunch arrangements were satisfactory

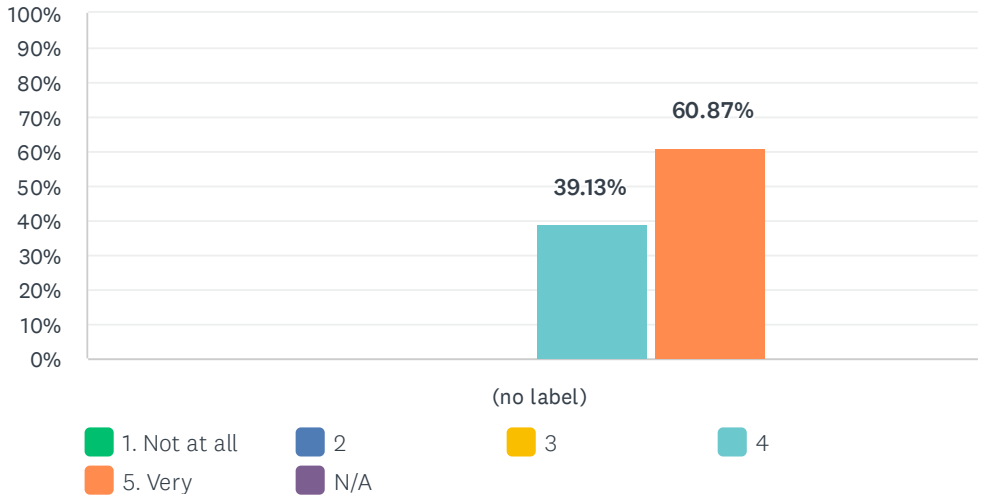
Answered: 23 Skipped: 28



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	8.70% 2	0.00% 0	39.13% 9	47.83% 11	4.35% 1	23	4.32

Q16 The MSRI tea arrangements were satisfactory

Answered: 23 Skipped: 28



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	39.13% 9	60.87% 14	0.00% 0	23	4.61

Q17 Additional comments about the MSRI staff, facilities and food

Answered: 4 Skipped: 47

#	RESPONSES	DATE
1	Just to reiterate, the staff was amazing and helpful.	2/9/2022 9:14 AM
2	Thank you for keeping everyone safe and making the best of a very difficult pandemic situation!	2/4/2022 7:33 PM
3	Not a fan of the cost of Thai Delight (but realize choices are limited)	2/4/2022 5:10 PM
4	I'm very grateful to the staff!	2/4/2022 3:38 PM

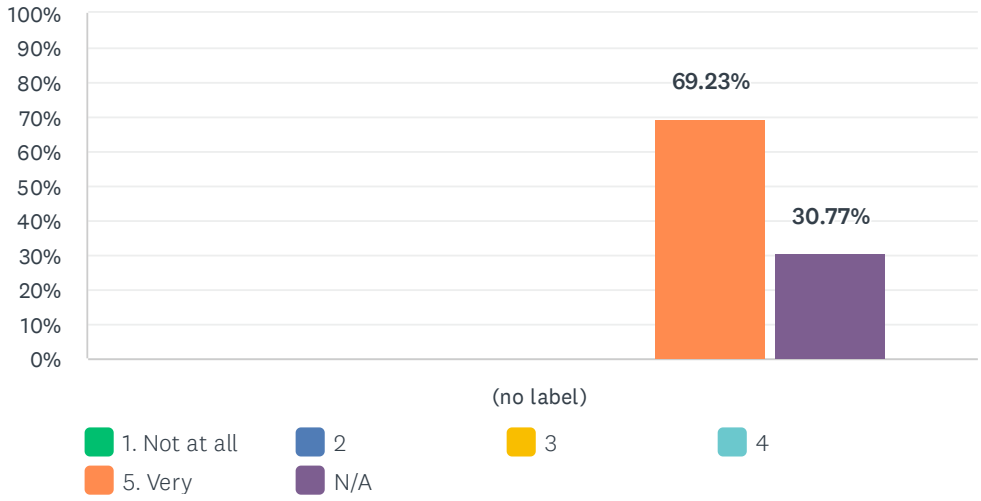
Q18 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 0 Skipped: 51

#	RESPONSES	DATE
	There are no responses.	

Q19 I found the MSRI staff helpful

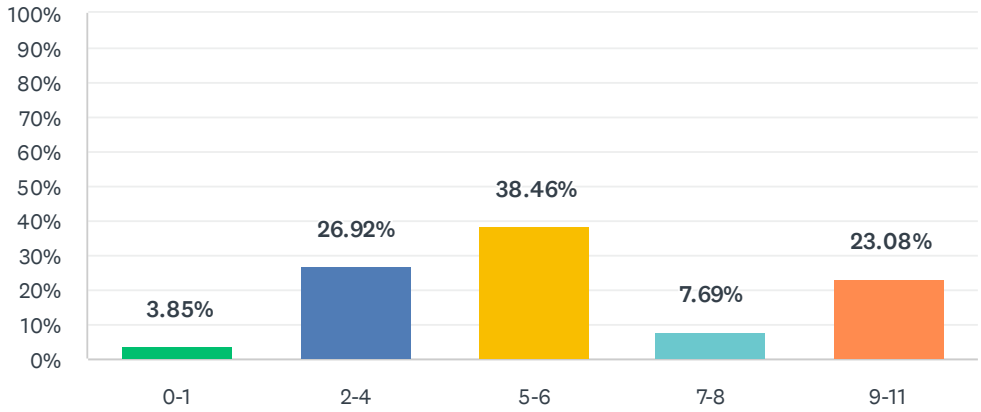
Answered: 26 Skipped: 25



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	0.00% 0	69.23% 18	30.77% 8	26	5.00

Q20 How many talks did you watch live?

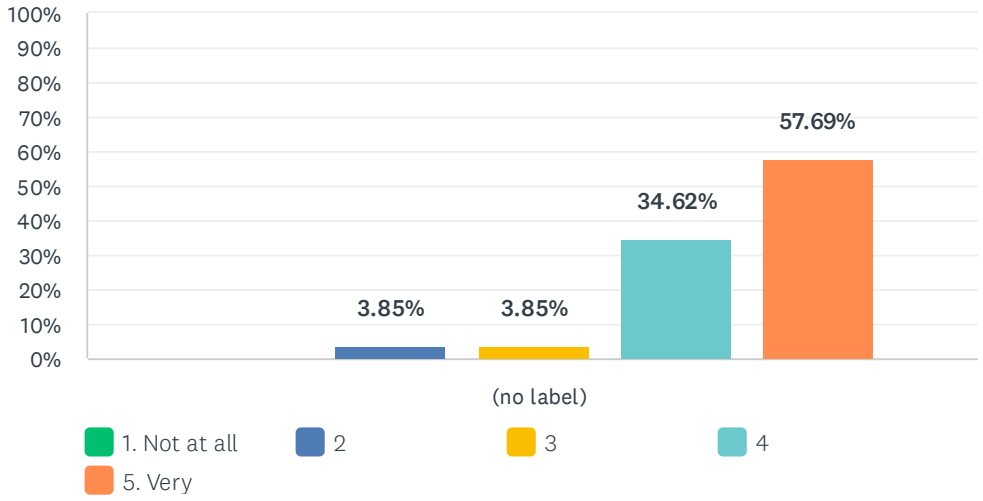
Answered: 26 Skipped: 25



ANSWER CHOICES	RESPONSES	
0-1	3.85%	1
2-4	26.92%	7
5-6	38.46%	10
7-8	7.69%	2
9-11	23.08%	6
TOTAL		26

Q21 The workshop was intellectually stimulating

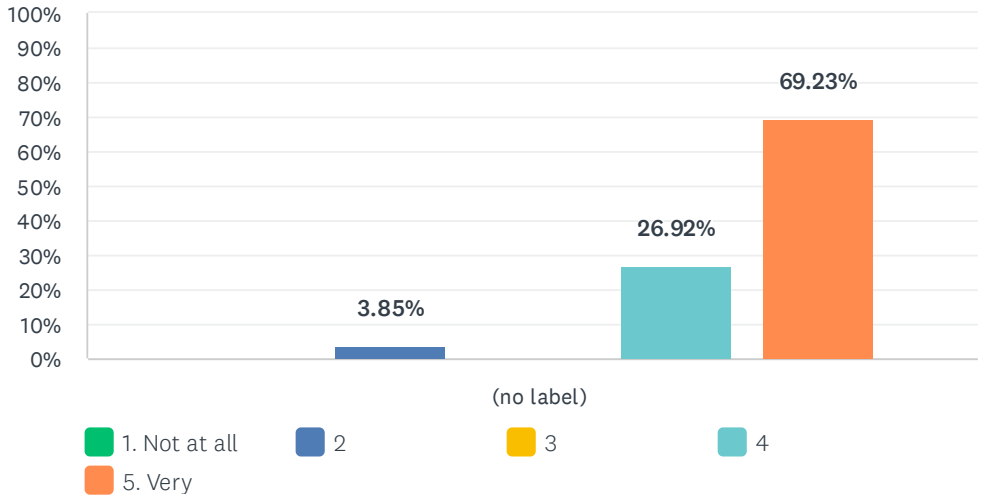
Answered: 26 Skipped: 25



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	3.85% 1	3.85% 1	34.62% 9	57.69% 15	26	4.46

Q22 The overall experience of the workshop was worthwhile

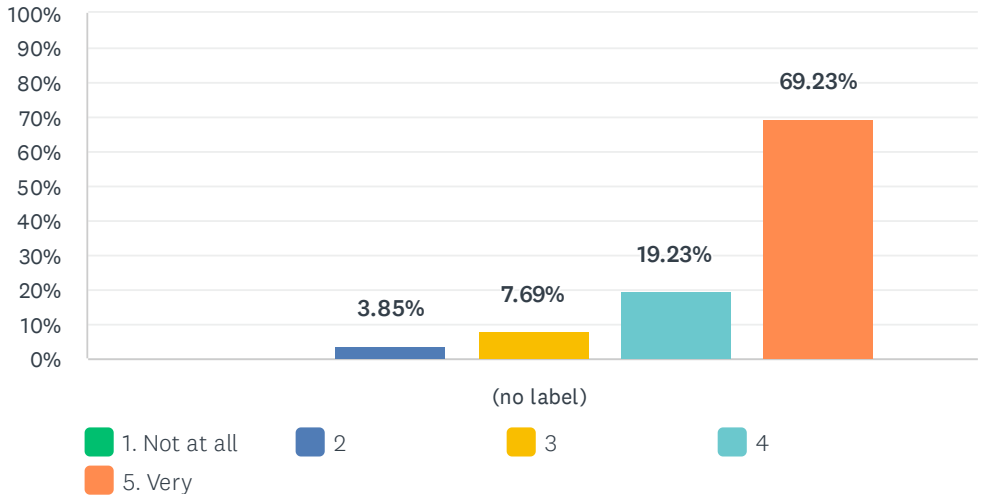
Answered: 26 Skipped: 25



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	3.85% 1	0.00% 0	26.92% 7	69.23% 18	26	4.62

Q23 The lectures were at an appropriate level

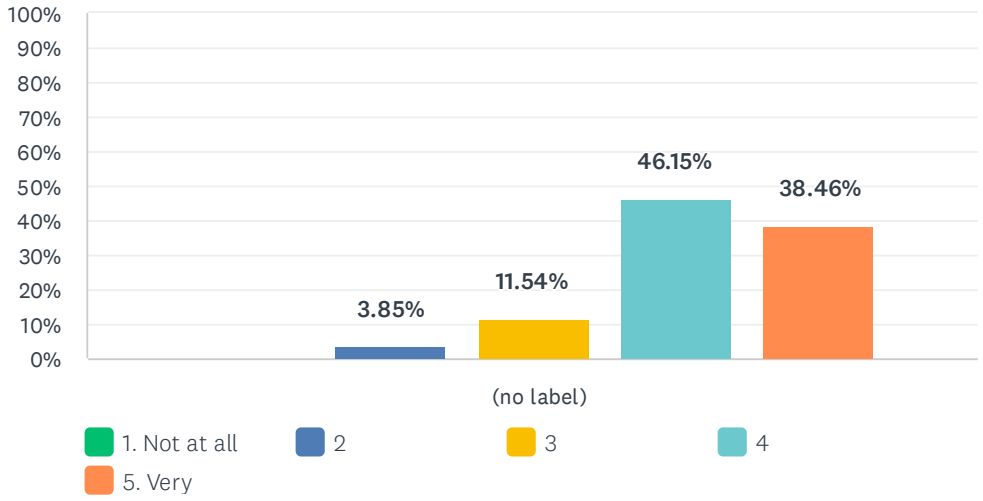
Answered: 26 Skipped: 25



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	3.85% 1	7.69% 2	19.23% 5	69.23% 18	26	4.54

Q24 I was well prepared to benefit from the lectures

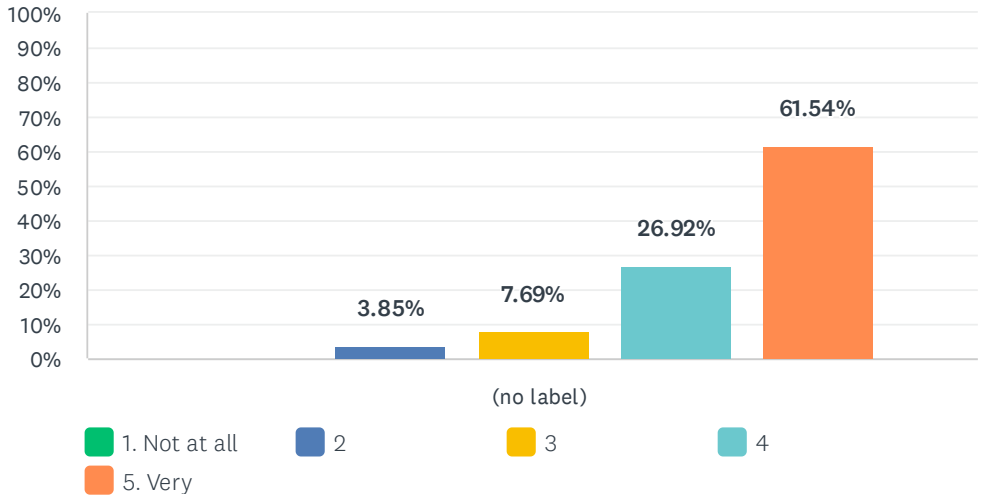
Answered: 26 Skipped: 25



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	3.85% 1	11.54% 3	46.15% 12	38.46% 10	26	4.19

Q25 My interest in the subject matter was increased by the workshop

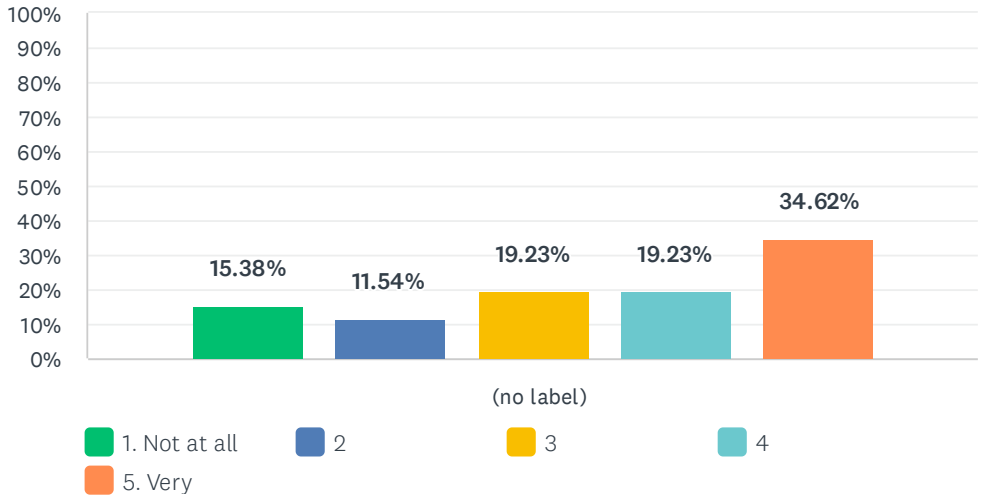
Answered: 26 Skipped: 25



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	3.85% 1	7.69% 2	26.92% 7	61.54% 16	26	4.46

Q26 The workshop helped me meet people with similar scientific interests

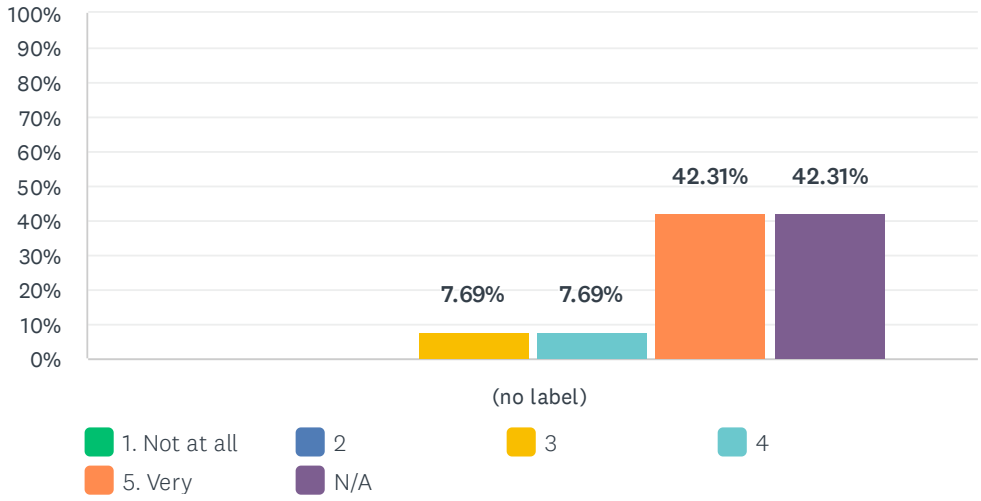
Answered: 26 Skipped: 25



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	15.38% 4	11.54% 3	19.23% 5	19.23% 5	34.62% 9	26	3.46

Q27 Did you find the panel discussion worthwhile?

Answered: 26 Skipped: 25



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	7.69% 2	7.69% 2	42.31% 11	42.31% 11	26	4.60

Q28 What other subjects should be discussed in future panel discussions?

Answered: 5 Skipped: 46

#	RESPONSES	DATE
1	The current PhD system and how much priority is given to publication, instead of education and broad understanding.	2/9/2022 9:11 AM
2	Current topics in mathematics of complex systems	2/5/2022 4:56 AM
3	Equity and diversity issues in mathematics, women in mathematics.	2/4/2022 7:53 PM
4	Computation of Julia sets graphically	2/4/2022 7:40 PM
5	Have someone with a PhD and post-doc experience who now works in "traditional" industry as part of the panel.	2/4/2022 5:17 PM

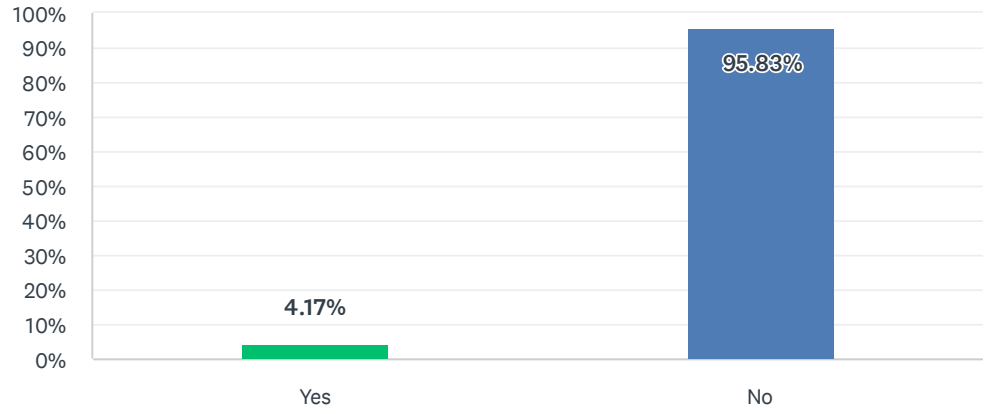
Q29 Additional comments

Answered: 4 Skipped: 47

#	RESPONSES	DATE
1	I thank MSRI staff, organizers and co ordinators for this workshop. It was very helpful. Thank you one and all for your cooperation. Thanking you KukkePrasanna J	2/4/2022 9:40 PM
2	It was great to be able to attend online! I would love to have that option available in future!	2/4/2022 7:53 PM
3	Myself Gaurav Kumar, 2nd year PhD Student. Workshop was very helpful. I got lot of new ideas from this workshop. Highly Thanks to the organisers. I will happy to see you everyone in future. I have suffered from small timing issue(Since i am from India, Lecture timing start from 10:30 p.m. to 2:00 p.m. ist). Thanks you one again.	2/4/2022 6:19 PM
4	I think the panel discussion was worthwhile, but more valuable for people at an earlier stage of their career.	2/4/2022 3:35 PM

Q30 Did you experience any technical difficulties accessing the workshop online?

Answered: 24 Skipped: 27



ANSWER CHOICES	RESPONSES	
Yes	4.17%	1
No	95.83%	23
TOTAL		24

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
1	Local internet connection difficulties	2/5/2022 5:02 AM

Q31 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 24 Skipped: 27

#	RESPONSES	DATE
1	The possibility of participating online was positive for me, as I could not leave my university to participate in person.	3/7/2022 6:46 AM
2	I couldn't come for heath reason so I am very happy to participate online. Time zone difference affects a little because it is evening in France and you cannot have a family life at the same time.	2/9/2022 12:16 PM
3	It was easy to participate remotely.	2/9/2022 11:38 AM
4	Because I was not able to attend the workshop in person, many of the talks conflicted with classes and other appointments I had.	2/9/2022 11:16 AM
5	The time difference made it difficult to attend all talks, but it was great that an effort was made to have the talks only at a time that could be reasonably attended from Europe.	2/9/2022 10:36 AM
6	It didn't impact it much	2/9/2022 9:11 AM
7	I participated online despite being at MSRI because of the limited seating situation. This was fine as I could chat to speakers afterwards during tea breaks.	2/9/2022 8:58 AM
8	Time zone issue but recordings eliminated this issue	2/8/2022 4:00 AM
9	No significant impact.	2/5/2022 11:22 AM
10	I was not able to come in person anyway --- got sick just before the departure. I was so grateful that I had a chance to participate via zoom!	2/5/2022 7:02 AM
11	n/a	2/5/2022 5:28 AM
12	The time zone difference was a bit of a difficulty to select when I could log into the meeting, but mostly it was an incredible opportunity to participate in a workshop organized by the MSRI, since in the current situation any personal attendance for me would have been impossible. Thank you you to all the staff for making it possible.	2/5/2022 5:02 AM
13	I couldn't travel due to the pandemics	2/5/2022 12:14 AM
14	The time difference made it hard for me to attend the afternoon talks.	2/4/2022 11:32 PM
15	Yes, time zone difference was the main barrier.	2/4/2022 9:41 PM
16	Not at all!	2/4/2022 7:56 PM
17	NA	2/4/2022 7:42 PM
18	Everything was Good. There is no barrier to participation due to time zone. But Time Zone difference is Very High. That why i am watching recorded lectures.	2/4/2022 6:24 PM
19	I would not have been able to participate in any form if the workshop had not been held online.	2/4/2022 5:22 PM
20	It is a little bit difficult for me to participate and interact with other participants and, therefore, to meet new people since I felt far away from everybody due to my online attendance.	2/4/2022 5:07 PM
21	none	2/4/2022 4:39 PM
22	time zones differences + teaching duties	2/4/2022 4:08 PM

23	I would not have been able to participate if it had only been held in person.	2/4/2022 3:38 PM
24	I think having the workshop held online offers more flexibility.	2/4/2022 3:18 PM

Q32 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 8 Skipped: 43

#	RESPONSES	DATE
1	No, precisely. Perhaps the creation of chat rooms for each lecture, so that questions and doubts can be discussed more closely.	3/7/2022 6:46 AM
2	Sometimes gather spaces can work well for this type of informal interaction between participants for purely online meetings. But I do not know for sure how to integrate this with the hybrid format.	2/9/2022 10:36 AM
3	virtual coffee breaks?	2/5/2022 7:02 AM
4	Perhaps with some open basics questions open for all the audience at the moment of the participation, so most participants could interact based in these introducing questions	2/5/2022 5:02 AM
5	Maybe include breakout rooms during breaks to have people interact with others.	2/4/2022 7:56 PM
6	Few minutes free discussion among participants.	2/4/2022 7:42 PM
7	This is a good question. I could not have follow-up conversations after talks. However, I was able to attend talks that were happening 3000 miles from where I am located.	2/4/2022 5:22 PM
8	This is a common issue that I haven't seen any good solutions to yet, even when all participants are online.	2/4/2022 3:38 PM

Q33 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 3 Skipped: 48

#	RESPONSES	DATE
1	I'm very happy for being a part of the workshop. Thank you MSRI.	2/4/2022 9:41 PM
2	I think it was a great experience that I had!	2/4/2022 7:56 PM
3	If you have more hybrid workshops, you may want to "spotlight" the speaker more if possible. Often valuable screen real estate was taken up by black boxes with names on them while I would have preferred seeing the speaker's hand gestures, etc., in more detail.	2/4/2022 5:28 PM

Introductory Workshop: Complex Dynamics - from Special Families to Natural Generalizations in One and Several Variables

February 08 - February 17, 2022

Hybrid Workshop

Organizers:

Anna Miriam Benini (Università di Parma)

Fabrizio Bianchi (Université de Lille)

Mikhail Hlushchanka (Universiteit Utrecht)

Dylan Thurston (Indiana University)

REPORT ON THE MSRI WORKSHOP
"Introductory Workshop: Complex Dynamics - from special families to natural generalizations in one and several variables (Hybrid Workshop)"
February 08 – February 17, 2022

Organizers

- Anna Miriam Benini (Università di Parma)
- Fabrizio Bianchi (Université de Lille)
- Mikhail Hlushchanka (Universiteit Utrecht)
- Dylan Thurston (Indiana University)

Scientific Description

This workshop was built around four minicourses that introduced the participants to a range of recent techniques in various areas of holomorphic dynamics, given by specialists in these topics. The event was complemented by a series of talks by leaders in the field, aimed at a large audience and presenting current research directions in the areas.

Highlights of the Workshop

The participants particularly appreciated the quality of the minicourses: the lecturers not only provided an extensive introduction to their subjects, but also highlighted recent advanced results, making them accessible and interesting to both experts and non-experts. The choice of speakers (young mathematicians for the minicourses, and more senior ones for the plenary talks) was also positively acknowledged. It is evident that the recordings will provide a very useful resource to current and future students and researchers.

All talks were followed by most of the members of the semester program and by a good number of online participants. The lectures were particularly interactive, with a large number of questions and comments from the audience. Many discussions continued during the breaks in the program by in-person participants. Several comments by participants who are not strictly in complex dynamics indicated that the participation in this workshop have raised their interest in the field.

Because of the hybrid mode of the workshop, instead of having a full week of all day talks it was chosen to have only morning sessions spread over two weeks (while keeping the same global structure of the workshop: four minicourses of four lectures each, and five plenary talks). This format allowed a larger number of people to attend the event online. At the same time, this was also really appreciated by the in-person participants, who could facilitate longer discussions with the speakers during the free afternoons.

Organizers		
First Name	**Last Name**	**Institution**
Anna Miriam	Benini	Università di Parma
Fabrizio	Bianchi	Université de Lille
Mikhail	Hlushchanka	Universiteit Utrecht
Dylan	Thurston	Indiana University
Speakers		
First Name	**Last Name**	**Institution**
Matthieu	Astorg	Université d'Orléans
Eric	Bedford	State University of New York, Stony Brook
Dzmitry	Dudko	Stony Brook University
Vasiliki	Evdoridou	The Open University
Núria	Fagella	University of Barcelona
Thomas	Gauthier	Université Paris-Saclay
Sarah	Koch	University of Michigan
Mikhail	Lyubich	State University of New York, Stony Brook
David	Martí-Pete	University of Liverpool
Curtis	McMullen	Harvard University
Nikita	Selinger	University of Alabama at Birmingham
Liz	Vivas	Ohio State University

Mathematical Sciences Research Institute

Introductory Workshop: Complex Dynamics - From Special Families to Natural Generalizations in One and Several Variables [Hybrid Workshop]

February 08 to February 17, 2022

Tuesday, February 08		
09:20 AM - 09:30 AM		Welcome
09:30 AM - 10:30 AM	Matthieu Astorg	Local Dynamics in SCV and Applications: Parabolic Implosion in Dimension 1
10:45 AM - 11:45 PM	Dzmitry Dudko	Thurston Theory and Application: Pt I

Wednesday, February 09		
09:00 AM - 10:00 AM	Dzmitry Dudko	Thurston Theory and Application: Pt II
10:15 AM - 11:15 AM	Liz Vivas	Local Dynamics in SCV and Applications: Parabolic Dynamics in Several Dimensions
11:30 AM - 12:20 PM	Sarah Koch	Postcritically Finite Endomorphisms

Thursday, February 10		
09:30 AM - 10:30 AM	Matthieu Astorg	Local Dynamics in SCV and Applications: Parabolic Implosion in Higher Dimension
10:45 AM - 11:45 AM	Nikita Selinger	Thurston Theory and Application: Pt III

Friday, February 11		
09:00 AM - 10:00 AM	Dzmitry Dudko	Thurston Theory and Application: Pt IV
10:15 AM - 11:15 AM	Liz Vivas	Local Dynamics in SCV and Applications: Parabolic Curves and Parabolic Domains
11:30 AM - 12:20 PM	Mikhail Lyubich	A Priori Bounds for Quadratic Maps

Monday, February 14		
09:30 AM - 10:30 AM	Thomas Gauthier	Potential Theory Tools in Rational Dynamics: Pt I
10:45 AM - 11:45 AM	David Martí-Pete	Approximation Theory in Transcendental Dynamics Pt I

Tuesday, February 15		
09:00 AM - 10:00 AM	Vasiliki Evdoridou	Approximation Theory in Transcendental Dynamics Pt II
10:15 AM - 11:15 AM	Thomas Gauthier	Potential Theory Tools in Rational Dynamics: Pt II
11:30 AM - 12:20 PM	Núria Fagella	The Denjoy-Wolff Theorem: from the Unit Disk to Wandering Domains of Holomorphic Functions

Wednesday, February 16		
09:00 AM - 10:00 AM	Thomas Gauthier	Potential Theory Tools in Rational Dynamics: Pt III
10:15 AM - 11:15 AM	Vasiliki Evdoridou	Approximation Theory in Transcendental Dynamics Pt III
11:30 AM - 12:20 PM	Eric Bedford	Dynamics of Rational Surface Automorphisms

Thursday, February 17		
09:00 AM - 10:00 AM	Thomas Gauthier	Potential Theory Tools in Rational Dynamics: Pt IV
10:15 AM - 11:15 AM	David Martí-Pete	Approximation Theory in Transcendental Dynamics Pt IV
11:30 AM - 12:20 PM	Curtis McMullen	Dynamics on Complex Surfaces with Minimal Entropy

Participants

First Name	Last Name	Institution
Marco	Abate	Università di Pisa
Tom	Alberts	University of Utah
Mariam	Al-Hawaj	University of Toronto
Yan Sheng	Ang	Massachusetts Institute of Technology
Matthieu	Astorg	Université d'Orléans
Tahmineh	Azizi	Florida State University
Juhun	Baik	Korea Advanced Institute of Science and Technology (KAIST)
Eric	Bedford	State University of New York, Stony Brook
Veronica	Beltrami	Università di Parma
Anna Miriam	Benini	Università di Parma
Tania G.	Benitez	University of Liverpool
Fabrizio	Bianchi	Université de Lille
Sebastien	Biebler	Institut de Mathematiques de Jussieu
Ilia	Binder	University of Toronto
Richard	Birkett	University of Notre Dame
Christopher	Bishop	Stony Brook University
Paul	Blanchard	Boston University
Luka	Boc Thaler	University of Ljubljana
Araceli	Bonifant	University of Rhode Island
Andrew	Brown	University of Liverpool
Jack	Burkart	University of Wisconsin-Madison
Jordi	Canela Sánchez	Universitat Jaume I
Marco	Carfagnini	University of Connecticut
Melida	Carranza	Centro de Investigación en Matemáticas A.C.
Scott	Crass	California State University, Long Beach
Caroline	Davis	Indiana University
André	de Carvalho	University of São Paulo
Jeff	Diller	University of Notre Dame
Devon	Ding	University of California, Berkeley
Arcelino	do Nascimento	Institute of Mathematics and Statistics (IME)
Kostiantyn	Drach	Institute of Science and Technology Austria
Schinella	D'Souza	University of Michigan
Dzmitry	Dudko	Stony Brook University
Vasiliki	Evdoridou	The Open University
Núria	Fagella	University of Barcelona
Charles	Favre	École Polytechnique
Tanya	Firsova	Kansas State University
Robert	Florido-Llinàs	University of Barcelona
Hang	Fu	National Taiwan University
Joanna	Furno	University of South Alabama
Thomas	Gauthier	Université Paris-Saclay
Lukas	Geyer	Montana State University
Adi	Glucksam	Northwestern University
Igors	Gorbovickis	Jacobs University Bremen
Vesselin	Gueorguiev	Ronin Institute for Independent Scholarship
Funda	Gultepe	University of Toledo
Minsik	Han	Brown University
Susanna	Heikkilä	University of Helsinki
Hafedh	Herichi	Santa Monica College
Wade	Hindes	Texas State University
Eriko	Hironaka	Florida State University
Mikhail	Hlushchanka	Universiteit Utrecht
Mi	Hu	Università di Parma
Zheng	Huang	CUNY, Graduate Center
Valentin	Huguin	Jacobs University Bremen
Annina	Iseli	University of California, Los Angeles
Kukkeprasanna	J	Bengaluru City University
Xavier	Jarque	Universitat de Barcelona

Participants		
First Name	**Last Name**	**Institution**
Anna	Jové-Campabadal	University of Barcelona
Jeremy	Kahn	Brown University
Sharada	Kalanidhi	Stanford University School of Medicine
Alex	Kapiamba	University of Michigan
Scott	Kaschner	Butler University
Linda	Keen	CUNY, Graduate Center
Kyounghee	Kim	Florida State University
Sungwoon	Kim	Jeju National University
Bruno	Klingler	Humboldt-Universität
Sarah	Koch	University of Michigan
Ellen	Krusell	Royal Institute of Technology
Gaurav	Kumar	Indian Institute of Technology
Lorena	López Hernanz	Universidad de Alcalá
Therese	Landry	University of California, Riverside
Kirill	Lazebnik	University of Toronto
Chifan	Leung	Oregon State University
Zhiqiang	Li	Peking University
Willie	Lim	State University of New York, Stony Brook
Peter	Lin	State University of New York, Stony Brook
Joan	Lind	University of Tennessee
Jessica	Liu	CUNY, Graduate Center
Yusheng	Luo	Stony Brook University
Liangbing	Luo	University of Connecticut
Mikhail	Lyubich	State University of New York, Stony Brook
Víctor	Maciá	Autonomous University of Madrid
Firdous	Mala	University of Kashmir
David	Martí-Pete	University of Liverpool
Jacob	Mazor	State University of New York, Stony Brook
Christopher	McKay	Montana State University
Curtis	McMullen	Harvard University
Sergiy	Merenkov	City College, CUNY
Chebbab	Mesbah	University of Science and Technology Houari Boumedienne (USTHB)
Tim	Mesikepp	Peking University
Daniel	Meyer	University of Liverpool
John	Milnor	Institute for Mathematical Sciences
Sabyasachi	Mukherjee	Tata Institute of Fundamental Research
Malavika	Mukundan	University of Michigan
Mathav	Murugan	University of British Columbia
Hamid	Naderiyan	University of North Texas
Shizuo	Nakane	Tokyo Polytechnic University
Hongming	Nie	Stony Brook University
Chatchai	Noytaptim	Oregon State University
Pekka	Pankka	University of Helsinki
Dan	Paraschiv	University of Barcelona
Leticia	Pardo Simon	University of Manchester
Eveliina	Peltola	Rheinische Friedrich-Wilhelms-Universität Bonn
Andres	Perico	University of California, Santa Cruz
Pietro	Poggi-Corradini	Kansas State University
Nikolai	Prochorov	Université d'Aix-Marseille I (Université de Provence)
Wei	Qian	Université Paris-Saclay
Remus	Radu	Institute of Mathematics of the Romanian Academy
Jasmin	Raissy	Institut de Mathématiques de Bordeaux
Rohini	Ramadas	University of Warwick
Shivam	Rawat	Hemvati Nandan Bahuguna Garhwal University
Bernhard	Reinke	Institut de Mathématiques de Bordeaux
Lasse	Rempe	University of Liverpool
Thomas	Richards	University of Warwick
Larissa	Richards	University of Lancaster

Participants		
First Name	**Last Name**	**Institution**
Àlex	Rodríguez	University of Barcelona
Gustavo	Rodrigues Ferreira	The Open University
Pascale	Roesch	IMT
Steffen	Rohde	University of Washington
Rafael	Saavedra	Harvard University
Mohammad	Sajid	Qassim University
Dierk	Schleicher	Université d'Aix-Marseille (AMU)
Nikita	Selinger	University of Alabama at Birmingham
Tom	Sharland	University of Rhode Island
Xianghui	Shi	Peking University
Hyungeun	Shin	University of Victoria
Rob	Silversmith	University of Warwick
Zachary	Smith	University of California, Los Angeles
Alan	Sola	Stockholm University
Stan	Srednyak	Duke University
Leon	Staresinic	Imperial College, London
Margaret	Stawiska-Friedland	Mathematical Reviews
Danny	Stoll	University of Michigan
Scott	Sutherland	State University of New York, Stony Brook
Emanuel	Sygal	Tel Aviv University
Raluca	Tanase	Institute of Mathematics of the Romanian Academy
Zhuang	Tao	State University of New York, Stony Brook
Dylan	Thurston	Indiana University
Vladlen	Timorin	HSE University
Diederik	van Engelenburg	University of Vienna
Liz	Vivas	Ohio State University
Dan-Virgil	Voiculescu	University of California, Berkeley
Yilin	Wang	Massachusetts Institute of Technology
Alan	Wang	Shandong University
Dasheng	Wang	Northern Illinois University
James	Waterman	State University of New York, Stony Brook
Max	Weinreich	Brown University
Rebecca	Winarski	College of the Holy Cross
Jang-Mei	Wu	University of Illinois at Urbana-Champaign
Xiangjin	Xu	Binghamton University (SUNY)
Jonguk	Yang	Stony Brook University
Fei	Yang	Nanjing University
Yang	Yu	University of Washington
Runze	Zhang	Institut de Mathématiques de Toulouse
Shengyuan	Zhao	State University of New York, Stony Brook

Identifiable Participants' Information

Participants		156

Gender		156
Male	69.87%	109
Female	27.56%	43
Other	1.28%	2
Declined to state	1.28%	2

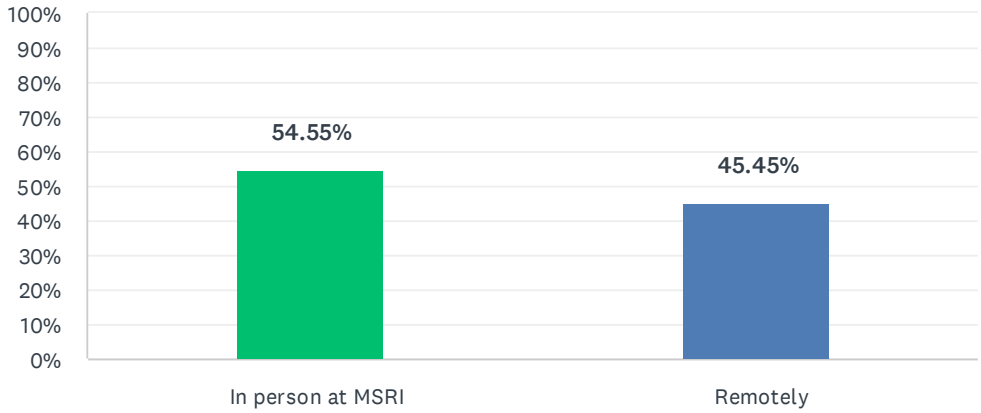
Ethnicity*		165
White	55.15%	91
Asian	26.67%	44
Hispanic	4.24%	7
Pacific Islander	0.61%	1
Black	1.21%	2
Native American	0.00%	0
Mixed	3.03%	5
Declined to state	9.09%	15

* ethnicity specifications are not exclusive

There were 13 unidentifiable participants.

Q1 I primarily participated in the workshop:

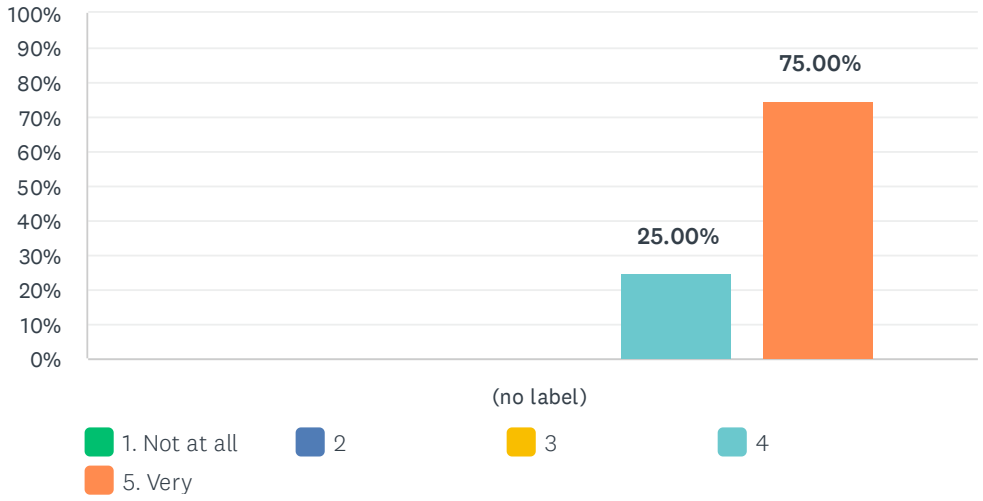
Answered: 44 Skipped: 0



ANSWER CHOICES	RESPONSES	
In person at MSRI	54.55%	24
Remotely	45.45%	20
TOTAL		44

Q2 The workshop was intellectually stimulating

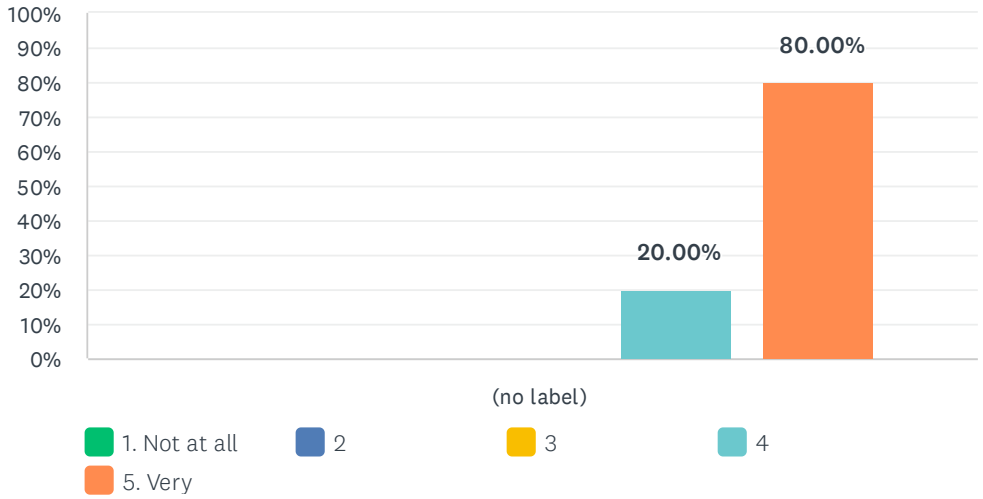
Answered: 20 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	25.00% 5	75.00% 15	20	4.75

Q3 The overall experience of the workshop was worthwhile

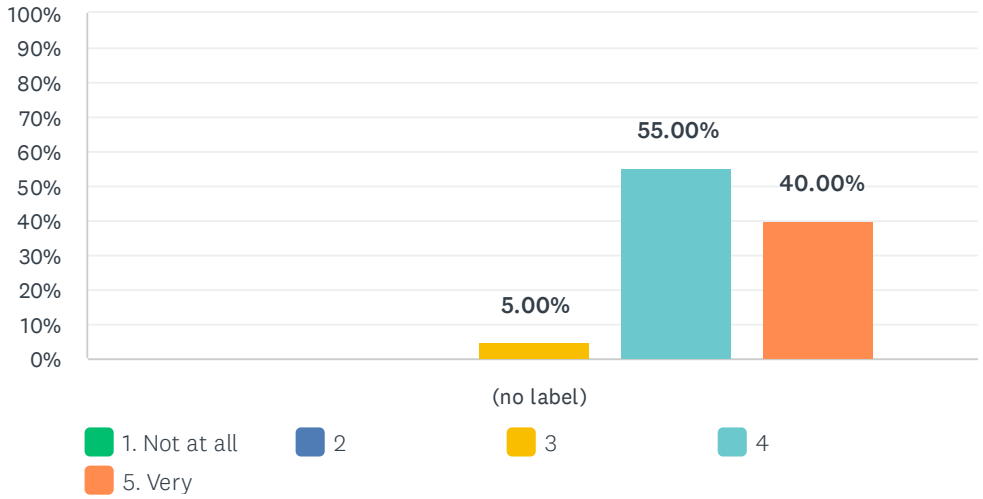
Answered: 20 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	20.00% 4	80.00% 16	20	4.80

Q4 The lectures were at an appropriate level

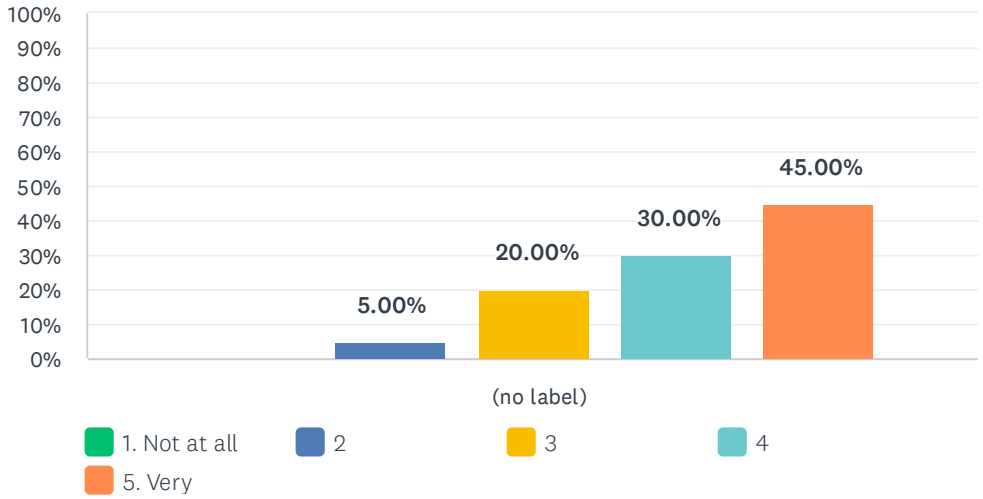
Answered: 20 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.00% 1	55.00% 11	40.00% 8	20	4.35

Q5 I was well prepared to benefit from the lectures

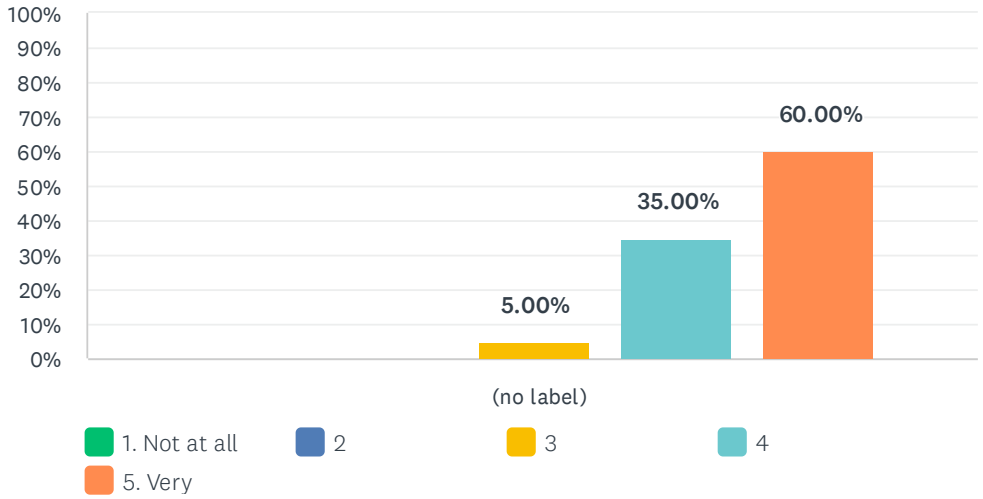
Answered: 20 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.00% 1	20.00% 4	30.00% 6	45.00% 9	20	4.15

Q6 My interest in the subject matter was increased by the workshop

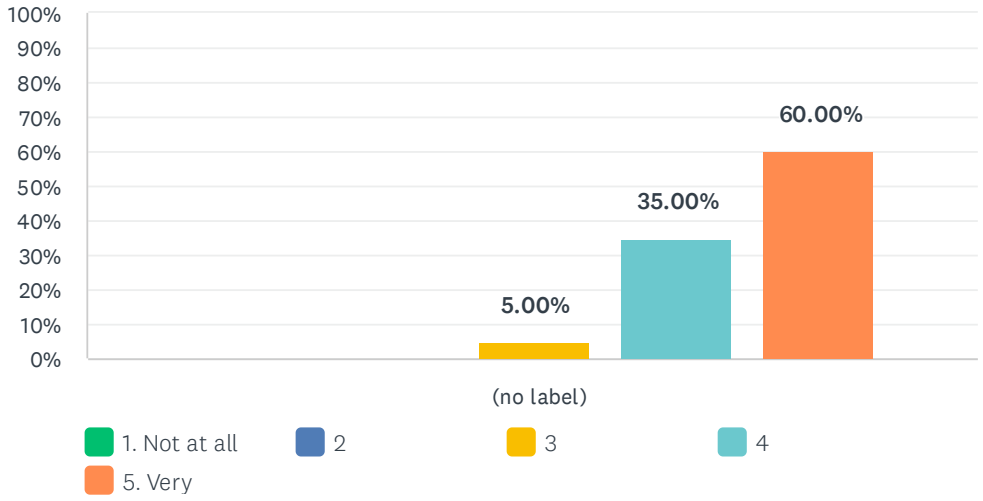
Answered: 20 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.00% 1	35.00% 7	60.00% 12	20	4.55

Q7 The workshop helped me meet people with similar scientific interests

Answered: 20 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.00% 1	35.00% 7	60.00% 12	20	4.55

Q8 What were the highlights of the mini-courses?

Answered: 20 Skipped: 24

#	RESPONSES	DATE
1	I really liked Thomas's first talk	2/24/2022 7:24 PM
2	The minicourse on Approximation theory was given by two young mathematicians and these was refreshing and stimulating. All minicourses were well prepared, and three of them were taught with blackboard or equivalent (writing on tablet), which made it possible to take notes and to follow.	2/23/2022 4:00 PM
3	I greatly enjoyed the minicourses in approximation theory and potential theory	2/23/2022 10:23 AM
4	Introduce varieties of topics	2/23/2022 9:54 AM
5	They were comprehensive and started with the basics	2/23/2022 9:11 AM
6	They were all excellent and dealt with very relevant and important research topics. The level of the lectures balances very well introductory and more advanced topics.	2/23/2022 8:50 AM
7	--	2/20/2022 6:59 AM
8	They started at an appropriate level for non-experts, but built into new research.	2/19/2022 12:40 PM
9	Gave nice introductions to areas I was not familiar with in a way that piqued my interest.	2/18/2022 6:42 PM
10	Beautiful Thurston theory. For me understanding the vase one complex variable was very educative. I'm not very familiar with the topic from before.	2/18/2022 4:54 PM
11	The minicourse in local dynamics in several complex bariables and the one in approximation theory.	2/18/2022 3:49 PM
12	.	2/18/2022 1:37 PM
13	I appreciated how the topics started from basic and principles and worked up to contemporary problems.	2/18/2022 12:12 PM
14	Parabolic aspects of SCV	2/18/2022 11:57 AM
15	learning new material	2/18/2022 11:56 AM
16	Too many to mention, but certainly the counterexample to Eremenko's conjecture in the mini-course on approximation theory and dynamics was one of them.	2/18/2022 10:44 AM
17	Very digestible introduction to research level material	2/18/2022 10:34 AM
18	I think the schedule of the minicourses was very good so that the day was not all full of lectures and people could work and discuss in the free time. The courses covered a good range of topics and I feel this is very useful to see what people in adjacent research areas are interested in. In my opiniom all the speakers made an effort to make their talks as understandable as possible. As a speaker, my only comment is that reducing the length of each talk from 1h 20min to 1h made us have to rethink what to say a bit in the last moment.	2/18/2022 10:20 AM
19	Accessible beginning	2/18/2022 9:54 AM
20	Intro to transcendental dynamics	2/18/2022 9:48 AM

Q9 What were the highlights of the lectures?

Answered: 20 Skipped: 24

#	RESPONSES	DATE
1	I liked Sarah's talk	2/24/2022 7:24 PM
2	It was fantastic to listen to all of them.	2/23/2022 4:00 PM
3	All of the plenary lectures very exciting, both mathematically and presentation-wise	2/23/2022 10:23 AM
4	Open questions addressed by experts	2/23/2022 9:54 AM
5	The survey-type lectures covered a lot of sophisticated material in one hour	2/23/2022 9:11 AM
6	They dealt with several topics which I was familiar with but did not know where the frontier of knowledge was.	2/23/2022 8:50 AM
7	--	2/20/2022 6:59 AM
8	The highlighted a broad range of different perspectives of complex dynamics research	2/19/2022 12:40 PM
9	They were excellent and inspiring	2/18/2022 6:42 PM
10	I was mainly attending the mini-courses.	2/18/2022 4:54 PM
11	All the lectures were extremely interesting.	2/18/2022 3:49 PM
12	.	2/18/2022 1:37 PM
13	The interactive nature of the lectures, even with people online, was incredibly well-done. It's so much easier to be productive in this environment!	2/18/2022 12:12 PM
14	Curt McMullen's talk	2/18/2022 11:57 AM
15	NA	2/18/2022 11:56 AM
16	Again there were quite a few, but Curt McMullen's tour de force through number theory, dynamical systems, and algebraic geometry stood out.	2/18/2022 10:44 AM
17	These added depth nicely to the mini courses	2/18/2022 10:34 AM
18	I was happy with the lectures too. It is nice that more or less there was one lecture associated to each of the minicourses so that they could expand a bit on that topic and see a different perspective. Of course the chosen speakers were all exceptional researchers and it was a fantastic opportunity to attend their talks in person.	2/18/2022 10:20 AM
19	Very interesting	2/18/2022 9:54 AM
20	a priori bounds	2/18/2022 9:48 AM

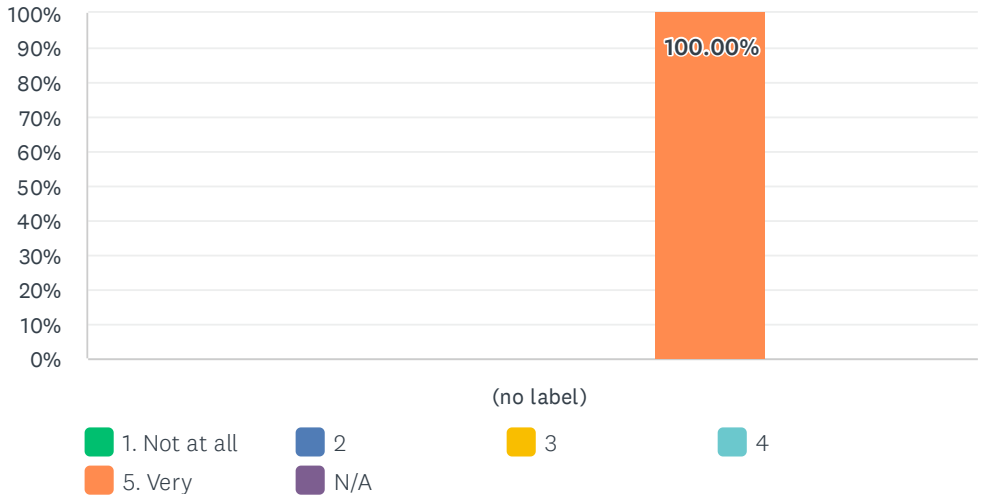
Q10 Additional comments

Answered: 6 Skipped: 38

#	RESPONSES	DATE
1	It is nobody's fault but it was a bit sad to have such an empty auditorium. I very much hope we can have a fully in-person workshop in May! In any event the wonderful technical organization made it really easy for speakers and attendants (in person or not) to follow the talks with no technical problems. Thanks!	2/23/2022 4:00 PM
2	Tech services were excellent	2/23/2022 9:11 AM
3	I'm in the other program and a novice to the complex dynamics. Nevertheless the lectures were stimulating and some of them I could follow.	2/18/2022 4:54 PM
4	Thank you!	2/18/2022 12:12 PM
5	I am very grateful for the oportunity to come here in person for these 3 weeks. I feel that MSRI offers one of the best environments I have seen to support research and promote the interactions with other researchers. The staff are all very friendly and helpful, and I was very impressed that Sierra would remember all our names and always greet us with a smile in the morning. The facilities work very well and provide with a lot of places for discussion. Being able to use the guest office helped me a lot as well to prepare the talks. One small comment is that the chalk that is not Hagoromo it does not work very well, so when we were giving the minicourses we had to go around to find some - I feel it would be nice for the speaker to offer them this for their lectures. I would be very happy to return later in this semester or in other programs in the future.	2/18/2022 10:20 AM
6	takes place too early to be enjoyed by locals.	2/18/2022 9:48 AM

Q11 I found the MSRI staff helpful

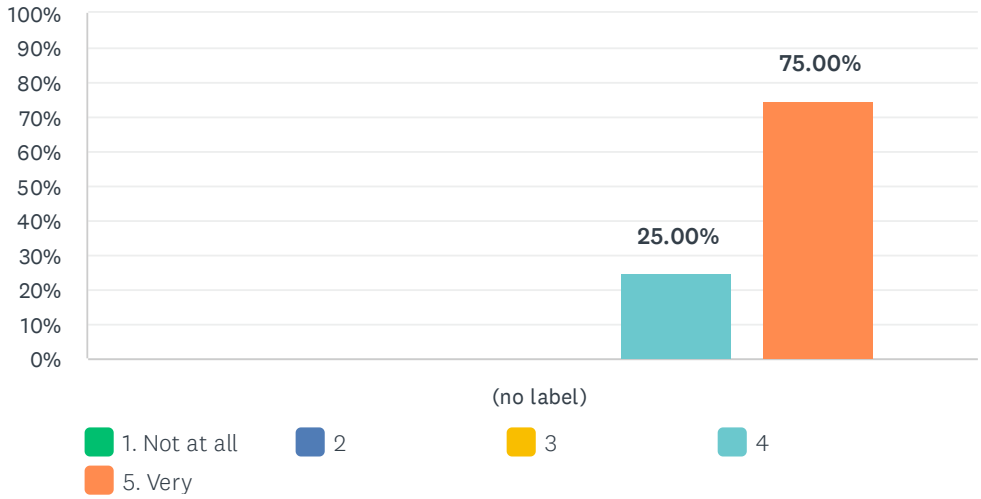
Answered: 20 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	0.00% 0	100.00% 20	0.00% 0	20	5.00

Q12 The MSRI facilities were conducive for such a workshop

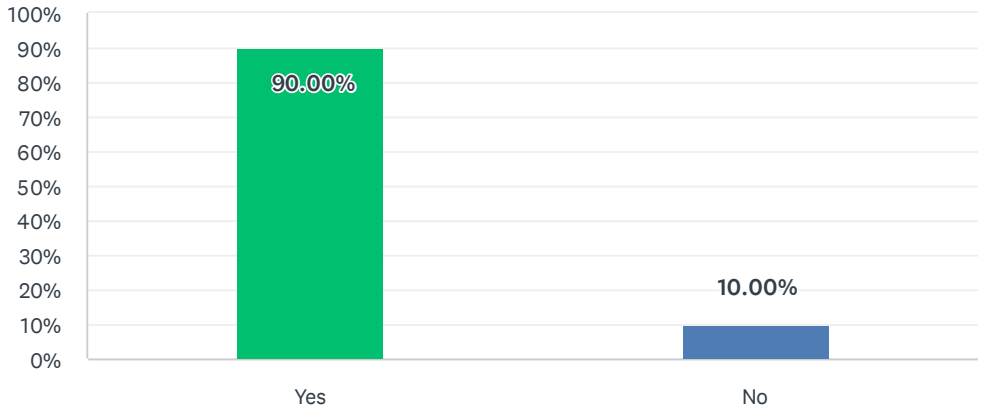
Answered: 20 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	25.00% 5	75.00% 15	20	4.75

Q13 Did you use MSRI's wireless network?

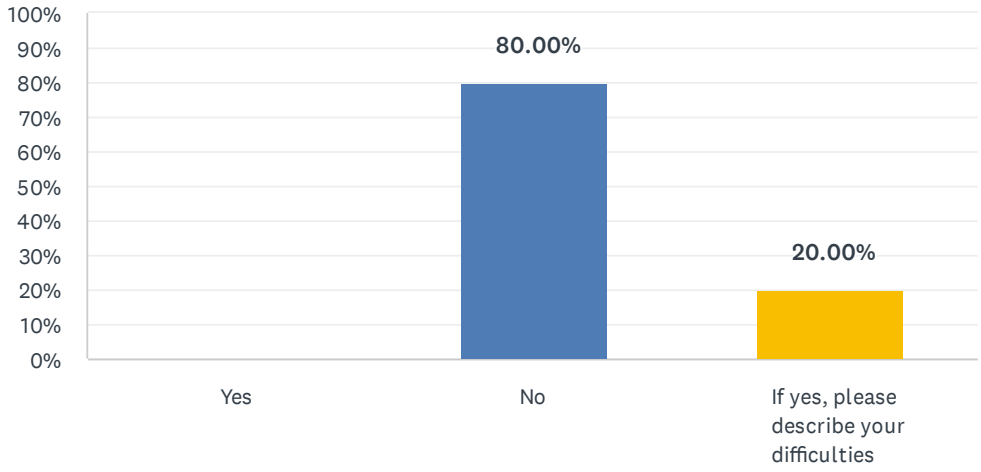
Answered: 20 Skipped: 24



ANSWER CHOICES	RESPONSES	
Yes	90.00%	18
No	10.00%	2
TOTAL		20

Q14 Did you experience any difficulties with the network?

Answered: 20 Skipped: 24

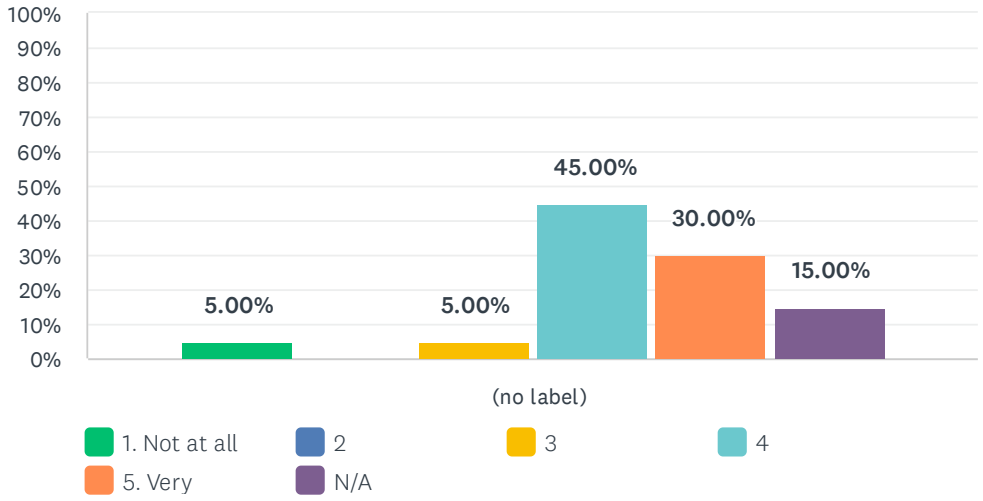


ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	80.00%	16
If yes, please describe your difficulties	20.00%	4
TOTAL		20

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	Sometimes it gets very slow	2/23/2022 9:54 AM
2	For some reason eduroam does not work very well here.	2/18/2022 10:23 AM
3	Sometimes would disconnect	2/18/2022 9:56 AM
4	very slow.	2/18/2022 9:48 AM

Q15 The MSRI lunch arrangements were satisfactory

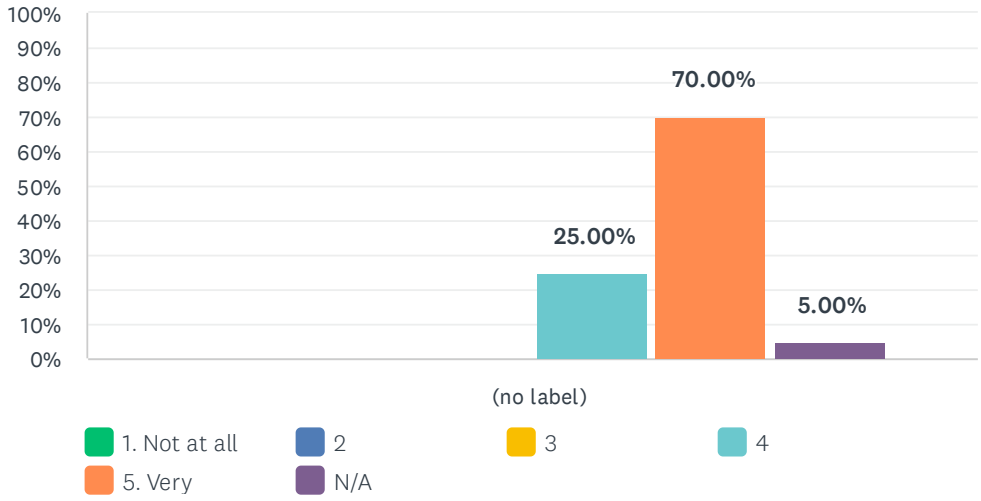
Answered: 20 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	5.00% 1	0.00% 0	5.00% 1	45.00% 9	30.00% 6	15.00% 3	20	4.12

Q16 The MSRI tea arrangements were satisfactory

Answered: 20 Skipped: 24



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	25.00% 5	70.00% 14	5.00% 1	20	4.74

Q17 Additional comments about the MSRI staff, facilities and food

Answered: 6 Skipped: 38

#	RESPONSES	DATE
1	The staff was incredibly helpful, thank you so much! On the other hand, the lunch arrangements could be improved with respect to people with dietary requirements. No real vegan choice is present on the Monday lunch. In general, it is not really possible to understand from the menu which dishes are vegan or not. The staff was really helpful with this (and with the tea break, where also vegan options are provided), but I think that this should be improved by asking directly to the restaurants to highlight the vegan options in the menu on the website (or other restrictions). This is not only for people with personal restrictions but also for possible allergies. It was not really possible to be sure that a dish did not contain milk, for instance. I guess that if someone has problems with gluten, this could be even more problematic.	2/20/2022 7:07 AM
2	Everything worked excellently!	2/18/2022 4:55 PM
3	Thank you very much!!	2/18/2022 12:13 PM
4	Thanks for all the support!	2/18/2022 10:45 AM
5	The staff is great, and the kitchen equipment - microwave, dishwasher, dishes, salt shaker, etc make lunch very pleasant. As someone who brings a packed lunch, it was nice to be able to eat with colleagues who order their lunch	2/18/2022 9:56 AM
6	i wish the lunches were ordered from different set of restaurants.	2/18/2022 9:48 AM

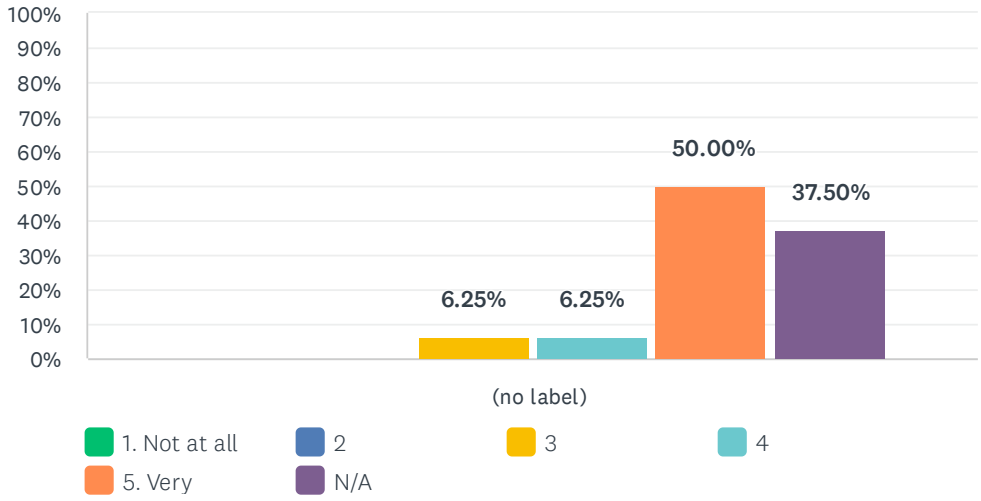
Q18 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 1 Skipped: 43

#	RESPONSES	DATE
1	MSRI is a wonderful place and I am very happy to be able to be here and to attend the workshops and lectures. All the staff have been very helpful and Sierra, the receptionist, is very friendly and welcoming (and (gently) shouts at me for forgetting my mask every now and again).	2/23/2022 8:53 AM

Q19 I found the MSRI staff helpful

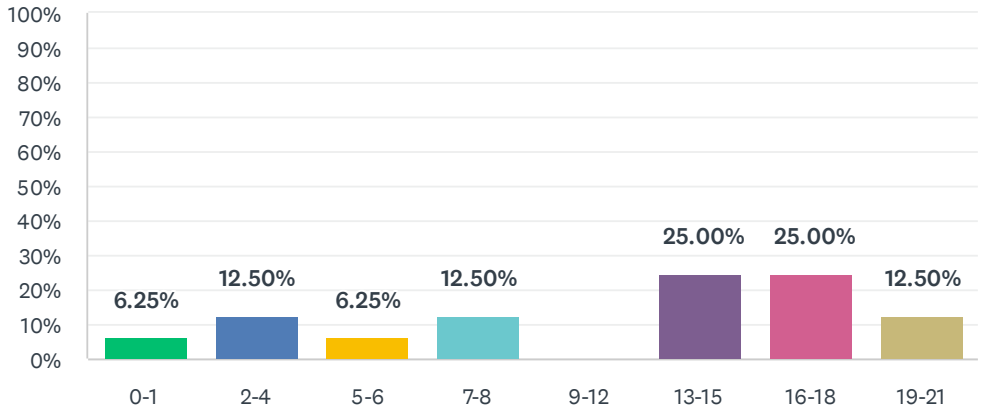
Answered: 16 Skipped: 28



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	6.25% 1	6.25% 1	50.00% 8	37.50% 6	16	4.70

Q20 How many talks did you watch live?

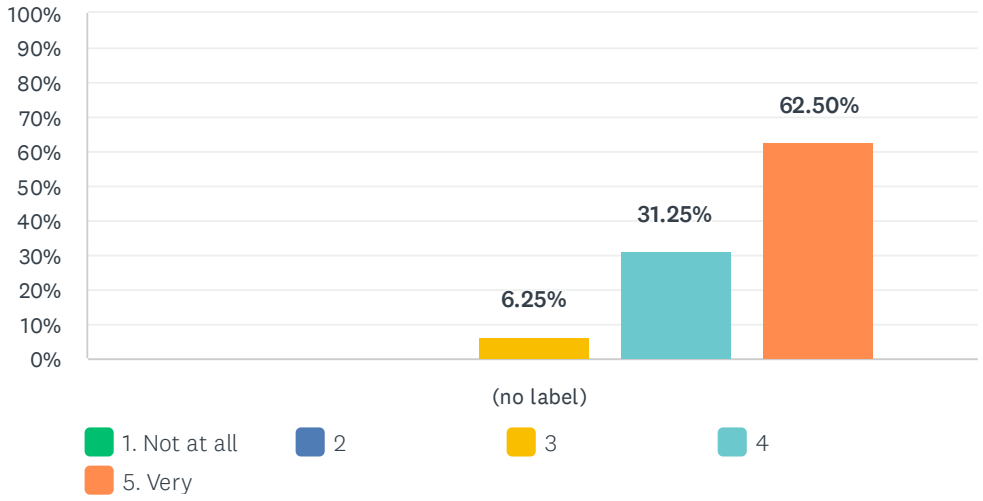
Answered: 16 Skipped: 28



ANSWER CHOICES	RESPONSES	
0-1	6.25%	1
2-4	12.50%	2
5-6	6.25%	1
7-8	12.50%	2
9-12	0.00%	0
13-15	25.00%	4
16-18	25.00%	4
19-21	12.50%	2
TOTAL		16

Q21 The workshop was intellectually stimulating

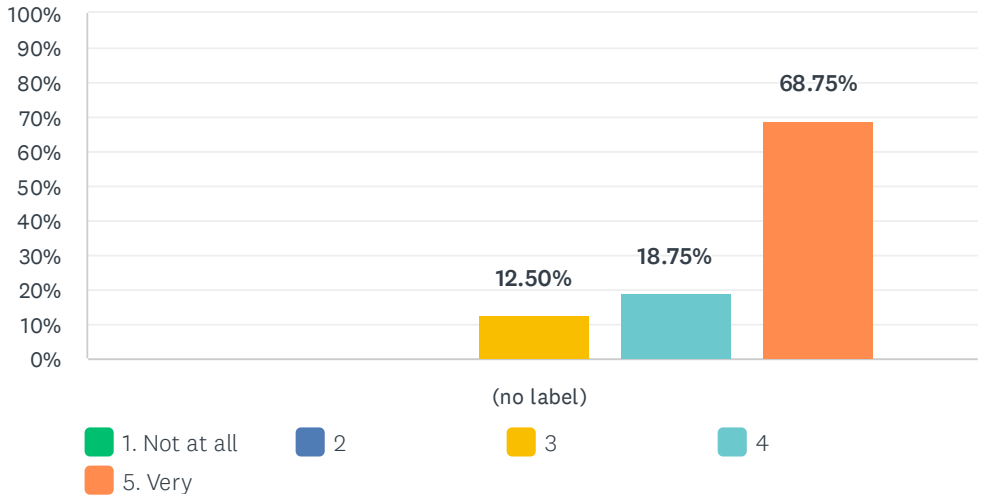
Answered: 16 Skipped: 28



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	6.25% 1	31.25% 5	62.50% 10	16	4.56

Q22 The overall experience of the workshop was worthwhile

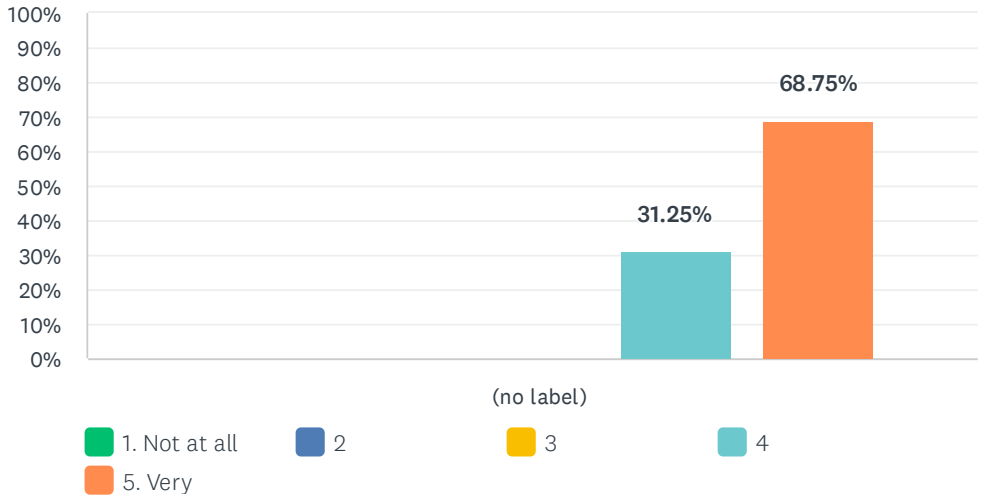
Answered: 16 Skipped: 28



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	12.50% 2	18.75% 3	68.75% 11	16	4.56

Q23 The lectures were at an appropriate level

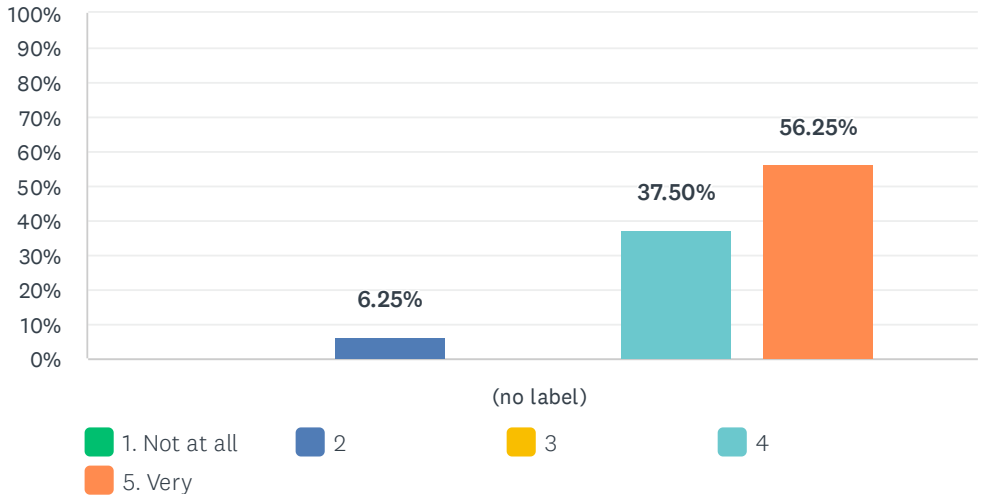
Answered: 16 Skipped: 28



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	31.25% 5	68.75% 11	16	4.69

Q24 I was well prepared to benefit from the lectures

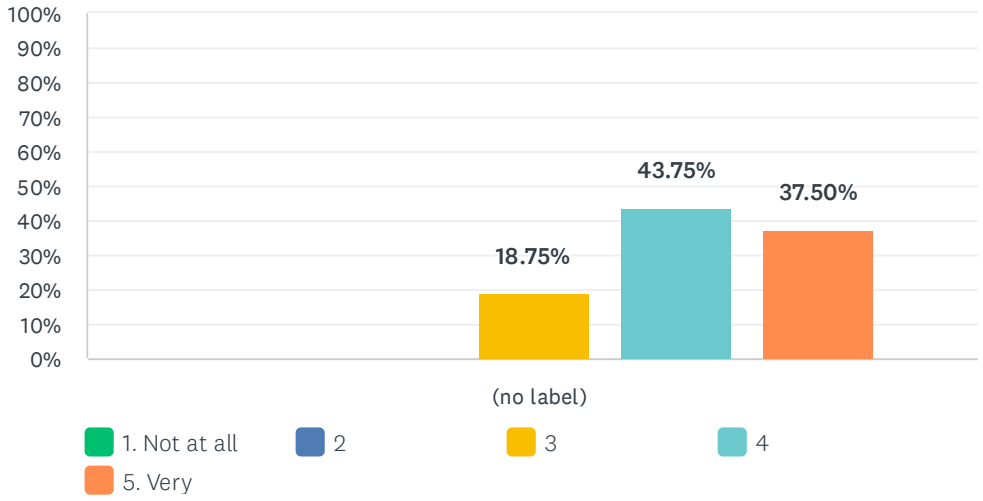
Answered: 16 Skipped: 28



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	6.25% 1	0.00% 0	37.50% 6	56.25% 9	16	4.44

Q25 My interest in the subject matter was increased by the workshop

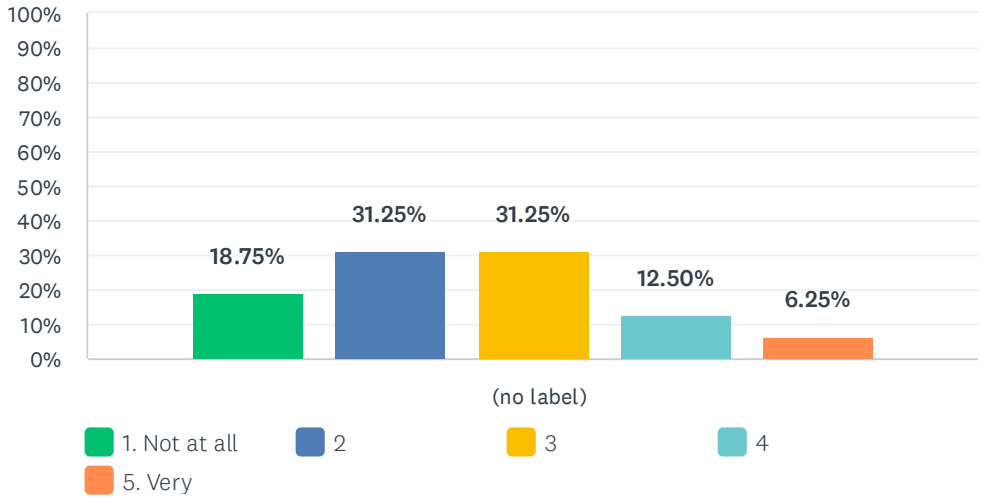
Answered: 16 Skipped: 28



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	18.75% 3	43.75% 7	37.50% 6	16	4.19

Q26 The workshop helped me meet people with similar scientific interests

Answered: 16 Skipped: 28



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	18.75% 3	31.25% 5	31.25% 5	12.50% 2	6.25% 1	16	2.56

Q27 What were the highlights of the mini-courses?

Answered: 16 Skipped: 28

#	RESPONSES	DATE
1	I especially enjoyed the potential theory & dynamics lectures I watched.	2/25/2022 11:56 AM
2	Topics and video record is also very helpful	2/24/2022 12:25 AM
3	Learning about useful/interesting techniques/ideas from other areas of complex dynamics that I'm unlikely to explore myself.	2/23/2022 10:19 AM
4	The one by matthieu astorg et al about parabolic implosion for me.	2/23/2022 9:32 AM
5	Dudko/Selinger	2/23/2022 9:10 AM
6	They were designed to be accessible to non experts, while still maintaining quality and breadth of subject covered.	2/23/2022 8:50 AM
7	I had to miss some of the lectures of the minicourses, but I enjoyed all of them.	2/23/2022 8:43 AM
8	Approximation in complex dynamics course	2/21/2022 4:10 AM
9	The speakers/organizers were clearly very committed to providing detailed introductions to the topics.	2/21/2022 3:59 AM
10	No anwer	2/21/2022 1:21 AM
11	Introduction of Gleason polynomials and Misiurewicz polynomials.	2/20/2022 1:50 AM
12	Detail analytical approaches to study complex dynamics	2/18/2022 1:46 PM
13	I followed the mini-courses on Thurston theory, local dynamics in SCV and potential theory in dynamics. They were all excellent and very accessible.	2/18/2022 10:22 AM
14	-	2/18/2022 10:19 AM
15	I think Thomas Gauthier did the best job starting at an appropriate level.	2/18/2022 9:52 AM
16	Very interesting and well-explained	2/18/2022 9:50 AM

Q28 What were the highlights of the lectures?

Answered: 16 Skipped: 28

#	RESPONSES	DATE
1	Didn't attend any of the one-off lectures	2/25/2022 11:56 AM
2	Related to my research	2/24/2022 12:25 AM
3	Curt McMullen's talk.	2/23/2022 10:19 AM
4	The lecture by Curt McMullen, even though I could not see it live. I also liked very much Misha Lyubich and Eric Bedford's talks	2/23/2022 9:32 AM
5	McMullen	2/23/2022 9:10 AM
6	There were a great variety of topics within the field of complex dynamics within the lectures.	2/23/2022 8:50 AM
7	The lectures were excellent; I particularly enjoyed Sarah Koch's talk.	2/23/2022 8:43 AM
8	Curt McMullen	2/21/2022 4:10 AM
9	All of them were very well done.	2/21/2022 3:59 AM
10	No answer	2/21/2022 1:21 AM
11	Approximation theory	2/20/2022 1:50 AM
12	Provide deep concepts of some themes from complex dynamics	2/18/2022 1:46 PM
13	I only followed the lecture by Sarah Koch on the construction of postcritically finite projective endomorphisms. It was very good.	2/18/2022 10:22 AM
14	-	2/18/2022 10:19 AM
15	Seeing open questions.	2/18/2022 9:52 AM
16	Very good speakers	2/18/2022 9:50 AM

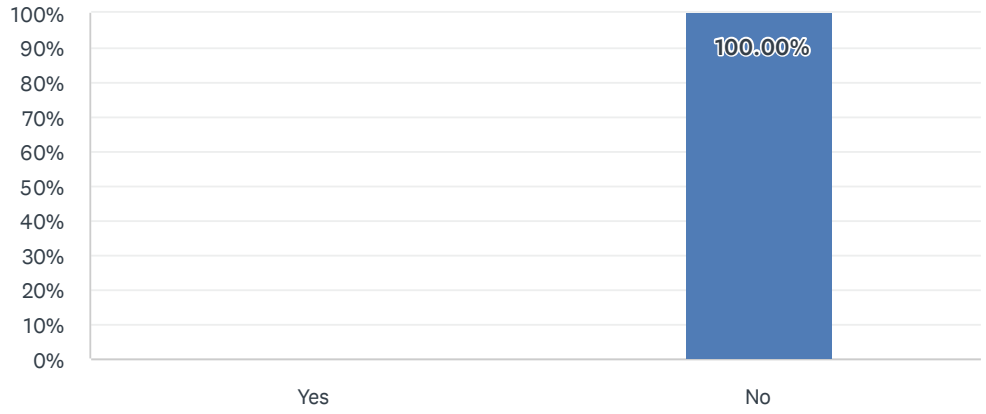
Q29 Additional comments

Answered: 5 Skipped: 39

#	RESPONSES	DATE
1	I've been working in this area for awhile, so I just wanted to hear points of view more than new math.	2/25/2022 11:56 AM
2	It was frustrating not to be here, but too complicated to join from France for me	2/23/2022 9:32 AM
3	I wish I could attend in person next time.	2/23/2022 8:50 AM
4	Please remove mentioning tea-time for online participants in the schedule. As if it is possible to participate remotely. This increases a feeling of exclusion and segregation (live vs. online participants).	2/21/2022 4:10 AM
5	Thank you for letting me participate remotely. I probably would not have been able to attend in person. However, I'm looking forward to participating in person in May if possible.	2/21/2022 3:59 AM

Q30 Did you experience any technical difficulties accessing the workshop online?

Answered: 16 Skipped: 28



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	100.00%	16
TOTAL		16

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
	There are no responses.	

Q31 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 16 Skipped: 28

#	RESPONSES	DATE
1	I probably couldn't have attended in person, so it's good I got to watch online.	2/25/2022 11:57 AM
2	Due to pandemic	2/24/2022 12:30 AM
3	Whilst it was better than other Zoom experiences, there was still a significant struggle to take notes on everything when I am restricted to a certain camera view/frame. The camera often moves before I am done copying.	2/23/2022 10:22 AM
4	I essentially did not follow talks live, almost only because I have very young kids, and the schedule was essentially during dinner and goin to bed times	2/23/2022 9:34 AM
5	Not able to interact with others, except at lectures. Harder to carve out time while not physically present.	2/23/2022 9:11 AM
6	Time zone difference certainly made participation less convenient.	2/23/2022 8:53 AM
7	Due to the time zone difference, I could not attend all of the talks, as I had commitments in the evening. But it was great that every effort was made to schedule the talks so that people in Europe could attend the lectures, in particular having the workshop over two weeks with lectures in the morning (local time).	2/23/2022 8:44 AM
8	I would've liked to participate in person. But MSRI has closed its doors for non-speakers and non-program participants, even fully vaccinated. Such a pity.	2/21/2022 4:12 AM
9	The time difference was awkward, but as I said earlier, I probably would not have been able to attend in person.	2/21/2022 4:01 AM
10	I probably would have participated in person if physical attendance had been higher	2/21/2022 1:22 AM
11	Time zone difference was the main barrier	2/20/2022 1:54 AM
12	NA	2/18/2022 1:46 PM
13	I was happy to see that the talks were scheduled in the morning so that I could follow them live from Europe in the evening.	2/18/2022 10:24 AM
14	-	2/18/2022 10:19 AM
15	I would not have been able to participate at all had it not been online.	2/18/2022 9:53 AM
16	yes	2/18/2022 9:51 AM

Q32 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 7 Skipped: 37

#	RESPONSES	DATE
1	Don't hold them online... But you could try to have coffee breaks where participants are encouraged to talk (in little groups). But please return to in-person, you can throw all the covid tests and vaccine requirements you want at me.	2/23/2022 10:22 AM
2	Maybe program one slot for discussions in the schedule	2/23/2022 9:34 AM
3	no.	2/23/2022 9:11 AM
4	-	2/23/2022 8:53 AM
5	Virtual coffee breaks via breakout rooms.	2/21/2022 4:12 AM
6	This is a tough question to answer. I've participated in a couple of Zoom social events, but they are difficult unless you know the others well.	2/21/2022 4:01 AM
7	Still no. Most casual interaction revolves around food, and that doesn't really work online.	2/18/2022 9:53 AM

Q33 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 1 Skipped: 43

#	RESPONSES	DATE
1	Nothing in addition to the comments I've already made. Once again, thank you for letting me participate.	2/21/2022 4:02 AM

[Virtual] Hot Topics: Foundations of Stable, Generalizable and Transferable Statistical Learning

March 07 – March 10, 2022

Hybrid Workshop

Organizers:

Peter Bühlmann (ETH Zurich)

John Duchi (Stanford University)

Elizabeth Tipton (Northwestern University)

Bin Yu (University of California, Berkeley)

REPORT ON THE MSRI WORKSHOP
"Hot Topics: Foundations of Stable, Generalizable and Transferable Statistical Learning (Virtual Workshop)"
March 07 – March 10, 2022

Organizers

- Peter Bühlmann (ETH Zurich)
- John Duchi (Stanford University)
- Elizabeth Tipton (Northwestern University)
- Bin Yu (University of California, Berkeley)

Scientific Description

Despite the remarkable success in extracting information from complex and (often) large-scale datasets over the last two decades, further progress is needed to making automated statistical and machine learning algorithms more reliable, robust, interpretable and trustworthy. This workshop focused on foundational aspects of this goal, linking areas at the interface between statistics, optimization, machine learning and computer science, such as distributional robustness and stability, adversarial and transfer learning, generalizability and meta analysis, and causality.

Highlights of the Workshop

The four days workshop has been structured into blocks of presentations and discussion, every day: five presentations of 25 minutes plus a 60-80 minutes discussion on the theme(s) of the day. The discussion sessions have been moderated by the workshop organizers. Since this was an online workshop only, the four discussion sessions have been real highlights: the participants were highly engaged and we experienced a surprisingly fruitful and constructive way of lively interactions. Thus, for our workshop, this format was a real success.

The first day of the workshop had the theme of external validity and domain adaptation of statistical estimation techniques, including practical applications. Five high quality presentations by Madry, Chen, McShane, Hartman and Schauer have contributed to set the overall theme of the workshop. The second day was mainly devoted to causal inference, and the three talks by Ogburn, Ding and Peters explained interesting approaches how causality can be used for better generalizations. On the third day, there were three exciting presentations on the mathematical foundations of robustness and statistical learning by Sur, Yang and Blanchet followed by two methodological presentations with original ideas on distributional robustness and stability by Rothenhäusler and Namkoong. Finally, on the last day, there have been application oriented presentations by Zheng, Murray and Staide followed by talks on external validity and reliability of machine learning by Steinhardt and Lipton.

Organizers		
First Name	**Last Name**	**Institution**
Peter	Bühlmann	ETH Zürich
John	Duchi	Stanford University
Elizabeth	Tipton	Northwestern University
Bin	Yu	University of California, Berkeley
Speakers		
First Name	**Last Name**	**Institution**
Jose	Blanchet	Stanford University
Tamara	Broderick	Massachusetts Institute of Technology
Yuansi	Chen	Duke University
Peng	Ding	University of California, Berkeley
Raaz	Dwivedi	Harvard University
Erin	Hartman	University of California, Berkeley
Zachary	Lipton	Carnegie Mellon University
Aleksander	Madry	Massachusetts Institute of Technology
Blake	McShane	Northwestern University
Jared	Murray	University of Texas, Austin
Hongseok	Namkoong	Columbia University
Betsy	Ogburn	Johns Hopkins University
Jonas	Peters	University of Copenhagen
Dominik	Rothenhaeusler	Stanford University
Jacob	Schauer	Northwestern University
Bradly	Stadie	Toyota technological Institute at Chicago
Jacob	Steinhardt	University of California, Berkeley
Pragya	Sur	Harvard University
Fanny	Yang	ETH Zürich
Tian	Zheng	Columbia University

Mathematical Sciences Research Institute

[Virtual] Hot Topics: Foundations of Stable, Generalizable and Transferable Statistical Learning

March 07 to March 10, 2022

Monday, March 07		
07:55 AM - 08:00 AM		Welcome
08:00 AM - 08:25 AM	Aleksander Madry	Datamodels: Predicting Predictions with Training Data
08:30 AM - 08:55 AM	Yuansi Chen	Domain Adaptation Under Structural Causal Models
09:00 AM - 09:25 AM	Blake McShane	Assessing Replicability Via Multi-lab Collaborations
10:00 AM - 10:25 AM	Erin Hartman	Elements of External Validity: Framework, Design, and Analysis
10:30 AM - 10:55 AM	Jacob Schauer	Evaluating Replicability: Considerations for Analyses and Implications for Design
11:15 AM - 12:15 PM		Discussion

Tuesday, March 08		
08:00 AM - 08:25 AM	Betsy Ogburn	Disentangling Confounding and Nonsense Associations Due to Dependence
08:30 AM - 08:55 AM	Peng Ding	Interpretable Sensitivity Analysis for the Baron–Kenny Approach to Mediation with Unmeasured Confounding
09:00 AM - 09:25 AM	Jonas Peters	Distribution Generalization in Underidentified Causal Models
10:00 AM - 10:25 AM	Tamara Broderick	An Automatic Finite-Sample Robustness Metric: Can Dropping a Little Data Change Conclusions?
10:30 AM - 10:55 AM	Raaz Dwivedi	Near-Optimal Compression in Near-Linear Time
11:15 AM - 12:15 PM		Discussion

Wednesday, March 09		
08:00 AM - 08:25 AM	Pragya Sur	A Precise High-Dimensional Asymptotic Theory for AdaBoost
08:30 AM - 08:55 AM	Fanny Yang	Prospects and Perils of Interpolating Models
09:00 AM - 09:25 AM	Jose Blanchet	Distributionally Robust Bayesian Nonparametric Regression
10:00 AM - 10:25 AM	Dominik Rothenhaeusler	Calibrated Inference: Statistical Inference that Accounts for Both Sampling Uncertainty and Distributional Uncertainty
10:30 AM - 10:55 AM	Hongseok Namkoong	Assessing External Validity Over Worst-Case Subpopulations
11:15 AM - 12:15 PM		Discussion

Thursday, March 10		
08:00 AM - 08:25 AM	Tian Zheng	Veridical Network Embedding
08:30 AM - 08:55 AM	Jared Murray	Bayesian Nonparametric Models for Treatment Effect Heterogeneity: Model Parameterization, Prior Choice, and Posterior Summarization
09:00 AM - 09:25 AM	Bradly Stadie	Sim2Real Transfer in Robotics: Thoughts on Model Pruning and Robust Visual Transfer
10:00 AM - 10:25 AM	Jacob Steinhardt	Predicting Out-of-Distribution Error with the Projection Norm
10:30 AM - 10:55 AM	Zachary Lipton	Structured Adaptation & Deep Learning: When Prediction Yields Adaptation
11:15 AM - 12:15 PM		Discussion

Participants		
First Name	**Last Name**	**Institution**
Shanti	Agung	Masyarakat Pendidikan Sejati
Elie	Alhajjar	United States Military Academy
Abdullah	Al-Shabili	New York University
Ayman	Alzaatreh	American University of Sharjah
Yu	An	University of Cincinnati
Jerry	Anunrojwong	Columbia Business School
Kellie	Archer	The Ohio State University
Pol	Arranz-Gibert	University of Barcelona
Kuldip Singh	Atwal	George Mason University
Mona	Azadkia	ETH Zurich
Layal	B H	American University of Sharjah
Peter	Bühlmann	ETH Zurich
Nicolas	Baron	Universidad de los Andes
Peter	Bates	Michigan State University
Enzo	Battistella	Northeastern University
Bryan	Baxter	Massachusetts General Hospital
Zoë	Bell	University of California Berkeley
Thomas	Bengtsson	University of California, Berkeley
Polina	Berezina	Ohio State University
Yuan	Bian	University of Western Ontario
Peter	Bickel	University of California, Berkeley
Jose	Blanchet	Stanford University
Lenore	Blum	Carnegie Mellon University
Henry	Boateng	San Francisco State University
Sarah	Boufelja	Imperial College, London
Tamara	Broderick	Massachusetts Institute of Technology
Michael	Brodie	Harvard University
Shaofei	Cai	ICT, CAS
Tiffany	Cai	Columbia University
Trevor	Campbell	University of British Columbia
Fei	Cao	Arizona State University
Hongyuan	Cao	Florida State University
Enrico	Capobianco	Consiglio Nazionale delle Ricerche (CNR)
Rene	Carmona	Princeton University
Karan	Chadha	Stanford University
Jossy	Chalissery	RSM US LLP
Hao	Chang	Johns Hopkins University
Moses	Charikar	Stanford University
Yuansi	Chen	Duke University
Li	Chen	University of the District of Columbia
Ke	Chen	University of Texas, Austin
Yang	Chen	University of Michigan
Hongfei	Chen	University of Wisconsin-Madison
Xiaohui	Chen	University of Illinois at Urbana-Champaign
Huajie	Chen	Beijing Normal (Teachers) University
Andrew	Chen	Boston University
Mayee	Chen	Stanford University
Guang	Cheng	University of California, Los Angeles
Sylvia	Cheng	University of California, Berkeley
Yi-Jen	Chiang	New York University
Francesca	Chiaromonte	Pennsylvania State University
Tsenguun	Chinzorig	Haverford College
Andrew	Clark	Retired
Romain	Cosentino	University of Southern California
Evzenie	Coupkova	Purdue University
Marzia	Cremona	Université Laval
Ashlynn	Crisp	Portland State University
Jingyu	Cui	Western University
Huy	Dang	Pennsylvania State University
Latifa	Debbi	National Polytechnic School, Algiers, Algeria
Mario	Delgado	Northwestern University
Maria Ailynn	Diansuy	Antipolo Institute of Technology
Peng	Ding	University of California, Berkeley
Mariano	Dominguez	OAC
Constantin	Drabo	Université de Picardie (Jules Verne)
John	Duchi	Stanford University
Raaz	Dwivedi	Harvard University
Nicholas	Dwork	University of Colorado Anschutz
Carlos	Echegoyen	Public University of Navarre
Kossi	Edoh	North Carolina Agricultural and Technical State University
Zahra	Eghtesadi	Carnegie Mellon University
David	Eisenbud	MSRI - Mathematical Sciences Research Institute
Muna	El Shaikh	University of Bath
Tina	Eliassi-Rad	Northeastern University
Steven	Ellis	Columbia University
Saleh	Elmohamed	University of California, Berkeley
Fei	Fang	Duke University

Participants		
First Name	**Last Name**	**Institution**
Nick	Feng	New York University
Mason	Ferlic	University of Michigan
Andrey	Feuerverger	Dept of Statistical Sciences University of Toronto
Arjuna	Flenner	GE Aviation
Daniel	Fletcher	Northwestern University
Luella	Fu	San Francisco State University
Yuxin	Ge	University of Toulouse 3
Nikhil	Ghosh	University of California, Berkeley
Vittorio	Giammarino	Boston University
Andrew	Gillette	Lawrence Livermore National Laboratory
Tomas	Goicoa	Universidad Pública de Navarra
Rinkaj	Goyal	G. G. S. Indraprastha University
Quanquan	Gu	University of California, Los Angeles
Zhiling	Gu	Iowa State University
Osman	Guler	University of Maryland Baltimore County
Funda	Gunes	Duke University
Zijian	Guo	Rutgers, The State University of New Jersey
Cristian	Gutiérrez	Temple University
Anna	Halldorsdottir	Ohio State University
Fang	Han	University of Washington
Junheng	Hao	University of California, Los Angeles
Saminul	Haque	Stanford University
Erin	Hartman	University of California, Berkeley
Yiyun	He	University of California, Irvine
Tao	He	San Francisco State University
Christina	Heinze-Deml	Apple Inc
C	Hester	University of Massachusetts, Amherst
Walter	Holmquist	University of California, Berkeley
Songyan	Hou	ETH Zurich
Meng Hsuan	Hsieh	University of Michigan
Jessica	Hullman	Northwestern University
Neil	Hwang	City University of New York (CUNY)
Luca	Insolia	Sant'Anna School of Advanced Studies
Kukkeprasanna	J	Bengaluru City University
Saksham	Jain	Duke University
Sharon	Jan	GAO
Bruno	Jedynak	Portland State University
Flenner	Jennifer	Lansing Community College
Seonghyeon	Jeong	National Center for Theoretical Science
Hongmei	Jiang	Northwestern University
Ruijie	Jiang	Tufts University
Yihang	Jiang	Duke University
Ying	Jin	Stanford University
Yijie	Jin	Georgia Institute of Technology
Marcin	Joachimiak	Lawrence Berkeley National laboratory
Jeremiah	Johnson	University of New Hampshire
Eloise	Kaizar	Ohio State University
Stuart	Kaler	Archbishop Riordan High School
Rafail	Kartsioukas	University of Michigan
Ana	Kenney	University of California, Berkeley
Junghwan	Kim	University of Michigan
Lukas	Koch	Max-Planck-Institut für Mathematik in den Naturwissenschaften
Nathan	Kong	Stanford University School of Medicine
William	Krinsman	University of California, Berkeley
Srikanth	Krishnamurthy	Northeastern University
Kun	Kuang	Zhejiang University
Christian	Kuemmerle	Johns Hopkins University
Bhumi	Kumar	University of Wisconsin-Madison
Therese	Landry	University of California, Riverside
Tim Tsz-Kit	Lau	Northwestern University
Steve	Lawford	ENAC (University of Toulouse)
Andrej	Leban	University of California, Berkeley
Hojae	Lee	University of Michigan
Jiung	Lee	Samsung
Alessandro	Leite	Institut National de Recherche en Informatique Automatique (INRIA)
Ismael	Lemhadri	Stanford University
Ethan	Lew	Portland State University
Xinyi	Li	Clemson University
Xiaobin	Li	Southwest (Xinan) Jiaotong University
Yi	Li	University of California, Berkeley
Jiayi	Li	University of California, Los Angeles
Fan	Li	Duke University
Jiaqi	Li	University of Western Ontario
Qian	Li	St Jude Children's Research Hospital
Xuheng	Li	University of California, Los Angeles
Chunlin	Li	University of Minnesota
Jia	Li	Pennsylvania State University

Participants		
First Name	**Last Name**	**Institution**
Jingyi Jessica	Li	University of California, Los Angeles
Yuying	Li	University of Western Ontario
Yifan	Li	University of Western Ontario
Jia	Liang	St. Jude Children's Research Hospital
Lauren	Liao	University of California, Berkeley
Peter	Lin	State University of New York, Stony Brook
Zachary	Lipton	Carnegie Mellon University
Lang	Liu	University of Washington
Chunmei	Liu	Howard University
Bruno	Loureiro	École Polytechnique Fédérale de Lausanne
Sizhu	Lu	University of California, Berkeley
Xinyu	Luo	New York University
Boyang	Lyu	Tufts University
Cong	Ma	University of Chicago
Aleksander	Madry	Massachusetts Institute of Technology
Firdous	Mala	University of Kashmir
Michalis	Mamakos	Northwestern University
Tyler	Maule	Northwestern University
Kevin	McLoughlin	Lawrence Livermore National Laboratory
Blake	McShane	Northwestern University
Nonhle	Mdziniso	Central Michigan University
Walter	Mebane	University of Michigan
Sarmad	Mehrdad	New York University
Eduardo	Mendoza	De La Salle University
Arshak	Minasyan	École Nationale de la Statistique et de l'Administration Économique
Hiroaki	Minato	U. S. Energy Information Administration
Aditya	Modi	Microsoft
Jonathan	Montaño	New Mexico State University
Taesup	Moon	Seoul National University
Fahad	Mostafa	Texas Tech University
Debarghya	Mukherjee	University of Michigan
John	Muller	Georgia Institute of Technology
Jared	Murray	University of Texas, Austin
Hongseok	Namkoong	Columbia University
Evangelos	Nastas	University at Albany (SUNY)
Thuan	Nguyen	Tufts University
Justice	Odiase	Lansing Community College
Betsy	Ogburn	Johns Hopkins University
Gahee	Oh	Marcus Institute for Aging Research
Arek	Ohanissian	General Electric Capital Corp
Arinze	Okafor	Duke University
Louis	Omenyi	Federal University, Ndufu-Alike, Ikwo, Nigeria
Vy	Ong	Augusta University
Guillermo	Ortiz Jimenez	École Polytechnique Fédérale de Lausanne
Wei	Pan	Duke University
Josiah	Park	Texas A & M University
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Taylor	Petty	University of North Carolina
Richard	Pinch	Institute of Mathematics and Its Applications
Vincent	Pisztora	Pennsylvania State University
Drago	Plecko	ETH Zürich
Jose	Pliego San Martin	Duke University
Pietro	Poggi-Corradini	Kansas State University
Farzad	Pourkamali	École Polytechnique Fédérale de Lausanne
Aditya	Pradeep	École Polytechnique Fédérale de Lausanne
Matthew	Pratola	Ohio State University
Amin	Rahimian	University of Pittsburgh
Aniruddh	Rao	University of Michigan
Paria	Rashidinejad	University of California, Berkeley
Bradley	Rava	University of Southern California, Marshall School of Business
Babak	Ravandi	Northeastern University
Tobias	Ried	Ludwig-Maximilians-Universität München
Alexander	Ritchie	University of Michigan
David	Ritzwoller	Stanford University
Dominik	Rothenhaeusler	Stanford University
Shiori	Sagawa	Stanford University
Mohammad	Sajid	Qassim University
Dido	Salazar	The Aerospace Corporation
Guzmán	Santafé	Public University of Navarre
Amartya	Sanyal	ETH Zürich
Jacob	Schauer	Northwestern University
David	Scott	Rice University
Jan	Segert	University of Missouri
Ayush	Sekhari	Cornell University
Alessandro	Selvitella	Purdue University Fort Wayne
Chris	Shannon	University of California, Berkeley
Yu	Shao	Harvard School of Medicine

Participants		
First Name	**Last Name**	**Institution**
Sarath	Shekkizhar	University of Southern California
Dennis	Shen	University of California, Berkeley
Judy	Shen	Stanford University
Lei	Shi	University of California, Berkeley
Toru	Shirakawa	Osaka University Graduate School of Medicine
Subir	Sinha	TMC
Keith	Sollers	University of California, Davis
Bradly	Stadie	Toyota technological Institute at Chicago
Jacob	Steinhardt	University of California, Berkeley
Marcel	Stozir	University of Bath
Hana	Sulieman	American University of Sharjah
Pragya	Sur	Harvard University
Armeen	Taeb	ETH Zürich
Kean Ming	Tan	University of Michigan
Wai Hoh	Tang	National University of Singapore
Qiaoyue	Tang	University of British Columbia
Rohan	Taori	Stanford University
Lorenzo	Testa	Sant'Anna School of Advanced Studies
Ellie	Thieu	Amherst
Alexandru	Tifrea	ETH Zürich
Elizabeth	Tipton	Northwestern University
Zhaoxue	Tong	Pennsylvania State University
Panagiotis	Toulis	University of Illinois, Chicago
Rob	Trangucci	University of Michigan
Alexander	Tsigler	University of California, Berkeley
Son	Tu	University of Wisconsin-Madison
Maria Dolores	Ugarte	Universidad Pública de Navarra
Arantxa	Urdangarin Iztueta	Universidad Pública de Navarra
Emiliano	Valdez	University of Connecticut
Shu	Wan	George Washington University
Xinmiao	Wang	University of British Columbia
Junyao	Wang	Boston University
Zihao	Wang	Computer Science
Zilin	Wang	University of Michigan
Yu	Wang	University of Michigan
Zhenyu	Wang	Rutgers University
Yunjuan	Wang	Johns Hopkins University
Joni	Webster	Emory University School of Public Health
Yuchen	Wei	Rutgers University
Michael	Wells	Portland State University
Dongxia	Wu	University of California
Guani	Wu	University of California, Los Angeles
Hau-Tieng	Wu	Duke University
Xuming	Xie	Morgan State University
Dexuan	Xie	University of Wisconsin-Milwaukee
Pan	Xu	California Institute of Technology
Yidan	Xu	University of Michigan
Gongjun	Xu	University of Michigan
Yingying	Xu	Riken
Wendao	Xue	University of Washington Seattle
Masanao	Yajima	Boston University
Jun	Yan	University of Connecticut
Konstantina	Yaneva	Harvard Extension School
Fanny	Yang	ETH Zürich
Ching-Chi	Yang	University of Memphis
Yu	Yang	University of Minnesota
Zhen	Yang	University of Michigan
Jeremy	Yang	Harvard University
Jiaqi	Yang	University of California, Berkeley
Bin	Yu	University of California, Berkeley
Rose	Yu	University of California, San Diego
Qiuhai	Zeng	Pennsylvania State University
Junxi	Zhang	University of Alberta
Qiong	Zhang	University of British Columbia
Archer	Zhang	PIMS - Pacific Institute for the Mathematical Sciences
Yuping	Zhang	University of Connecticut
Ethan	Zhang	University of Michigan
Yuan	Zhang	Ohio State University
Zheng	Zhang	Harvard University
Zhihui	Zhang	Bryn Mawr College
Wenbo	Zhang	University of California, Irvine
Bo	Zhao	University of California
Qingyuan	Zhao	Center for Mathematical Sciences
Xiliang	Zhao	Xiamen University
Tian	Zheng	Columbia University
Cong	Zhou	Indiana University
Xiaoyu	Zhou	University of Maryland

Participants		
First Name	**Last Name**	**Institution**
Yuren	Zhou	Duke University
Jet	Zhou	University of Western Ontario
Yizhe	Zhu	University of California, Irvine
Quanyan	Zhu	New York University

Identifiable Participants' Information

Participants		312

Gender		312
Male	68.91%	215
Female	27.56%	86
Other	0.32%	1
Declined to state	3.21%	10

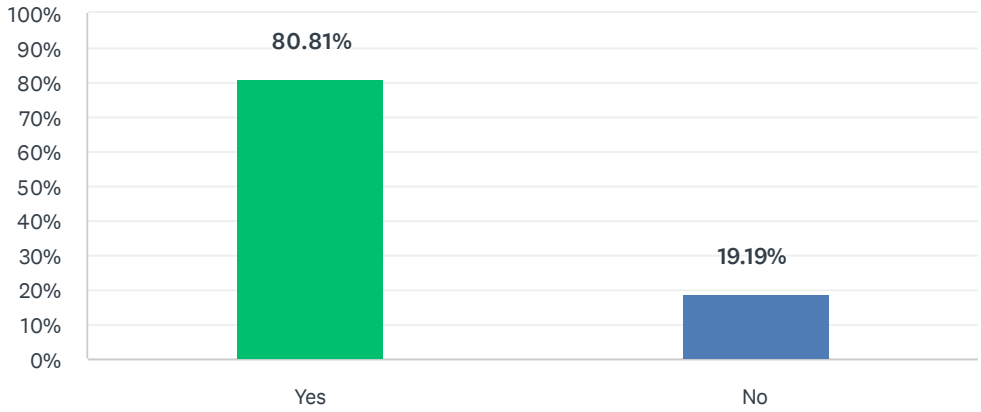
Ethnicity*		331
White	29.91%	99
Asian	50.45%	167
Hispanic	4.23%	14
Pacific Islander	0.30%	1
Black	2.72%	9
Native American	0.00%	0
Mixed	2.72%	9
Declined to state	9.67%	32

* ethnicity specifications are not exclusive

There were 13 unidentifiable participants.

Q1 Did you attend the virtual workshop?

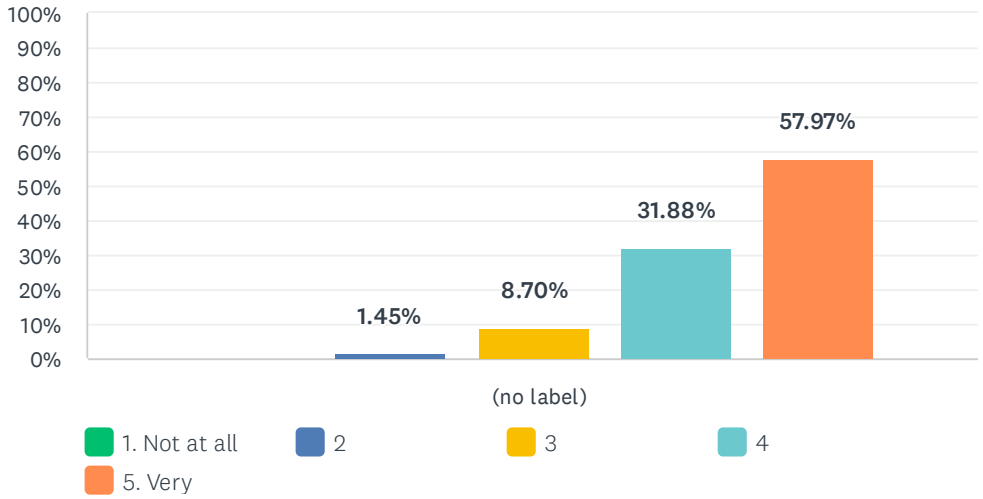
Answered: 99 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	80.81%	80
No	19.19%	19
TOTAL		99

Q2 The workshop was intellectually stimulating

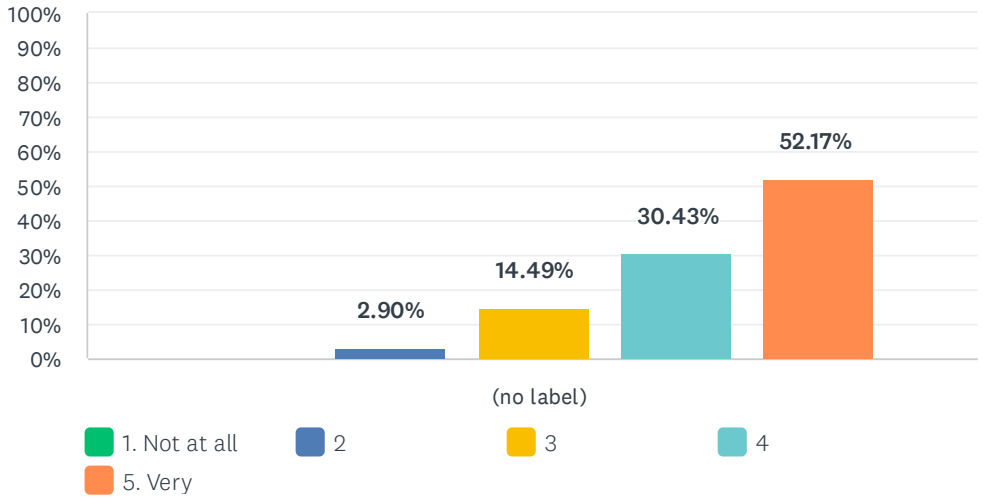
Answered: 69 Skipped: 30



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	1.45% 1	8.70% 6	31.88% 22	57.97% 40	69	4.46

Q3 The overall experience of the workshop was worthwhile

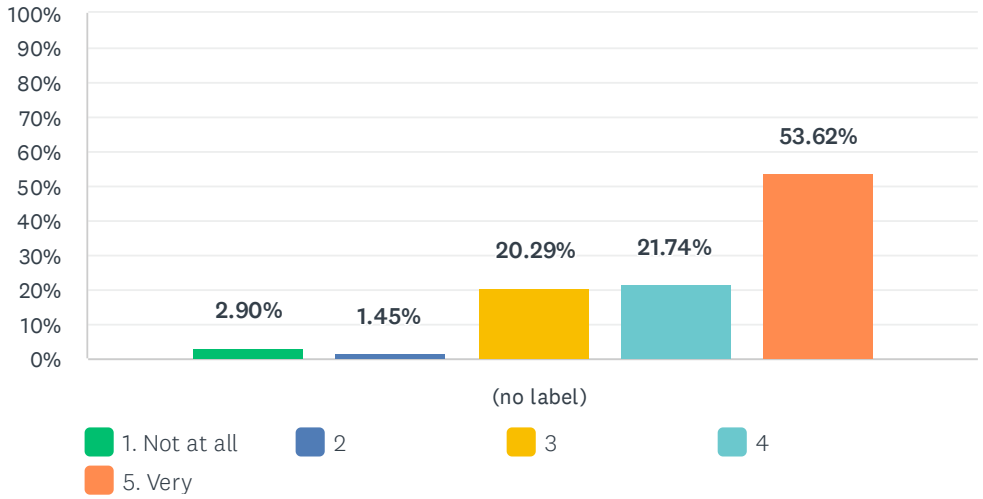
Answered: 69 Skipped: 30



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.90% 2	14.49% 10	30.43% 21	52.17% 36	69	4.32

Q4 The one hour discussions each day after the talks were helpful

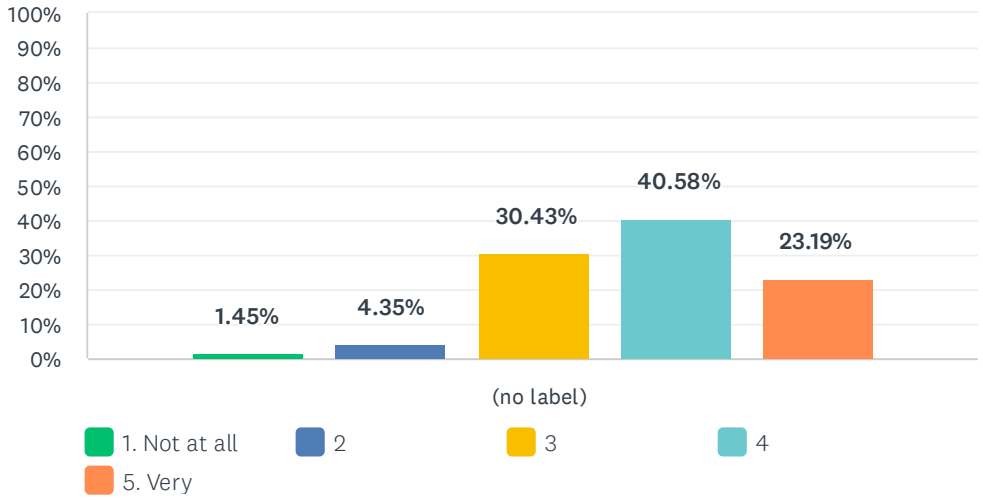
Answered: 69 Skipped: 30



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.90% 2	1.45% 1	20.29% 14	21.74% 15	53.62% 37	69	4.22

Q5 I was well prepared to benefit from the lectures

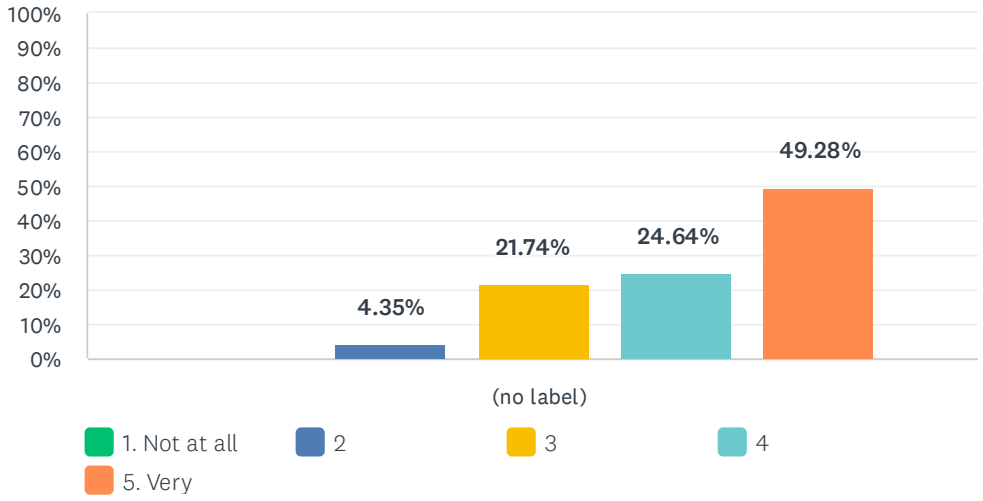
Answered: 69 Skipped: 30



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	1.45% 1	4.35% 3	30.43% 21	40.58% 28	23.19% 16	69	3.80

Q6 My interest in the subject matter was increased by the workshop

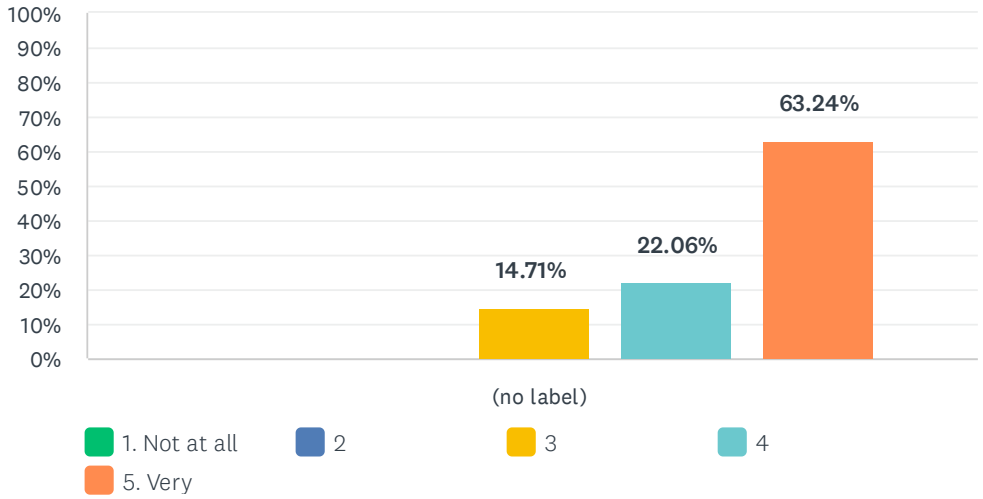
Answered: 69 Skipped: 30



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.35% 3	21.74% 15	24.64% 17	49.28% 34	69	4.19

Q7 I found the MSRI staff helpful

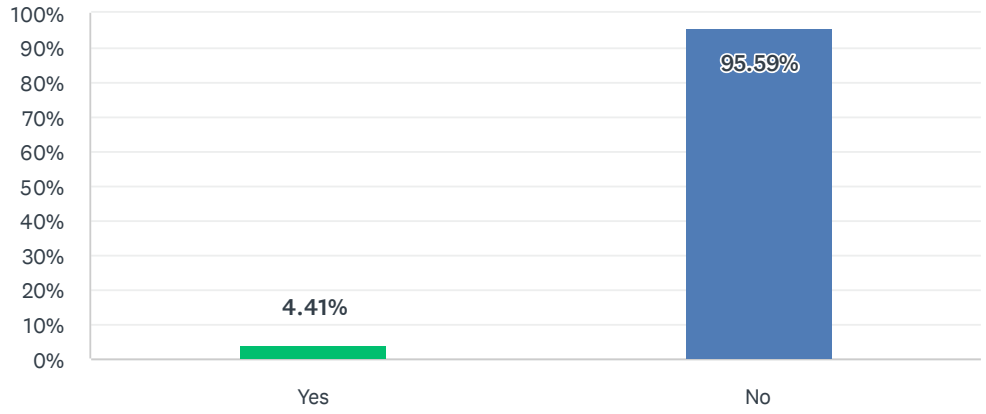
Answered: 68 Skipped: 31



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	14.71% 10	22.06% 15	63.24% 43	68	4.49

Q8 Did you experience any technical difficulties accessing the online workshop?

Answered: 68 Skipped: 31



ANSWER CHOICES	RESPONSES	
Yes	4.41%	3
No	95.59%	65
TOTAL		68

#	IF YES, PLEASE EXPLAIN	DATE
1	Poor network connection from my location.	3/13/2022 1:13 PM
2	small interruption in the internat connection	3/13/2022 6:25 AM

Q9 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 68 Skipped: 31

#	RESPONSES	DATE
1	both	4/9/2022 12:02 PM
2	Less direct communication with other participants..	4/5/2022 1:20 PM
3	N/A	3/30/2022 11:54 AM
4	I only attended one session.	3/30/2022 11:18 AM
5	In person would've been much better	3/30/2022 8:56 AM
6	It was a bit early.	3/30/2022 6:43 AM
7	I would have preferred to attend in person in order to interact more closely with the participants.	3/30/2022 6:24 AM
8	No	3/30/2022 5:27 AM
9	I was connected from Spain. The time difference is high but there was no problem for me to follow the workshop.	3/30/2022 12:13 AM
10	It did not affect my participation by much.	3/14/2022 12:35 PM
11	Would not have attended had it not been virtual (the cost would have outweighed my predicted benefit)	3/14/2022 11:30 AM
12	The fact that the workshop was online actually helped me participate in it in the first place (flying to California would not have been feasible). Therefore, not having to travel was a great aspect. However, the participation online did have its limitations, especially when it comes to asking very specific question about talks, or trying to go into detail with one of the speakers (which in person, I find, is usually much easier). In Central European Time (CET) the workshop was between 5pm and 9pm, which is not ideal, but doable. Of course, it is difficult to find a time slot which works for both folks in North America and Europe.	3/14/2022 8:48 AM
13	Only attended a few talks	3/14/2022 7:39 AM
14	My time zone is Beijing time zone. Very sleepy for attending online zoom meeting	3/14/2022 7:07 AM
15	The online workshop made it easier for me to participate, although some talks were relatively early PST.	3/13/2022 8:41 PM
16	online is good	3/13/2022 6:43 PM
17	time zone and remote participation are hard.	3/13/2022 5:45 PM
18	I was joining from Japan, so the workshop happened in my sleeping time, 1am~5am. I tried very hard to attend two nights, but I was half asleep and couldn't join the discussion awake. I was very tired after two nights, so I couldn't join the full workshop. After that effort, I needed to sleep for two days to recover myself back to normal time. But I was happy to know that there are recored videos to watch. Thank you very much for organizing this interesting workshop.	3/13/2022 5:20 PM
19	Yes both of these are examples. Better hold the workshop in-person next time.	3/13/2022 4:10 PM
20	A lot.	3/13/2022 4:06 PM
21	No problem	3/13/2022 2:19 PM

22	Sort of. I personally don't have the same level of concentration in the online format conferences.	3/13/2022 1:40 PM
23	-	3/13/2022 1:16 PM
24	It's easier for me to join via Zoom than in-persion	3/13/2022 1:14 PM
25	Difference in time zone made me join late.	3/13/2022 1:13 PM
26	For me it was very good.	3/13/2022 6:25 AM
27	yes	3/12/2022 5:58 PM
28	Because the workshops conflicted with my teaching schedule on Tuesday and Thursday and also with some meetings, I could not attend all the talks and all the discussions as I wanted to!	3/11/2022 6:31 PM
29	Time zone difference was fitting for my schedule.	3/11/2022 8:10 AM
30	I had family care issues that interrupted my last day of attendance. However, overall, being on line was the only reason I was able to participate and I would like to do it again.	3/11/2022 5:15 AM
31	I could only participate because virtual participation was offered. Thanks a lot for your work on this. I believe that virtual participation will become an integral part of our discipline.	3/11/2022 1:08 AM
32	It was crucial considering that I am outside the US	3/10/2022 11:35 PM
33	Barrier due to time zone differences	3/10/2022 10:18 PM
34	It was well managed.	3/10/2022 7:00 PM
35	I did not like the fact that the format was made online. It significantly impacted my participation in the conference. It is not just as interesting to do these things completely virtually.	3/10/2022 6:54 PM
36	I don't think I would have participated if not online. So it's wonderful that you decided to offer it in this format.	3/10/2022 6:08 PM
37	I think it was beneficial and convenient, given the difficulties of travelling. I would have missed the workshop if it had not been an online session.	3/10/2022 5:43 PM
38	Time zone difference was the main barrier	3/10/2022 5:18 PM
39	There was no impact	3/10/2022 5:08 PM
40	no	3/10/2022 4:52 PM
41	Having it online was and is fine and it did not impact my participation.	3/10/2022 4:31 PM
42	enabled attendance	3/10/2022 3:51 PM
43	It felt a bit detached. It was hard to focus sometimes. Would have been better to be in person, but having this online also improved accessibility (i.e. ease of accessing these sessions).	3/10/2022 3:51 PM
44	Yes	3/10/2022 3:49 PM
45	The online format almost entirely obviating the purpose of the conference. A real missed opportunity and a total pity.	3/10/2022 2:52 PM
46	Very convenient. I attended virtually from France, sessions were from 5pm to 8.15pm local time.	3/10/2022 2:49 PM
47	Everything went very smooth.	3/10/2022 2:34 PM
48	It allowed me to attend without having to take time off work to travel or request travel funds for attendance.	3/10/2022 2:29 PM
49	Online workshop works well for me.	3/10/2022 2:09 PM
50	It was fine and didn't impact my participation. .	3/10/2022 1:56 PM
51	I live in Italy, where the time zone difference is quite manageable, and I greatly appreciated the possibility of attending this workshop online (since it would have been more difficult for me to	3/10/2022 1:54 PM

	reach the US, beside the pandemic issues). I hope that an hybrid format would be taken into account also in the future in order to reach a wider audience.	
52	No problems experienced.	3/10/2022 1:45 PM
53	virtual = less time consuming	3/10/2022 1:37 PM
54	NA	3/10/2022 1:33 PM
55	This impacted my participation significantly, since I had to teach my two classes and do other administrative duties at my institution while participating.	3/10/2022 1:32 PM
56	Positively	3/10/2022 1:30 PM
57	Not at all	3/10/2022 1:29 PM
58	It was during my spring break, so I was able to attend all the entire workshop.	3/10/2022 1:28 PM
59	It made it easier to attend more talks than otherwise.	3/10/2022 1:23 PM
60	Virtual workshop was great!	3/10/2022 1:22 PM
61	I didn’t face the time zone difference problem.	3/10/2022 1:15 PM
62	I think the timing was good so that everyone could take part. That said, 4 hours on Zoom is a long time and by the end of the week I was dragging, especially since I still took part in other meetings and work before/after the workshop. In person would have been better. But for an online workshop, this worked as best as it could have.	3/10/2022 1:14 PM
63	I like the idea of an online workshop, as getting a US visa is hard and very time-consuming. Taking a flight is not environmentally friendly and especially for families with small kids, it's hard to find someone to take care of their babies while they are gone.	3/10/2022 1:13 PM
64	Would infinitely have preferred to have this in person and not via zoom.	3/10/2022 1:10 PM
65	Not that much	3/10/2022 1:09 PM
66	no	3/10/2022 1:07 PM
67	none	3/10/2022 1:06 PM
68	It did hamper my participation but I like replaying the workshop videos.	3/10/2022 1:05 PM

Q10 One important aspect that was missing due to the online format was interaction between participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 39 Skipped: 60

#	RESPONSES	DATE
1	no	4/9/2022 12:02 PM
2	N/A	3/30/2022 11:54 AM
3	No, it's a challenge and I don't have suggestions for improvement.	3/30/2022 6:24 AM
4	I think that the organization in this aspect was fine.	3/30/2022 12:13 AM
5	Strongly and repeatedly encourage participants to turn on video. Small random discussion breakout groups	3/14/2022 11:30 AM
6	I was wondering if having break-out rooms for discussions would be helpful, when there a specific idea to be discussed.	3/14/2022 8:48 AM
7	I have no idea temporarily.	3/14/2022 7:07 AM
8	no	3/13/2022 6:43 PM
9	not really, online participation is never going to fill the void of personal physical interactions.	3/13/2022 5:45 PM
10	From the atmosphere I guess most of participants know each other or belong to the same community? People are very kind and friendly, I felt this workshop is more relaxed and open compare to other online conferences I have seen. The difficulty for me was, I don't know anyone in person in the workshop, I only know few names from papers. So kind of hard to join the discussions just by jump in. I'm not a famous professor, just a researcher who is interested of this topic and no other colleaques with me.	3/13/2022 5:20 PM
11	No. You did very well.	3/13/2022 4:06 PM
12	Send the participants into breakout rooms.	3/13/2022 1:40 PM
13	-	3/13/2022 1:16 PM
14	None.	3/13/2022 1:13 PM
15	By increase the discussion time and opening it for all participants.	3/13/2022 6:25 AM
16	Perhaps have an hour or so on Gathertown (costs attendees something like $3/hour or $5 a day). It gives the online environment an in-person feeling because video chat begins when people are close to each other in the online space.	3/11/2022 6:31 PM
17	I actually attended with a colleague from my school and we talked about the presentations. Maybe see if there are multiple participants in the same area that could meet after the seminars to discuss in person.	3/11/2022 5:15 AM
18	I found the interaction fine. Still, maybe 2 ideas: * An advantage in zoom vs real life is that one can assign participants to randomly chosen breakout rooms, where one gets to know people whom one did not know before. One can do this during talks, after talks or during breaks, for example, and only for people who are interested (it's easy to redistribute people in 'empty rooms'). * Personally, I would limit the recording to the talks. Not everyone is comfortable being recorded while asking questions or suggesting ideas.	3/11/2022 1:08 AM
19	Maybe propose gather town rooms	3/10/2022 11:35 PM
20	Currently, almost everyone is tired of virtual workshops. I will hope we do not have completely online workshops---its not as interactive, and engaging. No one blocks off their time for the	3/10/2022 6:54 PM

	entire schedule. An online workshop acts as an additional workload on top of the usual workload.	
21	I think there is a benefit to possibly having a local chapter meetings that are held in different locations to increase localized networking.	3/10/2022 6:08 PM
22	As it went, there are no changes to be made	3/10/2022 5:08 PM
23	Maybe encourage chatting between speakers and participants either on 1-1 or 1-n basis ... Also allocate much more time for that. In addition to the 1-hour discussions period at the end of each day, perhaps have several discussion intervals between talks (maybe between every other talk). The drawback of this would lengthen the daily schedules but overall it would benefit the participants. ++ make it 1.5 hour discussion time at the end of each day.	3/10/2022 4:31 PM
24	Ask speakers to pause every 10 mins or so. That should help with improving interactivity (between participants and speaker, and among participants during discussions, etc).	3/10/2022 3:51 PM
25	Explicit time set aside for causual conversations.	3/10/2022 3:49 PM
26	Do not hold future workshops online.	3/10/2022 2:52 PM
27	Include surveys, quizzes, vary session formats to include shorter talks e.g. 10-15 mins as well as longer ones.	3/10/2022 2:49 PM
28	hold a zoom conference call/breakout room where anyone can join at any time during breaks and after discussion	3/10/2022 2:29 PM
29	A long and structured discussion every day (here after the talks) has been truly crucial to interact.	3/10/2022 1:56 PM
30	Perhaps, it might be interesting to organize some topic-specific sessions (even in parallel) where a small number of interested partecipants can gather to informally discuss in more details these topics and get to know each other.	3/10/2022 1:54 PM
31	breakout rooms	3/10/2022 1:37 PM
32	NA	3/10/2022 1:33 PM
33	Na	3/10/2022 1:30 PM
34	The lack of interaction might be the only concern. It might be worth trying small discussion rooms using Zoom. The idea is to have a full-participant discussion first, then decide some topics, then separate people into small discussion rooms based their interested topics.	3/10/2022 1:28 PM
35	group discussions as we had for this workshop and many breaks and short talks (less than 30 min).	3/10/2022 1:23 PM
36	The discussion section at the end of each day made up for the absence of f2f meeting.	3/10/2022 1:22 PM
37	The 1-hour discussion time provided quite a bit of interaction, but probably only because a smaller subset attended these (~20 people). If more had attended it would have been difficult. I suppose in that case break-out groups would work ... but then you'd want to make sure these groups were determined so that people weren't just hanging out with people / work they already knew.	3/10/2022 1:14 PM
38	In person meetings.	3/10/2022 1:10 PM
39	We could have had a slack channel or sth and perhaps with automated coffee dates for those who want to (including participants). Also no forced closed meetings during breaks since this is the only time you could chitchat and catch up.	3/10/2022 1:09 PM

Q11 We welcome any additional comments or suggestions you may have to improve the overall online experience for future participants.

Answered: 24 Skipped: 75

#	RESPONSES	DATE
1	My comments here are somewhat specific to the topic of this workshop, but perhaps will generalize to others, and I should preface by saying that this is the first MSRI workshop that I have attended, which may bias my viewpoint. To put it briefly, I did not find the content to align very well with my expectations for the workshop. I had hoped, given that this workshop was being held at MSRI, to hear a much more mathematically expansive take on the subject of generalizable, transferable, and stable statistical learning, perhaps bringing in new and innovative ideas from algebra, tropical geometry, and other areas of mathematics whose relevance to the topic has been shown but only superficially investigated. Instead, I felt that there wasn't much presented that distinguished this workshop from what I'd expect at a typical machine learning conference workshop - mostly similar incremental advances driven by empirically motivated methods with a limited amount of novel mathematical insight. That's not to say that I did not find portions of the workshop interesting and relevant, but in total it was not what I was hoping for.	3/30/2022 6:24 AM
2	I don't have adittional comments	3/30/2022 12:13 AM
3	Participation in discussions / Q&A from non-presenting participants should be more encouraged	3/14/2022 11:30 AM
4	A great overall effort. Hope this see it again next year!	3/14/2022 8:48 AM
5	More interdisciplinary workshops	3/14/2022 7:07 AM
6	It is a great workshop!	3/13/2022 6:43 PM
7	I also think the talks should be longer so that we can understand more about the details of the speakers' work.	3/13/2022 4:10 PM
8	Use Q/A to collect questions for the discussion section.	3/13/2022 4:06 PM
9	-	3/13/2022 1:16 PM
10	None.	3/13/2022 1:13 PM
11	This is a big ask, but could the workshop occur in the evening or Wed-Sat in order to decrease time conflicts with faculty duties? If not, that is fine. Thanks for organizing this!	3/11/2022 6:31 PM
12	The overall experience was great! Again, two quick ideas: * Maybe, I am missing sth but I am not entirely sure why it was necessary to stop the meeting during the breaks (zoom has the option of 'pause' and 'stop' recording). * It would have been an option to structure the with topics or 'lead' questions -- but even without the discussion rounds worked fine.	3/11/2022 1:08 AM
13	Thank you, the organizers and speakers	3/10/2022 11:35 PM
14	This was great. But I felt there were disconnect between some of the CS and statistics talks. It would have been great if there were bridges built.	3/10/2022 6:08 PM
15	More seminars, colloquiums would be appreciated	3/10/2022 5:08 PM
16	If multiple platforms (zoom and others) are used at the same time that also might improve the level of communication between the participants. In the mean time, we have to make the best of zoom communication features...	3/10/2022 4:31 PM
17	Do not hold future workshops online.	3/10/2022 2:52 PM
18	Change the schedule to allow a little more time for questions after each talk. The strict adherence to the published schedule was unforgiving in case of technical problems (some speakers could not share screen etc.) and in some cases left time for very few questions.	3/10/2022 2:49 PM

19	Problem Solving Workshop	3/10/2022 1:37 PM
20	NA	3/10/2022 1:33 PM
21	Na	3/10/2022 1:30 PM
22	4 days might be a bit long because of scheduling issues on the part of participants.	3/10/2022 1:22 PM
23	It would be nice to connect everyone on Twitter at some point - e.g., via a list.	3/10/2022 1:14 PM
24	On line works as well as can be expected but it's not the same as in person.	3/10/2022 1:10 PM

Critical Issues in Mathematics Education 2022: Initiating, Sustaining, and Researching Mathematics Department Transformation of Introductory Courses for STEM Majors

March 16 – March 18, 2022

Hybrid Workshop

Organizers:

Naneh Apkarian (Arizona State University)

David Bressoud (Macalester College)

Pamela Burdman (Just Equations)

Jamylle Carter (Diablo Valley College)

Ted Coe (Northwest Evaluation Association)

Courtney Ginsberg (Math for America)

Estrella Johnson (Virginia Polytechnic Institute and State University)

W Gary Martin (Auburn University)

Michael O'Sullivan (San Diego State University)

Chris Rasmussen (San Diego State University)

Daniel Reinholz (San Diego State University)

Wendy Smith (University of Nebraska)

David Webb (University of Colorado at Boulder)

Organizers

First Name	Last Name	Institution
Naneh	Apkarian	Arizona State University
David	Bressoud	Macalester College
Pamela	Burdman	Just Equations
Jamylle	Carter	Diablo Valley College
Ted	Coe	Northwest Evaluation Association
Courtney	Ginsberg	Math for America
Estrella	Johnson	Virginia Polytechnic Institute and State University
W Gary	Martin	Auburn University
Michael	O'Sullivan	San Diego State University
Chris	Rasmussen	San Diego State University
Daniel	Reinholz	San Diego State University
Wendy	Smith	University of Nebraska
David	Webb	University of Colorado at Boulder

Speakers

First Name	Last Name	Institution
Naneh	Apkarian	Arizona State University
Stephanie	Bohbot	High School of Telecommunication Arts and Technology
Kirsten	Bohl	MSRI - Mathematical Sciences Research Institute
David	Bressoud	Macalester College
Katelyn	Cooper	Arizona State University
Missy	Cosby	University of Michigan
Carrie	Diaz Eaton	Bates College
David	Eisenbud	MSRI - Mathematical Sciences Research Institute
Ricardo	Esttrada	High School of Sports Management
Lindsay	Fitzpatrick	The University of Texas at Austin
Alan	Garfinkel	University of California, Los Angeles
Amy	Getz	WestEd
Eric	Hsu	San Francisco State University
Christopher	Jett	University of West Georgia
Estrella	Johnson	Virginia Polytechnic Institute and State University
John	Johnson	Ohio State University
Nathan	Klingbeil	Wright State University
Dave	Kung	University of Texas at Austin
Sandra	Laursen	University of Colorado Boulder
Kathryn	Leonard	Occidental College
Karen	Marrongelle	National Science Foundation
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Jesús	Oliver	California State University, East Bay
Julia	Olkin	California State University, East Bay
Omayra	Ortega	Sonoma State University
Michael	O'Sullivan	San Diego State University
Chris	Rasmussen	San Diego State University
Daniel	Reinholz	San Diego State University
Padmanabhan	Seshaiyer	George Mason University
Brooke	Shipley	University of Illinois at Chicago
Wendy	Smith	University of Nebraska
April	Strom	Chandler-Gilbert Community College
Marilyn	Strutchens	Auburn University
Xueli	Wang	University of Wisconsin-Madison
David	Webb	University of Colorado at Boulder
Trena	Wilkerson	Baylor University
Charles	Wilkes	San Diego State University

Mathematical Sciences Research Institute

Critical Issues in Mathematics Education 2022: Initiating, Sustaining, and Researching Mathematics Department Transformation of Introductory Courses for STEM Majors [Hybrid Workshop]

March 16 to March 18, 2022

Wednesday, March 16		
03:30 PM - 04:00 PM		Registration
04:00 PM - 04:15 PM	David Eisenbud & Christine Marshall	Welcome and MSRI Logistics
04:15 PM - 04:45 PM	Chris Rasmussen	Workshop Overview and Highlights from the 2021 Teaser
04:45 PM - 06:15 PM	Karen Marrongelle	Systemic Change in Undergraduate Mathematics: Creating Visible Pathways for Diversity in STEM
06:15 PM - 07:15 PM		Reception

Thursday, March 17		
08:30 AM - 09:30 AM	Missy Cosby	Putting Equity at the Center of Change
09:30 AM - 10:45 AM	Katelyn Cooper, Christopher Jett & Charles Wilkes	Equity in Practice: Challenges and Opportunities
11:15 AM - 12:00 PM		Student Experiences in Introductory Math Courses
01:30 PM - 02:30 PM	Gary Martin	When (If?) Worlds Collide: Towards Coherence in Mathematics Pedagogy from High School to Post-Secondary
02:30 PM - 03:45 PM	David Kung, April Strom & Marilyn Strutchens	Advancing Department Transformation by Revolutionizing Instructional Practices
04:15 PM - 05:30 PM	Stephanie Bohbot , Carrie Diaz Eaton, Ricardo Esttrada, Estrella Johnson & Omayra Ortega	Perspectives on Professional Development: Reflections and Lessons Across Contexts
05:30 PM - 05:40 PM	Kirsten Bohl & Trena Wilkerson	Mathical Highlights
05:40 PM - 06:00 PM	Jack Burkart, Núria Fagella, Scott Kaschner, Rohini Ramadas & Rebecca Winarski	Reflections and Preview of Next Day Activities

Friday, March 18		
08:30 AM - 09:30 AM	Sandra Laursen	Anchors, Buoys, and Life Jackets: Thinking Strategically about Structures as Levers for Change
09:30 AM - 10:30 AM	Xueli Wang	Building Equitable STEM Transfer Pathways
11:00 AM - 12:00 PM	Alan Garfinkel, Nathan Klingbell & Kathryn Leonard	Perspectives from the Client Disciplines
01:30 PM - 02:00 PM	Naneh Apkarian & Daniel Reinholz	A Critical Look at Change: How Can Theory Help Scale and Sustain Equitable Practices?
02:00 PM - 03:00 PM	David Bressoud, Lindsay Fitzpatrick, Amy Getz, Gary Martin & Padmanabhan Seshaiyer	Preparing Pathways: Partners, Professional Organizations, and Policies
03:30 PM - 04:30 PM	Eric Hsu, John Johnson, Michael O'Sullivan, Jesús Oliver, Julia Olkin, Brooke Shipley, Wendy Smith, April Strom & David Webb	Change Agents in Action: Parallel Breakout Sessions: Discussion with Departmental Change Agents
04:30 PM - 05:00 PM		Individual or Group Reflections/Actions and Closing

Participants		
First Name	**Last Name**	**Institution**
Aaron	Abrams	Washington and Lee University
Nathan	Alexander	Morehouse College
Anita	Alexander	Bilkent University
Aida	Alibek	University of Georgia
Marcelo	Almora Rios	University of Montana
Nigar	Altindis	University of New Hampshire
Angelynn	Alvarez	Embry-Riddle Aeronautical University
Leesa	Anzaldo	University of California, San Diego
Naneh	Apkarian	Arizona State University
Federico	Ardila	San Francisco State University
Vinay	Arora	Panjab University, UIET (PUSSGRC, Hoshiarpur) India
Jayadev	Athreya	University of Washington
Mehsin	Atteya	Al-Mustansiriyah University
Yuliya	Babenko	Kennesaw State University
Vira	Babenko	Drake University
Matthew	Bates	Indiana University
Mary	Beisiegel	Oregon State University
Juliana	Belding	Boston College
Anna Marie	Bergman	Simon Fraser University
Gabrielle	Bernal	University of Michigan
Stephanie	Bohbot	High School of Telecommunication Arts and Technology
Kirsten	Bohl	MSRI - Mathematical Sciences Research Institute
Corey	Brady	Vanderbilt University
David	Bressoud	Macalester College
Marie	Brodsky	University of Maryland
Orly	Buchbinder	University of New Hampshire
Ron	Buckmire	Occidental College
Pamela	Burdman	Just Equations
Ernesto	Calleros	University of California, San Diego
Jan Tracy	Camacho	San Francisco State University
Amanda	Cangelosi	Utah State University
Carrie	Carmack	University of West Georgia
Jamylle	Carter	Diablo Valley College
Robert	Chamblin	Montana Tech
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Brian	Church	Stephen F. Austin State University
Marta	Civil	University of Arizona
Crystal	Clough	University of Cincinnati
Ted	Coe	Northwest Evaluation Association
Yong	Colen	Indiana University of Pennsylvania
Jung	Colen	Chadron State College
Brian	Conrad	Stanford University
Caitlin	Cooley-Chamblin	Montana Tech
Katelyn	Cooper	Arizona State University
Bruce	Corrigan-Salter	Wayne State University
Julien	Corven	University of Delaware
Missy	Cosby	University of Michigan
Judith	Covington	Northwestern State University
Bill	Crombie	The Algebra Project
Arlene	Crum	Office of Superintendent of Public Instruction
Guilherme	da Silva	Federal University of Alfenas
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Ellie	Dannenberg	University of Denver
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Zijian	Diao	Ohio University
Carrie	Diaz Eaton	Bates College
Stephanie	Dodson	University of California, Davis
Allan	Donsig	University of Nebraska
George	Dragomir	Columbia University
Lisa	Driskell	Colorado Mesa University
Katie	D'Silva	WestEd
Rob	Eby	Blinn College
Kossi	Edoh	North Carolina Agricultural and Technical State University
David	Eisenbud	MSRI - Mathematical Sciences Research Institute
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Kevser	Erdem	University of Cincinnati
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Ricardo	Esttrada	High School of Sports Management
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Participants		
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Fekadu Tolessa	Gedefa	Eötvös Loránd University
Amy	Getz	WestEd
Courtney	Ginsberg	Math for America
Bennet	Goeckner	University of Washington
Edray	Goins	Pomona College
Paul	Goodman	Skyline College
Jennifer	Graziano	Sacramento City Unified School District
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Erin	Griesenauer	Eckerd College
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Helen	Grundman	Bryn Mawr College
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William	Hall	Washington State University
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Shandy	Hauk	San Francisco State University
Meredith	Hegg	Temple University
Francesca	Henderson	University of Maryland
Marisa	Henderson	Wayne State University
Lenuel	Hernandez	Wayne State University
Eric	Hsu	San Francisco State University
Ann	Humes	Michigan Technological University
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Mohammad	jabbari	Washington University
Abdul	Jarrah	American University of Sharjah
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Olivia	Jessop	University of Queensland
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Laurie	Jordan	Loyola University
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Brian	Katz	California State University, Long Beach
Brendan	Kelly	Harvard University
Nadia	Kennedy	New York City College of Technology
Cathy	Kessel	Consultant
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Tanya	LaMar	Stanford University
Amanda	Lambertus	Arkansas State University
Therese	Landry	University of California, Riverside
Sabine	Lang	University of Denver
Sara	Lapan	University of California, Riverside
Talia	LaTona-Tequida	San Diego State University
Sandra	Laursen	University of Colorado Boulder
Catherine	Lebiedzik	Wayne State University
Kathryn	Leonard	Occidental College
Jennifer	Lewis	Wayne State University
Dexter	Lim	University of Minnesota
Melissa	Lindsey	University of Wisconsin-Madison
Pranay	Lingareddy	Rhodes College
Tuto	LopezGonzalez	University of California, San Francisco
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Yun	Lu	Kutztown University of PA
Alison	Lynch	California State University, Monterey Bay
Yanping	Ma	Loyola Marymount University

Participants		
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Firdous	Mala	University of Kashmir
Yorky	Man	California State University, East Bay
Forest	Mannan	Western Colorado University
Karen	Marrongelle	National Science Foundation
Dalton	Marsh	California State University, San Bernardino
Christine	Marshall	MSRI - Mathematical Sciences Research Institute
Antonio	Martinez	San Diego State University
Andre	Mathurin	Hillsborough Community College
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Colin	McGrane	San Diego State University
Jillian	McLeod	U.S. Coast Guard Academy
Amber	McNeill	California State University, East Bay
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Maria	Meehan	National University of Ireland, Dublin
Robert	Megginson	University of Michigan
Monica	Mendoza	University of California, Santa Barbara
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Elizabeth	Miller	The Ohio State University
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Channa	Navaratna	Indiana University of Pennsylvania
Christopher	Nazelli	Wayne State University
Rachael	Neilan	Duquesne University
Dawn	Nelson	Saint Peter's University
Maria Eloisa (Lisa)	Nuguid	Purdue University
W Gary	Martin	Auburn University
Jesús	Oliver	California State University, East Bay
Julia	Olkin	California State University, East Bay
Maria Amarakristi	Onyido	Auburn University
Omayra	Ortega	Sonoma State University
Michael	O'Sullivan	San Diego State University
Furuzan	Ozbek	University of Cincinnati
Sarah	Park	Georgia Gwinnett College
Rehana	Patel	African Institute for Mathematical Sciences (AIMS)
Rita	Patel	College of DuPage
MIchael	Pearson	MAA - Mathematical Association of America
David	Pengelley	Oregon State University
Kate	Penner	Harvard University
William	Penuel	University of Colorado
Serena	Peterson	Washington State University
Richard	Pineau	Wayne State University
Laura	Placzek	University of Illinois at Urbana-Champaign
Ellen	Powell	University of Durham
Amy	Prager	Cornell University
David	Quarfoot	University of California, San Diego
Jeffrey	Rabin	University of California, San Diego
John	Rafter	Vanderbilt University
Bobby	Ramsey	Ohio State University
Ellmaer	Ranjber	California State University, East Bay
Chris	Rasmussen	San Diego State University
Abigail	Raz	The Cooper Union for the Advancement of Science and Art
Ali	Raza	Abdus Salam School of Mathematical Sciences
Alison	Reddy	University of Illinois at Urbana-Champaign
Edel	Reilly	Indiana University of Pennsylvania
Daniel	Reinholz	San Diego State University
John	Reuterdahl	Skyline College
Lisa	Rice	Arkansas State University
Hilary	Risser	Montana Tech
John Clark	Robertosn	University of Hawaii at Manoa
Andrew	Ross	Eastern Michigan University
Jenny	Ross	University of Illinois at Chicago
Simon	Rubinstein-Salzedo	Euler Circle
Silvia	Saccon	Bates College
Naoki	Saito	University of California, Davis
Mohammad	Sajid	Qassim University
Bolanle	Salaam	University of Georgia
Widodo	Samyono	Jarvis Christian College
Ashley	Santos	University of California, Berkeley
David	Scott	University of Puget Sound
Joel	Scott	The University of Queensland
Padmanabhan	Seshaiyer	George Mason University
Nageswari	Shanmugalingam	University of Cincinnati
Tirunelveli	Shanmugam	Anna University

Participants		
First Name	**Last Name**	**Institution**
Otto	Shaw	Capital University
Annie	Shen	Ohio University
Brooke	Shipley	University of Illinois at Chicago
Patrick	Shipman	Colorado State University
Ksenija	Simic-Muller	Pacific Lutheran University
Courtney	Simmons	Florida State University
Inne	Singgih	University of Cincinnati
Dev	Sinha	University of Oregon
Simone	Sisneros-Thiry	California State University, East Bay
Wendy	Smith	University of Nebraska
Brian	Smith	University of Michigan
Elisha	Smith Arrillaga	University of Texas, Austin
Brent	Solie	Embry-Riddle Aeronautical University
Natasha	Speer	University of Maine
Dick	Stanley	University of California, Berkeley
Irma	Stevens	University of Michigan
Katherine	Stevenson	California State University, Northridge
Ilaria	Stewart	University of California, Berkeley
Amelia	Stone-Johnstone	California State University
Brinley	Stringer	San Diego State University
April	Strom	Chandler-Gilbert Community College
Marilyn	Strutchens	Auburn University
Joseph	Taban	University of Northern Philippines
Muhammad	Taqiyuddin	University of Auckland
Daniel	Teague	North Carolina School of Science and Mathematics
Michael	Tepper	Penn State University
Amrit	Thapa	Ohio University
Brian	Tran	University of California, San Diego
Uri	Treisman	University of Texas, Austin
Preety	Tripathi	SUNY College at Oswego
Lucieli	Trivizoli	State University of Maringá (UEM)
Maria	Trnkova	University of California, Davis
Belin	Tsinnajinnie	WestEd
Karina	Uhing	University of Nebraska, Omaha
Monica	VanDieren	Robert Morris University
Hillary	VanSpronsen	Maine Maritime Academy
Andrés	Vindas Meléndez	University of California, Berkeley
Madhavi	Vishnubhotla	Virginia Polytechnic Institute and State University
Matthew	Voigt	Clemson University
Nahid	Walji	University of British Columbia
Rebecca	Walker	Guttman Community College
Jane	Wang	Indiana University
Xueli	Wang	University of Wisconsin-Madison
Stephen	Wang	Rice University
Chloe	Wawrzyniak	University of Kentucky
David	Webb	University of Colorado at Boulder
Katrin	Wehrheim	University of California, Berkeley
Jonathan	Weisbrod	Rowan College at Burlington County
Megan	Wendler	Colorado Mesa University
Enzo	Wendler	Colorado Mesa University
Caryn	Werner	Allegheny College
Brandy	Wiegers	Central Washington University
Trena	Wilkerson	Baylor University
Charles	Wilkes	San Diego State University
Cameron	Williams	Embry-Riddle Aeronautical University
Robin	Wilson	California State Polytechnic University, Pomona
Elysee	Wilson-Egolf	University of California, Davis
Rebecca	Winarski	College of the Holy Cross
Alistair	Windsor	University of Memphis
Teresa	Woods	Michigan Technological University
Elizabeth	Wrightsman	Texas State University
Xiao	Xiao	Utica College
Karmen	Yu	Montclair State University
Yusuf F.	Zakariya	Univeristy of Agder
Anna	Zarkh	University of California, Berkeley
Jane	Zimmerman	Michigan State University

Identifiable Participants' Information

Participants		297

Gender		297
Male	40.07%	119
Female	55.22%	164
Other	1.01%	3
Declined to state	3.70%	11

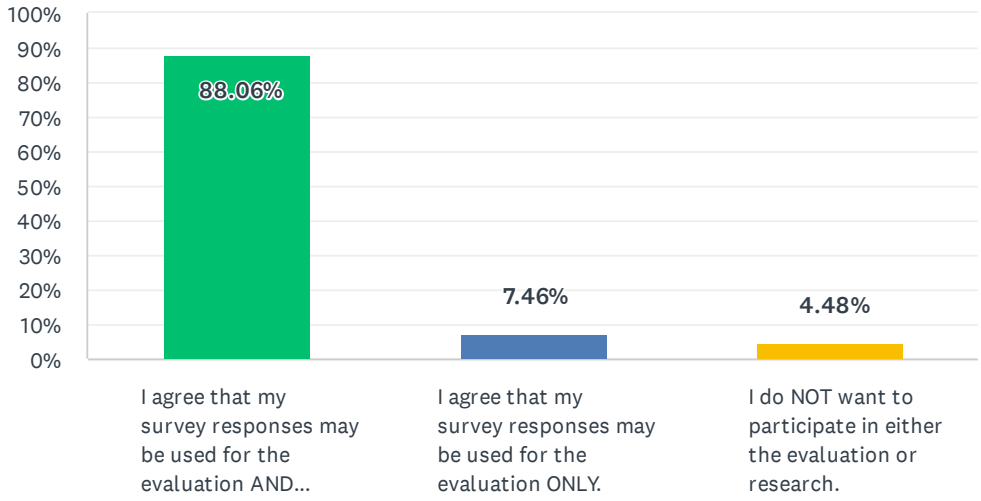
Ethnicity*		331
White	56.80%	188
Asian	15.11%	50
Hispanic	6.65%	22
Pacific Islander	0.91%	3
Black	9.97%	33
Native American	0.60%	2
Mixed	4.83%	16
Declined to state	5.14%	17

* ethnicity specifications are not exclusive

There were 10 unidentifiable participants.

Q1 Please let us know how your survey responses may be used:

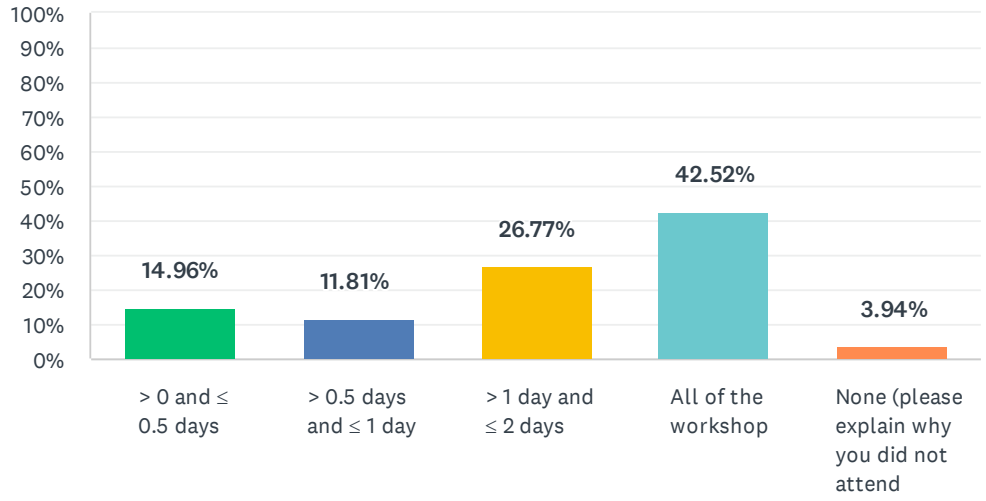
Answered: 134 Skipped: 0



ANSWER CHOICES	RESPONSES	
I agree that my survey responses may be used for the evaluation AND research.	88.06%	118
I agree that my survey responses may be used for the evaluation ONLY.	7.46%	10
I do NOT want to participate in either the evaluation or research.	4.48%	6
TOTAL		**134**

Q2 Which best characterizes how much of this year's CIME workshop you attended? (Check one.)

Answered: 127 Skipped: 7

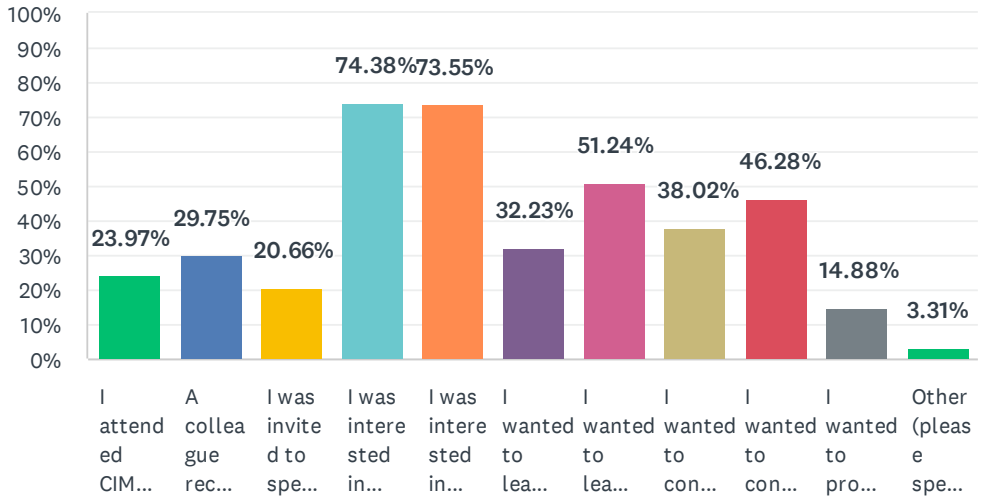


ANSWER CHOICES	RESPONSES	
> 0 and ≤ 0.5 days	14.96%	19
> 0.5 days and ≤ 1 day	11.81%	15
> 1 day and ≤ 2 days	26.77%	34
All of the workshop	42.52%	54
None (please explain why you did not attend	3.94%	5
TOTAL		**127**

#	NONE (PLEASE EXPLAIN WHY YOU DID NOT ATTEND	DATE
1	Unfortunately, I had to warn ahead of time that I had a problem with attendance. On short notice my wife had a cardiac defibrillator surgically implanted, and was in the hospital during the entire time (with the implant occurring that Friday). She is now doing well, but that was where I had to be.	3/26/2022 7:06 AM
2	Time Difference	3/25/2022 10:36 AM
3	Time innapropriate in my local region	3/25/2022 9:54 AM
4	It was unable to get away from work responsibilities.	3/25/2022 9:19 AM
5	too busy	3/20/2022 9:33 AM

Q3 Why did you attend this year's CIME Workshop? (Select all that apply.)

Answered: 121 Skipped: 13

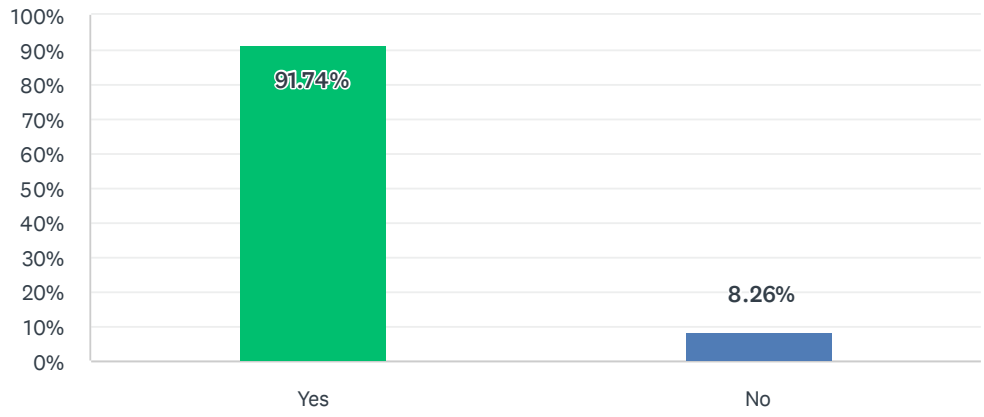


ANSWER CHOICES	RESPONSES	
I attended CIME previously and found it a valuable experience.	23.97%	29
A colleague recommended I attend.	29.75%	36
I was invited to speak, be on a panel, or facilitate a session.	20.66%	25
I was interested in this year's topic.	74.38%	90
I was interested in equitable mathematics education.	73.55%	89
I wanted to learn how to support others in work around this year's topic.	32.23%	39
I wanted to learn more about current issues in mathematics education.	51.24%	62
I wanted to connect with participants in other professional communities.	38.02%	46
I wanted to connect with others involved in mathematics education.	46.28%	56
I wanted to promote this year's topic.	14.88%	18
Other (please specify)	3.31%	4
Total Respondents: 121		

#	OTHER (PLEASE SPECIFY)	DATE
1	I co-organized	3/22/2022 12:25 PM
2	It was easy to attend because I could attend virtually	3/21/2022 1:33 PM
3	on the organizing team	3/21/2022 7:23 AM
4	I was very interested in hearing several of the speakers as I have followed their work.	3/20/2022 9:26 AM

Q4 Do you think you will attend a future CIME Workshop?

Answered: 121 Skipped: 13



ANSWER CHOICES	RESPONSES	
Yes	91.74%	111
No	8.26%	10
TOTAL		**121**

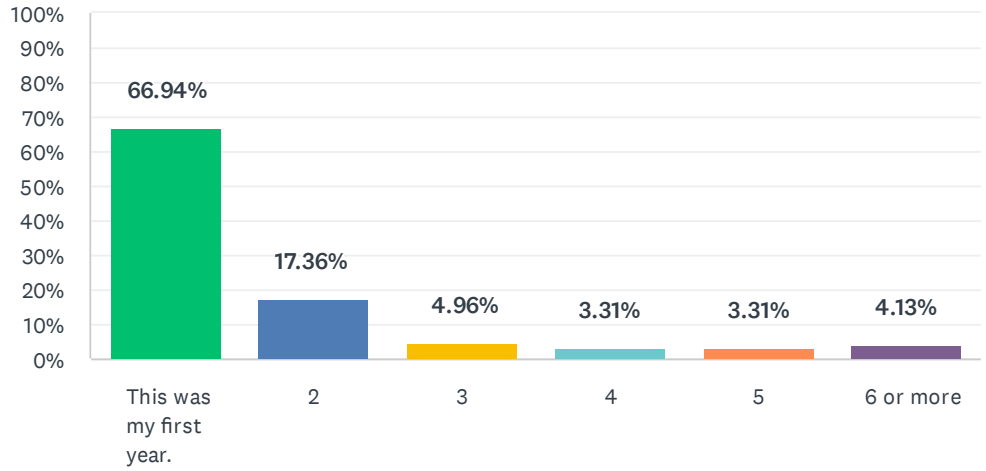
#	WHY OR WHY NOT?	DATE
1	I found the selection of in-person participants and speakers to be well crafted. Everyone was interesting and serious about the topic.	3/30/2022 7:19 PM
2	I find the CIME Workshops to be excellent blend of research and practice. They bring in experts, but are small enough to connect with others.	3/28/2022 7:59 AM
3	Possibly... if invited. My discipline is engineering, not mathematics... but I do teach math to engineers :-)	3/28/2022 7:25 AM
4	Because I want to keep informing myself about issues around math education	3/26/2022 8:39 PM
5	I'm not in math ed.	3/25/2022 7:44 PM
6	It was a very enriching experience	3/25/2022 6:39 PM
7	It helps me to get a sense of what is happening in math education.	3/25/2022 12:59 PM
8	I haven't really decided yet, but since you are forcing me to answer Yes or No, at this point, I'm a bit more inclined to say No.	3/25/2022 12:38 PM
9	The conference was relevant to my situation and it was well-run and concise which made attending feasible. I look forward to future topics that expect will also be relevant to my situation.	3/25/2022 12:37 PM
10	Maybe, but it’s difficult for me to travel to Berkeley	3/25/2022 12:35 PM
11	If the time works better with my schedule in the future I'd like to attend more sessions	3/25/2022 12:02 PM
12	If the subject is of interest	3/25/2022 11:59 AM
13	Great group of people, excellent assortment of information	3/25/2022 11:57 AM
14	Attending this workshop gave me a boost of energy at the perfect time in the semester. I particularly enjoyed that there was a wide range of participants, from tenured professors in this field for over 20 years to undergraduate and graduate students looking to learning more.	3/25/2022 11:23 AM

15	I learned so much at this workshop!	3/25/2022 9:53 AM
16	Please keep the free virtual option.	3/25/2022 9:44 AM
17	Interest in the topic.	3/25/2022 9:22 AM
18	This was one of the most beneficial math conferences ever attended. It actually focused on the teaching of mathematics, not fixing students.	3/25/2022 9:17 AM
19	good program and talks, well done hybrid workshop	3/25/2022 9:04 AM
20	This workshop really sparked an interest in diving into research presented by the speakers/panelists.	3/25/2022 7:54 AM
21	There was a lot of information and I found it very helpful	3/23/2022 5:13 PM
22	Looking for valuable classroom resources	3/23/2022 6:03 AM
23	The hybrid format allowed me to attend this year, but if the format reverts to "in-person" only, I will not be able to skip my classes.	3/23/2022 5:35 AM
24	I learned a great deal, and I will be able to use what I learned immediately.	3/22/2022 2:54 PM
25	How much funding is available to me will be a factor in whether I am able to participate in the future.	3/22/2022 1:43 PM
26	This is an important venue for discussions in mathematics education across the K-16 context.	3/22/2022 1:10 PM
27	if it's on teaching. Less interested in traditional math research conferences, which are highly specialized	3/22/2022 11:33 AM
28	As a college faculty member I want to contribute to improving math teaching.	3/22/2022 10:38 AM
29	I have found each workshop to be interesting and I want to continue to hear about issues in math education.	3/22/2022 10:06 AM
30	I'm a young mathematician and wants to explore critical issues in Mathematics education. I think this is one of the platform whre I can get enough information	3/22/2022 9:53 AM
31	Possibly-- I like getting together with colleagues from other institutions and hearing what works/not work in other contexts.	3/22/2022 9:12 AM
32	I feel like I gain a lot of information from these workshops.	3/22/2022 8:02 AM
33	CIME continues to be an important forum for issues in math education.	3/21/2022 9:30 PM
34	Helpful to see what other people are working on and doing.	3/21/2022 2:38 PM
35	Because I had a class to go to.	3/21/2022 10:50 AM
36	These are always great workshops and I look forward to them every year. I learn a lot that I can take into my own research and teaching, and I get to connect with others doing this type of work nationally.	3/21/2022 8:27 AM
37	This was my first time attending CIME and I found it incredibly valuable. The plenary talks did a great job summarizing a large body of math ed research and condensing them into a few themes, and were especially interesting for non-experts (like myself). Also, the panels and discussion sessions helped to connect the theory (as presented in the plenaries) with what's happening on the ground with participants.	3/21/2022 8:10 AM
38	I am a mathematics educator	3/21/2022 7:23 AM
39	Valuable information and networking	3/20/2022 3:00 PM
40	Subject to available funding. For all the reasons that I cited for the previous question, I found it a very valuable experience.	3/20/2022 9:26 AM
41	I enjoy the sessions, and I always want to learn about current research in Mathematics Education.	3/20/2022 8:25 AM
42	This was a fruitful experience, I learned a lot. Also, I was able to attend remotely.	3/19/2022 10:12 PM
43	Due to the excellent networking opportunities and the inspiration and ideas I drew from the	3/19/2022 9:33 PM

	speakers.	
44	Great conference and pertinent information	3/19/2022 2:29 PM
45	I found the workshop to be not very helpful in details on how to make classes more equitable.	3/19/2022 1:15 PM
46	This conference experience continues being one of the most empowering experiences of my academic career	3/19/2022 11:36 AM
47	I have found the workshop to be relevant, helpful in what I do as a math. educator.	3/19/2022 9:28 AM
48	I expected to do some research activities that I may present in the next workshop.	3/19/2022 7:58 AM
49	It is a great opportunity to connect with a variety of folks around a common goal.	3/19/2022 7:37 AM
50	CIME Workshop is very informative and inclusive	3/19/2022 7:10 AM
51	CIMC is so interesting for me. I believe, if it will be hold remote and physical attending, it will provide the opportunity to attend for more audiences.	3/19/2022 2:21 AM
52	There were hardly any group discussions or interactive components. I could have just watched video lectures and gained the same information.	3/18/2022 7:24 PM
53	I learned a lot of techniques to improve my teaching and made valuable connections to people I may consult for support.	3/18/2022 6:48 PM
54	The presentations I was able to attend were valuable and thoughtful.	3/18/2022 6:43 PM
55	The topics are important and it is a good way to learn about current research and initiatives.	3/18/2022 6:07 PM
56	As I am an Indian National I may not get travel and accommodation grants . This year I was in California I decided to attend	3/18/2022 5:56 PM
57	The topic is right down my alley!	3/18/2022 5:26 PM
58	I don’t have much vested interest in math curriculum, but the conference seemed very interesting and important.	3/18/2022 5:02 PM
59	Not sure. I think the conference very informative and I learned much from the presentations.	3/18/2022 4:59 PM
60	these are great experiences!!!	3/18/2022 4:54 PM
61	I think CIME is such an important space to engage in provocative and relevant dialogue around math education.	3/18/2022 4:52 PM
62	I wouldn't rule it out but my interest in this one is pretty topic-specific	3/18/2022 4:43 PM
63	It has been a very valuable experience and an opportunity to meet and engage with wonderful people.	3/18/2022 4:43 PM
64	While I did not find this workshop that helpful, I do think that it has potential.	3/18/2022 4:26 PM

Q5 Including this year's workshop, how many CIME workshops have you attended?

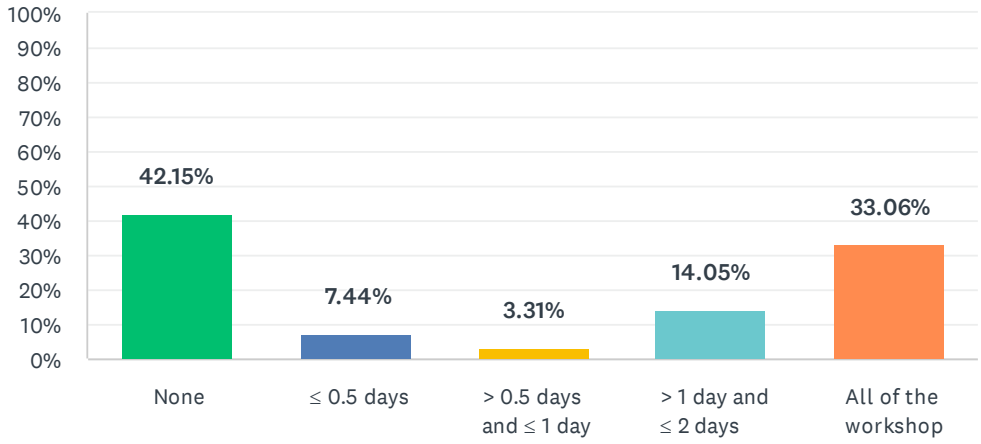
Answered: 121 Skipped: 13



ANSWER CHOICES	RESPONSES	
This was my first year.	66.94%	81
2	17.36%	21
3	4.96%	6
4	3.31%	4
5	3.31%	4
6 or more	4.13%	5
TOTAL		**121**

Q6 Which best characterizes how much of this year's CIME workshop you attended in person? (Check one.)

Answered: 121 Skipped: 13



QUIZ STATISTICS			
Percent Correct 30%	Average Score 1.9/4.0 (47%)	Standard Deviation 1.80	Difficulty 1/1

ANSWER CHOICES	SCORE	RESPONSES	
None	0/4	42.15%	51
≤ 0.5 days	1/4	7.44%	9
> 0.5 days and ≤ 1 day	2/4	3.31%	4
> 1 day and ≤ 2 days	3/4	14.05%	17
✓ All of the workshop	4/4	33.06%	40
TOTAL			**121**

Q7 If you did not attend all sessions, briefly describe the factors that impacted your attendance decisions.

Answered: 67 Skipped: 67

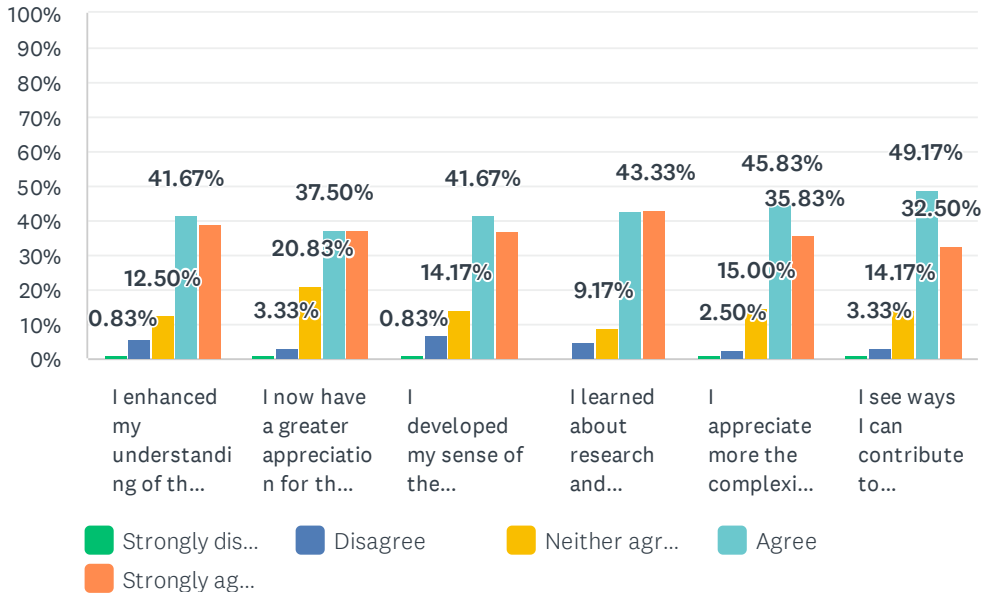
#	RESPONSES	DATE
1	Missed flight on the first day.	3/30/2022 7:19 PM
2	I had conflicts with my teaching schedule and meetings.	3/30/2022 12:44 PM
3	I have young children so did not want to travel. I attended all workshops remotely.	3/29/2022 7:00 AM
4	Travel and prior obligations impeded me from attending the entire workshop.	3/28/2022 7:59 AM
5	I was only available virtually for my own panel session	3/28/2022 7:25 AM
6	I had some meetings to attend virtually	3/26/2022 8:39 PM
7	I only attended the session I was invited to facilitate as a "change leader".	3/25/2022 7:44 PM
8	Other responsibilities such as grading, paper submission, and preparing for a talk	3/25/2022 6:39 PM
9	attending virtually with other commitments	3/25/2022 1:51 PM
10	I didn't attend most of the ones in the evening, mostly because I am on eastern time, so it was quite late after a long day of Zoom at that point.	3/25/2022 1:09 PM
11	I was about to have surgery and did not want to get COVID beforehand.	3/25/2022 12:59 PM
12	My schedule became so hectic, and I thought that videos of the sessions and talks will become available.	3/25/2022 12:38 PM
13	I missed part of one panel because I had a work meeting that I had to attend which I was able to do via zoom while in-person at CIME.	3/25/2022 12:37 PM
14	I already had a conference scheduled and was traveling to it during most of the workshop	3/25/2022 12:35 PM
15	I attended the opening plenary and the session in which I was on the panel	3/25/2022 11:59 AM
16	I had other travel plans	3/25/2022 11:57 AM
17	I got food poisoning and so missed much of the event.	3/25/2022 11:23 AM
18	I had classes, but I went to as much as I could (remotely) and hope to watch recordings for the sessions I missed.	3/25/2022 9:53 AM
19	I attended virtually	3/25/2022 9:44 AM
20	I live far from Berkeley and close to participate virtually. I attended all of the first day online, and found the talks to be excellent. However, I didn't find much benefit to attending "in real time" as there was little scope for interaction, so I decided to watch videos of the second and third days after the conference, at a more convenient.	3/25/2022 9:22 AM
21	The opposite time zones due to me in India and the weak internet connection here caused some problems, but all the lectures I attended were very informative.	3/25/2022 9:21 AM
22	My teaching schedule.	3/25/2022 9:17 AM
23	timing, competing obligations	3/25/2022 9:04 AM
24	I attended online, and currently in time zobe with 12 hours time difference!	3/25/2022 9:04 AM
25	Attending virtually, I found it hard to prioritize attending over other obligations.	3/25/2022 9:01 AM
26	I was remote and attended the talks that best represented my interests.	3/23/2022 6:03 AM
27	My teaching schedule and travel issues.	3/23/2022 5:35 AM

28	I missed sessions when I was teaching. I never would have attended this workshop in person due to work and family obligations and was grateful I could attend so many sessions virtually.	3/22/2022 9:51 PM
29	Other work obligations - meet with my students at my home institution.	3/22/2022 9:01 PM
30	I had work conflicts with the other sessions.	3/22/2022 2:03 PM
31	The workshop was offered during my finals week as a grad student and I couldn't finish as much work ahead of time as I expected. Also, I haven't traveled for a conference in a while and struggled with getting around.	3/22/2022 1:10 PM
32	Scheduling my teaching	3/22/2022 12:25 PM
33	I had a raging migraine the whole time :-(	3/22/2022 11:08 AM
34	I had teaching obligations Thursday and Friday. I attended only the opening plenary, and I attended it virtually.	3/22/2022 10:38 AM
35	COVID	3/22/2022 9:53 AM
36	I chose to attend remotely, and had other meetings/obligations during some of the talks.	3/22/2022 9:07 AM
37	Attended online, scheduling conflict with other work commitment. I would not have been able to attend at all in person, so the hybrid format allowed me to attend at least some part of the workshop.	3/22/2022 9:04 AM
38	The travel distance was too great at this time of year. However, I would much prefer to attend the conference in person in the future.	3/22/2022 8:02 AM
39	I had book a flight back home, and the timing interfered with the last few sessions	3/21/2022 1:55 PM
40	Time zone differences	3/21/2022 1:33 PM
41	I always miss the first day because I am teaching. I had not planned on attending this year because I was actually busy all 3 days, but since I was invitied to speak, I attended just that session and the 2 sessions that followed mine. I wish that I could have attended more.	3/21/2022 12:24 PM
42	I did not attend a workshop at 4:15pm due to my academic performance that should have impacted me.	3/21/2022 10:50 AM
43	I attended the conference virtually.	3/21/2022 8:10 AM
44	Attended virtually to the sessions I could make room for (did not cancel classes I was teaching but did reschedule most meetings). Attened about 8 hours of conference sessions across Wed-Thu-Fri	3/20/2022 3:00 PM
45	I missed the last two sessions on Friday due to flight reservations. It would be great if we went a full day on Wednesday and a half day on Friday. This way people could arrive Tuesday evening and depart Friday afternoon.	3/20/2022 12:18 PM
46	I was unable to attend the second day of sessions since i had to fly back early Friday morning. It was prohibitively expensive to fly over the weekend.	3/20/2022 9:26 AM
47	I currently live in Turkey, so I could only attend sessions via Zoom.	3/20/2022 8:25 AM
48	I missed Wednesday afternoon.	3/19/2022 10:12 PM
49	I had teaching responsibilities on the first two days	3/19/2022 9:33 PM
50	I zoomed in on my teaching day (March 16-17), and attended in person on March 18.	3/19/2022 2:29 PM
51	I had other meetings to attend during part of the time of the workshop.	3/19/2022 1:15 PM
52	NA	3/19/2022 7:58 AM
53	I am local and so attended remotely Thursday morning and taught during some of the afternoon sessions	3/19/2022 7:37 AM
54	I attended virtually. I had other meetings that I could not miss. Otherwise, I would have attended all of CIME virtually.	3/18/2022 7:58 PM
55	There were no group discussions or interactive sessions. Putting in the effort to travel to the	3/18/2022 7:24 PM

	venue in person felt pointless.	
56	schedule conflicts that prevented me from attending some sessions	3/18/2022 7:20 PM
57	My school is on spring break, so I was attending around other stuff.	3/18/2022 7:06 PM
58	Time of session - afternoon sessions were very late for me. I also had other commitments for Friday. The sessions I attended were valuable, but I felt that I learned very little new information, so I was not sure how important other sessions were for me to attend for my own professional development. However, I have ample other opportunities to engage with these issues.	3/18/2022 6:43 PM
59	Personal health situation	3/18/2022 6:15 PM
60	My institution is not supporting travel out of state during the pandemic.	3/18/2022 6:07 PM
61	There are too many sessions, and need to be more breaks for socialization and networking.	3/18/2022 5:31 PM
62	Work conflicts and exhaustion from traveling	3/18/2022 4:59 PM
63	I had a departmental meeting on Friday morning during Zoom that I needed to facilitate.	3/18/2022 4:59 PM
64	Having the conference really helped because I was having car trouble, but was able to join virtually while driving to the conference.	3/18/2022 4:52 PM
65	I missed half of a session, because I felt a bit crammed in the Brower center auditorium seats and needed to step out and stretch my legs.	3/18/2022 4:42 PM
66	remote, other duties	3/18/2022 4:40 PM
67	Other schedule obligations	3/18/2022 4:34 PM

Q8 Through participation in the CIME Workshop. [Indicate your level of agreement with the following statements.]

Answered: 120 Skipped: 14



	STRONGLY DISAGREE	DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE	TOTAL	WEIGHTED AVERAGE
I enhanced my understanding of the challenge of departmental and institutional change.	0.83% 1	5.83% 7	12.50% 15	41.67% 50	39.17% 47	120	4.13
I now have a greater appreciation for the importance of departmental and institutional change for improving mathematics teaching and learning.	0.83% 1	3.33% 4	20.83% 25	37.50% 45	37.50% 45	120	4.08
I developed my sense of the importance of attending to issues of diversity, inclusion, identity, language, culture, and equity for improving mathematics teaching and learning.	0.83% 1	6.67% 8	14.17% 17	41.67% 50	36.67% 44	120	4.07
I learned about research and development efforts that might enhance my own work.	0.00% 0	5.00% 6	9.17% 11	42.50% 51	43.33% 52	120	4.24
I appreciate more the complexity of making claims about departmental and institutional change.	0.83% 1	2.50% 3	15.00% 18	45.83% 55	35.83% 43	120	4.13
I see ways I can contribute to developing approaches to departmental and institutional change.	0.83% 1	3.33% 4	14.17% 17	49.17% 59	32.50% 39	120	4.09

Q9 Briefly describe one or two insights you gained from the workshop (if any).

Answered: 80 Skipped: 54

#	RESPONSES	DATE
1	I took away an appreciation for the challenges of institutional change, and learned many nuances of the challenges that come with participatory style learning and teaching	4/12/2022 9:38 AM
2	I can be a change agent right now, even as a graduate student.	3/30/2022 7:21 PM
3	Math in context is likely to work for other STEM disciplines outside engineering	3/28/2022 7:29 AM
4	I was surprised to find out that a lot of the models and inspiration for math reforms at the college level come from K12.	3/26/2022 8:47 PM
5	I learned about change theory and it’s potential impact and benefits in educational changes	3/26/2022 8:43 PM
6	drawing on change theory for departmental change. also the complexity of identity.	3/25/2022 1:56 PM
7	The importance of student voices (like on a panel) for getting buy-in, as well as structural barriers for making long-term, lasting changes and some pathways to overcoming those barriers.	3/25/2022 1:20 PM
8	There now seems to be more specific ways of discussing departmental and institutional change.	3/25/2022 1:07 PM
9	I learned a lot from Sandra Laursen's talk about the four frames, including not to anchor to people and not to overlook opportunities in other frames while focusing on one.	3/25/2022 12:55 PM
10	Interactive lectures are worthy yet quite nontrivial, especially for large audience classes.	3/25/2022 12:43 PM
11	That it’s possible to create an inclusive hiring experience	3/25/2022 12:36 PM
12	People should not be the anchor for change. Engineering and CS departments are making change with or without the mathematics departments, so we better be a part of the change.	3/25/2022 12:21 PM
13	Existence of theories of structural change	3/25/2022 12:00 PM
14	I've known how complex and important departmental change work is to making meaningful changes to student experiences, however the focus of these sessions on anti-racism, equity, et. was valuable for me in thinking about what direction these changes should go in/what change should focus on. I also really valued the student experiences panel, and think more conferences would benefit from similar panels.	3/25/2022 11:01 AM
15	Student voices for change are powerful motivators Contexualizing mathematics can make a significant difference in student engagement and performance in UG math	3/25/2022 10:54 AM
16	There is so much interest and movement to be had in this field. There are many others who want to fight this fight with me.	3/25/2022 10:08 AM
17	We're hoping to go through a departmental change at my University. We thought that this would be a relatively quick fix if everyone got on board, but now we've made plans for a Committee to start working on Calculus changes, with plans for professional development activities for the department. We're taking it one year at a time.	3/25/2022 9:59 AM
18	Individual departments, after trying to work with math departments, are creating mathematics courses within their discipline to meet the actual (useable) needs of their students.	3/25/2022 9:31 AM
19	framework for thinking about institutional change (from Larsen's talk), problems with making changes that rely on TAs and others who are only in the department for a couple of years, hadn't heard about "wicked" problems before	3/25/2022 9:13 AM
20	Students recognize the personality perks faculty have that make them appear more approachable.	3/25/2022 7:57 AM

21	One should not base the change on a person.	3/24/2022 6:52 PM
22	The importance of identity in mathematics instruction, some tips for enhancing active learning in the math classroom, the importance of contextualization for student understanding	3/23/2022 5:21 PM
23	1. the things that students want are should be attainable; their requests are important and more importantly realistic and achievable. 2. ∃ curriculum that prepares engineering students for the math that they'll need before completing the calculus sequence 3. ∃ a lot of resources from professional societies to lean on as directives for what to do that can also be leveraged for arguing for change	3/23/2022 12:12 PM
24	Small things matter to students (e.g. smiling or asking students how they're doing). Mathematics departments and faculty need to do a better job working with client disciplines (engineering, computer science, etc.) to develop curricula that are more relevant to these fields.	3/23/2022 8:33 AM
25	I became aware that colleagues can benefit from learning how to interact with students.	3/23/2022 6:06 AM
26	The value of utilizing multiple methods for students to share their thinking, and allowing students to form working groups they feel comfortable in.	3/23/2022 5:39 AM
27	Math Department and Mathematics Education faculty from across the country are interested in change. Simultaneously, many mathematicians seem to enjoy blocking change. The Math Department where I work, while dysfunctional, isn't the only difficult place to work.	3/22/2022 10:13 PM
28	How mathematics departments are dealing with the needs of the department they serve.	3/22/2022 9:52 PM
29	Math teachers should employ more empathy.	3/22/2022 9:14 PM
30	I was struck by the sense of urgency to reform mathematics instruction in the mathematics department before other departments and/or colleges start teaching these classes themselves. I also have a much better appreciation of the need for a theoretical framework before attempting systemic change.	3/22/2022 2:54 PM
31	A useful pathway must be in service to students and the courses should support their goals, not just be 'a sequence'. Therefore vertical alignment is crucial. New thinking about who the stakeholders are and their roles in supporting pathways.	3/22/2022 2:11 PM
32	Sandra Laursen's talk gave me a nice framework for thinking and talking about what we are working on in our department.	3/22/2022 2:03 PM
33	How many people are working on similar problems across contexts	3/22/2022 12:26 PM
34	1. Other people are trying to do the same thing I am. very encouraging. 2. need to work on the departmental/structural issues, not just come up with cool content and think everyone will adopt it.	3/22/2022 11:39 AM
35	It was helpful to hear a perspective from NSF about how that organization views change. Specifically it was helpful to learn that NSF may be willing to support radical experiments. I also learned about "competency-based" curricula.	3/22/2022 10:50 AM
36	The connections between high school and college efforts in math education - while different language is used to describe these efforts, the ideas are similar. The importance of institutional structures and how theories of change can be used to view reform efforts.	3/22/2022 10:20 AM
37	coherence between high school and college teaching	3/22/2022 10:09 AM
38	the importance of identity at all levels - student, instructor, dept. leader, and movement leader.	3/22/2022 10:09 AM
39	There is not "an" answer-- progress will be context-specific-- but that does not mean there is not benefit in hearing what worked elsewhere.	3/22/2022 9:15 AM
40	The presentation on the work of Bolman and Deal on four lenses for looking at an organization.	3/21/2022 9:40 PM
41	I really appreciated the comparison and emphasis on the correlation between the K-12 world and higher education.	3/21/2022 1:58 PM
42	n/a	3/21/2022 12:24 PM
43	I loved the first night when Karen was answering questions about NSF grant funding and she encouraged us to put in grant applications to blow up and completely transform undergrad math	3/21/2022 8:36 AM

	education and departments. I also loved the talk about change theory and so many other talks that grounded institutional change in research based theories to help guide that work.	
44	The language around social identity markers. The new models from Sandra Laursen's talk on institutional change	3/21/2022 7:26 AM
45	I learned about identity and its relation to action, and I learned to approach institutional change as a "pebble dropping and making a ripple in a lake" (rephrased from Missy Cosby).	3/20/2022 5:26 PM
46	Usefulness of four frames for making sense of actual change. Difference in the areas of focus between 2-year and 4-year research and development.	3/20/2022 3:10 PM
47	1) On day 1, the session by Karen provided some insight into NSF's work in this area. As a co-PI on an NSF ADVANCE grant, i am aware of the transformative power of NSF. I think they can do more about equitability. 2) Missy's work and her session was very illuminating - I really appreciated her research methods as a means to study the questions that she was studying and mean to look up her work for more details.	3/20/2022 11:08 AM
48	I learned about MathEdAtlas.	3/20/2022 8:30 AM
49	The importance of working from the bottom of the pyramid upwards (gaining allies, for example) rather than using a top down approach.	3/20/2022 8:02 AM
50	The inclusion of multiple voices: students, teachers, community colleges, instructors, administration and faculty from other disciplines in the conversation about improving STEM gateway courses.	3/19/2022 10:19 PM
51	Four frames of change (systemic, political, HR, symbolic) Wright State Engineering Math Education model	3/19/2022 9:45 PM
52	Sustainability requires attention to structures and symbols, as well as finding the right people.	3/19/2022 4:56 PM
53	I knew about the four frame model (structural, political, human resources, symbolic), but not in a really clear way. Sandra's talk on Friday clarified and solidified my understanding. Also interesting to hear the talks on identity.	3/19/2022 2:37 PM
54	Parallel paths for K-12 and post-secondary math ed. There should be more working together. Larsen's talk was also illuminating.	3/19/2022 12:19 PM
55	- Black identities are dynamic and context dependent - community of practice methodologies and implementation	3/19/2022 11:41 AM
56	DEI in mathematical teaching and learning is much more complex than previously assumed. I will make a greater effort to gauge more about how students feel within the space that I create.	3/19/2022 9:37 AM
57	1) I understood more about equity and diversify 2) I understood more about equitable STEM and contextualized mathematics courses	3/19/2022 7:58 AM
58	I learned more about ways to conceptualize institutional change. I learned about the idea of having student advisory boards.	3/19/2022 7:52 AM
59	I became to think about how I can be more attentive to individual students.	3/19/2022 7:17 AM
60	How can deal with the students who have issue. Definitely, I Will do that via some strategies which posted of this workshop.	3/19/2022 2:43 AM
61	I loved the session on "Client departments" and how other departments are helping to improve math education.	3/18/2022 7:29 PM
62	The idea of bringing prerequisite mathematics INTO the respective STEM depts is a viable approach to addressing the Calculus Problem. (Wright State, UCLA, and Occidental examples from Friday were extraordinarily inspiring)	3/18/2022 7:26 PM
63	How to incorporate active learning in my teachers and how to influence my colleagues to key into it. How to motivate my students' enthusiasm for the material by showing them how they might use the concepts we're learning in their future areas How to encourage students' participation by looking out for the few students that didn't get the question right instead of just getting on with the class when the majority understand the concept. How to look out for my students, especially with respect to mental health. The concept of showing interest and believing in my students being crucial to their learning and confidence level, especially in foundational Math courses got re-inforced.	3/18/2022 7:01 PM

64	A reaffirmation of the need for actions towards making math a more inclusive subject so that it doesn't prevent students from pursuing degrees/careers in STEM.	3/18/2022 6:43 PM
65	It was great to hear from folks who are both researchers and practitioners in advocating for change within their departments in order to help bridge the divide between K-12 and college.	3/18/2022 6:17 PM
66	That is is important to attend to all 4 dimensions when trying to do institutional change. They are all related and all need to be attended to in order for there to be lasting change.	3/18/2022 6:14 PM
67	Periodically develop Change in Pedagogy ...	3/18/2022 6:14 PM
68	There are multiple aspects to identity.	3/18/2022 5:58 PM
69	change theory vs theory of change	3/18/2022 5:42 PM
70	We need to center students and equity in change. Also, we need to use theories to guide our change work.	3/18/2022 5:32 PM
71	I learned about social identities via Missy Cosby's session. I loved her talk!	3/18/2022 5:30 PM
72	Greater understanding of identities and systems change.	3/18/2022 5:04 PM
73	na	3/18/2022 4:56 PM
74	Change is hard.	3/18/2022 4:56 PM
75	Change theory vs. theory of change Low risk for math departments to explore options, high risk to not do so Lack of support for comm college	3/18/2022 4:55 PM
76	I was inspired to see a national effort to change math from a gatekeeper to a gateway I was struck by the thoughtful inquiry into Active learning and the complexities of its implementation I was excited to hear some people are thinking about co-requisite calculus, because I am interested in that too!	3/18/2022 4:54 PM
77	Equity as a lever and Failure in the process	3/18/2022 4:53 PM
78	I learned about some projects that were unfamiliar to me. I appreciated catching up with work done by colleagues in this area.	3/18/2022 4:49 PM
79	The importance of theory of change to address these issues. The importance of listening to student voices	3/18/2022 4:46 PM
80	Finding anchors in the department to sustain change efforts	3/18/2022 4:39 PM

Q10 Briefly describe one or two actions you have taken or are likely to take as a result of your participation in this workshop (if any).

Answered: 77 Skipped: 57

#	RESPONSES	DATE
1	When I teach, I am more aware of some issues around equity in the classroom and try to balance broad research based techniques with individual classroom dynamics to foster a better learning environment for everyone.	4/12/2022 9:38 AM
2	I connected with a mathematics instructor to discuss collaborating on studying the effectiveness of first year instruction in proof.	3/30/2022 7:21 PM
3	I haven't taken actions yet, but I would like to pursue more efforts in improving specific mathematics courses. A few of us in teaching the Calculus sequence have started to take actions towards more active learning approaches to encourage others in the department to try active learning approaches in their own courses, besides in Calculus.	3/30/2022 12:50 PM
4	Continued collaboration with those interested in teaching math in context	3/28/2022 7:29 AM
5	More efforts at collaboration at the departmental and cross-departmental level.	3/26/2022 8:47 PM
6	I'd like to explore how change theory can be applied specifically to the school and the class I'm teaching	3/26/2022 8:43 PM
7	I really want to follow up on some of the resources that were shared.	3/25/2022 3:07 PM
8	sharing a reading from the workshop with department members.	3/25/2022 1:56 PM
9	I downloaded "Talking about Leaving, Revisited" and plan to read it over the summer. I also plan to read some more of the research around institutional change, change theory, things like that, which I hope will give me some insight for my own big change projects, and hopefully that will make them more likely to succeed.	3/25/2022 1:20 PM
10	I may do some reading related to Missy Cosby and Sandra Laursen's talks.	3/25/2022 1:07 PM
11	We are in the midst of transformations in my department. I will work to ensure that the transformations are sustainable and not anchored to specific people, including myself. I will create a plan(s) for if/when those heavily involved leave the department so that the work already done is not lost.	3/25/2022 12:55 PM
12	Increase more interactions with students taking my large class via technology (e.g., iClicker, etc.)	3/25/2022 12:43 PM
13	I have applied to lead a book club as the start of a faculty learning community in my department.	3/25/2022 12:21 PM
14	looking for more similar workshop that better suits my schedule.	3/25/2022 12:05 PM
15	Reading scholarship on theories of structural change	3/25/2022 12:00 PM
16	I am thinking more about how different active learning activities impact various students' experiences. E.g., I know several people in my department would consider student presentations, random calling, etc. to be a necessary component of an active learning classroom, but such activities need to be carefully crafted and introduced to serve the purpose of supporting student learning AND making students feel comfortable. As one of the sessions mentioned, activities like this can also have a negative impact on students.	3/25/2022 11:01 AM
17	Share recent research with colleagues in my math department Partner with other institutions to support math ed change efforts	3/25/2022 10:54 AM
18	Collaboration within my department to discuss change and hopefully make movement towards meaningful changes.	3/25/2022 10:08 AM

19	We've started working on change in Calculus by setting up a committee to meet all of next year, creating a plan, materials, and planning professional development for the department. We're hoping to apply for grant funding, to implement our changes, around February 2023.	3/25/2022 9:59 AM
20	Work on my lesson planning to make sure I am considering the use of the math when teaching and assigning practice. I want to think beyond the exact skill to how it will be used in the world.	3/25/2022 9:31 AM
21	collecting papers and other resources for reference to guide changes to calculus program	3/25/2022 9:13 AM
22	Download the videos and slides: look up referenced research for further study.	3/25/2022 7:57 AM
23	Discuss with the department leadership how to approach other departments/colleges that need math courses.	3/24/2022 6:52 PM
24	We are engaged in a long-term effort to revise our methods of teaching calculus and pre-calc and this workshop was very helpful to me in order to process my thoughts about the best way to proceed. It also brought my attention to a number of issues I was aware of but really hadn't thought of as relevant to the context of the changes I would like to see (e.g. lack of professional development for faculty, difficulty communicating cross-disciplines) I now appreciate that doing more to address to these issues may help facilitate change.	3/23/2022 5:21 PM
25	1. figure out how to implement more contextualized modeling problems before calculus; specifically, some of the engineering problems from Nathan. (contextualize to learn) 2. figure out what is and how to implement “grading for growth” and… - class contact list for missing days - mental health check in - in class peer tutors	3/23/2022 12:12 PM
26	I'm planning on trying to incorporate some projects that engineering faculty at Wright State have developed in my Precalculus course.	3/23/2022 8:33 AM
27	I will be reaching out to others that attended to determine how to work with other faculty to enrich their student's classroom experiences.	3/23/2022 6:06 AM
28	I am planning to read articles that were referenced in various talks and look at freely available textbooks and other class materials that have had positive impacts.	3/22/2022 10:13 PM
29	Discuss working with the Business school to modify the calculus for business course.	3/22/2022 9:52 PM
30	N/A	3/22/2022 9:14 PM
31	I have started to connect with (recruit) colleagues who can engage with other departments.	3/22/2022 2:54 PM
32	Leading colleagues in a conversation about vertical alignment of courses, not just content details.	3/22/2022 2:11 PM
33	I will be reaching out to Eric Hsu to have a conversation about how we rethink math course placement. This is a priority for our campus.	3/22/2022 2:03 PM
34	Finding out how to get "transferability" for new-style high school and community College courses	3/22/2022 11:39 AM
35	I will continue to incorporate active learning in my own courses and will work with other members of my department to provide structural support (e.g. tutoring, course on study skills) for students.	3/22/2022 10:20 AM
36	I hope to get one of the speakers in front of MAA Project NExTers this coming summer.	3/22/2022 10:09 AM
37	Already have a strategic plan working group focused on establishing a welcoming and diverse student experience.	3/22/2022 9:15 AM
38	Mostly reading articles that were suggested as resources during some talks, and try to incorporate some of this knowledge while planning my courses for next quarter	3/22/2022 9:06 AM
39	There are a couple of people I met with at the workshop that I will connect with to further the work I am doing with Math Circles. This is about individuals and not about most of the workshop themes.	3/21/2022 9:40 PM
40	n/a	3/21/2022 12:24 PM
41	I will attend some of the conferences that were advertised on the last day of the workshop. I will continue my research efforts, especially knowing that others around the country are doing work in this area. I will be a change agent in my future job (I'm just finishing up my PhD now).	3/21/2022 8:36 AM

42	Register for a SEA Change Workshop; apply Sandra Laursen's model to local data on institutional change	3/21/2022 7:26 AM
43	I'll email Missy Cosby to speak at my math ed seminar.	3/20/2022 5:26 PM
44	Have already modified work with colleagues on an proposal we are writing to use info from Sandra Laursen's talk and to consider our plan in terms of the four frames.	3/20/2022 3:10 PM
45	1) I have plans to initiate some research in my own classrooms. 2) I am passionate about math education and ensuring access to all, particularly young women and women of color. I hope to delve more into areas that I could work towards this goal in my own dept and institution.	3/20/2022 11:08 AM
46	An increased focus on Equity while implementing Project-Based Learning.	3/20/2022 8:30 AM
47	I will be meeting with my department's coordinated courses committee and trying to gather allies that way. Also, I plan to investigate in more detail the Wright State University EGR1010 course.	3/20/2022 8:02 AM
48	Communicate as much as possible of the content of the workshops to the colleagues at my institution, and share with them the workshop recourses.	3/19/2022 10:19 PM
49	Talking to client disciplines to see to to develop entry level math courses that use applications and prepare students to take Calculus later on. Second action is having a conversation with other faculty members about how to anchor our current effort.	3/19/2022 9:45 PM
50	I can see trying to create a broad workshop on improving teaching, hopefully one that involves multiple departments.	3/19/2022 4:56 PM
51	Incorporate rewards and celebrations more in our Community of Practice. (symbolic). Reach out more to my students and show that I care and want to listen (student panel).	3/19/2022 2:37 PM
52	I'm already doing what I need and can do. But more focus on partnering with K-12 and CC (I'm a math faculty)	3/19/2022 12:19 PM
53	CONTINUE MY PHD STUDIES	3/19/2022 11:41 AM
54	I will be more sensitive to students' learning atmosphere, and I will consider more ways to teach relevant, meaningful mathematics. Gather their input and perspectives are also important.	3/19/2022 9:37 AM
55	1) make the equity as the central change in my department to recruit, retain, and to sustain or increase the graduation rates. 2) conduct more research in undergraduate mathematics education and department.	3/19/2022 7:58 AM
56	I will have a student advisory board for as many of my new projects as possible. I will email and connect with other folks from the conference to connect on new initiatives.	3/19/2022 7:52 AM
57	I am planning to form a math circle to connect local K-12 math teachers and math dept faculty members.	3/19/2022 7:17 AM
58	I now understand the environment of my class and an analysis what happened.	3/19/2022 2:43 AM
59	There were many references to literature, and some were explicitly linked in Zoom's chat window. I have been reading some of these references.	3/18/2022 8:00 PM
60	I'm not sure.	3/18/2022 7:29 PM
61	I have more confidence to back the proposals I have made, in directions that I have seen can be successful.	3/18/2022 7:26 PM
62	I will re-watch some of the videos especially that of teaching differential equations through modeling approach and use the ideas and techniques in it to design my next differential equations class. Previously I only send emails to students who are struggling in my class, but now from what I've learned, I will also email students who are doing well to appreciate them and encourage them to keep up the good work.	3/18/2022 7:01 PM
63	Continue to work on adapting the undergraduate curriculum at the home institution to the needs of STEM students.	3/18/2022 6:43 PM
64	A group of colleagues from my department attended this conference. We will be forming a	3/18/2022 6:17 PM

	committee to put into practice much of what was learned.	
65	As currently I am a Honorary Secretary of a School , I will be taking the message to our school teachers to improve their teaching skills	3/18/2022 6:14 PM
66	I will make sure that my students know that I care. I will continue to advocate for all students.	3/18/2022 5:58 PM
67	Planning to run some workshops for other participants at the conference.	3/18/2022 5:32 PM
68	I plan to reach out to Missy Cosby and Sandra Laursen and invite both to present at our TfP project meeting this summer.	3/18/2022 5:30 PM
69	Learn more about change theory.	3/18/2022 5:04 PM
70	na	3/18/2022 4:56 PM
71	Meet with my Department Chair about what I've learned. Start a state-oriented initiative to improve mathematics education.	3/18/2022 4:56 PM
72	Initiate better connection to community college Initiate a local cross-departmental meeting, including high schools, community colleges and universities	3/18/2022 4:55 PM
73	I am interested in looking at the student data at my institutions and hopefully reviewing it with the current instructors for calculus. During this institute, I put in a request based on Wendy Smith’s group interactive session	3/18/2022 4:54 PM
74	Collaborate with a partner outside my area Work on a joint initiative work an organization	3/18/2022 4:53 PM
75	Will follow up with some people on specific actions	3/18/2022 4:49 PM
76	Build connections with colleagues to discuss what further things we can work on and do. Read more about theories of change.	3/18/2022 4:46 PM
77	Reached out to mentors to schedule meetings to discuss dissertation ideas	3/18/2022 4:39 PM

Q11 What are you most fascinated with, interested in, or concerned about with regard to departmental and institutional change?

Answered: 80 Skipped: 54

#	RESPONSES	DATE
1	promoting change in a way that supports ALL learners, learners' sense of identity in the math classroom.	4/12/2022 9:38 AM
2	Developing a plan, including a vision or mission, short-term and long-term goals to work towards departmental change.	3/30/2022 12:50 PM
3	Sustainability... which means changes to the required curriculum, preferably accompanied by a business model related to increased student success and degree attainment.	3/28/2022 7:29 AM
4	The discipline-specific challenges in reforming mathematics education at the college level.	3/26/2022 8:47 PM
5	What not to change	3/26/2022 8:43 PM
6	Colleagues who resist change.	3/25/2022 3:07 PM
7	building a critical mass interested in similar issues. changing practices and belief systems about teaching and students.	3/25/2022 1:56 PM
8	Even with a lot of buy-in for evidence-based pedagogies, it's very hard to think of teaching as anything other than what we're already used to, so there are other structural barriers to change.	3/25/2022 1:20 PM
9	How it's communicated.	3/25/2022 1:07 PM
10	I am most interested in the buy-in aspect both from tenured faculty who are not interested in the into courses or are highly tied to their "academic freedom" in teaching those courses and the buy-in from full-time instructors (non-tenure-line, master's degree) who have less support, experience, and/or motivation to change the way they are teaching.	3/25/2022 12:55 PM
11	Relationship between Data Science and Mathematics.	3/25/2022 12:43 PM
12	Finding ways we can infuse programming into the undergraduate mathematics curriculum. This means completely reimagining what our introductory mathematics courses look like.	3/25/2022 12:21 PM
13	concerned: many people in different levels both departmentally and institutionally seems to be aware what needs to be changed, but in the same time also aware that the changes won't be made anyway since "the higher-ups", or "politics" or "parents" won't stand by those changes.	3/25/2022 12:05 PM
14	How to arrive a positive outcomes with an opinionated and heterogeneous group of independent thinkers	3/25/2022 12:00 PM
15	(Both fascinated and concerned) Delighted to hear about the change efforts and successes shared. But why has it taken so long to get to this point of committing to this work? (and many faculty and depts are still not part of the conversation)	3/25/2022 10:54 AM
16	Student Success being a bigger priority in the actions of the department.	3/25/2022 10:08 AM
17	I'm most concerned with inertia. It's hard to change, and we'll need everyone on board.	3/25/2022 9:59 AM
18	I am interested in whether or not math departments will ever see the need to grow and to be inclusive. Also that inclusive does not mean lowering standards or rigor, it means "teaching".	3/25/2022 9:31 AM
19	The question I am left with is: What incentives can instigate departments and institutions into making these changes? Perhaps this was discussed on the second and third days. (I only attended the first.)	3/25/2022 9:23 AM
20	seems like a really hard problem, but hearing about case studies and places that have made progress gives me hope	3/25/2022 9:13 AM
21	The mix of pedagogy, content expertise, and higher ed politics is a complex problem.	3/25/2022 7:57 AM

22	How to implement equity issues in the classroom.	3/24/2022 6:52 PM
23	Just overall the difficulty/sheer amount of work involved	3/23/2022 5:21 PM
24	Helping underprepared students succeed in the math course they are placed into their first semester in college; Having students learn how to break out of their comfort zone to learn, all while holding on to the different identities they have.	3/23/2022 2:20 PM
25	I'm fascinated by how many people are doing such interesting and impactful work. I am interested in how to rethink all of introductory math to match where students are, what they're interested in, and what they'll need to know moving into the future. I am concerned about how many structures actually need to change and how long that change will actually take.	3/23/2022 12:12 PM
26	Trying to develop a common vision and momentum for change in our department (as well as collecting data on our efforts) so that there is less opposition to it.	3/23/2022 8:33 AM
27	Maintaining a team who are passionate about the change, rather than a few individuals who could burn out.	3/23/2022 5:39 AM
28	The people involved! There seem to be more than expected arrogant, hostile, condescending mathematicians in Math Departments. How do they continue to get away with their resistance to change?	3/22/2022 10:13 PM
29	Getting department heads and administrators to buy into making changes to existing service-math courses.	3/22/2022 9:52 PM
30	N/A	3/22/2022 9:14 PM
31	I am most interested in finding ways to provoke the demand for change.	3/22/2022 2:54 PM
32	How do we assure that we are elevating equity as we move forward?	3/22/2022 2:11 PM
33	Knowing small changes over time add up is important. How do we sustain or keep advancing when there are so many cuts to education? I'm also curious about how the effects of COVID will affect the bigger educational picture in the longer term.	3/22/2022 2:03 PM
34	Getting folks on the same page so efforts are amplified not diluted	3/22/2022 12:26 PM
35	The incredible difficulty of getting synchronized change across different educational levels and institutions	3/22/2022 11:39 AM
36	The prospect of completely overhauling the curriculum to make the student experience more valuable.	3/22/2022 10:50 AM
37	I am happy to see the continued attention to equity issues in math education, but concerned by the vastness of the problems.	3/22/2022 10:20 AM
38	instituting the change so that it stays and is not a fad	3/22/2022 10:09 AM
39	It's such a hard ("wicked") problem - but we in math love hard problems!	3/22/2022 10:09 AM
40	How powerful it can be to make something easy and accessible, and how lasting such changes can actually be.	3/22/2022 9:15 AM
41	I am in a teaching position with very little power, and am not sure how I can bring that change at the departmental/institutional level.	3/22/2022 9:06 AM
42	What was not talked about - what participants might want to preserve from the current structure.	3/21/2022 9:40 PM
43	I think what interest me the most how to apply the idea as a newer faculty member at the institution.	3/21/2022 1:58 PM
44	n/a	3/21/2022 12:24 PM
45	How it is sustainable.	3/21/2022 8:36 AM
46	this is my main research area, so I'm interested in all of it, particularly models for change and change theories	3/21/2022 7:26 AM
47	I am most fascinated by how students' language, actions, and utterances contribute to departmental/institutional change.	3/20/2022 5:26 PM

48	Fascinated by two things: (1) organizers' limited use of learner-centered design ideas to be more inclusive and responsive to online participant experience (e.g., there was not a person designated to support think-pair-share in brief breakout rooms online when it happened in the physical space; plans for breakouts in last session on Friday made participation by online participants untenable) and (2) opportunities for using existing research to adapt/scale to new contexts (happy to hear about the new NSF directorate in this area).	3/20/2022 3:10 PM
49	I am fascinated by the ways in which issues of access an equitability can be studied and explored, and intervention strategies can be planned. My concerns are: 1) The inequity starts much earlier when students in K-12 don't have equal access to good school education. Thus, efforts to build that access need to start much earlier - through organizations like NSF, MSRI, etc. 2) Depts and institutions are led by people who are generally from more privileged backgrounds (in terms of gender, race and/or minority status). They are unaware or unwilling to address issues of DEI. In addition, the business focus of institutions of higher education tend to address these issues superficially at best, and such measures often make the problem worse.	3/20/2022 11:08 AM
50	Increasing engagement and discourse in University Mathematics.	3/20/2022 8:30 AM
51	My department chair seems quite content with the status quo, even though the Provost is getting after us for high DFW rates in calculus. A colleague and I spent a lot of time looking into possible improvements we could make and pitched them to the Dean (assuming he would put pressure on our chair). The Dean was very engaged for a while, but ultimately he said the chair was the decision maker. Change efforts are currently stalled as a result.	3/20/2022 8:02 AM
52	Most concerned with getting senior faculty on board with the need for improving introductory math courses.	3/19/2022 10:19 PM
53	Sustainability and support students of color.	3/19/2022 9:45 PM
54	Building effective systems of professional development, instructional support, physical facilities, and student supports that allow the full range of students to succeed in our programs	3/19/2022 4:56 PM
55	Fascinating to hear the case studies about changes that don't sustain or succeed because not enough attention is given to all four frames.	3/19/2022 2:37 PM
56	The focus seem to be on changing college mathematics department, when it seems to me that the change has to be made in the K-12 mathematics education. From my colleagues who have taught prospective K-12 teachers, I heard that many of the K-12 teachers of math have themselves a fear of mathematics; this is a problem that contributes to the lack of quality K-12 education. Unfortunately, the mathematics education community has failed to redress this, but instead is focused on "reforming" institutions of higher education.	3/19/2022 1:20 PM
57	The role and implementation of mental health and well-being in math classes	3/19/2022 11:41 AM
58	Math Ed faculty represent a minority. We have much say in shaping our programs but not in math, cs, stats, etc. Chang may come about incrementally, but one needs to initiate a synergy so that our members are pondering, etc. I will elicit ways to form a teaching circle to share my learning at the workshop and continue my journey to explore ways to improve mathematical learning experience for our students.	3/19/2022 9:37 AM
59	I most interested in increasing the number of minority underrepresented Undergraduate mathematics students with regard to the department and institutional change.	3/19/2022 7:58 AM
60	Being able to connect the different levels and hold the ideas and multiple stakeholders in mind.	3/19/2022 7:52 AM
61	My institution focuses on teaching and every faculty member have heavy loads of teaching and I am a relatively new member. I am afraid that they would be reluctant to my change or would listen to my voice.	3/19/2022 7:17 AM
62	I respect to every thing may be has effect of my class.	3/19/2022 2:43 AM
63	If anything, I'm not too optimistic about the future of math courses and now feel that these should be taken over by other departments.	3/18/2022 7:29 PM
64	I am mostly fascinated by the techniques that suggest that we start by making the new goal appealing to people so that if more people buy into it, it gradually becomes a norm, and little by little it can be incorporated into requirements. I also like the idea of having communities of Practice to help infuse active learning into our teaching.	3/18/2022 7:01 PM

65	I am most interested in how other institutions will found easy to overcome traditional views and modernize their curriculum.	3/18/2022 6:43 PM
66	I would say the structural and political mechanisms which drive both my instruction and my department. Both work in tandem and also have their own unique elements that must be considered with any proposed changes.	3/18/2022 6:17 PM
67	How can community college math departments work with other depts so that the math courses serve the majors but don't disadvantage students who change majors.	3/18/2022 6:14 PM
68	No specific remarks	3/18/2022 6:14 PM
69	I am interested in how we can sustain positive changes once we have made them.	3/18/2022 5:58 PM
70	We need to work together to create a positive mathematical future.	3/18/2022 5:32 PM
71	The momentum that has built up for implementing change!	3/18/2022 5:30 PM
72	change theory	3/18/2022 5:04 PM
73	more women in stem	3/18/2022 4:56 PM
74	I am fascinated with the work that is being in Alabama with mathematics education. I am concerned about what is happening in Virginia concerning mathematics education.	3/18/2022 4:56 PM
75	Change theory	3/18/2022 4:55 PM
76	I am concerned and interested in how to get faculty buy-in. Prior to coming to this conference I thought it had to be top down, but now I think it has to be top-down and bottom-up	3/18/2022 4:54 PM
77	Growth Mindset change	3/18/2022 4:53 PM
78	People have a hard time thinking at the departmental level. Conversations kept dropping back to classroom and individual level.	3/18/2022 4:49 PM
79	The quote about supply of ideas versus demand from Elmore.	3/18/2022 4:46 PM
80	TA and LA involvement	3/18/2022 4:39 PM

Q12 How did who you are, as well as why you attended the workshop, shape your views of departmental and institutional change? Please give an example.

Answered: 65 Skipped: 69

#	RESPONSES	DATE
1	I am a non-traditional grad student returning to school after a long absence, with the goal of teaching community college. I was surprised to read research about the way students learn and the contradiction of the research versus what is actually happening in math classrooms. This workshop was a amazing opportunity to have exposure to what is happening on an institutional level and gave me a deeper and broader understanding of the challenges and pitfalls that come with departmental and institutional change. For instance, many issue with equity and inclusion came up that were not on my radar previously.	4/12/2022 9:38 AM
2	I try to be very focused on student understanding and success, I see my role as a mathematics educator and to look for ways to make positive changes in terms of issues surrounding equity and inclusion, student success, and learning.	3/30/2022 12:50 PM
3	I have worked with dozens of institutions to remove curricular bottlenecks to student success in STEM, primarily associated with math requirements. Every institution has its own unique challenges.	3/28/2022 7:29 AM
4	Before coming to higher ed, I was a K-12 teacher and have also taken a leave to return to K12.	3/26/2022 8:47 PM
5	I am teaching-focused faculty in an R1 university, and my department has a general culture of support for evidence-based pedagogies, but there is still a lot of momentum keeping the old ways around. For example, active learning is generally accepted as good practice in the department, even though the extent it is used varies from instructor to instructor. However, other ways of re-thinking what classes look like to better match what we know from the research are still hard to implement. A big part of my job is course coordination, where I have almost complete freedom to make the course look the way I want. So, I have been working since last year to get rid of exams in the class I am coordinating and move to a more growth-based grading system. Despite a lot of buy-in around the general idea, it's easily going to take another 2 or more years before we are fully transitioned away from exams. So, while I believe institutional change can happen, I think there are a lot of major barriers that are hard to define or even see.	3/25/2022 1:20 PM
6	I've seen or heard about a lot of changes in departments over the years.	3/25/2022 1:07 PM
7	I am a department head who is in the middle of enacting departmental and institutional change. I know and see all of the challenges including budget, (lack of) human capital, buy-in from partner disciplines, etc. My biggest challenge is the time require to move forward on a project of such a large scale, including creating proposals backed by research, while also fulfilling the other duties of my role. The workshop gave me other ways to look at and think about these challenges and who I may be able to leverage for the project.	3/25/2022 12:55 PM
8	More faculty members should attend this type of workshop in order for them to realize the emergence and importance of Data Science education in any mathematics departments.	3/25/2022 12:43 PM
9	I am a graduate student in my final year of my studies (ABD) and I will be joining a mathematics and statistics department in the fall as an assistant professor of mathematics education. I am motivated to hit the ground running to improve student success. My goal is to find the already-established structures in the department that can be used as anchors for change.	3/25/2022 12:21 PM
10	Significantly -- I am moving into a new administrative position and so was interested in the structural parts in a way a wouldn't have been before	3/25/2022 12:00 PM
11	I am on the leadership team for SEMINAL so I was very well versed on change efforts in the UG calculus sequence. Still, this workshop was incredibly informative and offer much new	3/25/2022 10:54 AM

	information.	
12	I work as a support coordinator for students taking developmental mathematics and see their struggles and frustrations first hand. There is too much focusing on "there is a problem" rather than trying to find possible solutions for the problem.	3/25/2022 10:08 AM
13	I'm a person who really likes change in general, and who really wants this change in particular (for my department). So I really went in with an open mind, ready to get ideas and make some plans.	3/25/2022 9:59 AM
14	I am a high school math teacher, who is also a supervising teacher for future math teachers. I am consistently working and adapting to teach students who were wrecked by a pandemic, in holistic ways. Without talking about "loss" or "deficits", I work to build on the skills they developed during online learning, and be a bridge to the content with real world application. I am also a part of the Math Leaders Collaborative for Los Angeles Unified School District, compiling resources to support math teachers. This conference was so important to my thinking about that.	3/25/2022 9:31 AM
15	I am non-TT faculty but I have the ear of the current Dept Chair. Thinking about ideas to bring to the Chair.	3/25/2022 9:13 AM
16	I am a teaching faculty member, so hearing the perspectives of faculty in other disciplines, students, and others was valuable.	3/25/2022 7:57 AM
17	I think I am coming at this from the point of view of a faculty member in a math department who wants change but needs specific actionable items -- a quick fix, as you will. I know a quick fix is not possible but I also know that most of the more theoretical concepts discussed at the workshop will have no traction in my department at all. So this is a difficult needle to thread, as it were.	3/23/2022 5:21 PM
18	I'm not sure I know how to answer this question.	3/23/2022 12:12 PM
19	I have studied departmental/institutional change through the SEMINAL project, so I have a pretty strong foundation in this research area. We are currently enacting major changes in my department, so this workshop provided an opportunity for me to share some of this work with one of my colleagues who attended CIME with me.	3/23/2022 8:33 AM
20	I felt that I already held many of the views represented in the workshop, but what was most interesting was that these views need to be demonstrated the the larger faculty.	3/23/2022 6:06 AM
21	As noted above, I work in a dysfunctional Math Department. I would describe it as HOMOGENEOUS, INEQUITABLE, and EXCLUSIONARY. This is a 180 from the Diversity, Equity, and Inclusiveness the UNIVERSITY that houses the department advertises. I find it ironic and depressing. To date, I have failed to leave, mostly because I love teaching and learning and working with university students (OUR university students, who are mostly first gen college). The pandemic also helped - sadly, not seeing colleagues was pleasant. It's a bummer, though, because I'm a people person and enjoy working WITH (not against) a team. As Tom Petty wrote, "It just seems so useless to have to work so hard, and nothing ever really seem to come from it."	3/22/2022 10:13 PM
22	Have an open mind listening to the long and short term needs of students and departments	3/22/2022 9:52 PM
23	N/A	3/22/2022 9:14 PM
24	My belief that our department is in crisis were confirmed by many of the speakers/presenters. I know have a better understanding of just how difficult change will be.	3/22/2022 2:54 PM
25	I have a very specific focus on K-12 Mathematics Education and recognized how that lens colored my perspective. Change must support diverse school formats (urban/rural, large small, cultural perspectives...) to increase equity.	3/22/2022 2:11 PM
26	I am in a new role as Director of Quantitative Reasoning at a new institution. I have been tasked with reimagining the first year mathematics curriculum with a goal of reducing the DFW rate and increasing retention. This has resulted in hiring a team of 8 new instructors. We are working on changing our departmental and institutional culture to be one that is more welcoming. We are moving away from an emporium model and moving toward a student-centered, active learning classroom - we are putting an emphasis on bringing the human side back to mathematics. I wanted (and got) language to frame our work. It was also nice to hear	3/22/2022 2:03 PM

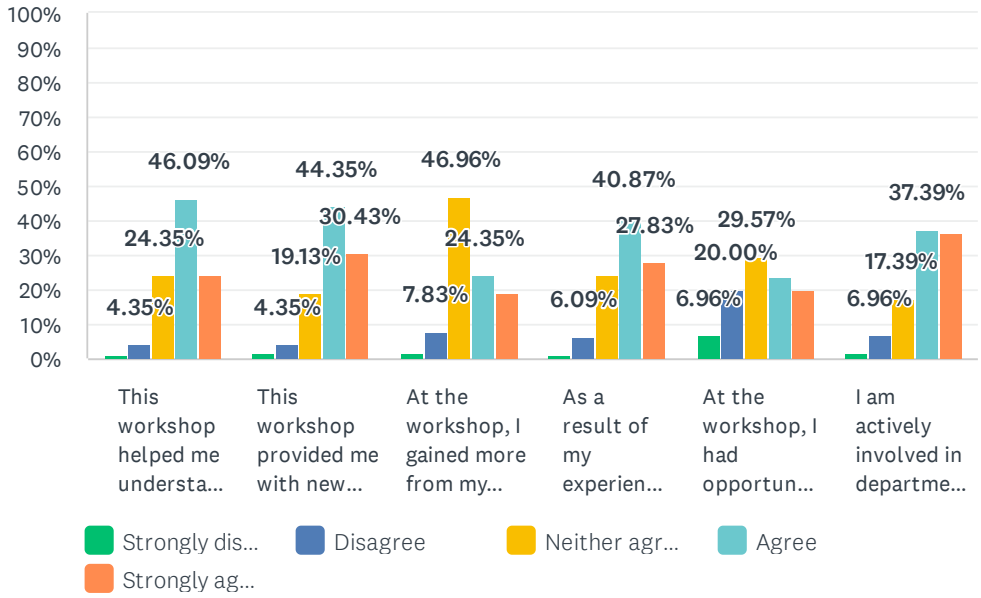
	that many of the little things we are doing (knowing students' names) are what others are having success.	
27	I come from a school where I had the backing of powerful Deans. Could not have made reforms without them.	3/22/2022 11:39 AM
28	Since being trained at an early age in mathematical reasoning, and even more so since becoming a college faculty member, I have opposed the teaching of calculus in high school. I would much rather work with students who can reason than students who can perform challenging but algorithmic symbolic manipulations.	3/22/2022 10:50 AM
29	My college has seen much recent change due to the pandemic and institutional budget concerns. My attentions now are focused primarily on student needs and concerns.	3/22/2022 10:20 AM
30	This is the space I work in - institutional change (though not just at the departmental level.) So nearly everything was applicable to my work.	3/22/2022 10:09 AM
31	It just reinforced my view that having students better prepared in math on entering a university is the best path to equity. This will not happen without community support for out of school programs.	3/21/2022 9:40 PM
32	n/a	3/21/2022 12:24 PM
33	My experience as a long-time teaching faculty (before I decided to finish my PhD in math ed) in a fairly hostile-to-teaching R1 math department has deeply impacted my understanding of how this type of change can or cannot happen. My own experience taught me that change requires one or a few people who take on the bulk of the burden of that work (as well as almost all the push-back and hostility), but now I see that when that person leaves the department, their work of creating and supporting change that's aligned with EDI and evidence-based teaching literally goes out the window within months. This is not a sustainable model. I suspected as much, but my personal experience with that as well as the research presented at the workshop was excellent grounding for why that was true. I also learned how to more sustainably impact departmental change wherever I end up in the future. Furthermore, I'm truly convinced now that there are indeed healthy math departments that authentically take on this work and are successful in doing so. That's encouraging to know that only some departments are toxic and others are supportive. I needed to see role models of reasonably healthy and functioning departments to know it's not just a dream in my head that they exist.	3/21/2022 8:36 AM
34	I appreciated that the speakers/panelists collectively had a lot of diversity; I could see myself as someone who can also be influential with research on institutional/departmental change	3/21/2022 7:26 AM
35	I attended this workshop because I want to research departmental and institutional change. I also met Naneh Apkarian and was excited to see her present.	3/20/2022 5:26 PM
36	I work at a "minority serving institution" and my views about what was needed and what was possible seemed to be on the "cutting edge" compared to many things reported/shared. The amazement that many had regarding student panelist reports was depressing (that so many of my colleagues were amazed).	3/20/2022 3:10 PM
37	As of now, I am reflecting on what I learned and making plans to read and study more on the issues that were discussed. Too early for me to plan action right now.	3/20/2022 11:08 AM
38	I am a constructivist, and I am very interested in promoting Equity, so I believe in the need for institutional change on an International level.	3/20/2022 8:30 AM
39	I spent some time working in our university's College of Business, so I am familiar with organizational behavior theories but I had not applied them to the challenges currently facing the mathematical sciences department. This workshop helped me realize the importance of doing that.	3/20/2022 8:02 AM
40	As I wrote above, the way the workshop shaped my views is by increasing my awareness of the importance of inclusion of multiple voices: students, teachers, community colleges, instructors, administration and faculty from other disciplines in the conversation about improving STEM gateway courses.	3/19/2022 10:19 PM
41	I am a mathematician of color. Seeking community has been part of my cultural background and my personal story. I believe in seeking change through community efforts.	3/19/2022 9:45 PM
42	We've been working on changing our department's teaching for more than 5 years, so it is clear	3/19/2022 4:56 PM

	that this is ongoing work, involving multiple aspects of the department.	
43	I'm a chair and work with other chairs and I tried to have time to collaborate with CC and HS. The workshop propelled that.	3/19/2022 12:19 PM
44	I think my education and experience have a tremendous say in my current thinking. Previously, I focused more on the content and pedagogy. As an agent of change, I will seek more research to shape my views.	3/19/2022 9:37 AM
45	The number of minority underrepresented mathematics students is decreasing. So, we may increase the number of the students if we change our department in terms of recruitments, teaching strategies, curriculum development, course design/redesign, technology inclusion, faculty professional development, equitable transfer, teaching observations, etc.	3/19/2022 7:58 AM
46	As a junior faculty member in a small department, it helped me see different possible roles for my involvement, now and over the course of the career. It also helped me ground my practice in student feedback.	3/19/2022 7:52 AM
47	First of all, I attended to this workshop becuse it represents a great opportunity to enrich my information and skills. About my views of departmental and institutional change? In fact, after the sell of information which pushed via several authors during this workshop. My answering , no way to just say, I am with any changing of departmental and institutional who leads to updating according to the situation.	3/19/2022 2:43 AM
48	I did not know about the literature on the subject, and I did not know about the work being done in K-12. I was only previously aware of discussions at the undergraduate level.	3/18/2022 8:00 PM
49	Tbh, I did not gain any practical or useful information from this workshop. I did learn about the state of things in a lot of colleges but nothing practical that can be transferred to my institution.	3/18/2022 7:29 PM
50	It affected the things I consider important. For instance, since I'm not yet in a leadership position to affect any considerable change, I just focus on the ones that will directly influence my teaching. So I'm more interested in individual changes rather than institutional or departmental. However, I also noted some things that might be helpful to my department which I will offer as suggestions if I get the opportunity.	3/18/2022 7:01 PM
51	I attended the workshop because I teach undergraduate students and I'm invested into making mathematical education more accessible and inclusive. We undergo a curriculum revision in the department and we were faced with many of the critical issues addressed at the workshop, e.g., how to increase student engagement and retention or how to incorporate service courses in the curriculum.	3/18/2022 6:43 PM
52	I work at a community college within a large urban higher education system. It is difficult to figure out how to best serve the students we have and also prepare them for transfer to a senior college that may be much more traditional both I terms of curriculum, technology use, and pedagogy.	3/18/2022 6:14 PM
53	No specific remarks	3/18/2022 6:14 PM
54	I was already interested and working on departmental and institutional change prior to coming to the conference.	3/18/2022 5:58 PM
55	We need theory to drive change!	3/18/2022 5:32 PM
56	My context -- the community college -- shaped my view of the work presented in that we are uniquely positioned to "hijack" the best parts of K-12 and university change as we imagine and implement our change!	3/18/2022 5:30 PM
57	I am not an at institution but support institutions to change so I tend to think about changing multiple departments through systemic levers	3/18/2022 5:04 PM
58	I am a women in stem	3/18/2022 4:56 PM
59	N/A	3/18/2022 4:56 PM
60	As a math department outsider, I was struck by a number of ways I could strike up a dialogue with them.	3/18/2022 4:55 PM
61	I think never having worked in a math department, I had this singular view of what I thought it would take to institute change.	3/18/2022 4:54 PM

62	Collaborate with someone from outside the department to enhance your own pedagogical practices.	3/18/2022 4:53 PM
63	Useful to me to hear people's responses to different aspects of the program	3/18/2022 4:49 PM
64	As a mathematician switching into mathematics education research it is interesting to pay attention to things that bridge the two areas, especially post-secondary and K-12. I think that informed my perspective quite a bit.	3/18/2022 4:46 PM
65	I've only gotten this far in the field of math because of my roles as a LA and TA in undergrad and my masters. I know they are important levers and I came to learn more about how they can be/are utilized	3/18/2022 4:39 PM

Q13 Indicate your level of agreement with the following statements.

Answered: 115 Skipped: 19



	STRONGLY DISAGREE	DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE	TOTAL	WEIGHTED AVERAGE
This workshop helped me understand my responsibility to use my influence in my department, program, or situation.	0.87% 1	4.35% 5	24.35% 28	46.09% 53	24.35% 28	115	3.89
This workshop provided me with new ways of talking and working with people outside my local context.	1.74% 2	4.35% 5	19.13% 22	44.35% 51	30.43% 35	115	3.97
At the workshop, I gained more from my exchanges with participants who have a professional role different from my own than I did from those who have a similar professional role.	1.74% 2	7.83% 9	46.96% 54	24.35% 28	19.13% 22	115	3.51
As a result of my experience at the workshop, I feel more inclined and able to engage with people outside of my professional community in efforts to improve mathematics education.	0.87% 1	6.09% 7	24.35% 28	40.87% 47	27.83% 32	115	3.89
At the workshop, I had opportunities to share my own work related to the issue addressed — for example, related to course development, research, teaching, or assessment.	6.96% 8	20.00% 23	29.57% 34	23.48% 27	20.00% 23	115	3.30
I am actively involved in departmental and institutional change.	1.74% 2	6.96% 8	17.39% 20	37.39% 43	36.52% 42	115	4.00

Q14 Identify anything that stands out as difficult or challenging for these exchanges.

Answered: 59 Skipped: 75

#	RESPONSES	DATE
1	The disconnect between the virtual community and the in-person community was a challenge at certain points during the conference.	4/12/2022 9:43 AM
2	Because I wasn't able to attend many of the sessions, I was not part of any exchanges among participants.	3/30/2022 12:51 PM
3	More difficult to connect with people remotely	3/29/2022 7:03 AM
4	Different backgrounds means different realities, in regard to student success in math. Solutions for engineers may not be the same as solutions for other disciplines.	3/28/2022 7:32 AM
5	Actually identify and debrief about teaching practices	3/26/2022 8:48 PM
6	changing hearts and minds.	3/25/2022 1:58 PM
7	I attended virtually.	3/25/2022 1:21 PM
8	Because I participated remotely, except for the chat feature on Zoom here was only one opportunity (the breakout session on the last day) for me to participate in such an exchange. Being able to type and listen at the same time is sometimes difficult.	3/25/2022 1:15 PM
9	I only attended remotely via zoom, and it was not natural than those in-person interactions happening at the MSRI conference room. The hybrid mode, I feel, is more difficult than purely remote mode.	3/25/2022 12:46 PM
10	Nothing really stands out other than perhaps having more time to discuss change efforts.	3/25/2022 12:27 PM
11	Time. It's hard to work around each and everyone schedule to have productive exchanges around these topics.	3/25/2022 12:07 PM
12	Finding common language, unearthing unspoken assumptions	3/25/2022 12:00 PM
13	I think that the workshop would have benefited from smaller breakout rooms (for the online folks).	3/25/2022 11:02 AM
14	Changing belief systems about what mathematics is and what should be taught for intro undergrads is challenging. The status quo is well entrenched at multiple levels, but org change can happen and has happened.	3/25/2022 10:57 AM
15	We all come from different places around the country with our own challenges. The common ground of developmental mathematics may not be enough, and some consensus on other topics might need to be brought to the forefront.	3/25/2022 10:11 AM
16	I was at the conference remotely and largely missed this aspect.	3/25/2022 10:02 AM
17	The Stanford teacher in the chat who, in my opinion, represents the traditional math stance: Math is elite, for the best, we don't need support or change; anything worthy will come through the math department or else it will be dissolved.	3/25/2022 9:33 AM
18	I'm new to CIME. It was challenging to connect with other attendees that I had not met before.	3/25/2022 7:58 AM
19	As someone who is not part of the math education community, I found a lot of the jargon challenging.	3/23/2022 5:28 PM
20	Sometimes it's difficult to talk about change when your institution types are very different. You might be working with different populations, structure, courses, class sizes, you name it.	3/23/2022 12:16 PM
21	There was little to no interactivity between participants during sessions. All of the "networking" or sharing of our own experiences had to take place in "informal" settings (i.e. coffee breaks,	3/23/2022 8:35 AM

	mealtimes) which makes it more difficult to make meaningful connections.	
22	Having to participate online, it was it was challenging to interact with participants.	3/23/2022 5:42 AM
23	Need to bring in faculty from the disciplines served by the math department to the workshop to know what they need.	3/22/2022 10:23 PM
24	N/A	3/22/2022 9:14 PM
25	Most of the exchanges were one-directional. There was not much dialogue. Having said that, even these one-directional exchanges were productive.	3/22/2022 2:57 PM
26	I was only able to attend presentation sessions.	3/22/2022 2:13 PM
27	There were not as many chances to have more informal discussions as I would have liked.	3/22/2022 2:09 PM
28	I was unable to participate in these exchanges.	3/22/2022 10:52 AM
29	I did not find anything particularly difficult or challenging.	3/22/2022 10:24 AM
30	I attended fully online, and could not attend all the sessions, so I don't think I had many exchanges.	3/22/2022 9:07 AM
31	There seems to be a growing sentiment at some schools of education that personal and social identity are the main issues in marginalization and inequity. When I talk to high school and middle school math teachers, they regularly report that it took them five or so years until they felt they had a handle on how to lead the class. I wonder if schools of education could think more about how to teach classroom management rather than blaming the broader society. It is extremely difficult to bring up an issue like this since it is typically taken as an insult rather that as a question.	3/21/2022 9:53 PM
32	n/a	3/21/2022 12:25 PM
33	It was a little loud in the room and difficult to hear (masks didn't help with that). I would have liked a little more time to interact with others in small groups.	3/21/2022 8:39 AM
34	The main challenge was the hybrid format; as an in-person attendee, I didn't get to interact with those on zoom very much (but I don't think there was a good way to facilitate this)	3/21/2022 7:28 AM
35	I had a difficult time interacting with a variety of people since I interacted with the same people I met on Day 1.	3/20/2022 5:27 PM
36	As a virtual participant, exchanges were minimal (as noted in earlier comments, this was a weakness of the design/implementation of the online environment).	3/20/2022 3:13 PM
37	Getting buy in from the rest of the faculty.	3/20/2022 12:19 PM
38	Limitations of time. The transitions between workshops and sessions are a little too quick.	3/20/2022 11:10 AM
39	It is difficult to create these exchanges in a remote environment because it does not happen organically.	3/20/2022 8:32 AM
40	I think it would be helpful to have a directory of who attended, the organizations they represent, and their roles within those organizations. If that was provided, my apologies for missing it.	3/20/2022 8:11 AM
41	everyone perspective seems important. it's difficult to identify an entry point into dealing with a complex problem.	3/19/2022 10:22 PM
42	There is a bit of in-crowd language and style in the math ed community that can be a bit off putting for mathematicians.	3/19/2022 12:24 PM
43	I very much appreciated the wealth of varying perspectives. CIME is very special in this sense. Throughout the workshop, I sensed a high level of conformity. I wish there could have been a greater dialogue with different perspectives.	3/19/2022 9:40 AM
44	We may set up the workshop as more engaging, so we may have more time to communicate with different professional communities.	3/19/2022 7:58 AM
45	There was not much intention around creating mixed groups. Most of the opportunities to ‘work’ with others came in the form of think pair share - if you mostly wanted to talk with someone you already know, there wasn’t much built in to disrupt that. I would like for it to be more intentional.	3/19/2022 7:56 AM

46	Difference of the level of information and skills	3/19/2022 2:46 AM
47	I had a hard time getting a sense of who was here and why. I'm not sure everyone understood the topic the same way; it seemed easy for some to lose the thread of the story line the organizers had set up. While it's good in many ways to have a diverse group, I would have liked to explore people's roles, backgrounds, short bios, whatever. I'd have liked to better understand the audience for my own talk. The difficulty of reading nametags contributed to this.	3/18/2022 10:39 PM
48	Trying to understand some terms used by the Math. Education faculties. For instance, I didn't understand what they meant by tracking until I googled it. Some of these terms are taken for granted but it affects one's understanding if they're not known during the talk or discussion.	3/18/2022 7:06 PM
49	they are not common/frequent enough.	3/18/2022 6:49 PM
50	N/A	3/18/2022 6:18 PM
51	I was online only and so did not interact with others. But one thing I find difficult at my insitilution is that other disciplines don’t communicate with us about how the math courses are not serving their students. Rather they move to replace them.	3/18/2022 6:18 PM
52	NA	3/18/2022 6:08 PM
53	We don't always have a common background or language.	3/18/2022 5:32 PM
54	N/A	3/18/2022 5:06 PM
55	No, this was fairly seamless.	3/18/2022 4:58 PM
56	Please make talks more engaging. A lot of talks were “sage on the stage” style which is one of the biggest Critical Issues in Mathematics Education (CIME)	3/18/2022 4:57 PM
57	I think it is difficult to change the mindsets of faculty in math departments. We see this evidenced by other disciplines creating their own math classes.	3/18/2022 4:55 PM
58	How can we continue to work on things, especially when there is lack of funding to continue investing the time into maintaining that work.	3/18/2022 4:49 PM
59	Attending virtually	3/18/2022 4:41 PM

Q15 Please give an example of an exchange you found particularly productive and explain what made it productive.

Answered: 47 Skipped: 87

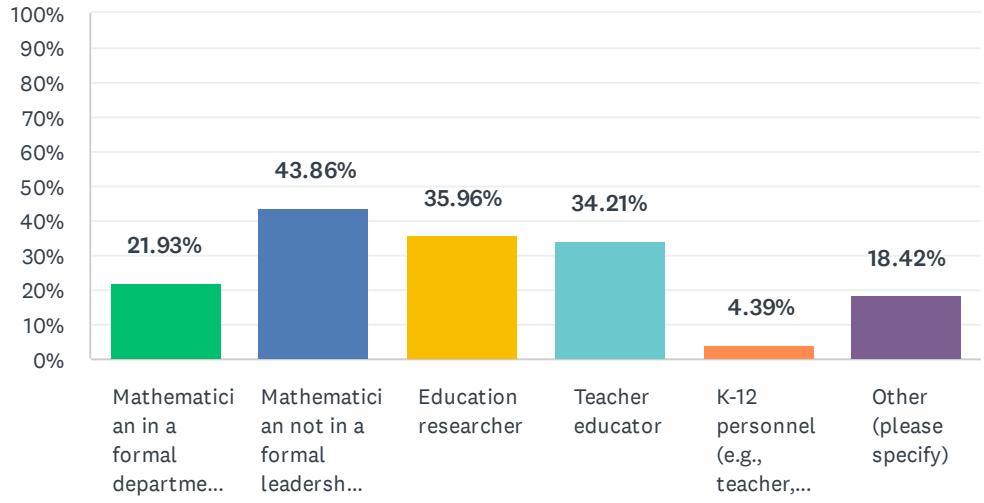
#	RESPONSES	DATE
1	When the speaker gave the audience the opportunity to share ideas between neighbors, those exchanges were beneficial to me, many times a neighbor had an insight or suggestion that related to my perspective or situation specifically and vice versa, super productive (even though this can be uncomfortable).	4/12/2022 9:43 AM
2	I was not part of any exchanges.	3/30/2022 12:51 PM
3	Loved hearing the work of my fellow panelists, who each came from a different STEM discipline than my own. The common thread was math in context, which I believe can enhance student learning in any discipline.	3/28/2022 7:32 AM
4	I got into a discussion about assessment and grading that made me reflect how each individual educator approach might impact differently in student's rate of success	3/26/2022 8:48 PM
5	I thought the discussion (live and via Zoom chat) during the panel about courses in different departments was particularly interesting. This was mainly because I haven't heard much lately about courses and programs in different departments.	3/25/2022 1:15 PM
6	I found the break out session particularly productive. I was able to ask specific questions of someone who has been through the transformational change process. This was both informative and encouraging as I was able to see that I was making many of the same decisions and felt as though I was on the right track in the transformation of my department and I was able to learn about issues/decisions that I may be faced with in the future.	3/25/2022 1:00 PM
7	Hearing from the client disciplines (CS, biology and engineering) was particularly impactful due to the changes they are making without the help from the mathematics departments.	3/25/2022 12:27 PM
8	The student panel was eye opening -- we should have more of these, locally, to motivate change efforts.	3/25/2022 10:57 AM
9	The exchanges in the chat allowed a sharing of resources and ideas that I could see and take proper note.	3/25/2022 10:11 AM
10	I was at the conference remotely and largely missed this aspect.	3/25/2022 10:02 AM
11	There were many! I discussed the SEMINAL project with people from UNL and found some great ideas to try to move forward with reforms at my own institution. On the more theoretical side, there was a short but fascinating discussion of "what is equity" in the question-and-answer portion of Dr. Cosby's talk on the first morning of the conference. I did not participate in that discussion but have been thinking of it since and it is helping me reframe my thinking in this matter. In fact, a discussion of hostile vs. neutral vs. supportive environments came up multiple times during the workshop, and I would say I honestly never thought about a `supportive' environment being significantly different than a `neutral' environment.	3/23/2022 5:28 PM
12	I was particularly impressed by the advice from some of the client disciplines. I was looking for a curriculum exactly like what the engineering and physiology professors described. That was dope.	3/23/2022 12:16 PM
13	Find the balance between theory and application in math courses	3/22/2022 10:23 PM
14	N/A	3/22/2022 9:14 PM
15	The theoretical frameworks for institutional change were new and have potential to inform upcoming change efforts.	3/22/2022 2:57 PM
16	I was only able to attend presentation sessions.	3/22/2022 2:13 PM
17	Talking with Eric Hsu about placement. There was a small group bouncing around ideas about	3/22/2022 2:09 PM

	placement - always good to hear ideas. Afterwards, Eric and I made a plan to meet up (in about 2 weeks) and discuss things further. I also had a talk with Jane Zimmerman who wanted to learn more about how we are using standards based grading - she indicated she would likely reach out afterwards. This was a case where I could share what we have learned in our transformation efforts.	
18	I found it very useful to hear from high school students about their experiences.	3/22/2022 10:24 AM
19	Talking with the guy from the UCLA medical school was fascinating and informative.	3/22/2022 10:11 AM
20	As I mentioned before, the presentations and discussions around frames for viewing organizations.	3/21/2022 9:53 PM
21	I really like the breakout sessions in the afternoon of the last day. It was helpful to hear about what things other people were doing.	3/21/2022 2:40 PM
22	my session was great! I wish that I could have listened to more of the talks	3/21/2022 12:25 PM
23	Actually, I think some of the most productive exchanges with others occurred over meals (lunch or dinner) outside of the workshop.	3/21/2022 8:39 AM
24	had lunch with Sandra Laursen and got to talk to her about change levers	3/21/2022 7:28 AM
25	This workshop gave me the opportunity to reconnect with my undergraduate advisor, Eric Hsu.	3/20/2022 5:27 PM
26	Private chat with one of the presenters in Zoom. Though brief, made it possible to find a resource link.	3/20/2022 3:13 PM
27	Hard to think of one specific example but several good conversations.	3/20/2022 11:10 AM
28	I did not have a productive exchange.	3/20/2022 8:32 AM
29	Nathan Klingbeil's presentation of EGR 1010 was very intriguing. My university is primarily an engineering school, and we are struggling with student engagement and high DFW rates in our first year mathematics courses. We keep trying to identify improvements we could make to our math courses (which we should absolutely do), but creating something like the EGR 1010 course might be the secret ingredient that leads to dramatic improvements.	3/20/2022 8:11 AM
30	the last workshop session with small groups. I appreciate the ability to ask specific questions of the people who have positive experience.	3/19/2022 10:22 PM
31	Social time was invaluable for me....lunch and drinks after the meeting. Since I was there for only one day in person, and thus my interaction was reduced to one day, what sticks out is being able to meet some new people and reconnect with colleagues I haven't seen in so long.	3/19/2022 2:40 PM
32	Hearing directly from students made a big difference in how better I can serve my students.	3/19/2022 9:40 AM
33	The exchange that particularly productive is sharing or collaborating for conducting research activities in developing better department for increasing the number of underrepresented students in mathematics.	3/19/2022 7:58 AM
34	I appreciated the breaks and welcome reception as those were times to connect with other people. The breakout session was also helpful in being able to be a little more part of a conversation about placement.	3/19/2022 7:56 AM
35	I like how the CIME tries to bridge the gaps between/among all mathematics educators (4- or 2- year colleges, community colleges, K-12 schools, other disciplines).	3/19/2022 7:21 AM
36	Really enjoyed the conversation with a change agent late on Friday. More of this!	3/18/2022 10:39 PM
37	My interaction with some colleagues after the panel discussion with the students was particularly productive as I gained insights into other issues that affect students' learning and how my colleagues dealt with them, and some other very simple but impactful practices that affect students' class experiences.	3/18/2022 7:06 PM
38	I found the intervention of the non-mathematics STEM fields very interesting and inspiring.	3/18/2022 6:49 PM
39	N/A	3/18/2022 6:18 PM
40	I thought the exchange around the mathematics teaching practices and the 5 equity practices was helpful because people could see the intersections and how they complemented each other at the same time.	3/18/2022 6:08 PM

41	I met with a really interesting mathematician from Berkeley who I otherwise would not have met!	3/18/2022 5:32 PM
42	The breakouts on Friday were a nice opportunity to have deeper discussions.	3/18/2022 5:06 PM
43	The break time proved to be productive. The hallway chatter allows me to meet, talk with, and hear others' perspectives and learn from them.	3/18/2022 5:06 PM
44	Discussion of how to provide pathways while maintaining equity	3/18/2022 4:58 PM
45	Activities that engaged all participants talk to each other.	3/18/2022 4:57 PM
46	I liked the student panel. It was productive because the things they were asking for were so minimal, it was a wake up call for many people in the room.	3/18/2022 4:55 PM
47	My conversation with a fellow grad student in a radically different university, and talking about different struggles in different institutions.	3/18/2022 4:49 PM

Q16 With which of the following professional roles do you strongly identify? (Check all that apply.)

Answered: 114 Skipped: 20



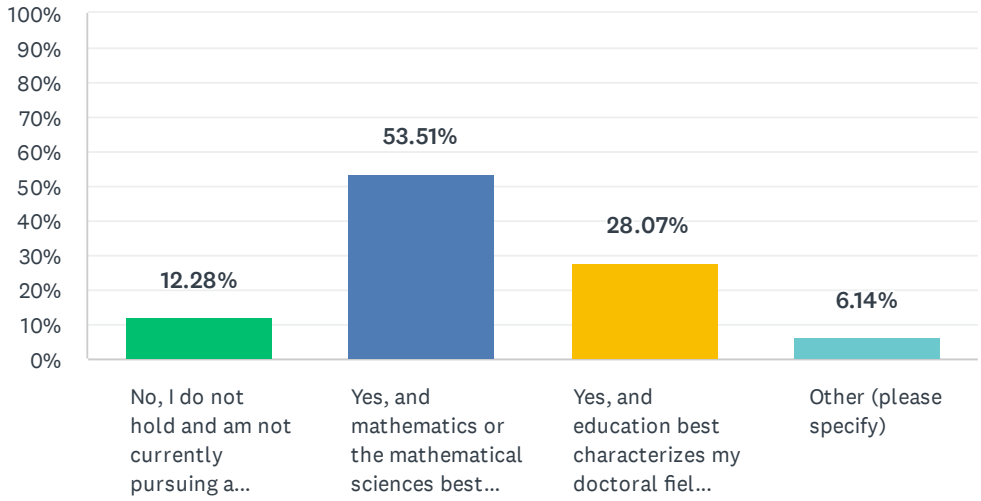
ANSWER CHOICES	RESPONSES	
Mathematician in a formal departmental or institutional leadership role (e.g., chair, director of undergraduate teaching, provost)	21.93%	25
Mathematician not in a formal leadership role	43.86%	50
Education researcher	35.96%	41
Teacher educator	34.21%	39
K-12 personnel (e.g., teacher, curriculum specialist, administrator)	4.39%	5
Other (please specify)	18.42%	21
Total Respondents: 114		

#	OTHER (PLEASE SPECIFY)	DATE
1	I'm more of a change agent than an education researcher. My primary interest is in removing curricular bottlenecks to student success, which in STEM disciplines are primarily related to math requirements.	3/28/2022 7:34 AM
2	Undergraduate Student	3/27/2022 6:33 AM
3	consultant in math education	3/25/2022 1:16 PM
4	Academic Advisor	3/25/2022 10:12 AM
5	Mathematician who supports and works with prospective and current K-12 math teachers.	3/22/2022 10:19 PM
6	student	3/22/2022 9:15 PM
7	Professor in a "client discipline"	3/22/2022 11:41 AM
8	Teaching faculty at a college	3/22/2022 9:08 AM
9	I aim a mathematics educator that chairs a Department of Mathematics & Statistics	3/22/2022 8:05 AM

10	I am retired but continue to run Math Teachers Circles at the university I retired from.	3/21/2022 9:56 PM
11	Instructional Designer	3/21/2022 2:18 PM
12	Undergraduate Student	3/21/2022 10:52 AM
13	I am not the chair but I am advisement coordinator and assessment coordinator + senior faculty	3/20/2022 11:12 AM
14	I’m the lead faculty of mathematics in a small liberal arts HBCU.	3/19/2022 7:59 AM
15	In	3/18/2022 7:09 PM
16	Former Professor of Mathematics in Anna University, Chennai, India and Presently , The Secretary , CDNayagam T Nagar Higher Secondary School , Chennai 600017, India	3/18/2022 6:21 PM
17	Teaching faculty in a math dept; heavily involved in Academic Senate	3/18/2022 6:19 PM
18	Mathematics education researcher	3/18/2022 5:09 PM
19	Advocacy and technical assistance	3/18/2022 5:08 PM
20	Graduate Student	3/18/2022 4:56 PM
21	graduate student	3/18/2022 4:51 PM

Q17 Do you hold or are you pursuing a doctorate degree? (Choose one.)

Answered: 114 Skipped: 20

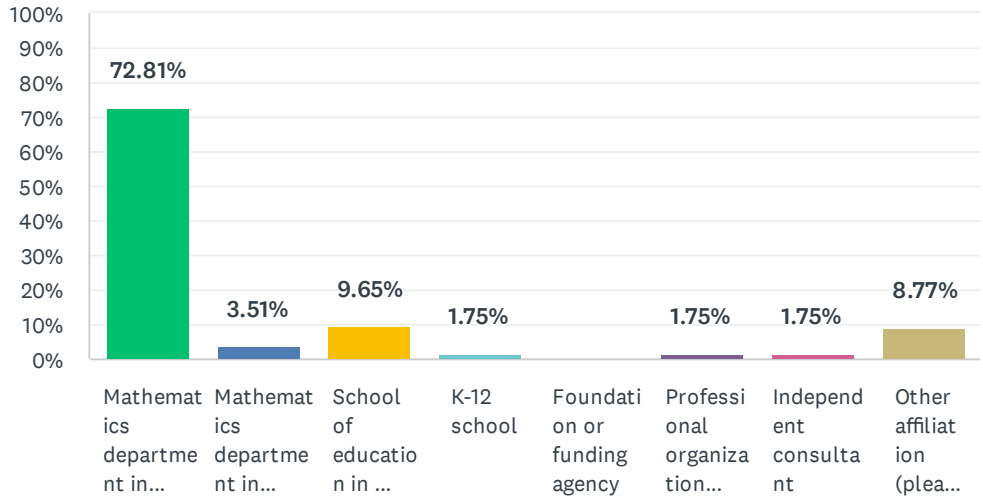


ANSWER CHOICES	RESPONSES	
No, I do not hold and am not currently pursuing a doctorate degree	12.28%	14
Yes, and mathematics or the mathematical sciences best characterizes my doctoral field of study	53.51%	61
Yes, and education best characterizes my doctoral field of study	28.07%	32
Other (please specify)	6.14%	7
TOTAL		**114**

#	OTHER (PLEASE SPECIFY)	DATE
1	Yes, Ph.D. in Mechanical Engineering	3/28/2022 7:34 AM
2	Yes and mathematics education best characterizers my doctoral field of study. I'm not sure how I would untangle them.	3/23/2022 12:18 PM
3	PhD in mathematics education, MA in mathematics	3/22/2022 12:28 PM
4	Yes, and my PhD is in mathematics education	3/20/2022 11:12 AM
5	yes / other field	3/18/2022 10:39 PM
6	I am a Doctorate in Mathematics from 1990 on wards	3/18/2022 6:21 PM
7	Yes, and mathematics education best characterizes my doctoral field of study	3/18/2022 5:09 PM

Q18 Of the following, which best characterizes your professional affiliation? (Choose one.)

Answered: 114 Skipped: 20



ANSWER CHOICES	RESPONSES	
Mathematics department in a 4-year or 4+ year post-secondary institution	72.81%	83
Mathematics department in a community college or 2-year post-secondary institution	3.51%	4
School of education in a post-secondary institution	9.65%	11
K-12 school	1.75%	2
Foundation or funding agency	0.00%	0
Professional organization (e.g., AMATYC, MAA, NCTM, TODOS, ...)	1.75%	2
Independent consultant	1.75%	2
Other affiliation (please specify)	8.77%	10
TOTAL		**114**

#	OTHER AFFILIATION (PLEASE SPECIFY)	DATE
1	Engineering department at a regional comprehensive state university.	3/28/2022 7:34 AM
2	Computer Science dept 4+year institution	3/25/2022 12:01 PM
3	Recent PhD, looking for a postdoc position.	3/25/2022 9:24 AM
4	student	3/22/2022 9:15 PM
5	SEA	3/22/2022 2:14 PM
6	Professor of Medicine and Integrative Biology and Physiology	3/22/2022 11:41 AM
7	Retired from a department in a four year institution. I also work with K-12 school teachers.	3/21/2022 9:56 PM
8	4+ post-sec, other field	3/18/2022 10:39 PM
9	primary appointment in a school of education with secondary appointment in mathematics.	3/18/2022 7:30 PM

10	Research and technical assistance center	3/18/2022 5:08 PM

Q19 What did you like most about the workshop?

Answered: 113 Skipped: 21

#	RESPONSES	DATE
1	The organization, the topics, the speakers on Equity were my favorite.	4/12/2022 9:46 AM
2	The people and the talks.	3/30/2022 7:38 PM
3	The variety of talks, but that they all were related in some way.	3/30/2022 12:53 PM
4	The wide range of ideas, perspectives, people.	3/29/2022 7:06 AM
5	The engagement of the attendees, which was outstanding.	3/28/2022 7:35 AM
6	Opportunities for Q&A based discussion from the audience	3/27/2022 6:34 AM
7	The rooms, the well organized and well put together a hybrid method to participate, the discussions about teaching vs research	3/26/2022 8:52 PM
8	Multiple ways to engage.	3/26/2022 8:49 PM
9	That I was able to attend virtually.	3/25/2022 7:47 PM
10	hybrid was great	3/25/2022 2:13 PM
11	Hearing from others - I was energized and encouraged that I am on the right path and that transforming the intro-level math courses is a worthy and important(!) endeavor to continue pursuing.	3/25/2022 1:28 PM
12	There was a lot to like: Talks by Marrongelle, Cosby, and Laursen; the panel on courses outside math depts.	3/25/2022 1:26 PM
13	Hearing so many perspectives.	3/25/2022 1:22 PM
14	Dealing with the most urgent issues in mathematics education.	3/25/2022 12:49 PM
15	I attended so little that it’s hard to say	3/25/2022 12:38 PM
16	The opportunity to speak with others about their change efforts and know that there is a growing community of mathematicians and education researchers wanting to make change to the introductory mathematics curriculum.	3/25/2022 12:31 PM
17	that it's hybrid, since it's impossible for me to attend in-person.	3/25/2022 12:09 PM
18	Ability to join remotely.	3/25/2022 12:02 PM
19	the people!	3/25/2022 12:02 PM
20	The content.	3/25/2022 11:26 AM
21	The speakers were excellent and came from a wide variety of backgrounds	3/25/2022 11:04 AM
22	Fantastic program of speakers and panels.	3/25/2022 11:00 AM
23	I liked the mix of presentation on the theory of organizational changes (along with governmental agencies and various professional societies goal of enacting change) and the practice (what's actually happening on the ground).	3/25/2022 10:45 AM
24	The hybrid option.	3/25/2022 10:13 AM
25	I learned a lot from the speakers - especially the action-oriented parts. I like to have specific ideas for how I can take action.	3/25/2022 10:05 AM
26	Opportunity to sit in a positive attitude after a difficult few covid semesters.	3/25/2022 10:00 AM
27	High quality of speakers	3/25/2022 9:48 AM

28	The speakers perspective and data were phenomenal. The speakers who are willing to stand up for students in the face of unyielding math departments. The data on the lost million being discouraged by that first year of college mathematics.	3/25/2022 9:38 AM
29	Karen Marrongelle's talk was informative in delineating the role of federal agencies.	3/25/2022 9:31 AM
30	Very informative	3/25/2022 9:25 AM
31	great talks and panels, the mic in a cube, pretty well done for a hybrid conference, the ability to participate remotely	3/25/2022 9:18 AM
32	Networking and research-heavy presentations	3/25/2022 8:00 AM
33	Many interesting presentations.	3/24/2022 6:57 PM
34	No comment, sorry. I'm just too tired.	3/24/2022 11:02 AM
35	Everybody was very pleasant and welcoming. I learned a tremendous amount from the talks.	3/23/2022 5:35 PM
36	The *in-person* talks and panels in the mornings, as well as the breaks so we can socialize and network with other participants. I also loved the breakout session at the end-of-the-day because it was very interactive and I got to meet participants with similar interests.	3/23/2022 2:25 PM
37	Meeting new people and hearing about so many new ideas.	3/23/2022 12:20 PM
38	Hearing new ideas and learning about new research in this area.	3/23/2022 8:38 AM
39	Learning about ways to impact my own department.	3/23/2022 6:08 AM
40	Hearing about changes in other schools.	3/23/2022 5:45 AM
41	The presentations	3/22/2022 10:45 PM
42	That I felt like I WAS THERE! This workshop was truly hybrid - the online participants had active chats going and many presenters were virtual. The best hybrid experience I've had (to date). Way to go organizers!	3/22/2022 10:22 PM
43	It seemed like there was a large diversity of speakers and topics.	3/22/2022 9:15 PM
44	The ideas were presented clearly by experts in the field.	3/22/2022 2:59 PM
45	High level but accessible thinking.	3/22/2022 2:16 PM
46	The opportunity to interact with others who are also passionate about institutional change. Most of the talks were fantastic.	3/22/2022 2:12 PM
47	The breadth of speakers	3/22/2022 12:28 PM
48	time to talk and ask questions	3/22/2022 11:41 AM
49	Examples of courses and curricula; learning that others in high places also want to burn the village down.	3/22/2022 11:11 AM
50	I would have liked to participate more fully, perhaps even in person, but circumstances did not allow it. I enjoyed the one talk I was able to attend.	3/22/2022 10:53 AM
51	The community - such great people.	3/22/2022 10:43 AM
52	The opportunity to hear from a range of participants and the collegial atmosphere.	3/22/2022 10:29 AM
53	The informal conversations in between sessions	3/22/2022 10:14 AM
54	it was accessible on Zoom	3/22/2022 10:11 AM
55	Everything.	3/22/2022 9:58 AM
56	Attending virtually was a great benefit to me.	3/22/2022 9:18 AM
57	The panel with professors from client disciplines.	3/22/2022 9:11 AM
58	I really enjoyed having speakers from very different background and institutions (including some STEM education researchers who are not necessarily focused on math).	3/22/2022 9:11 AM
59	I liked the interactive nature of the workshop and the thought put into the panels.	3/22/2022 8:06 AM

60	Meeting a few people who I will get in touch with later and insights about analyzing organizational structure.	3/21/2022 10:09 PM
61	It was nice to meet people from different institutions interested in similar topics.	3/21/2022 2:42 PM
62	I really liked Saundra Larson's talk and the other talk about theory of change. It think it really helps to put our work in context and helps one see that progress is begin made even if all changes are not implemented immediately.	3/21/2022 2:21 PM
63	I thought the sessions were very thought provoking!	3/21/2022 2:01 PM
64	this meeting brought together a lot of the heavy hitters in this field. I thoroughly enjoyed the conversations that we had.	3/21/2022 12:27 PM
65	N/A	3/21/2022 10:52 AM
66	I liked being in person. Also, it was nice to be in Berkeley so we could find different places to eat and socialize with other workshop attendees. I also loved all the talks and the variety of folx we got to hear from. I liked that it was a mix of things we could apply to research and teaching, as well as departmental change.	3/21/2022 8:42 AM
67	The topic and sessions	3/21/2022 7:29 AM
68	Sessions on critical issues in mathematics such as equity and diversity	3/20/2022 6:39 PM
69	The opening talks in the morning and panels	3/20/2022 5:30 PM
70	Presentations -- all that I attended were very good.	3/20/2022 3:16 PM
71	Getting to interact with colleagues for the first time in 2 years.	3/20/2022 12:21 PM
72	Sessions presented by people who have worked in the field, and good participants	3/20/2022 11:18 AM
73	The focus on Equity.	3/20/2022 8:33 AM
74	The size (number of participants, duration), the quality of the speakers, not needing to choose between parallel sessions, the location. I liked being on our own for meals so we could indulge in some of the great food that Berkeley has to offer.	3/20/2022 8:25 AM
75	The variety of angles, perspectives, presenters and topics.	3/19/2022 10:24 PM
76	The high caliber of the speakers and the great sense of community	3/19/2022 9:51 PM
77	All presenters have significant and important achievements which they described well	3/19/2022 5:12 PM
78	I appreciated the lack of parallel sessions...that only one session was parallel. We all had a shared experience of listening to the same talks and panels. The tech support was superb. Great location (Brower Center). I appreciate the snacks served also. I like checking for vaccines and negative covid tests....I felt very safe. Fantastic line-up of speakers. I felt engaged.	3/19/2022 2:45 PM
79	Attending the workshop gave me a glimpse into the discourse going on within the math education community.	3/19/2022 1:24 PM
80	Talk by Sandra Larsen, Gary Martin, Panel of Client disciplines, Estrella Johnson's talk, April Strom's, Marilyn Strutchens.	3/19/2022 12:30 PM
81	Community building with people of like minded interests; people's interests in getting to know students as well	3/19/2022 12:01 PM
82	I really liked the in-person, panel formats.	3/19/2022 9:43 AM
83	Students discussion	3/19/2022 9:07 AM
84	The variety of the presentations and how the connect with each other over the course of the conference.	3/19/2022 8:04 AM
85	I could learn lots of things about improving mathematics department.	3/19/2022 7:59 AM
86	Diverse perspectives of the presenters	3/19/2022 7:26 AM
87	The Style of the answering of question which divided into ways : 1. indirect via the author's. 2. In direct via chatting	3/19/2022 2:56 AM

88	The talks and panel discussions were so informative. I also liked the variety and diversity of all the speakers. I felt like equity and diversity are put into consideration in making the choice on speakers and it enhanced my appreciation of equity and diversity. As a black woman, I feel so inspired seeing other women especially black women in very impactful positions and making strong contributions to the issues under discussion.	3/19/2022 1:51 AM
89	Good conversation and fellowship with colleagues, meeting new folks. Appreciated the inclusion of grad students and younger scholars. Appreciated the story line that organizers crafted. Good diversity among speakers and panelists, compared to many math events. I got some ideas which will be valuable to me. Overall well worth attending.	3/18/2022 10:44 PM
90	I loved how wonderful the talks were. The speakers were engaging and interesting.	3/18/2022 8:01 PM
91	The session on "Client departments".	3/18/2022 7:34 PM
92	stories of success, accounting for the specifics of context.	3/18/2022 7:34 PM
93	.	3/18/2022 7:09 PM
94	I liked the virtual option.	3/18/2022 7:09 PM
95	MSRI staff are very helpful, this workshop increased my interest in mathematics education	3/18/2022 6:57 PM
96	being hybrid, great selection of speakers and topics and wonderfully structured in five modules.	3/18/2022 6:57 PM
97	Choice of presenters.	3/18/2022 6:47 PM
98	Organisation of the workshop and the technology used to deliver various talks ...	3/18/2022 6:31 PM
99	There was good positive energy.	3/18/2022 6:21 PM
100	The variety of topics presented was very beneficial.	3/18/2022 6:20 PM
101	The panels on Thursday morning.	3/18/2022 6:14 PM
102	Learning from folks that I haven't met before -- Missy Cosby, for example!	3/18/2022 6:01 PM
103	synthesis plenaries	3/18/2022 5:52 PM
104	Meeting great people!	3/18/2022 5:33 PM
105	The interactive portions and the accessibility of leaders in the field	3/18/2022 5:11 PM
106	The variety of topics	3/18/2022 5:10 PM
107	Great program with powerful speakers.	3/18/2022 4:59 PM
108	Themes	3/18/2022 4:59 PM
109	networking!	3/18/2022 4:58 PM
110	I liked the themes for each day, and how the workshops fit within the daily themes.	3/18/2022 4:57 PM
111	The community that is cultivated in the workshop.	3/18/2022 4:54 PM
112	Talk topics felt like the right level of theory and application	3/18/2022 4:45 PM
113	I appreciated the online option.	3/18/2022 4:30 PM

Q20 What did you like least about the workshop? How could it be improved?

Answered: 113 Skipped: 21

#	RESPONSES	DATE
1	The daily schedule was long!	4/12/2022 9:46 AM
2	This is silly, but not enough meat or poultry in the snacks for break.	3/30/2022 7:38 PM
3	I can't think of anything.	3/30/2022 12:53 PM
4	This was probably due to the hybrid nature, but it felt like three days of mostly lectures. I think more time was supposed to be available for conversation and Q&A, but it often didn't happen as such.	3/29/2022 7:06 AM
5	The Covid restrictions... which will hopefully not affect future meetings.	3/28/2022 7:35 AM
6	Would have been great to have some interactive workshops earlier on in the conference so people could exchange ideas	3/27/2022 6:34 AM
7	I struggled sometimes finding the application of some research to actually teaching on a classroom. I don’t know how to improve this	3/26/2022 8:52 PM
8	I was surprised at how frontal the sessions were.	3/26/2022 8:49 PM
9	It would have been interesting to see the full audience in the auditorium (at least briefly) for those attending by zoom.	3/25/2022 7:47 PM
10	more people of color involved	3/25/2022 2:13 PM
11	None	3/25/2022 1:28 PM
12	I didn't get a lot out of the session on theories of change. Some specific examples of such theories or their instantiations might have helped.	3/25/2022 1:26 PM
13	It was a very long two days, but I don't know that that can be changed. There is nothing I would cut out, and I wouldn't recommend spreading it out over more days.	3/25/2022 1:22 PM
14	As I already mentioned, the hybrid mode is not necessarily easier than the purely remote mode as a workshop, especially the interactions among the participants are encouraged.	3/25/2022 12:49 PM
15	I also couldn’t attend enough to have an opinion	3/25/2022 12:38 PM
16	There were too many "lectures" throughout the day. For a workshop focused on improving undergraduate education and changing the mode of instruction away from traditional lecture to more active forms of learning, it seemed ironic that we were just sitting and listening throughout most of the conference.	3/25/2022 12:31 PM
17	NA	3/25/2022 12:09 PM
18	Not being there in person	3/25/2022 12:02 PM
19	I wanted to talk about institutional change in the abstract at the end, but the sessions were about institutionalizing active learning. I've been doing active learning for decades and it's pretty well institutionalized already where I am	3/25/2022 12:02 PM
20	While the location was beautiful the first day, it was difficult to get to.	3/25/2022 11:26 AM
21	Not enough small group participation for online participants	3/25/2022 11:04 AM
22	Another breakout of parallel sessions on Day 2 would have helped. Towards the end of Day 2, it was difficult to stay focused.	3/25/2022 11:00 AM
23	Not really an area for improvement, but I participated virtually in an eastern timezone state, so several of the sessions went into the early evenings.	3/25/2022 10:45 AM

24	It would have been helpful to have the slides as their were presenting rather than afterwards.	3/25/2022 10:13 AM
25	I wish I could have been there in-person, but since I'm not local, the fact that it was broadcast meant that I could still participate - which I really appreciate, so I'm glad I had the opportunity. But I probably would have gotten more out of it if I had been there physically.	3/25/2022 10:05 AM
26	Nothing comes to mind at this time.	3/25/2022 10:00 AM
27	I Liked everything especially bc it was being free and online	3/25/2022 9:48 AM
28	The only thing to improve would be to maybe have an onsite tech person. The delays took time away that I could not get back.	3/25/2022 9:38 AM
29	I realize it is difficult to run hybrid sessions and I appreciate the efforts of the organizers and speakers. However, the online audience sometimes seemed to be an afterthought, as when we were told on the first day -- after the in-person participants were asked to "think-pair-share" with their neighbor -- that we should just find someone via the chat with whom to do the same. This is not so easy in an online context! Some of the first-day moderator's informal comments, like saying at the end of formal sessions that participants would move on to a reception, without acknowledging that the online audience couldn't do so, also led to a sense that the online audience hadn't been integrated into the conference planning. This is not a criticism so much as encouragement to explore ways of creating truly inclusive hybrid conference environments.	3/25/2022 9:31 AM
30	None that I can think of.	3/25/2022 9:25 AM
31	wish we had access to Sandra Laursen's slides	3/25/2022 9:18 AM
32	N/A	3/25/2022 8:00 AM
33	Need more time for interaction. The second day (Thursday) had too many presentations.	3/24/2022 6:57 PM
34	Same thing, too tired.	3/24/2022 11:02 AM
35	It was quite overwhelming and the days were long. On Thursday, I was pretty much mentally done before the last panel, and that panel was fully virtual -- so for me it was very hard to pay attention to all the speakers. It went really long, too. On Friday, the last thing was the breakout sessions which for me was one of the highlights of the conference and extremely useful. It might have been a good idea to have breakout sessions both evenings (with the same people running them, but then we could listen to more than one person).	3/23/2022 5:35 PM
36	I wish we had shorter, more frequent breaks. One 30 minute break seemed like too long, and not having a break in between two talks/panels was mentally draining. I also wish we had more time to work in breakout sessions to develop any short-term and long-term action plans that we can bring back to our home institutions, as well as have deeper discussions about various concerns/issues with the people in our groups.	3/23/2022 2:25 PM
37	If anything I would have like a little more time to meet the participants and chat.	3/23/2022 12:20 PM
38	The workshop needed more sessions where conference participants could engage with one another. It is ironic that a workshop about departmental change and using evidence based instructional practices (i.e. active learning) did not include these elements in it.	3/23/2022 8:38 AM
39	NA	3/23/2022 6:08 AM
40	In the parallel session on Sunday, there were multiple groups in the same room which made it difficult to hear the group I was trying to follow.	3/23/2022 5:45 AM
41	Fewer panel discussions	3/22/2022 10:45 PM
42	Math education has a long way to go.	3/22/2022 10:22 PM
43	N/A	3/22/2022 9:15 PM
44	The workshop was mostly passive.	3/22/2022 2:59 PM
45	I couldn't attend most of it due to conflicts. Hoping there will be recordings of the sessions that would be meaningful that way.	3/22/2022 2:16 PM
46	Each day was very long. An extra day or a few more shorter breaks to not be sitting in one place so much. I would have appreciated a few more opportunities for informal conversations.	3/22/2022 2:12 PM

47	Weekdays are hard, would prefer Thu-Sat	3/22/2022 12:28 PM
48	nothing	3/22/2022 11:41 AM
49	I'm not interested in theory.	3/22/2022 11:11 AM
50	see above	3/22/2022 10:53 AM
51	It was hard to apply some of the theory about making changes to my situation. Also - Thursday was way too long.	3/22/2022 10:43 AM
52	The hybrid format made it challenging to connect with those online. However the organizers made good efforts to include those online and I don't have suggestions for improvement.	3/22/2022 10:29 AM
53	Many of the sessions were not very interactive. More "turn to your neighbor" moments or other structured interactions would have been great. Also, getting us to move around the room (instead of sitting next to the same people every session) would have been good. When I run sessions, I try to abide by the 10 Minute Talk Test - at no point should participants be sitting passively listening for more than 10 minutes straight. Many sessions failed this test.	3/22/2022 10:14 AM
54	nothing	3/22/2022 10:11 AM
55	I don't have.	3/22/2022 9:58 AM
56	Would have liked a bit more description of each session in advance. But this is primarily due to attending virtually and needing to make choices.	3/22/2022 9:18 AM
57	N/A	3/22/2022 9:11 AM
58	Having abstract available. On the website, I could only find the title of some talks, and it was sometimes hard to decide if this was a talk I was interested in or not.	3/22/2022 9:11 AM
59	I wish I had been able to attend in person.	3/22/2022 8:06 AM
60	What I think is the misplaced analysis of how to move the needle for marginalized groups. There seems to be too much wishful thinking and post modern analysis and too little careful thinking about details effective teaching. The goal of bringing "active learning" to all introductory classes avoided any discussion of what problems are best for group learning and how to handle problems that can arise in expecting students to work in groups.	3/21/2022 10:09 PM
61	It would be nice to have more hands-on activities.	3/21/2022 2:42 PM
62	I would have appreciated if recordings could have been available right away. Being on EST, I was hoping to watch recordings of the Thursday afternoon sessions on friday morning but they were not available.	3/21/2022 2:21 PM
63	I wish there was more time built within the schedule for discussion about sessions/time to share ideas with others.	3/21/2022 2:01 PM
64	The thing I liked the least was how the conference conflicted with my schedule this year. I would have liked to attend more the meeting.	3/21/2022 12:27 PM
65	N/A	3/21/2022 10:52 AM
66	I thought it was a bit too long to sit through talks. They could have been more interactive or had scheduled times for small group action items. I guess it felt more like passive learning as a participant rather than enough active learning.	3/21/2022 8:42 AM
67	I would have appreciated more interactive sessions; there was a lot of sitting/listening	3/21/2022 7:29 AM
68	I enjoyed all that I attended	3/20/2022 6:39 PM
69	Talks that were 1.5 hours long. I found it difficult to pay attention for more than 50 min, and I would have preferred speakers to make their 1.5 hour long talks more interactive with an audience activity or audience participation.	3/20/2022 5:30 PM
70	Second-class citizen / after-thought / marginalized situation for online participants.	3/20/2022 3:16 PM
71	More small group break out sessions. You can only get so much from one hour talks.	3/20/2022 12:21 PM
72	The time frame was very short. I had to miss the second day of the workshop since it was too expensive to travel over the weekend. Thus, I ended up missing the second day of sessions -	3/20/2022 11:18 AM

	several important persons that I owuld have liked to hear from. I really would have liked to have been there in person for the entire workshop.	
73	The lack of opportunity to collaborate with others due to the remote environment.	3/20/2022 8:33 AM
74	It seemed like the virtual attendance option and schedule were announced later than the workshop dates (my apologies if that was not the case). In hindsight I'm very happy that I attended in person and arrived a day early, but technically my employer could give me a hard time about not minimizing expenses as much as possible.	3/20/2022 8:25 AM
75	n/a	3/19/2022 10:24 PM
76	Please make the names on the name tags bigger!	3/19/2022 9:51 PM
77	The material came very quickly and it take time to process the key ideas and understand them. I'm glad the videos will be available. It would be great is speakers slides/references could also be made available.	3/19/2022 5:12 PM
78	I know when a talk starts late it's enticing to go late but I would rather cut short the Q&A time (since we can never get to everyone's questions anyway) and try to get back to the normal schedule as much as possible. Sitting for long periods of time is difficult, and those 30 minutes breaks are invaluable for the pauses they give us, plus the time to network and connect.	3/19/2022 2:45 PM
79	Unfortunately, the workshop did not include input from research mathematicians and/or engineers and physicists (whose courses need a basic background in mathematics).	3/19/2022 1:24 PM
80	The last breakout event didnt go well for me. I was leading a small session with a large group in the same room. Messed up with zoom. Kind of a mess. Generally I think there was too much packed in. I didnt actually talk with other in depth.	3/19/2022 12:30 PM
81	P	3/19/2022 12:01 PM
82	Online presentations that goes beyond 20 min. can be difficult to focus.	3/19/2022 9:43 AM
83	NA	3/19/2022 9:07 AM
84	It would have been great for some of the presentations to be more workshop style, with active learning and smaller group discussion. It would also have been nice to have been ‘mixed up’ a little bit more intentionally (creating groups randomly, or even more frequently by topic). In the past, there has been more representation of math teacher educators and K-12 teachers. This perspective was missing.	3/19/2022 8:04 AM
85	I didn’t have much time to engage with other participants and speakers. We may improve this in the next workshop.	3/19/2022 7:59 AM
86	The meeting place. The seats were very uncomfortable. Also, the program is a bit too long.	3/19/2022 7:26 AM
87	Nothing. It is nice for everything.	3/19/2022 2:56 AM
88	Wish we had supper in common	3/19/2022 1:51 AM
89	-It was a lot of talking. I would have liked a sprinkle of some more active ways to participate and more small group exchange. The change agent sessions at the end were a welcome change of pace AND they were interesting and useful. - Seems like the same people asked questions, sometimes kinda off the wall: what approaches might generate more audience participation? (one I have seen used to good effect: come up with a question for the panel or speaker, discuss in a group of 3 and pick the best one to ask)	3/18/2022 10:44 PM
90	I did not like that there were not faculty from HBCUs.	3/18/2022 8:01 PM
91	Very few group sessions. Little to no rigorous statistical analysis of data. Too much anecdotal and statistically insignificant evidence. Lack of opposing POVs. Lack of industry input.	3/18/2022 7:34 PM
92	i think sharing the metrics that people have used to gauge success; as well as the attempts made by hostile voices to prevent implementation measures, to dismiss successes, or treat them as failures.	3/18/2022 7:34 PM
93	.	3/18/2022 7:09 PM
94	It would be nice if the sessions were recorded, and posted later. At least maybe for those	3/18/2022 7:09 PM

	registered.	
95	Nothing	3/18/2022 6:57 PM
96	no scheduled breaks.	3/18/2022 6:57 PM
97	Time of sessions - this is understandably difficult for a hybrid/virtual meeting.	3/18/2022 6:47 PM
98	As being a non US Citizen I was not given any financial assistant to attend this worksop on all days. As on each day I need to travel 2 hours each way from my place of residence to the venue to attend the lectures. Because of this I missed the first two lectures in the morning and the last lecture in the evening. Hence in future all the participants may be given at least an accommodation to the participants.	3/18/2022 6:31 PM
99	The days were very long.	3/18/2022 6:21 PM
100	N/A	3/18/2022 6:20 PM
101	I did not like on online panel that occurred late Thursday. I thought that the panelist spoke to long and did not have good visuals to help with the discuss.	3/18/2022 6:14 PM
102	Nothing! It was great! Well-planned and well-executed!	3/18/2022 6:01 PM
103	small group discussions hybrid with multiple speakers in the same room	3/18/2022 5:52 PM
104	Too many meetings and not enough free time.	3/18/2022 5:33 PM
105	I didn't like sitting for the extended periods of time. I think that might be more personal though because I've been doing more sitting during this pandemic than before.	3/18/2022 5:11 PM
106	The PL session on Thursday afternoon (the one with the zoom panel) lacked focus. The programs described were interesting but I'm not sure what the point of the session was.	3/18/2022 5:10 PM
107	None	3/18/2022 4:59 PM
108	More need for interactive sessions	3/18/2022 4:59 PM
109	could be spread out over more days. >8am to 6pm+ long days!!	3/18/2022 4:58 PM
110	n/a	3/18/2022 4:57 PM
111	The seating is pretty small, so having more breaks to stretch would be really nice.	3/18/2022 4:54 PM
112	Attending virtually, it was hard to see the speaker and their slides in the same screen. Would be helpful if those were separated in the future.	3/18/2022 4:45 PM
113	Overall, I felt like the speakers took a long time to say very little. I would have appreciated if talks were more directed and concise with concrete data and suggestions for change.	3/18/2022 4:30 PM

Q21 What else would you like to say about the workshop or how it might be improved (perhaps about the content, organization, venue, logistics, schedule, interactions with organizers or MSRI staff, etc.)?

Answered: 56 Skipped: 78

#	RESPONSES	DATE
1	Not enough time between being notified of funding and the workshop. Tickets were particularly expensive.	3/30/2022 7:38 PM
2	I thought everyone did a fantastic job, I would just find ways to better adhere to times for presentations so there would be plenty of dialogue.	3/29/2022 7:06 AM
3	Workshop seemed very well done!	3/28/2022 7:35 AM
4	I loved the schedule including the timing and breaks and don't have other suggestions.	3/25/2022 1:28 PM
5	I very much appreciated the chance to participate remotely even if it's not as beneficial as attending in person. If remote participation remains an option for future workshops, I suggest having some breakout sessions as was done at last year's CIME workshop.	3/25/2022 1:26 PM
6	I think more people would have benefited from "working groups" or some structure that would have allowed them to brainstorm different ideas about how they can make changes in their own departments.	3/25/2022 12:31 PM
7	For my first MSRI and CIME workshop, I was impressed with all facets of the program. I will certainly keep an eye on other CIME workshops going forward.	3/25/2022 11:00 AM
8	Presentations and other materials already on the CIME page.	3/25/2022 10:13 AM
9	Thank you	3/25/2022 9:48 AM
10	It was really good. I wished I could have attended more, but could not due to my teaching schedule. I would like to know how to get on the list for upcoming events. I found out about this one only 1 week prior.	3/25/2022 9:38 AM
11	Thanks so much for organizing this meeting! It's heartening to see attention being paid to structural institutional change, rather than piecemeal individual efforts.	3/25/2022 9:31 AM
12	The chat in the virtual sessions was very helpful but as an in-person participant, I could not see it. Some people from my university attended virtually and they were great about pulling links that were added to the chat, so I have all those. If we didn't have friends doing that, I would have missed some very helpful information, unless you all are planning to send out the chat transcripts later, or some such thing. I think that this should be planned for and announced ahead of time! Otherwise, fantastic place, really great.	3/23/2022 5:35 PM
13	They were very full days, which I appreciated, but I'm also glad they didn't go any longer than scheduled.	3/23/2022 12:20 PM
14	The Brower Center was great, but the stadium style seating didn't allow us to talk with other people around us easily.	3/23/2022 8:38 AM
15	Want to see people from the disciplines the mathematics departments serve.	3/22/2022 10:45 PM
16	n/a	3/22/2022 9:15 PM
17	More active learning opportunities. Other than that, this was remarkably well run and jam-packed with useful ideas and interactions.	3/22/2022 2:59 PM
18	Berkley is great!	3/22/2022 10:43 AM
19	I am very appreciative of the organizers and staff who enabled us to meet in person while feeling safe. The schedule was very tight; perhaps some additional breaks or downtime would have enabled more informal conversations.	3/22/2022 10:29 AM

20	Staff was great - everything was incredibly smooth. That's notable, given the hybrid nature of the conference.	3/22/2022 10:14 AM
21	Please keep offering an hybrid option when possible! Lots of folks in teaching position have very little or no travel budget from their institution, and the time might conflict with a time when they are teaching (and they cannot necessarily ask someone else to sub for them, this can be seen fairly negatively by their department depending on their role). It allowed me to attend several talks, and I could not have joined at all in person.	3/22/2022 9:11 AM
22	I prefer the facilities at MSRI over those at the Brower Center. MSRI staff handled the whole workshop extremely well. Kudos to them.	3/21/2022 10:09 PM
23	I would encourage CIME to continue the option to attend virtually for those without funding to travel in person to the conference.	3/21/2022 2:21 PM
24	I can't wait to watch the videos. I missed so much of the workshop but I am thankful that I can watch it at my leisure now.	3/21/2022 12:27 PM
25	I loved the organization of it and the schedule. It worked perfectly for me.	3/21/2022 8:42 AM
26	Having a facility that would allow more concurrent breakout sessions (so each could be in their own room) would have been helpful	3/21/2022 7:29 AM
27	Thank you for funding my trip and for a wonderful workshop!!	3/20/2022 5:30 PM
28	MSRI staff is fabulous.	3/20/2022 12:21 PM
29	The timing of the workshop coincided with my spring break which was perfect. But, a slightly longer workshop with some informal interactions (like around meals - even like sandwiches and soup luncheons) would definitely offer more scope for productive conversations.	3/20/2022 11:18 AM
30	I just want to say that I was very impressed by how smoothly you conducted a hybrid meeting. Conversations between people in the auditorium and on Zoom and presentations made over Zoom were always easy to hear, visual aids were used effectively, etc. Nice work!	3/20/2022 8:25 AM
31	n/a	3/19/2022 10:24 PM
32	nothing else. grateful for the opportunity to participate in this workshop!	3/19/2022 9:51 PM
33	Overall, the workshop worked very well. The Brouwer center was convenient to the hotel and breaks provided useful social time.	3/19/2022 5:12 PM
34	It would be more appropriate for a workshop to be more balanced by including other voices.	3/19/2022 1:24 PM
35	Dont put two breakouts in one room.	3/19/2022 12:30 PM
36	It would be nice to have a group outing so that we can interact more intimately. Also, I very much prefer the MSRI facility over the downtown location.	3/19/2022 9:43 AM
37	It would be great if the names on the name tags were larger and the conference name was abbreviated. As a virtual attendee on one day, I really appreciated having the option and it would have been great to have some designated time to network in breakout rooms as well.	3/19/2022 8:04 AM
38	We may need to add the topics about recruitment, retention, and graduation rates. I believed these topics are urgent to address, because the number of underrepresented mathematics students is decreasing.	3/19/2022 7:59 AM
39	The funding is very appreciated.	3/19/2022 7:26 AM
40	I would like for the next copy sill open two way which are remote and physical presenting.	3/19/2022 2:56 AM
41	Thank you so much for this great opportunity. Given the chance, I'll definitely like to come again.	3/19/2022 1:51 AM
42	- I am totally OK not being bombarded with emails but this seemed almost extremely avoidant of information to participants, perhaps especially because it was a first venture out of home-based COVID routines for many of us (as I understand from informal conversations). Maybe send a note when there is a major update to the website/program? - I appreciated the carefulness of the meeting policies re COVID and people's generally good compliance with these, other than a few people who routinely had saggy masks. However I hunted for information on the website as to what constituted proof of a negative COVID test - did I need	3/18/2022 10:44 PM

	to pay for a certified rapid test? -high quality snacks and breaks. Loved that we got to use lovely outdoor spaces.	
43	In today's world, there is simply no point in having talks and lectures when these can be recorded and played at your own leisure. The workshops should focus entirely on group discussions and brainstorming sessions.	3/18/2022 7:34 PM
44	.	3/18/2022 7:09 PM
45	Many thanks to the MSRI staff and the organizers - what a wonderful effort!!	3/18/2022 6:57 PM
46	Interactions with MSRI staff was excellent. Had a good interaction with fellow participants also	3/18/2022 6:31 PM
47	Nothing	3/18/2022 6:21 PM
48	Overall, I think the workshop did what it was intended to do. I think that most of the sessions met the intended goals. I think that more of the overall committee should be invited to the conference.	3/18/2022 6:14 PM
49	This workshop was superbly planned. I learned something from each session. There was a variety of speakers and while their presentation focused on different aspects of change, the messaging was consistent! Well done!	3/18/2022 6:01 PM
50	The venue and everything was beautiful. Thank you so much!	3/18/2022 5:33 PM
51	N/A	3/18/2022 5:11 PM
52	None come to mind.	3/18/2022 4:59 PM
53	Thank you	3/18/2022 4:59 PM
54	neat idea having it at the center downtown near housing	3/18/2022 4:58 PM
55	I loved how it was hybrid. You all facilitated that wonderfully. I think the planning committee did an amazing job of providing diversity of speakers, workshops, and ideas.	3/18/2022 4:57 PM
56	I did not like that the breakout sessions had more than one group in the same room. Zoom folks couldn't hear and some virtual participants even left our meeting because they couldn't hear. Or at least provide better equipment (mics?)	3/18/2022 4:54 PM

[Virtual] Hot Topics: Regularity Theory for Minimal Surfaces and Mean Curvature Flow

March 21 – March 24, 2022

Hybrid Workshop

Organizers:

Christine Breiner (Brown University)

Otis Chodosh (Stanford University)

Luca Spolaor (University of California, San Diego)

Lu Wang (Yale University)

REPORT ON THE MSRI WORKSHOP
"Hot Topics: Regularity Theory for Minimal Surfaces and Mean Curvature Flow (Virtual Workshop)"
March 21 – March 24, 2022

Organizers

- Christine Breiner (Brown University)
- Otis Chodosh (Stanford University)
- Luca Spolaor (University of California, San Diego)
- Lu Wang (Yale University)

Scientific Description

This workshop explored connections between the regularity theory of minimal surfaces and of mean curvature flow. Recent breakthroughs have improved our understanding of singularity formation in both settings but the current research trends are becoming increasingly disparate. Experts from both areas presented their research and there was ample free time to establish connections between the topics.

Highlights of the Workshop

The talks covered new and exciting work related to minimal surfaces and mean curvature flow.

For minimal surfaces, Xin Zhou reported on exciting progress towards understanding multiplicity in min-max, requiring a delicate analysis of degeneration of minimal surfaces. Chao Li described work on the regularity (at the boundary) of free boundary surfaces in polyhedral domains, an old topic in minimal surface theory that has recently found new geometric applications. Zihui Zhao reported on progress towards understanding the boundary regularity for area-minimizing minimal surfaces in higher codimension. Antoine Song described new work related to minimizing area in infinite codimension, and explained how this could be related to geometrization via mean curvature flow in this setting. Nick Edelen explained how stable/bounded index hypersurfaces can degenerate in the first dimension where singularities can occur. Connor Mooney described new examples and counterexamples for the special Lagrangian equation. These talks represent a diverse take on the study of the regularity theory for minimal surfaces, and we feel that the most prominent trends in the field were well represented.

There were also several talks about problems related to minimal surfaces, including one by Bozhidar Velichkov on free boundary problems and a talk by Ling Xiao on constant mean curvature surfaces in Minkowski space.

The mean curvature flow side was also well represented, with Panagiota Daskalopoulos describing new work classifying Type II singularity models, Natasa Sesum describing the space of singularity models of mean curvature flow, and Brian White describing new classification and existence results for translators. Felix Schulze described new work on Lagrangian mean curvature flow and

Toby Colding explained new tools to handle gauge problems in the analysis of singularities in flows. Jonathan Zhu described new methods to derive explicit Łojasiewicz inequalities in mean curvature flow and Ricci flow. Davi Maximo described an exciting application of mean curvature flow to the study of positive scalar curvature.

As we hoped, this workshop brought together these two groups and encouraged them to think about the relationships between their topics of interest. Although the workshop was held online, a successful use of the gathertown software allowed us to encourage individual conversations during breaks. Several attendees expressed their enjoyment of the workshop and we feel that it was a big success. Based on our informal interactions with the attendees (in gathertown) it seems that many students and young researchers listened to the talks and gained some understanding of both topics, as well as the relationship between them.

Organizers		
First Name	**Last Name**	**Institution**
Christine	Breiner	Brown University
Otis	Chodosh	Stanford University
Luca	Spolaor	University of California, San Diego
Lu	Wang	Yale University
Speakers		
First Name	**Last Name**	**Institution**
Tobias	Colding	Massachusetts Institute of Technology
Panagiota	Daskalopoulos	Columbia University
Guido	De Philippis	Hausdorff Research Institute for Mathematics, University of Bonn
Nick	Edelen	University of Notre Dame
Daniel	Ketover	Imperial College, London
Chao	Li	
Davi	Maximo	University of Pennsylvania
Connor	Mooney	University of California, Irvine
Felix	Schulze	University of Warwick
Natasa	Sesum	Rutgers University
Antoine	Song	University of California, Berkeley
Bozhidar	Velichkov	Università di Pisa
Brian	White	Stanford University
Ling	Xiao	University of Connecticut
Zihui	Zhao	University of Chicago
Xin	Zhou	Cornell University
Jonathan	Zhu	Princeton University

Mathematical Sciences Research Institute

Hot Topics: Regularity Theory for Minimal Surfaces and Mean Curvature Flow [Virtual Workshop]

March 21 to March 24, 2022

Monday, March 21		
07:55 AM - 08:00 AM		Welcome
08:00 AM - 08:45 AM	Tobias Colding	Singularities and Diffeomorphisms
09:00 AM - 09:45 AM	Nick Edelen	Degeneration of 7-Dimensional Minimal Hypersurfaces with Bounded Index
10:15 AM - 11:00 AM	Xin Zhou	Min-Max Minimal Hypersurfaces with Higher Multiplicity
11:00 AM - 11:45 AM	Chao Li	Regularity of Free Boundary Minimal Surfaces in Locally Polyhedral Bomains

Tuesday, March 22		
08:00 AM - 08:45 AM	Bozhidar Velichkov	Free Boundary Clusters with Two Phases
09:00 AM - 09:45 AM	Jonathan Zhu	Explicit Łojasiewicz Inequalities for Shrinking Solitons
10:15 AM - 11:00 AM	Panagiota Daskalopoulos	Type II Smoothing in Mean Curvature Flow
11:00 AM - 11:45 AM	Zihui Zhao	Boundary Regularity of Area-Minimizing Currents: a Linear Model with Analytic Interface

Wednesday, March 23		
08:00 AM - 08:45 AM	Antoine Song	The Spherical Plateau Problem
09:00 AM - 09:45 AM	Felix Schulze	Ancient Solutions and Translators in Lagrangian Mean Curvature Flow
10:15 AM - 11:00 AM	Connor Mooney	Some Regularity Questions for the Special Lagrangian Equation
11:00 AM - 11:45 AM	Davi Maximo	The Waist Inequality and Positive Scalar Curvature

Thursday, March 24		
08:00 AM - 08:45 AM	Ling Xiao	Entire Spacelike Hypersurfaces with Constant Curvature in Minkowski Space
09:00 AM - 09:45 AM	Natasa Sesum	The Space of Convex Ancient Solutions to Mean Curvature Flow
10:15 AM - 11:00 AM	Brian White	Translators for Mean Curvature Flow

Participants

First Name	Last Name	Institution
Mohd Almie	Alias	Universiti Kebangsaan Malaysia
Robert	Argus	University of Wisconsin-Madison
Pol	Arranz-Gibert	University of Barcelona
Shrey	Aryan	ETH Zürich
Aidan	Backus	Brown University
Olajuwon	Bakai Ishola	Federal University of Agriculture Abeokuta Nigeria
Hélène	Barcelo	MSRI - Mathematical Sciences Research Institute
Arunima	Bhattacharya	University of Washington
Sandipan	Bhattacherjee	Birla Institute of Technology, Mesra, Ranchi, India
Animesh	Biswas	University of Nebraska
Evans	Boadi	Brock University
Melkana	Brakalova	Fordham University
Christine	Breiner	Brown University
Paul	Bryan	Macquarie University
Gianmarco	Caldini	Università di Trento
Yasser	Chamaoui	Université Libre de Bruxelles
Letian	Chen	Johns Hopkins University
Shuli	Chen	Stanford University
Yifan	Chen	University of California, Berkeley
Otis	Chodosh	Stanford University
Kyeongsu	Choi	Korea Institute for Advanced Study (KIAS)
Tobias	Colding	Massachusetts Institute of Technology
Santiago	Cordero Misteli	Stony Brook University
Jarbas	Dantas da Silva	Universidade Federal de Pernambuco
Panagiota	Daskalopoulos	Columbia University
Guido	De Philippis	Hausdorff Research Institute for Mathematics, University of Bonn
Roberto	de Santana Araujo	Westfälische Wilhelms-Universität Münster
Latifa	Debbi	National Polytechnic School, Algiers, Algeria
Stefano	Decio	Norwegian University of Science and Technology (NTNU)
Qi	Ding	Shanghai Center for Mathematical Sciences
Nick	Edelen	University of Notre Dame
Saleh	Elmohamed	University of California, Berkeley
Waqas	Faridi	University of Management and Technology Lahore
Ian	Fleschler	Princeton University
Giada	Franz	ETH Zürich
Ailana	Fraser	University of British Columbia
Xin	Fu	University of California, Irvine
Padi	Fuster Aguilera	University of Colorado
Fekadu Tolessa	Gedefa	Eötvös Loránd University
Promit	Ghosal	Massachusetts Institute of Technology
Bo	Guan	Ohio State University
Yifan	Guo	University of California, Irvine
Siming	He	Duke University
Zheng	Huang	CUNY, Graduate Center
Kukkeprasanna	J	Bengaluru City University
Yu	Jinchao	Liaoning University
Divya	Joseph Kayyunnapara	Unaffiliated
Aram	Karakhanyan	University of Edinburgh
Changho	Keem	Seoul National University
Aaron	Kennon	University of California, Santa Barbara
Daniel	Ketover	Imperial College, London
Anna	Kis	University of Waterloo
Dan	Knopf	University of Texas, Austin
Dongyeong	Ko	Rutgers University
Marilyn	Koshlap	City College of San Francisco
Yi	Lai	Stanford University
Sajjad	Lakzian	Isfahan University of Technology
Therese	Landry	University of California, Riverside
Jorge	Lauret	Universidad Nacional de Cordoba
Carlos	León	National University of Colombia

Participants

First Name	Last Name	Institution
Tang-Kai	Lee	Massachusetts Institute of Technology
Eunjoo	Lee	Soongsil University
Yangyang	Li	Princeton University
Chao	Li	
Peter	Lin	State University of New York, Stony Brook
Max	Lipton	Cornell University
Junyu	Ma	University of Pennsylvania
Martin	Magid	Wellesley College
Francisco	Martin	University of Granada
Jared	Marx-Kuo	Stanford University
Davi	Maximo	University of Pennsylvania
Halima	Meddour	University Batna 2
Jiri	Minarcik	Czech Technical University in Prague
Paul	Minter	University of Cambridge
Rodrigo	Montes	Federal University of Paraná
Connor	Mooney	University of California, Irvine
Frank	Morgan	Williams College
Ameth	Ndiaye	Faculté des Sciences et Technologies de L'éducation et de la Formation (FASTEF)
Manh Tien	Nguyen	Université Libre de Bruxelles
Gongping	Niu	University of California, San Diego
Peter	Olanipekun	Monash University
Jiewon	Park	Yale University
Sathyanarayanan	Rengaswami	University of Tennessee
Fabio	Ricci	University of California, Santa Barbara
Jorge	Robinson Arrieta	University of Arkansas
John	Ross	Southwestern University
Antônio	Sá Barreto	Purdue University
Dido	Salazar	The Aerospace Corporation
Lorenzo	Sarnataro	Princeton University
Felix	Schulze	University of Warwick
Natasa	Sesum	Rutgers University
Yuanzhen	Shao	University of Alabama
Zhongwei	Shen	University of Kentucky
Eric	Silva	Princeton University
Anna	Skorobogatova	Princeton University
Arjun	Sobnack	University of Warwick
Antoine	Song	University of California, Berkeley
Luca	Spolaor	University of California, San Diego
Daniela	Stauber	National University of Cordoba
Douglas	Stryker	Princeton University
Hunter	Stufflebeam	University of Pennsylvania
Qi	Sun	University of Wisconsin-Madison
Durvudkhan	Suragan	Nazarbayev University
Zhongkai	Tao	University of California, Berkeley
Bankteshwar	Tiwari	Banaras Hindu University
Tatiana	Toro	University of Washington
Tin Yau	Tsang	University of California, Irvine
Malik	Tuerkoen	University of California, Santa Barbara
Hannes	Uecker	Universität Oldenburg
Bozhidar	Velichkov	Università di Pisa
Jose Antonio	Villa Morales	UNAM - Universidad Nacional Autonoma de Mexico
John	Villavert	University of Texas Rio Grande Valley
Lu	Wang	Yale University
Zhihan	Wang	Princeton University
Xiaokang	Wang	University of California, Irvine
Bojue	Wang	Rutgers University
Guofang	Wei	University of California, Santa Barbara
Daniel	Weser	University of Texas, Austin
Brian	White	Stanford University
Haotian	Wu	University of Sydney

Participants		
First Name	**Last Name**	**Institution**
Yujie	Wu	Stanford University
Yusen	Xia	University of California, Santa Barbara
Ling	Xiao	University of Connecticut
Xiangjin	Xu	Binghamton University (SUNY)
Ruocheng	Yang	University of Wisconsin-Madison
Lingxiao	Zhang	University of Wisconsin-Madison
Junsheng	Zhang	University of California, Berkeley
Zihui	Zhao	University of Chicago
Xinrui	Zhao	MIT
Xin	Zhou	Cornell University
Hengyu	Zhou	Chongqing University
Bo	Zhu	University of Minnesota
Jonathan	Zhu	Princeton University

Identifiable Participants' Information

Participants		133

Gender		133
Male	72.18%	96
Female	22.56%	30
Other	0.00%	0
Declined to state	5.26%	7

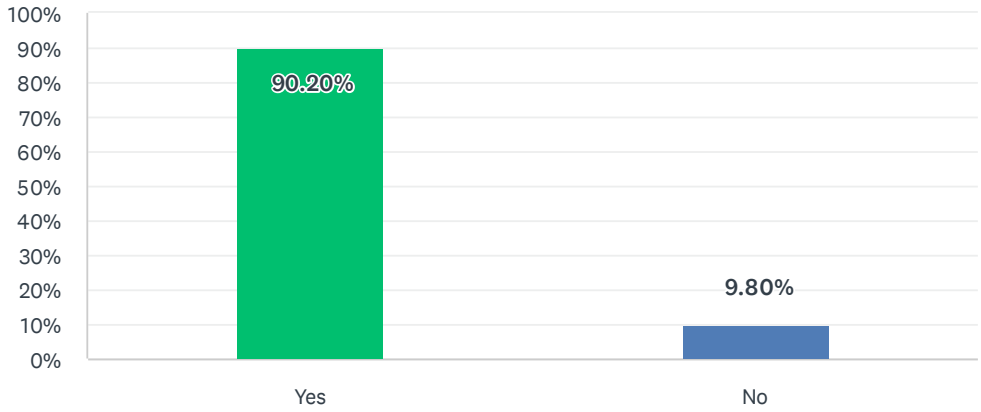
Ethnicity*		152
White	30.26%	46
Asian	40.79%	62
Hispanic	9.87%	15
Pacific Islander	0.66%	1
Black	3.29%	5
Native American	0.00%	0
Mixed	5.92%	9
Declined to state	9.21%	14

* ethnicity specifications are not exclusive

There were 2 unidentifiable participants.

Q1 Did you attend the virtual workshop?

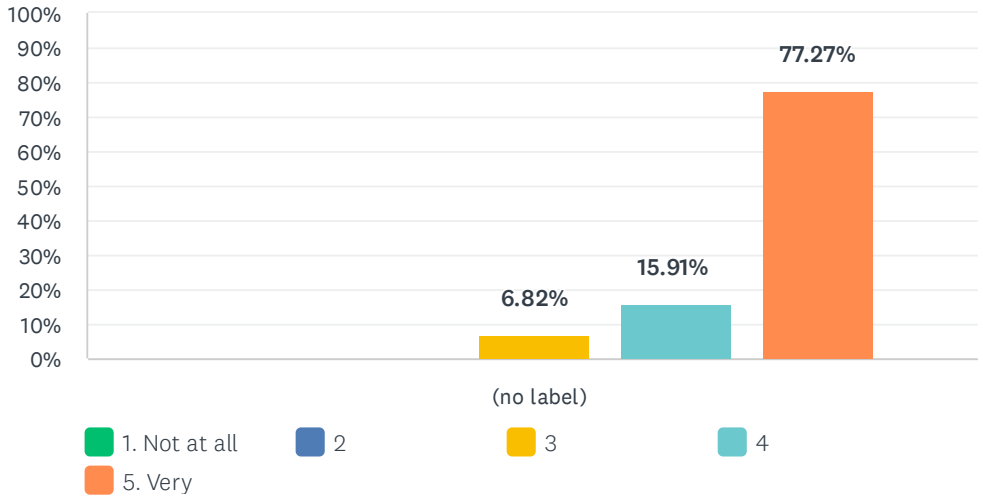
Answered: 51 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	90.20%	46
No	9.80%	5
TOTAL		51

Q2 The workshop was intellectually stimulating

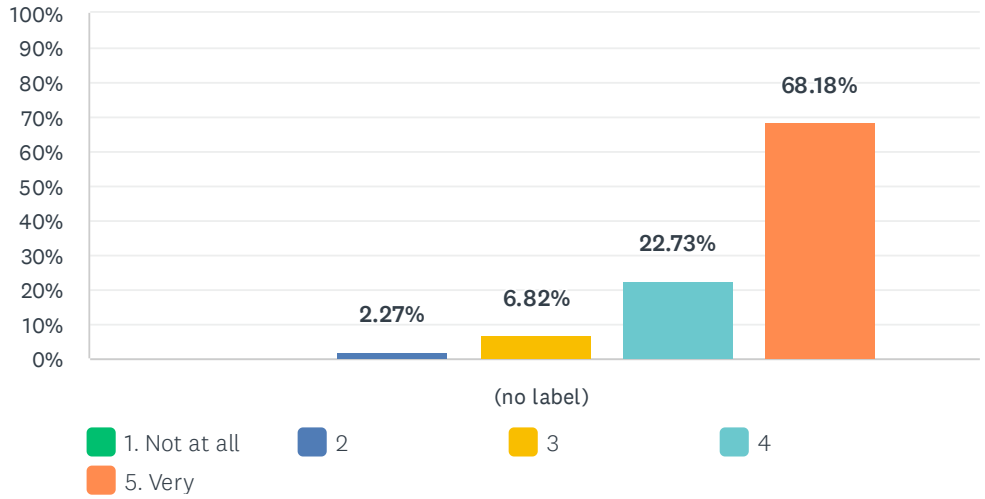
Answered: 44 Skipped: 7



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	6.82% 3	15.91% 7	77.27% 34	44	4.70

Q3 The overall experience of the workshop was worthwhile

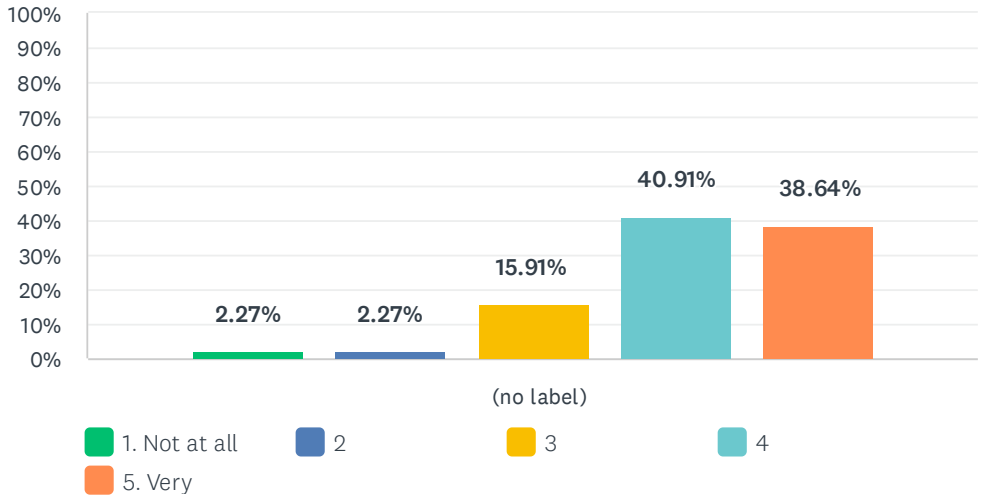
Answered: 44 Skipped: 7



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.27% 1	6.82% 3	22.73% 10	68.18% 30	44	4.57

Q4 I was well prepared to benefit from the lectures

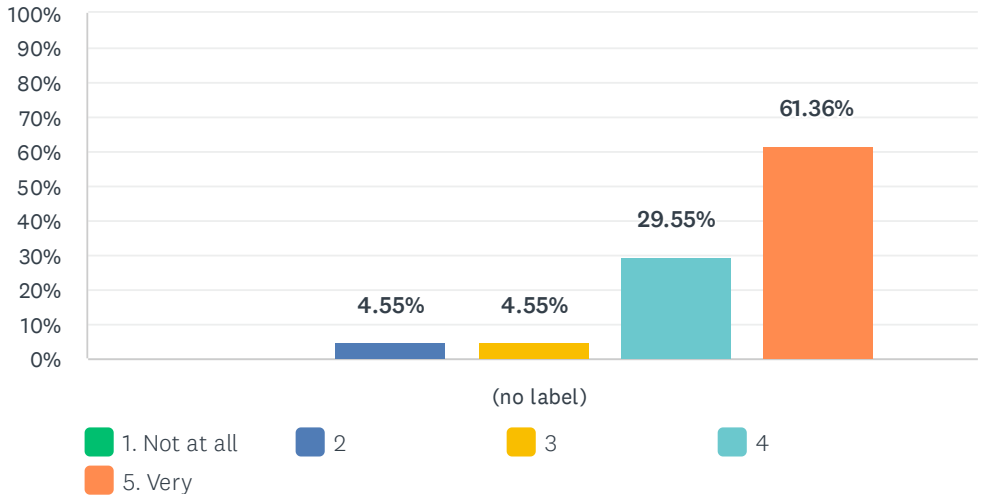
Answered: 44 Skipped: 7



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.27% 1	2.27% 1	15.91% 7	40.91% 18	38.64% 17	44	4.11

Q5 My interest in the subject matter was increased by the workshop

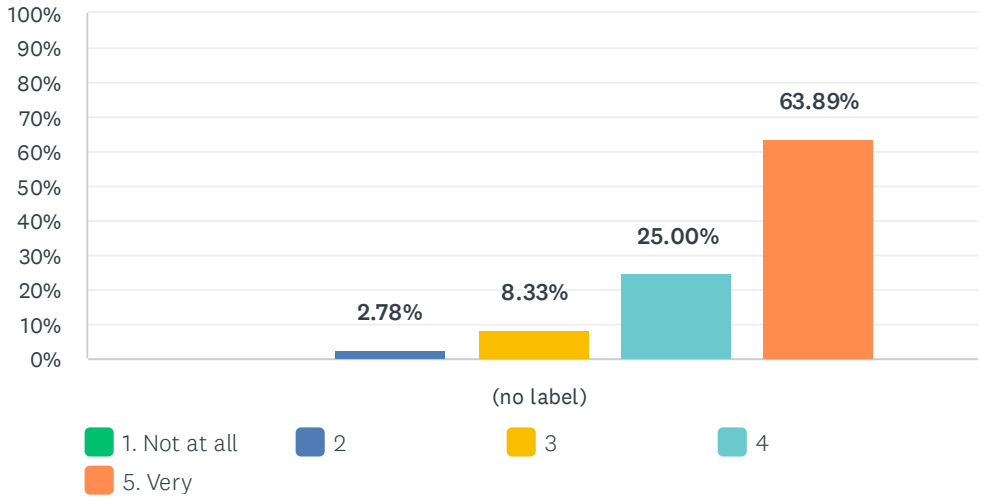
Answered: 44 Skipped: 7



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.55% 2	4.55% 2	29.55% 13	61.36% 27	44	4.48

Q6 I found the MSRI staff helpful

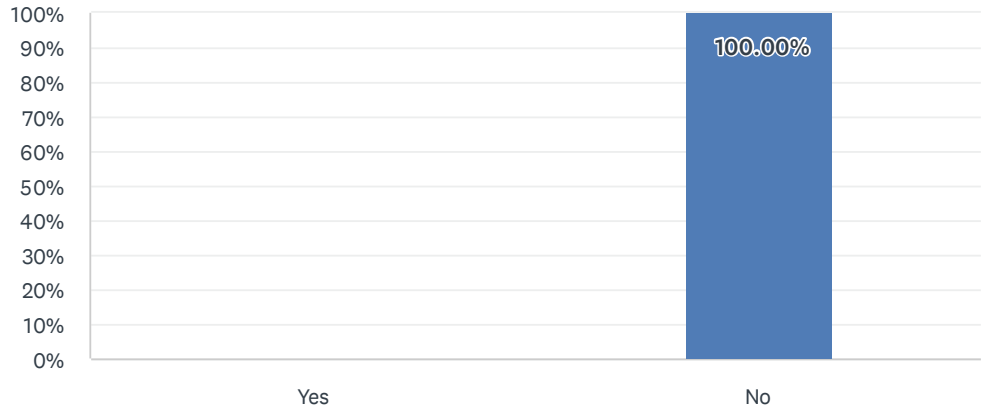
Answered: 36 Skipped: 15



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.78% 1	8.33% 3	25.00% 9	63.89% 23	36	4.50

Q7 Did you experience any technical difficulties accessing the online workshop?

Answered: 36 Skipped: 15



ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	100.00%	36
TOTAL		36

#	IF YES, PLEASE EXPLAIN	DATE
	There are no responses.	

Q8 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 36 Skipped: 15

#	RESPONSES	DATE
1	As a consequence of Pandemic, it was more pertinent to me to attend virtually to the workshop. There was not any difficulty due to time zone differences.	4/6/2022 7:27 AM
2	The time is too late for me as the beginning time is 11 pm at Beijing time.	3/29/2022 8:29 PM
3	None	3/29/2022 4:59 PM
4	I think that the pandemic have a positive consequence in the way that workshops are given in an online version, which allow the African or Asian researchers to participate and improve their academic level.	3/29/2022 2:35 PM
5	I mean it was harder to follow but also less stressful. Since when it is in person the environment of the talk might be tense for students（at least for me it is true）. Also it causes less schedule confliction since I was having other courses and recitations sometime.	3/29/2022 1:15 PM
6	Yes. It is not easy to communicate online after talks for me.	3/29/2022 12:34 PM
7	Since it is online, as a grad student, we still have to do TA tasks and hence cannot fully take part in the activity.	3/29/2022 12:24 PM
8	If it hadnt been online, then I would not have been able to join. So, I am very happy that I could participate in this way.	3/29/2022 12:19 PM
9	A little bit; attending such a workshop in person could help personal interactions.	3/28/2022 8:19 AM
10	It was better for me! time zone was not an issue!	3/27/2022 8:12 PM
11	I had no issues.	3/26/2022 1:13 PM
12	No	3/25/2022 7:32 PM
13	No impact	3/25/2022 5:30 PM
14	not much, I like it to be online.	3/25/2022 2:49 PM
15	It doesn't have any impact for me to participate this workshop online.	3/25/2022 2:01 PM
16	more difficult to interact with participants	3/25/2022 1:00 PM
17	no difficulties in attending	3/25/2022 12:38 PM
18	I would have much preferred an in person workshop. I do admit sensing some tiredness re online workshops.	3/25/2022 12:35 PM
19	I would have interacted with other participants much more if it were in person.	3/25/2022 11:51 AM
20	None.	3/25/2022 11:39 AM
21	It was convenient to participate the workshop in online, but I am looking forward to meet in person.	3/25/2022 11:29 AM
22	I am going through a moment in my academic life when I need to experience international events in order to make English more natural for me.	3/25/2022 10:47 AM
23	Online is not as good as a real conference	3/25/2022 10:44 AM

24	It was excellent experience for me to attend it, although I missed few talks(generally last one) because of time differences from India.	3/25/2022 10:10 AM
25	No time zone issues. As far as online conference experiences go, this was as good as it gets.	3/25/2022 9:50 AM
26	Very convenient	3/25/2022 9:44 AM
27	Online workshop reduces the possiblities to talk to the speakers, even if the “gather” app was a nice compromise.	3/25/2022 9:33 AM
28	I would have liked to have more opportunities for interaction.	3/25/2022 9:26 AM
29	No issues	3/25/2022 9:19 AM
30	Time zone differences and the weak internet connection here caused some problems, but it was a good experience overall	3/25/2022 9:16 AM
31	Because of my personal schedule, I had to miss several talks (for teaching, meetings, etc) that I would have liked to attend during the live session.	3/25/2022 9:15 AM
32	No	3/25/2022 9:15 AM
33	less social time	3/25/2022 9:10 AM
34	Having online talks helped me integrate the workshop with my work schedule. Nonetheless, in-person workshops offer more opportunities for personal interactions. So I recommend providing both modalities in the future.	3/25/2022 9:09 AM
35	Time zone difference was the main barrier	3/25/2022 9:09 AM
36	It’s a good experience	3/25/2022 9:06 AM

Q9 One important aspect that was missing due to the online format was interaction between participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 15 Skipped: 36

#	RESPONSES	DATE
1	Not sure.	3/29/2022 12:34 PM
2	gathertown seems to be a decent enough substitute for in person chats over breaks	3/29/2022 12:19 PM
3	Some zoom meeting just to hang out?	3/27/2022 8:12 PM
4	schedule longer breaks between talks	3/25/2022 1:00 PM
5	I don't know. There was a virtual meeting space provided, but I did not use it.	3/25/2022 11:51 AM
6	The interaction between participants was excellent!	3/25/2022 10:47 AM
7	No	3/25/2022 10:44 AM
8	I have one suggestion: it can be extended for longer days with 2 or 3 lectures a day.	3/25/2022 10:10 AM
9	In my opinion, there is no online version of interaction between participants that can replace the value of in-person interactions. The online format works well for the dissemination of interesting results, but if there is ever a choice in the future between online and in-person I would greatly prefer in-person.	3/25/2022 9:50 AM
10	It was there and I used it.	3/25/2022 9:44 AM
11	No: the “gather” app was pretty nice.	3/25/2022 9:33 AM
12	Adding activities to enhance discussion in small groups. Maybe the discussions could be about status of open problems.	3/25/2022 9:26 AM
13	Have breakout rooms.	3/25/2022 9:15 AM
14	Optional break-out sessions between talks	3/25/2022 9:09 AM
15	Interaction is very important with maths teaching	3/25/2022 9:06 AM

Q10 We welcome any additional comments or suggestions you may have to improve the overall online experience for future participants.

Answered: 4 Skipped: 47

#	RESPONSES	DATE
1	Very nice workshop. Thanks organisers for giving this opportunity to me. I hope in future more workshops on geometry and topology will be held.	3/25/2022 10:10 AM
2	It was an enjoyable and very motivating workshop.	3/25/2022 9:16 AM
3	I wholeheartedly thank MSRI for organizing programs. I thank MSRI staff for support and response. Thank you very much. Thanking you KukkePrasanna J	3/25/2022 9:09 AM
4	No	3/25/2022 9:06 AM

The Analysis and Geometry of Random Spaces

March 28 – April 01, 2022

Hybrid Workshop

Organizers:

Nikolai Makarov (California Institute of Technology)

Steffen Rohde (University of Washington)

Eero Saksman (University of Helsinki)

Amanda Turner (University of Lancaster)

Fredrik Viklund (Royal Institute of Technology)

Jang-Mei Wu (University of Illinois at Urbana-Champaign)

REPORT ON THE MSRI WORKSHOP
"The Analysis and Geometry of Random Spaces (Hybrid Workshop)"
March 28 – April 01, 2022

Organizers

- Nikolai Makarov (California Institute of Technology)
- Steffen Rohde (University of Washington)
- Eero Saksman (University of Helsinki)
- Amanda Turner (University of Lancaster)
- Fredrik Viklund (Royal Institute of Technology)
- Jang-Mei Wu (University of Illinois at Urbana-Champaign)

Scientific Description

The aim of this workshop was to bring together researchers whose work contributes to the study of random structures that exhibit some form of conformal self-similarity. Notable examples include the Schramm-Loewner evolution SLE, the Brownian map and random trees, Liouville Quantum Gravity, and Conformal Field Theory. A particular focus was the discussion of analytic tools needed to address the challenges arising from the often rough underlying sets and spaces.

Highlights of the Workshop

The main activities of the workshop were 18 hourlong research seminar talks, covering a broad range of topics of interest to the research program. On the more analytic side, Kari Astala demonstrated the powerful use of a degenerate Beltrami equation in the description of scaling limits of dimer models, while Joan Lind provided a surprising counterexample to a natural question regarding the complex Loewner equation. First steps towards a probabilistic complex Loewner theory, namely complex SLE, was discussed by Ewain Gwynne, whereas Amanda Turner presented her results on the Hastings-Levitov growth model, a model of Laplacian aggregation inspired by diffusion limited aggregation. Antti Kupiainen reported on exciting progress on the mathematical side of Liouville conformal field theory and the conformal bootstrap. Other highlights were Xin Sun's talk on moduli of annuli in Random Conformal Geometry, and Yilin Wang's talk on Jordan curves passing through a given set of points with the property such that each edge is the hyperbolic geodesic in the complement of the rest of the curve and their relation to minimizers of the Loewner energy.

On Wednesday afternoon, there were no talks scheduled and while some participants worked in small groups and some went on an excursion, a large number of participants attended a two hour long impromptu lecture by Ewain Gwynne on his groundbreaking work around the existence of the Liouville Quantum Gravity metric. This lecture was continued on Saturday, after the official end of the workshop.

Organizers		
First Name	**Last Name**	**Institution**
Nikolai	Makarov	California Institute of Technology
Steffen	Rohde	University of Washington
Eero	Saksman	University of Helsinki
Amanda	Turner	University of Lancaster
Fredrik	Viklund	Royal Institute of Technology
Jang-Mei	Wu	University of Illinois at Urbana-Champaign
Speakers		
First Name	**Last Name**	**Institution**
Kari	Astala	University of Helsinki
Sourav	Chatterjee	Stanford University
Zhen-Qing	Chen	University of Washington
Julien	Dubedat	Columbia University
Ewain	Gwynne	University of Chicago
Nina	Holden	ETH Zürich
Nam-Gyu	Kang	Korea Institute for Advanced Study (KIAS)
Antti	Kupiainen	University of Helsinki
Peter	Lin	State University of New York, Stony Brook
Joan	Lind	University of Tennessee
Eveliina	Peltola	Rheinische Friedrich-Wilhelms-Universität Bonn
Ellen	Powell	University of Durham
Eric	Schippers	University of Manitoba
Mikhail	Sodin	Tel Aviv University
Karl-Theodor	Sturm	Universität Bonn
Xin	Sun	University of Pennsylvania
Amanda	Turner	University of Lancaster
Yilin	Wang	Massachusetts Institute of Technology

Mathematical Sciences Research Institute

The Analysis and Geometry of Random Spaces [Hybrid Workshop]

March 28 to April 01, 2022

Monday, March 28		
09:15 AM - 09:30 AM		Welcome
09:30 AM - 10:30 AM	Kari Astala	Geometry, Universality and Beltrami Complex Structure for Scaling Limits of Random Dimer Coverings
11:00 AM - 12:00 PM	Nina Holden	Integrability of SLE via Conformal Welding of Random Surfaces
02:00 PM - 03:00 PM	Joan Lind	The Loewner Equation with Complex-Valued Driving Functions
03:30 PM - 04:30 PM	Sourav Chatterjee	Some Progress on 3D Yang-Mills

Tuesday, March 29		
09:30 AM - 10:30 AM	Mikhail Sodin	Random Weierstrass Zeta-Functions
11:00 AM - 12:00 PM	Julien Dubedat	Random Clusters in the Villain Model
02:00 PM - 03:00 PM	Eveliina Peltola	On Log-CFT for Uniform Spanning Trees and SLE(8)
03:30 PM - 04:30 PM	Ellen Powell	Critical Liouville Quantum Gravity and Brownian Half-Plane Excursions
04:30 PM - 06:20 PM		Reception

Wednesday, March 30		
09:30 AM - 10:30 AM	Ewain Gwynne	Loewner Evolution Driven by Complex Brownian Motion
11:00 AM - 12:00 PM	Karl-Theodor Sturm	Conformally Invariant Random Geometry on Riemannian Manifolds of Even Dimension

Thursday, March 31		
09:30 AM - 10:30 AM	Amanda Turner	Stability of Regularized Hastings-Levitov Aggregation in the Subcritical Regime
11:00 AM - 12:00 PM	Antti Kupiainen	Plumbing Liouville Theory
02:00 PM - 03:00 PM	Peter Lin	Conformal Structures on Random Fractal Surfaces Arising from Subdivision Rules
03:30 PM - 04:30 PM	Eric Schippers	Scattering of Harmonic Functions and Forms in Quasicircles

Friday, April 01		
09:30 AM - 10:30 AM	Zhen-Qing Chen	Approximations of Liouville Brownian Motion
11:00 AM - 12:00 PM	Xin Sun	The Moduli of Annuli in Random Conformal Geometry
02:00 PM - 03:00 PM	Nam-Gyu Kang	Conformal Field Theory for Multiple Schramm-Loewner Evolutions
03:30 PM - 04:30 PM	Yilin Wang	Jordan Curves with the Piecewise Geodesic Property

Participants

First Name	Last Name	Institution
Osama	Abuzaid	Aalto University
Lekan	Adesina	Obafemi Awolowo University
Tom	Alberts	University of Utah
David	Aldous	University of California, Berkeley
Valeria	Ambrosio	University of Cambridge
Pol	Arranz-Gibert	University of Barcelona
Kari	Astala	University of Helsinki
Tahmineh	Azizi	Florida State University
Eric	Babson	University of California, Davis
Manan	Bhatia	Massachusetts Institute of Technology
Sandipan	Bhattacherjee	Birla Institute of Technology, Mesra, Ranchi, India
Ilia	Binder	University of Toronto
Mario	Bonk	University of California, Los Angeles
Jacopo	Borga	Stanford University
Sung-Soo	Byun	Korea Institute for Advanced Study (KIAS)
Sourav	Chatterjee	Stanford University
Dmitry	Chelkak	École Normale Supérieure
Zhen-Qing	Chen	University of Washington
Caroline	Davis	Indiana University
Devon	Ding	University of California, Berkeley
Julien	Dubedat	Columbia University
Moon	Duchin	Tufts University
Saleh	Elmohamed	University of California, Berkeley
Sylvester	Eriksson-Bique	University of Oulu
Eva	Gallardo-Gutierrez	Universidad Complutense de Madrid
Fekadu Tolessa	Gedefa	Eötvös Loránd University
Lukas	Geyer	Montana State University
Adi	Glucksam	Northwestern University
Maria	Gordina	University of Connecticut
Andrew	Graven	California Institute of Technology
Vladislav	Guskov	Royal Institute of Technology
Ewain	Gwynne	University of Chicago
Hrant	Hakobyan	Kansas State University
Vivian	Healey	Texas State University
Susanna	Heikkilä	University of Helsinki
Francis	Higgs	University of Lancaster
Mikhail	Hlushchanka	Universiteit Utrecht
Nina	Holden	ETH Zürich
Liam	Hughes	University of Cambridge
Annina	Iseli	University of California, Los Angeles
Kukkeprasanna	J	Bengaluru City University
Antoine	Jego	MSRI - Mathematical Sciences Research Institute
Sharada	Kalanidhi	Stanford University School of Medicine
Nam-Gyu	Kang	Korea Institute for Advanced Study (KIAS)
Alex	Kapiamba	University of Michigan
Konstantinos	Kavvadias	University of Cambridge
Patrick	Kayupe Kikodio	Ibn Tofail
Sungwoon	Kim	Jeju National University
Anna	Kis	University of Waterloo
Joshua	Kline	University of Cincinnati
Aleksandra	Korzhenkova	École Polytechnique Fédérale de Lausanne (EPFL)

Participants

First Name	Last Name	Institution
Simo	Koskinen	University of Eastern Finland
Ellen	Krusell	Royal Institute of Technology
Antti	Kupiainen	University of Helsinki
Therese	Landry	University of California, Riverside
Zhongyang	Li	University of Connecticut
Xiaobin	Li	Southwest (Xinan) Jiaotong University
Zhiqiang	Li	Peking University
Peter	Lin	State University of New York, Stony Brook
Joan	Lind	University of Tennessee
Yuxiang	Liu	Michigan State University
Tuto	Lopez Gonzalez	San Francisco State University
Issam	Louhichi	American University of Sharjah
Liangbing	Luo	University of Connecticut
Víctor	Maciá	Autonomous University of Madrid
Sid	Maibach	Rheinische Friedrich-Wilhelms-Universität Bonn
Nikolai	Makarov	California Institute of Technology
Firdous	Mala	University of Kashmir
Vlad	Margarint	NYU Shanghai
David	Martí-Pete	University of Liverpool
Jared	Marx-Kuo	Stanford University
Michael	McAuley	University of Helsinki
Curtis	McMullen	Harvard University
Xiangqian	Meng	University of Washington
Tim	Mesikepp	Peking University
Daniel	Meyer	University of Liverpool
Julia	Muench	Universität Bern
Mathav	Murugan	University of British Columbia
Evangelos	Nastas	University at Albany (SUNY)
Joona	Oikarinen	University of Helsinki
Pekka	Pankka	University of Helsinki
Leonie	Papon	University of Durham
Eveliina	Peltola	Rheinische Friedrich-Wilhelms-Universität Bonn
Pietro	Poggi-Corradini	Kansas State University
Ellen	Powell	University of Durham
Istvan	Prause	University of Eastern Finland
Nikolai	Prochorov	Université d'Aix-Marseille I (Université de Provence)
Wei	Qian	Université Paris-Saclay
Jasmin	Raissy	Institut de Mathématiques de Bordeaux
Gabriele	Rembado	Hausdorff Research Institute for Mathematics, University of Bonn
Rémi	Rhodes	Université d'Aix-Marseille (AMU)
Larissa	Richards	University of Lancaster
Steffen	Rohde	University of Washington
Miguel Angel	Rosas	Universidad del Bío-Bío
Marianna	Russkikh	Massachusetts Institute of Technology
Noussaiba	Saadoudi	Universite M'hammed Bouguerra de Boumerdes (UMBB)
Eero	Saksman	University of Helsinki
Eric	Schippers	University of Manitoba
Lukas	Schoug	Center for Mathematical Sciences
Anne	Schreuder	Center for Mathematical Sciences
Nageswari	Shanmugalingam	University of Cincinnati
Mikhail	Sodin	Tel Aviv University

Participants		
First Name	**Last Name**	**Institution**
Alan	Sola	Stockholm University
Karl-Theodor	Sturm	Universität Bonn
Xin	Sun	University of Pennsylvania
Emanuel	Sygal	Tel Aviv University
Matteo	Tabaro	Imperial College, London
Hassan	Tahir	Ocean University of China
Dylan	Thurston	Indiana University
Mayank	Totloor	New York University
Sascha	Troscheit	University of Vienna
Amanda	Turner	University of Lancaster
Jeffrey	Utley	University of Tennessee
Vyron	Vellis	University of Tennessee
Fredrik	Viklund	Royal Institute of Technology
Antonio	Villagómez	Universidad Yachay Tech
John	Villavert	University of Texas Rio Grande Valley
Jani	Virtanen	University of Reading
Dan-Virgil	Voiculescu	University of California, Berkeley
Mittu	Walia	National Institute of Technology Calicut
Yilin	Wang	Massachusetts Institute of Technology
Catherine	Wolfram	Massachusetts Institute of Technology
Mo Dick	Wong	Durham University
Jang-Mei	Wu	University of Illinois at Urbana-Champaign
Xiangjin	Xu	Binghamton University (SUNY)
Masahito	Yamazaki	Kavli Institute for the Physics and Mathematics of the Universe
Liding	Yao	University of Wisconsin-Madison
Malik	Younsi	University of Hawaii at Manoa
Yang	Yu	University of Washington
Yizheng	Yuan	TU Berlin
Evgeny	Zelenov	Steklov Mathematical Institute
Dapeng	Zhan	Michigan State University
Jiaxin	Zhang	California Institute of Technology
Hui	Zhu	University of Michigan
Michel	Zinsmeister	Université d'Orléans

Identifiable Participants' Information

Participants		135

Gender		135
Male	72.59%	98
Female	26.67%	36
Other	0.00%	0
Declined to state	0.74%	1

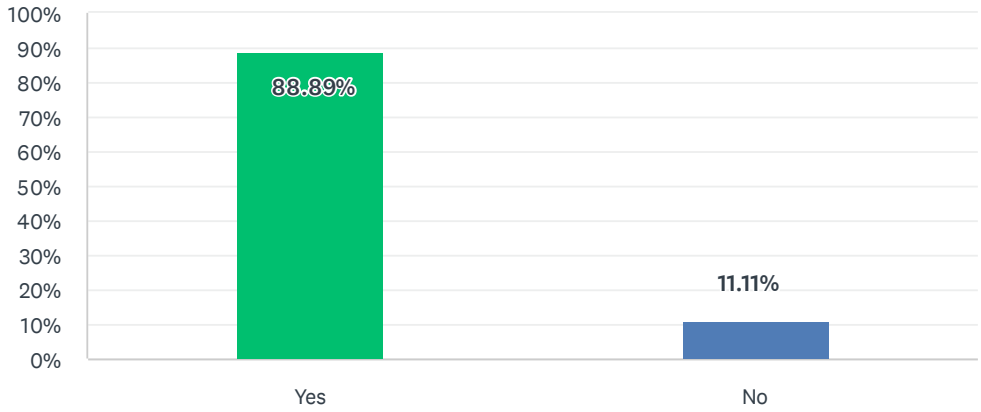
Ethnicity*		144
White	55.56%	80
Asian	27.08%	39
Hispanic	2.78%	4
Pacific Islander	0.69%	1
Black	3.47%	5
Native American	0.00%	0
Mixed	2.78%	4
Declined to state	7.64%	11

* ethnicity specifications are not exclusive

There were 13 unidentifiable participants.

Q1 Did you attend the workshop?

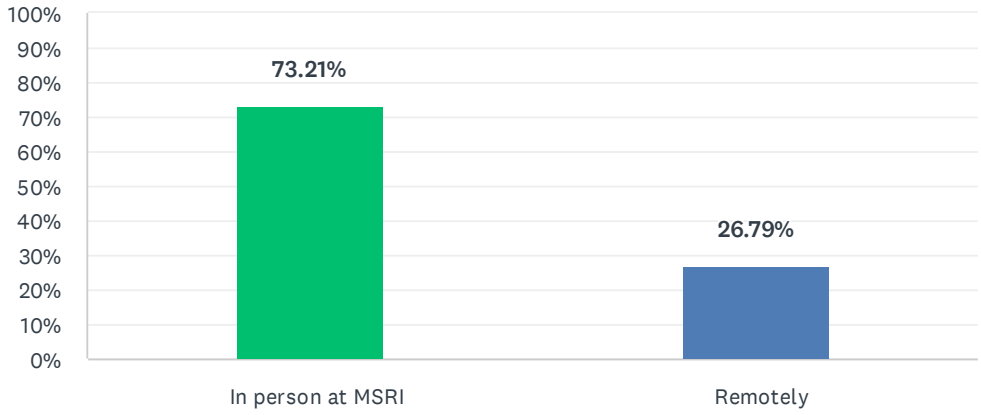
Answered: 63 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	88.89%	56
No	11.11%	7
TOTAL		63

Q2 I primarily participated in the workshop:

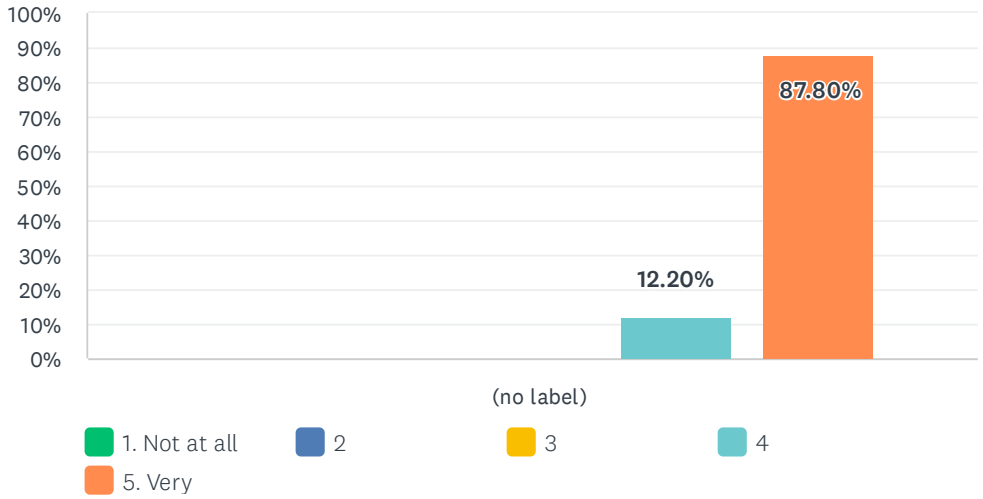
Answered: 56 Skipped: 7



ANSWER CHOICES	RESPONSES	
In person at MSRI	73.21%	41
Remotely	26.79%	15
TOTAL		56

Q3 The workshop was intellectually stimulating

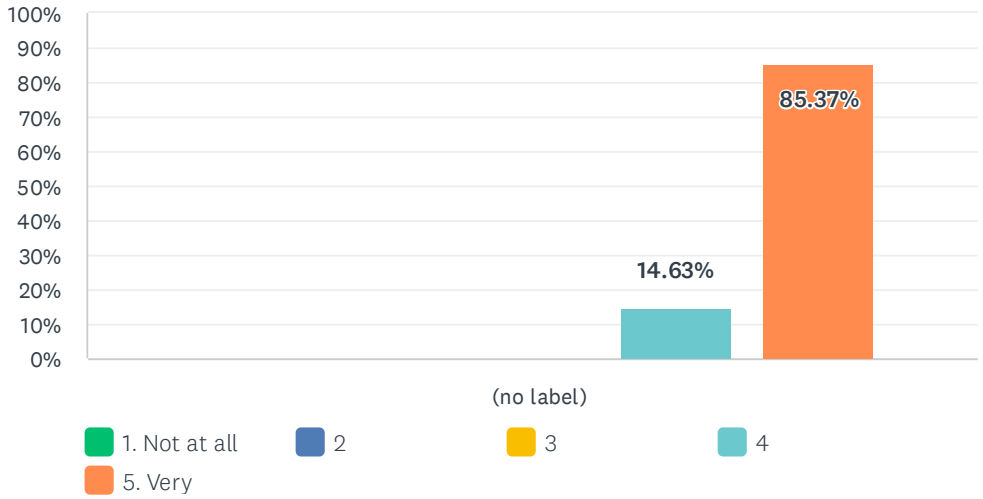
Answered: 41 Skipped: 22



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	12.20% 5	87.80% 36	41	4.88

Q4 The overall experience of the workshop was worthwhile

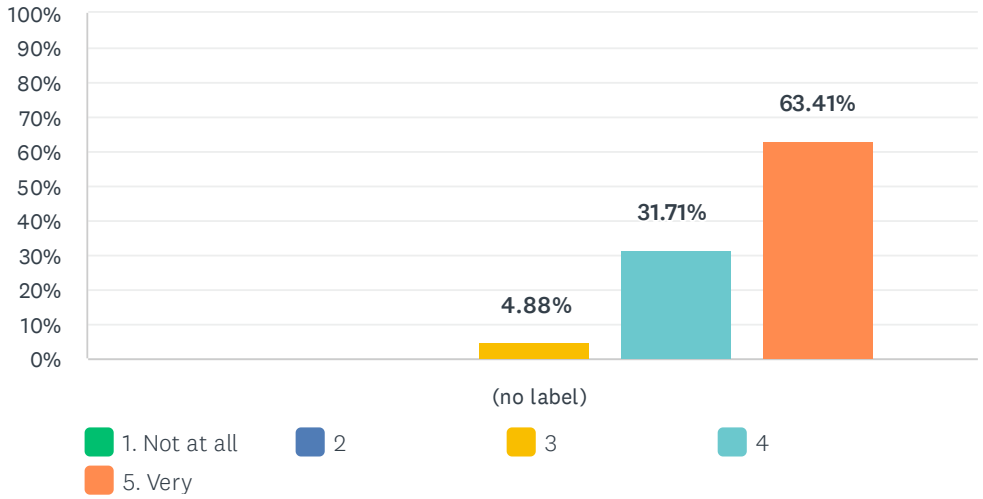
Answered: 41 Skipped: 22



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	14.63% 6	85.37% 35	41	4.85

Q5 The lectures were at an appropriate level

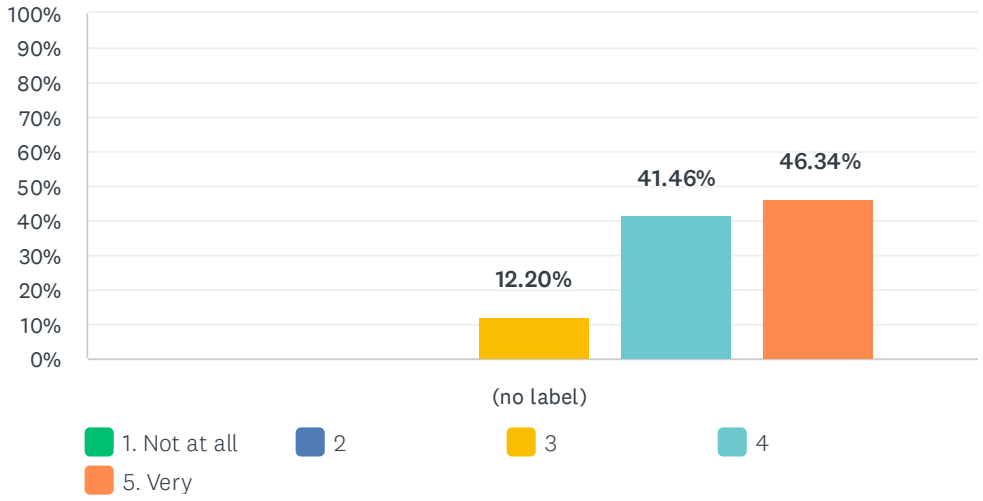
Answered: 41 Skipped: 22



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	4.88% 2	31.71% 13	63.41% 26	41	4.59

Q6 I was well prepared to benefit from the lectures

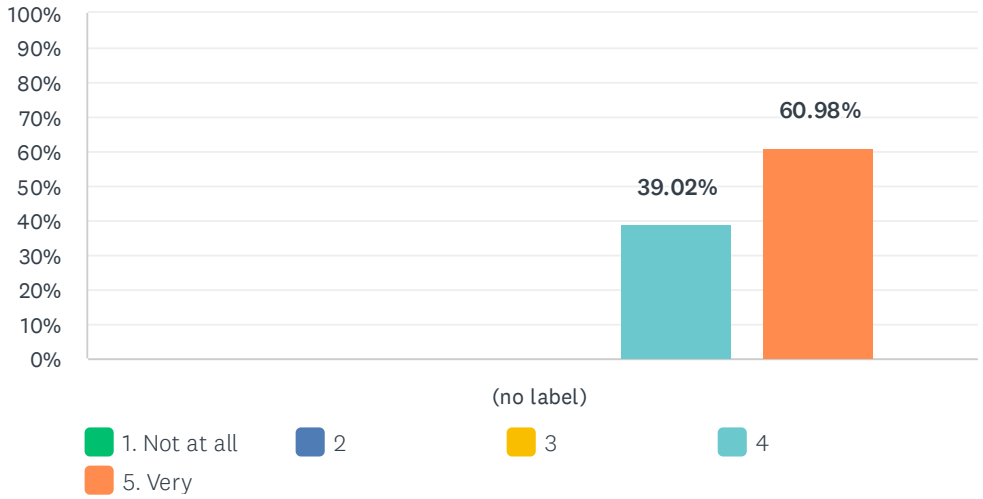
Answered: 41 Skipped: 22



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	12.20% 5	41.46% 17	46.34% 19	41	4.34

Q7 My interest in the subject matter was increased by the workshop

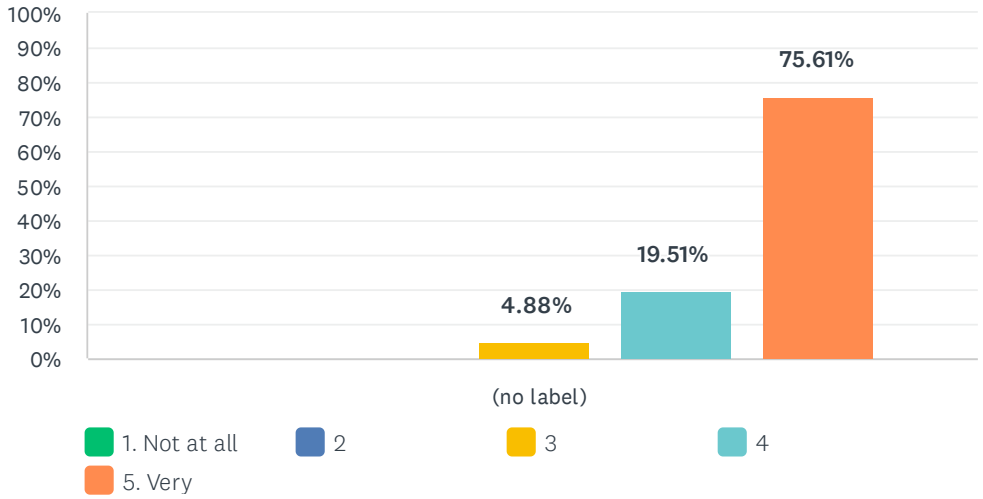
Answered: 41 Skipped: 22



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	39.02% 16	60.98% 25	41	4.61

Q8 The workshop helped me meet people with similar scientific interests

Answered: 41 Skipped: 22



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	4.88% 2	19.51% 8	75.61% 31	41	4.71

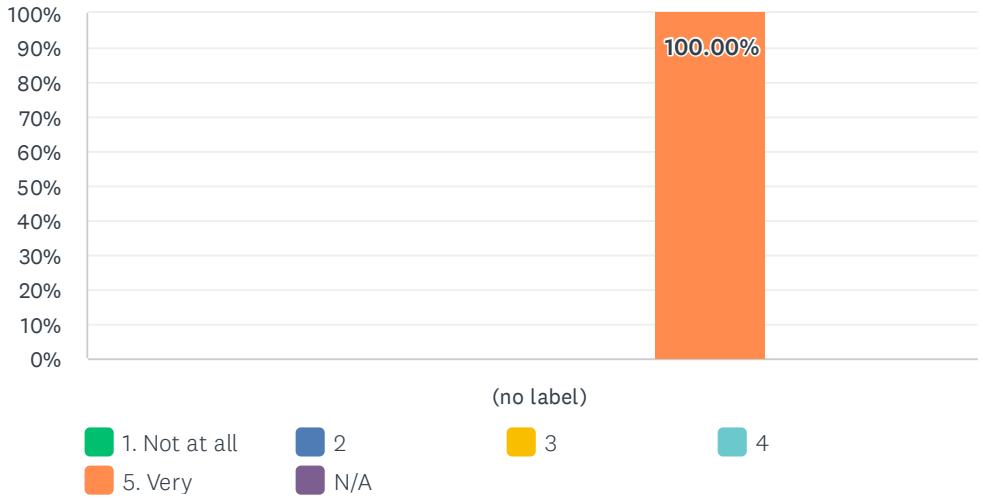
Q9 Additional comments

Answered: 3 Skipped: 60

#	RESPONSES	DATE
1	Some of the lectures were quite advanced, but they were still absolutely outstanding. This was one of the most exciting workshops I have attended.	4/6/2022 4:42 PM
2	Great program and great facilities!	4/5/2022 4:39 PM
3	The only complaint I have is that the WiFi connection is not strong in the MSRI building.	4/1/2022 6:30 PM

Q10 I found the MSRI staff helpful

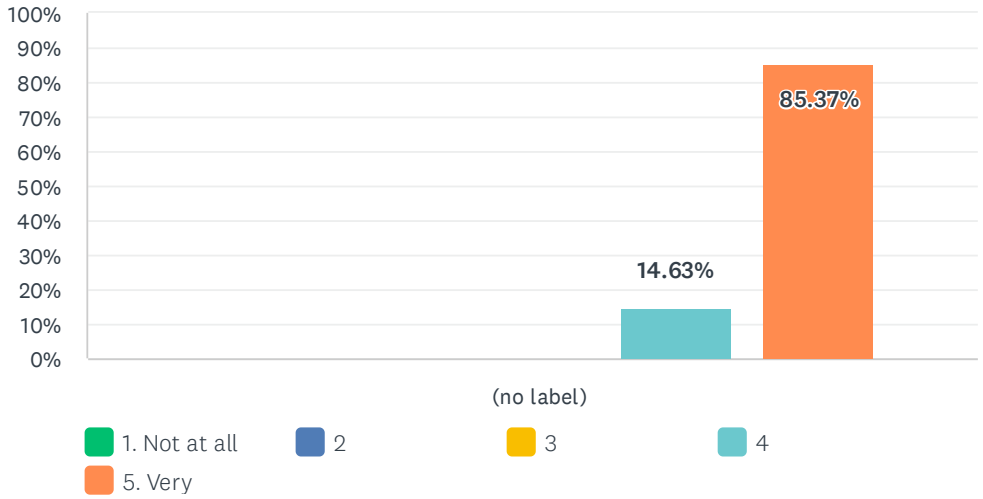
Answered: 41 Skipped: 22



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	0.00% 0	100.00% 41	0.00% 0	41	5.00

Q11 The MSRI facilities were conducive for such a workshop

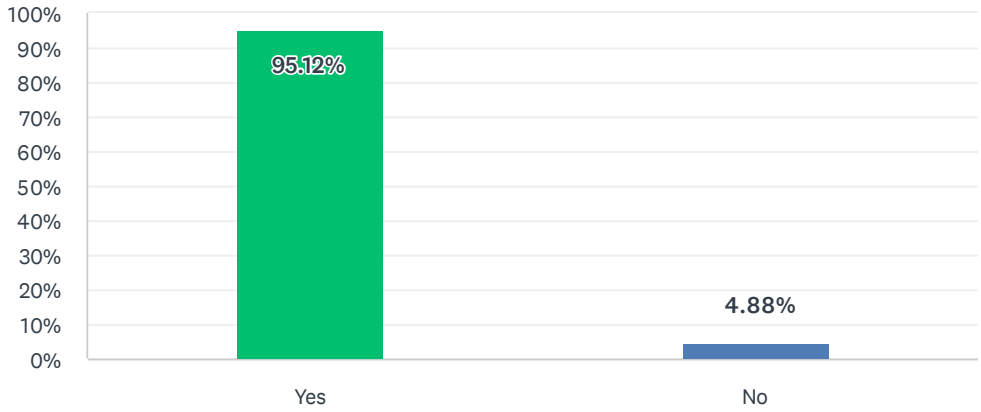
Answered: 41 Skipped: 22



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	14.63% 6	85.37% 35	41	4.85

Q12 Did you use MSRI's wireless network?

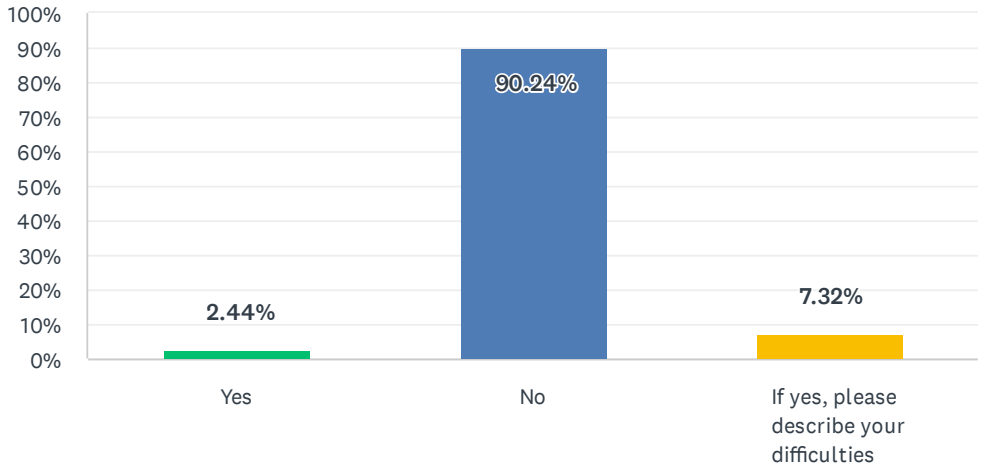
Answered: 41 Skipped: 22



ANSWER CHOICES	RESPONSES	
Yes	95.12%	39
No	4.88%	2
TOTAL		41

Q13 Did you experience any difficulties with the network?

Answered: 41 Skipped: 22

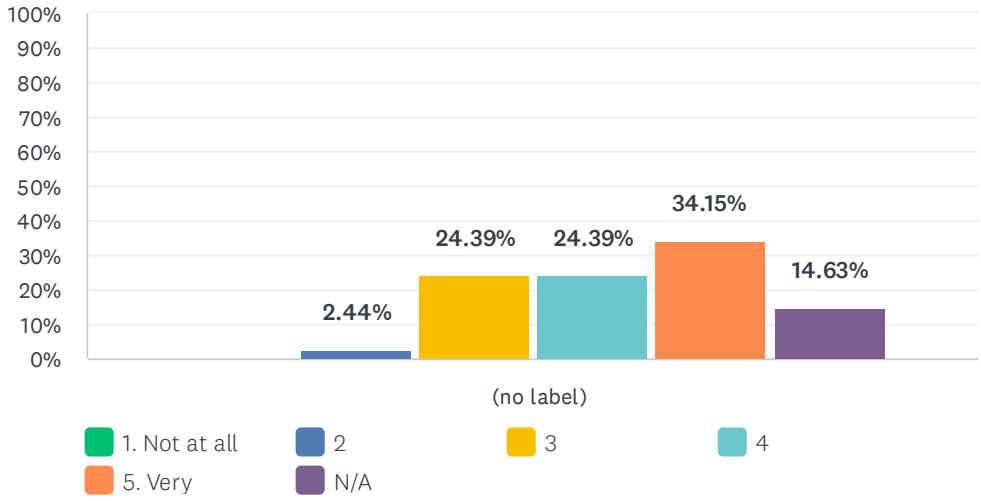


ANSWER CHOICES	RESPONSES	
Yes	2.44%	1
No	90.24%	37
If yes, please describe your difficulties	7.32%	3
TOTAL		41

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	Was very slow at random times	4/5/2022 4:40 PM
2	No signal around the entrance	4/1/2022 7:13 PM
3	The WiFi connection is vey slow.	4/1/2022 6:31 PM

Q14 The MSRI lunch arrangements were satisfactory

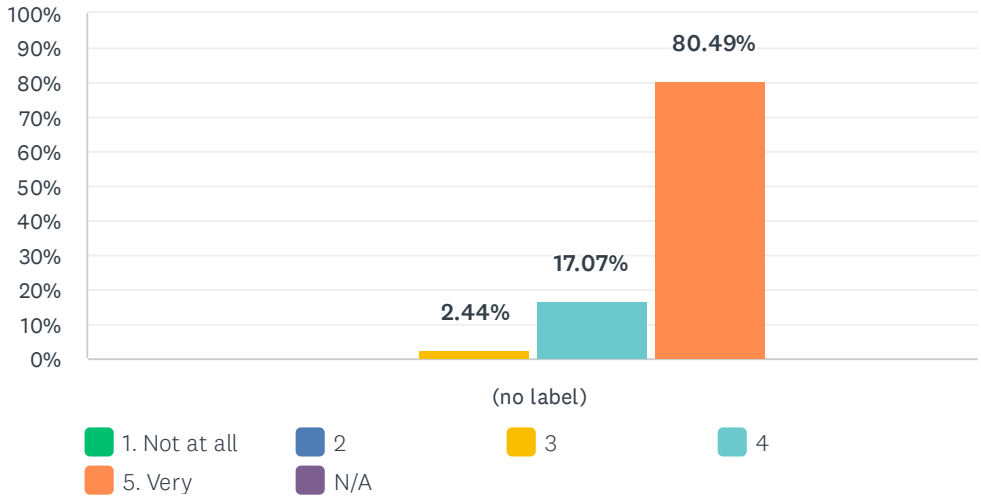
Answered: 41 Skipped: 22



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.44% 1	24.39% 10	24.39% 10	34.15% 14	14.63% 6	41	4.06

Q15 The MSRI tea arrangements were satisfactory

Answered: 41 Skipped: 22



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.44% 1	17.07% 7	80.49% 33	0.00% 0	41	4.78

Q16 Additional comments about the MSRI staff, facilities and food

Answered: 3 Skipped: 60

#	RESPONSES	DATE
1	Staff was amazing! The video broadcasting is really great	4/5/2022 4:40 PM
2	I once forgot to confirm my lunch order and it did not go through. Could that feature be improved?	4/4/2022 7:18 AM
3	The MSRI staff are amazing!	4/4/2022 6:07 AM

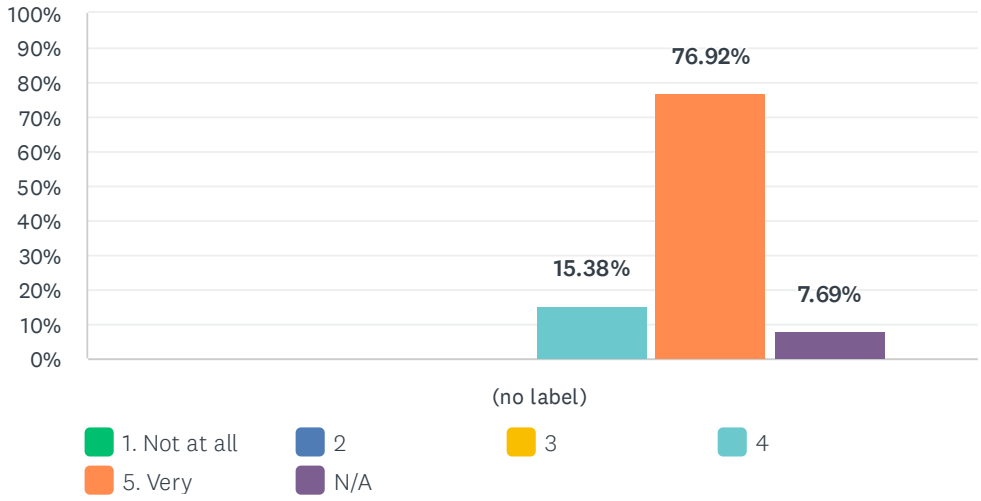
Q17 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 2 Skipped: 61

#	RESPONSES	DATE
1	Thanks to MSRI for creating a vibrant environment for discussing mathematics!	4/4/2022 6:08 AM
2	Please improve the WiFi connection.	4/1/2022 6:31 PM

Q18 I found the MSRI staff helpful

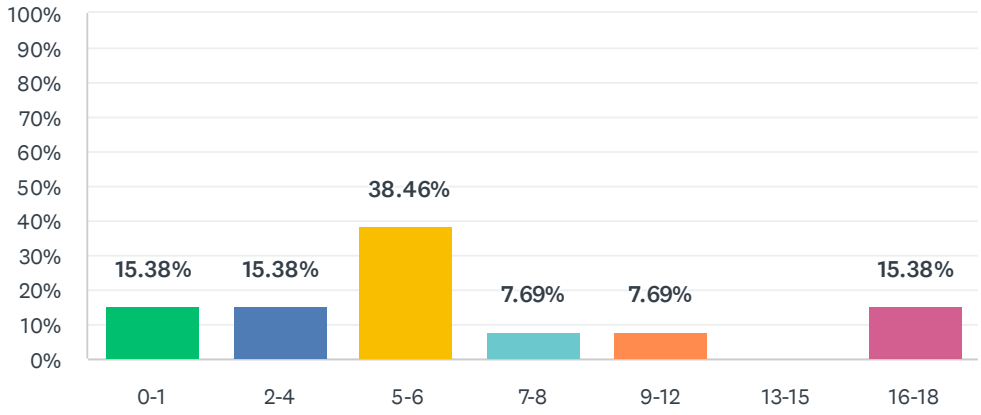
Answered: 13 Skipped: 50



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	15.38% 2	76.92% 10	7.69% 1	13	4.83

Q19 How many talks did you watch live?

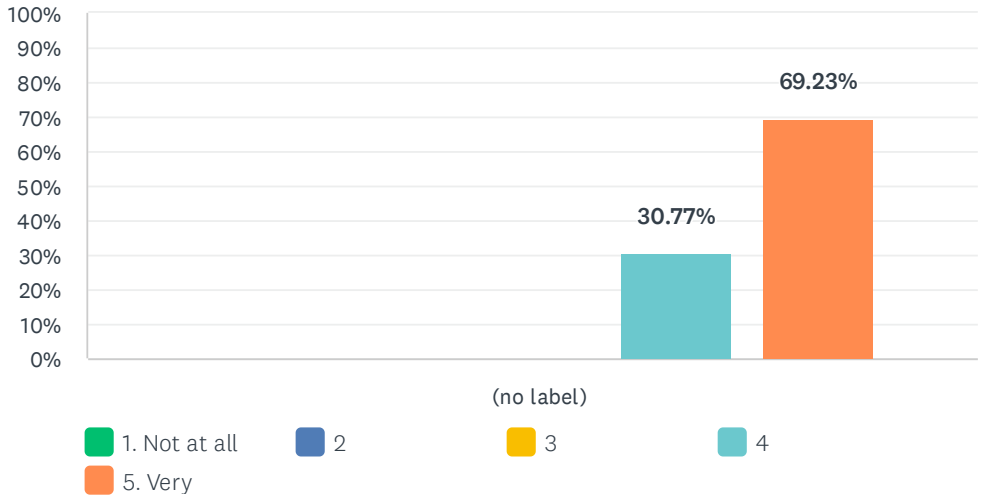
Answered: 13 Skipped: 50



ANSWER CHOICES	RESPONSES	
0-1	15.38%	2
2-4	15.38%	2
5-6	38.46%	5
7-8	7.69%	1
9-12	7.69%	1
13-15	0.00%	0
16-18	15.38%	2
TOTAL		13

Q20 The workshop was intellectually stimulating

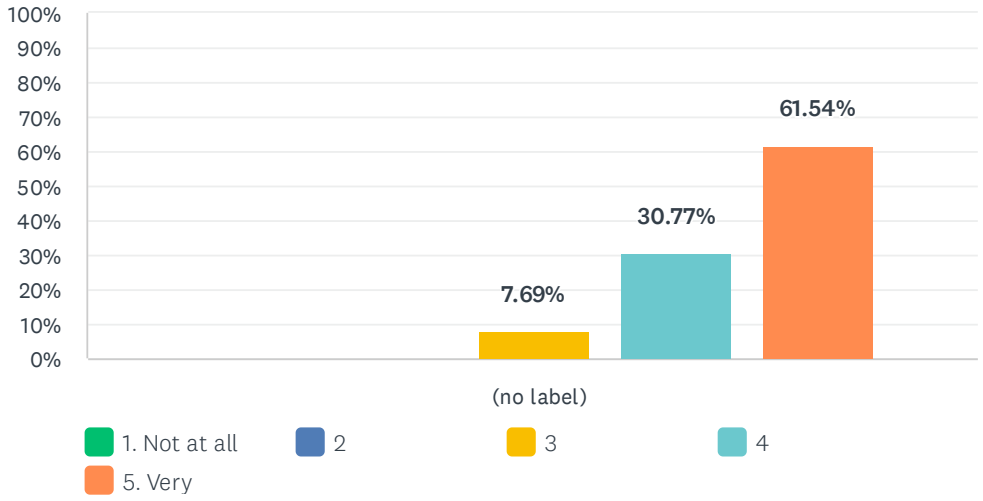
Answered: 13 Skipped: 50



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	30.77% 4	69.23% 9	13	4.69

Q21 The overall experience of the workshop was worthwhile

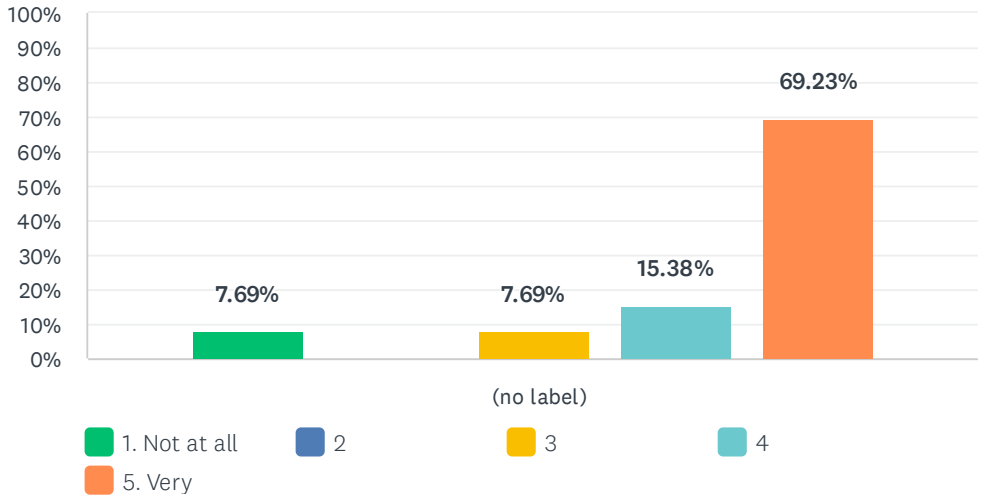
Answered: 13 Skipped: 50



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	7.69% 1	30.77% 4	61.54% 8	13	4.54

Q22 The lectures were at an appropriate level

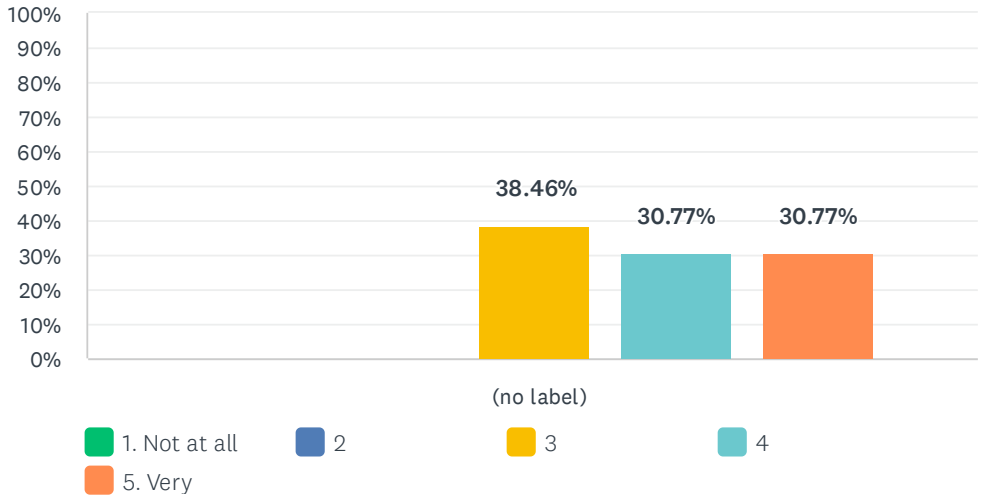
Answered: 13 Skipped: 50



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	7.69% 1	0.00% 0	7.69% 1	15.38% 2	69.23% 9	13	4.38

Q23 I was well prepared to benefit from the lectures

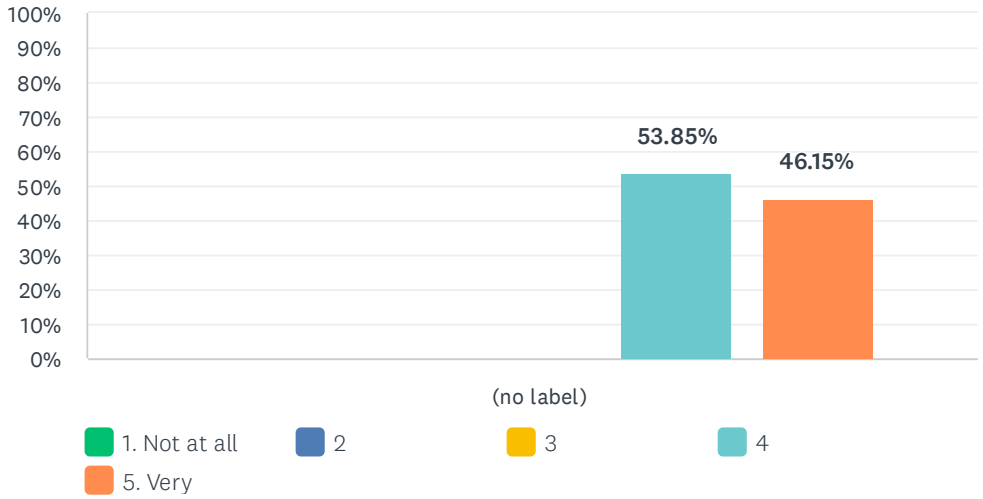
Answered: 13 Skipped: 50



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	38.46% 5	30.77% 4	30.77% 4	13	3.92

Q24 My interest in the subject matter was increased by the workshop

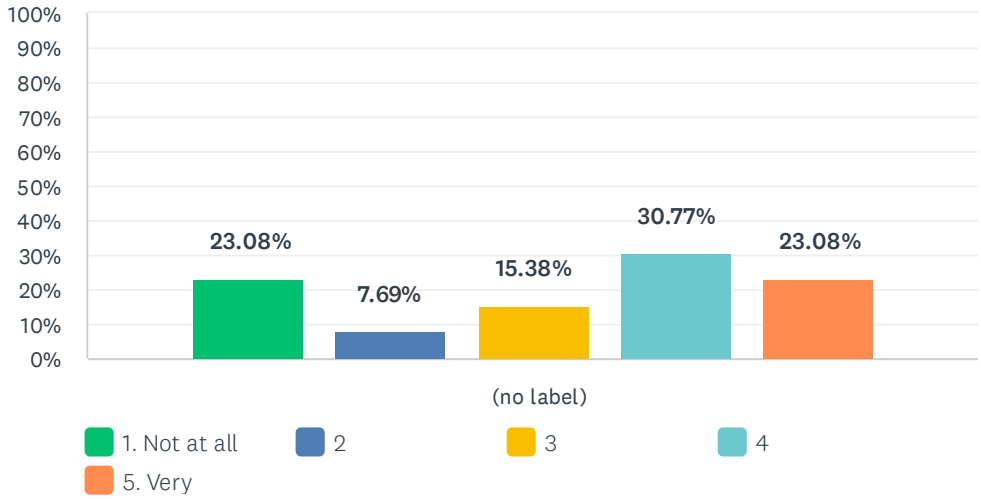
Answered: 13 Skipped: 50



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	53.85% 7	46.15% 6	13	4.46

Q25 The workshop helped me meet people with similar scientific interests

Answered: 13 Skipped: 50



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	23.08% 3	7.69% 1	15.38% 2	30.77% 4	23.08% 3	13	3.23

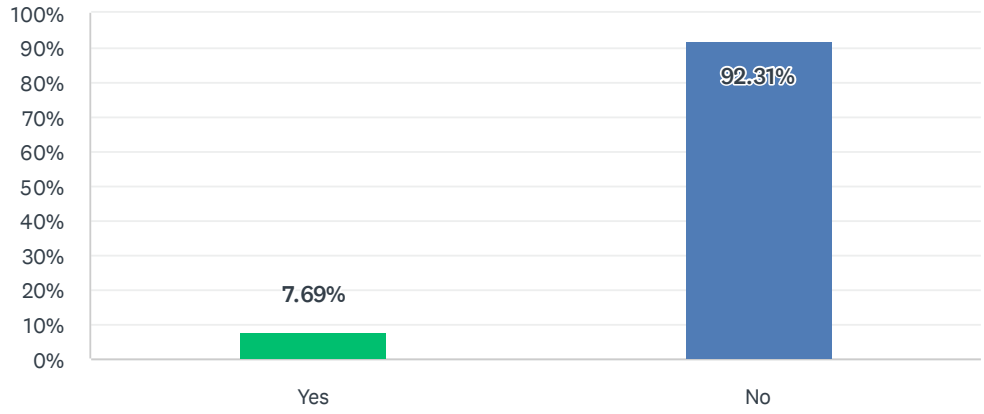
Q26 Additional comments

Answered: 1 Skipped: 62

#	RESPONSES	DATE
1	I was unable to watch the talks live due to the time-zone difference. It would have been helpful if the videos could have been uploaded a little sooner to allow time for catching up while the workshop was still taking place.	4/4/2022 12:15 AM

Q27 Did you experience any technical difficulties accessing the workshop online?

Answered: 13 Skipped: 50



ANSWER CHOICES	RESPONSES	
Yes	7.69%	1
No	92.31%	12
TOTAL		13

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
	There are no responses.	

Q28 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 13 Skipped: 50

#	RESPONSES	DATE
1	I could attend the workshop and still teach my courses at the same time.	4/12/2022 7:19 PM
2	Discussion in person is lacked	4/10/2022 6:44 AM
3	I could not participate in person because I was infected. Due to different time zones, unfortuantely I could only attend the morning sessions.	4/6/2022 12:21 AM
4	No impacts and barries to participate on the workshop.	4/5/2022 7:37 PM
5	Personal circumstances due to the pandemic prevented in person participation, and it was difficult to listen to live lectures due to the time difference. That is why it was very helpful to have all the lecture video recordings uploaded.	4/5/2022 6:59 PM
6	-	4/4/2022 1:38 AM
7	I would not have been able to participate at all if the workshop had not been online. Nevertheless, I did have difficulties participating due to the time zone difference.	4/4/2022 12:16 AM
8	I tested positive just before flying and thus could not fly to the US. Holding it hybrid at least allowed me to attend some of the talks	4/2/2022 4:42 AM
9	no idea	4/1/2022 10:57 PM
10	I would preferred meeting the other participants in person	4/1/2022 9:15 PM
11	Time zone difference was the main barrier	4/1/2022 7:07 PM
12	The time zone differences help to attend the major of lectures; however, by personal circumstances I couldn't attend to all of them.	4/1/2022 6:43 PM
13	Online is harder to focus attention	4/1/2022 5:09 PM

Q29 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 5 Skipped: 58

#	RESPONSES	DATE
1	no ideas	4/6/2022 12:21 AM
2	So far MSRI did best of all I have ever seen.	4/5/2022 7:37 PM
3	no	4/1/2022 10:57 PM
4	no idea	4/1/2022 9:15 PM
5	Perhaps it will be useful to assign a moderator to the zoom meeting so that at the the end of a lecture he organizes a disscusion group as if it were presential.	4/1/2022 6:43 PM

Q30 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 1 Skipped: 62

#	RESPONSES	DATE
1	I would love to see more involvement from graduates students and Postdocs	4/1/2022 9:16 PM

Adventurous Berkeley Complex Dynamics Workshop

May 02 – May 06, 2022

Hybrid Workshop

Organizers:

Mikhail Lyubich **(State University of New York, Stony Brook)**

Jasmin Raissy **(Institut de Mathématiques de Bordeaux)**

Roland Roeder **(Indiana University--Purdue University)**

Dierk Schleicher **(Université d'Aix-Marseille (AMU))**

REPORT ON THE MSRI WORKSHOP
"Adventurous Berkeley Complex Dynamics"
May 2 - May 6, 2022

Organizers

- Mikhail Lyubich (State University of New York, Stony Brook)
- Jasmin Raissy (Institut de Mathématiques de Bordeaux)
- Roland Roeder (Indiana University--Purdue University)
- Dierk Schleicher (Université d'Aix-Marseille (AMU))

Scientific Description

This workshop focused on complex dynamics in one and several variables. It brought together experts in rational dynamics, transcendental dynamics, and dynamics in several complex variables in order to get new perspective and foster discussions in a warm and stimulating atmosphere. A special focus was put on the interactions between one dimensional and higher dimensional complex dynamics, and on connections with adjacent areas of mathematics.

Highlights of the Workshop

This conference has covered a broad spectrum of themes in Holomorphic Dynamics and in their intimate interaction: dynamics in one and several variables, rational and transcendental dynamics, complex and non-Archimedian dynamics, discrete and continuous dynamics, as well as applications to spectral theory of fractal groups. The techniques exploiting methods of (quasi-)conformal geometry, pluripotential theory, ergodic theory, thermodynamical formalism, theory of foliations, number theory, and others.

Based on the surveys conducted by MSRI after the workshop, the vast majority of participants found this workshop to be very intellectually stimulating and that the talks very much were worthwhile and at the appropriate level. One of the survey respondents noted the following:

"I very much appreciated the variety of the subjects presented, this has been the most important feature of the workshop."

The sentiment presented in this quote was also expressed in person by many of the participants to the organizers. There were 19 talks during the span of this week. Let us now comment on some of the specific mathematical highlights.

One remarkable high point of the conference was a lucid talk by 91-year-old Fields Medalist and Abel Prize Laureate John Milnor on the dynamics of real quadratic rational maps with real critical points. This talk focused on recent progress about such a fundamental dynamical system by means of combinatorial arguments and Thurston's Theorem and also pointed out further issues for study.

The two presentations by Dzmitry Dudko (Stony Brook) and Kostiantyn Drach (IST Austria) were on complementary aspects of one of the deepest issues in all of (holomorphic) dynamics: "rigidity". Simply put, an iterated rational map is rigid if it can be distinguished from all other maps in the same space in terms of combinatorial invariants. Probably the deepest conjecture in the field is that "the Mandelbrot set is locally connected", a famous open conjecture for which special cases have been mentioned in several Fields medal citations. This means that all iterated quadratic polynomials are rigid. Dudko announced and outlined a proof of this conjecture (in joint work with Kahn and Lyubich) for all quadratic polynomials except possibly those that are endpoints of the Mandelbrot set.

The talk by Drach, in joint work with Clark, Kozlovski, and van Strien, presented conceptual work towards extending rigidity results from one-dimensional prototypical spaces (such as the ones presented by Dudko) to larger families of rational maps, exactly in the spirit of the semester program "from special families to natural generality".

The workshop highlight in transcendental dynamics were the two talks by Anna Miriam Benini (Parma) and Núria Fagella (Barcelona) with a conceptual investigation of bifurcation loci in transcendental meromorphic dynamics. The analogous issue in the dynamics of rational and entire transcendental functions had been investigated decades earlier in groundbreaking work by Mane-Sad-Sullivan and Eremenko-Lyubich, but the meromorphic case presents profound new difficulties, and the results presented here are of fundamental importance for the investigation of bifurcation phenomena in transcendental dynamics.

The talk by Xavier Buff, in joint work with Jasmin Raissy, presented the interplay between discrete and continuous dynamics leading to new surprising examples of local behavior of holomorphic 2D maps. The talks by Luna Lomonaco and Sabyasachi Mukherjee provided new insights on the interplay between Holomorphic Dynamics and Kleinian groups, in the spirit of the Fatou-Sullivan Dictionary.

The talks by Jeff Diller and Bac Dang focused on the equidistribution of pullbacks of algebraic curves for recently discovered maps with transcendental dynamical degree and for spectrum renormalization transformations associated with fractal groups, both of which provide considerable new challenges beyond the existing theory. The talk by Charles Favre discussed the interplay between arithmetic and holomorphic dynamics and how it leads to far-reaching generalizations of the classical formulas for the topological entropy.

The talks often led to more in-depth discussions, after they were finished, as researchers found new connections and topics for collaboration. Well beyond this, there was a tremendously active atmosphere of less formal interaction including collaboration on various research projects, some of which started because of this workshop. It is hard to quantify the number of new mathematical results and innovative publications that will come out of this workshop.

Although this workshop was primarily held in person, three of the talks were held via zoom because those speakers could not attend. Meanwhile, each talk attracted between 10 and 20 audience members over zoom and this flexibility allowed many who (for various reasons) could not attend to benefit from the workshop. The excellent quality video recordings of the talks will provide a significant resource for years to come.

Organizers		
First Name	**Last Name**	**Institution**
Mikhail	Lyubich	State University of New York, Stony Brook
Jasmin	Raissy	Institut de Mathématiques de Bordeaux
Roland	Roeder	Indiana University--Purdue University
Dierk	Schleicher	Université d'Aix-Marseille (AMU)
Speakers		
First Name	**Last Name**	**Institution**
Anna Miriam	Benini	Università di Parma
Fabrizio	Bianchi	Université de Lille
Xavier	Buff	Université de Toulouse III (Paul Sabatier)
Nguyen-Bac	Dang	Université Paris-Saclay
Jeff	Diller	University of Notre Dame
Kostiantyn	Drach	Institute of Science and Technology Austria
Dzmitry	Dudko	Stony Brook University
Romain	Dujardin	Sorbonne Université
Núria	Fagella	University of Barcelona
Charles	Favre	École Polytechnique
Thomas	Gauthier	Université Paris-Saclay
Nataliia	Goncharuk	University of Toronto, Mississauga
Luciana Luna Anna	Lomonaco	Institute of Pure and Applied Mathematics (IMPA)
John	Milnor	Institute for Mathematical Sciences
Sabyasachi	Mukherjee	Tata Institute of Fundamental Research
Volodymyr	Nekrashevych	
Rohini	Ramadas	University of Warwick
Juan	Rivera-Letelier	University of Rochester
Mitsuhiro	Shishikura	Kyoto University

Mathematical Sciences Research Institute

Adventurous Berkeley Complex Dynamics Workshop

May 02 to May 06, 2022

Monday, May 02		
09:15 AM - 09:30 AM		Welcome
09:30 AM - 10:30 AM	Xavier Buff	Spiraling Domains in Dimension 2
11:00 AM - 12:00 PM	John Milnor	Real Quadratic Maps
02:00 PM - 03:00 PM	Nguyen-Bac Dang	Spectrum of the Laplacian for the Basilica Group and Renormalization
03:30 PM - 04:30 PM	Nataliia Goncharuk	Complex Rotation Numbers and Renormalization

Tuesday, May 03		
09:30 AM - 10:30 AM	Volodymyr Nekrashevych	Dimension of Expanding Maps
11:00 AM - 12:00 PM	Thomas Gauthier	Stable Marked Points in Holomorphic Dynamics
02:00 PM - 03:00 PM	Rohini Ramadas	Irreducibility of Gleason polynomials Implies Irreducibility of Per_n
03:30 PM - 04:30 PM	Dzmitry Dudko	MLC Along the Real Line

Wednesday, May 04		
09:00 AM - 10:00 AM	Charles Favre	Topogical Entropy of Rational Maps (Over any Metrized Field)
10:05 AM - 11:05 AM	Kostiantyn Drach	Out-of-the-Box Rigidity via Box Mappings
11:30 AM - 12:30 PM	Anna Miriam Benini	Special Parameters in Spaces of Meromorphic Maps

Thursday, May 05		
09:30 AM - 10:30 AM	Luciana Luna Anna Lomonaco	The Modular Mandelbrot Set
11:00 AM - 12:00 PM	Juan Rivera-Letelier	Nice Quasidisks and Prime Orbit Counting
02:00 PM - 03:00 PM	Fabrizio Bianchi	A Spectral Gap for the Transfer Operator on Complex Projective Spaces
03:30 PM - 04:30 PM	Mitsuhiro Shishikura	On the Limits of Quasiconformal Deformation of Rational Maps

Friday, May 06		
09:30 AM - 10:30 AM	Romain Dujardin	When do Two Rational Functions have Locally Biholomorphic Julia Sets?
11:00 AM - 12:00 PM	Sabyasachi Mukherjee	Deformation Space Analogies between Kleinian Reflection Groups and Rational Maps
02:00 PM - 03:00 PM	Jeff Diller	Invariant Currents for Surface Maps with Transcendental First Dynamical Degree
03:30 PM - 04:30 PM	Núria Fagella	Bifurcation Loci of Families Finite Type Meromorphic Maps

Participants

First Name	Last Name	Institution
Marco	Abate	Università di Pisa
Thomas	Alberts	University of Utah
Mariam	Al-Hawaj	University of Toronto
Ziad	Alhussin	University of California, Berkeley
Fuad	Alsarari	King Saud University
Pol	Arranz-Gibert	University of Barcelona
Kari	Astala	University of Helsinki
Matthieu	Astorg	Université d'Orléans
Juhun	Baik	Korea Advanced Institute of Science and Technology (KAIST)
Krzysztof	Barański	University of Warsaw
Christian	Beck	School of Mathematical Sciences, Queen Mary, University of London
Eric	Bedford	State University of New York, Stony Brook
Veronica	Beltrami	Università di Parma
Anna Miriam	Benini	Università di Parma
Tania G.	Benitez	University of Liverpool
Fabrizio	Bianchi	Université de Lille
Sebastien	Biebler	Institut de Mathematiques de Jussieu
Richard	Birkett	University of Notre Dame
Paul	Blanchard	Boston University
Luka	Boc Thaler	University of Ljubljana
Araceli	Bonifant	University of Rhode Island
Suzanne	Boyd	University of Wisconsin
Andrew	Brown	University of Liverpool
Xavier	Buff	Université de Toulouse III (Paul Sabatier)
Jack	Burkart	University of Wisconsin-Madison
Jordi	Canela Sánchez	Universitat Jaume I
Melida	Carranza	Centro de Investigación en Matemáticas A.C.
Adam	Christopherson	Ohio State University
Francisco José	Cruz Zamorano	University of Sevilla
Nguyen-Bac	Dang	Université Paris-Saclay
Caroline	Davis	Indiana University
André	de Carvalho	University of São Paulo
Jeff	Diller	University of Notre Dame
Devon	Ding	University of California, Berkeley
Arcelino	do Nascimento	Institute of Mathematics and Statistics (IME)
Kostiantyn	Drach	Institute of Science and Technology Austria
George	Dragomir	Columbia University
Schinella	D'Souza	University of Michigan
Dzmitry	Dudko	Stony Brook University
Romain	Dujardin	Sorbonne Université
Saleh	Elmohamed	University of California, Berkeley
Núria	Fagella	University of Barcelona
Charles	Favre	École Polytechnique
Tanya	Firsova	Kansas State University
Robert	Florido-Llinàs	University of Barcelona
Hang	Fu	National Taiwan University
Joanna	Furno	University of South Alabama
Thomas	Gauthier	Université Paris-Saclay
Lukas	Geyer	Montana State University
Adi	Glucksam	Northwestern University
Alex	Gomez	Pontificia Universidad Católica del Perú
Nataliia	Goncharuk	University of Toronto, Mississauga
Chen	Gong	École Polytechnique
Vesselin	Gueorguiev	Ronin Institute for Independent Scholarship
Funda	Gultepe	University of Toledo

Participants

First Name	Last Name	Institution
Cordell	Hammon	Baylor University
Eriko	Hironaka	Florida State University
Mikhail	Hlushchanka	Universiteit Utrecht
Mi	Hu	Università di Parma
Zheng	Huang	CUNY, Graduate Center
Valentin	Huguin	Jacobs University Bremen
Annina	Iseli	University of California, Los Angeles
Kukkeprasanna	J	Bengaluru City University
Xavier	Jarque	Universitat de Barcelona
Sheryne	John	Amrita School Of Engineering
Anna	Jové-Campabadal	University of Barcelona
Jeremy	Kahn	Brown University
Sharada	Kalanidhi	Stanford University School of Medicine
Alex	Kapiamba	University of Michigan
Jayaprakash	Karai	Centre for Statistical and Risk Management Solutions
Scott	Kaschner	Butler University
Kyounghee	Kim	Florida State University
Sungwoon	Kim	Jeju National University
Anna	Kis	University of Waterloo
Sarah	Koch	University of Michigan
Praveen	Kumar	Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
GAURAV	KUMAR	Indian Institute of Technology
Therese	Landry	University of California, Riverside
Chifan	Leung	Oregon State University
Genadi	Levin	The Hebrew University of Jerusalem
Xiaobin	Li	Southwest (Xinan) Jiaotong University
Zhiqiang	Li	Peking University
Willie	Lim	State University of New York, Stony Brook
Peter	Lin	State University of New York, Stony Brook
Russell	Lodge	Indiana State University
Luciana Luna Anna	Lomonaco	Institute of Pure and Applied Mathematics (IMPA)
Tuto	LopezGonzalez	San Francisco State University
Yusheng	Luo	Stony Brook University
Liangbing	Luo	University of Connecticut
Mikhail	Lyubich	State University of New York, Stony Brook
Firdous	Mala	University of Kashmir
Matheus	Manso Del Valle	Institute of Pure and Applied Mathematics (IMPA)
David	Martí-Pete	University of Liverpool
Florestan	Martin-Baillon	Université d'Angers
Jacob	Mazor	State University of New York, Stony Brook
Curtis	McMullen	Harvard University
Tim	Mesikepp	Peking University
Daniel	Meyer	University of Liverpool
John	Milnor	Institute for Mathematical Sciences
Ankita	Mitra	G H Raisoni University, Amravati
Milad	Mohammadi	Islamic Azad University Central Tehran Branch
Mónica	Moreno Rocha	Centro de Investigación en Matemáticas
Sabyasachi	Mukherjee	Tata Institute of Fundamental Research
Malavika	Mukundan	University of Michigan
Shizuo	Nakane	Tokyo Polytechnic University
Evangelos	Nastas	University at Albany (SUNY)
Volodymyr	Nekrashevych	
Hongming	Nie	Stony Brook University
Chatchai	Noytaptim	Oregon State University
Leticia	Pardo Simon	University of Manchester

Participants		
First Name	**Last Name**	**Institution**
Rodrigo	Perez	Indiana University--Purdue University
Pietro	Poggi-Corradini	Kansas State University
Nikolai	Prochorov	Université d'Aix-Marseille I (Université de Provence)
Feliks	Przytycki	Polish Academy of Sciences
Remus	Radu	Institute of Mathematics of the Romanian Academy
Jasmin	Raissy	Institut de Mathématiques de Bordeaux
Rohini	Ramadas	University of Warwick
Bernhard	Reinke	Institut de Mathématiques de Jussieu
Lasse	Rempe	University of Liverpool
Thomas	Richards	University of Warwick
Larissa	Richards	University of Lancaster
Juan	Rivera-Letelier	University of Rochester
Àlex	Rodríguez	University of Barcelona
Roland	Roeder	Indiana University--Purdue University
Pascale	Roesch	IMT
Steffen	Rohde	University of Washington
Matteo	Ruggiero	Institut de Mathematiques de Jussieu
Noussaiba	Saadoudi	Universite M'hammed Bouguerra de Boumerdes (UMBB)
Dierk	Schleicher	Université d'Aix-Marseille (AMU)
Nikita	Selinger	University of Alabama at Birmingham
Nageswari	Shanmugalingam	University of Cincinnati
Mitsuhiro	Shishikura	Kyoto University
Robert	Silversmith	University of Warwick
Zachary	Smith	University of California, Los Angeles
Alan	Sola	Stockholm University
Leon	Staresinic	Imperial College, London
Margaret	Stawiska-Friedland	Mathematical Reviews
Danny	Stoll	University of Michigan
Scott	Sutherland	State University of New York, Stony Brook
Matteo	Tabaro	Imperial College, London
Raluca	Tanase	Institute of Mathematics of the Romanian Academy
Dylan	Thurston	Indiana University
Giulio	Tiozzo	University of Toronto
Garima	Tomar	RPSDC
Tina	Torkaman	Harvard University
Athanasios	Tsantaris	University of Helsinki
Vyron	Vellis	University of Tennessee
Liz	Vivas	Ohio State University
Dan-Virgil	Voiculescu	University of California, Berkeley
James	Waterman	State University of New York, Stony Brook
Max	Weinreich	Brown University
Rebecca	Winarski	College of the Holy Cross
Jonguk	Yang	Stony Brook University
Fei	Yang	Nanjing University
Runze	Zhang	Institut de Mathématiques de Toulouse
Reila	Zheng	University of Toronto
Xinyun	Zhu	University of Texas-Permian Basin

Identifiable Participants' Information

Participants		157

Gender		157
Male	68.79%	108
Female	28.03%	44
Other	1.27%	2
Declined to state	1.91%	3

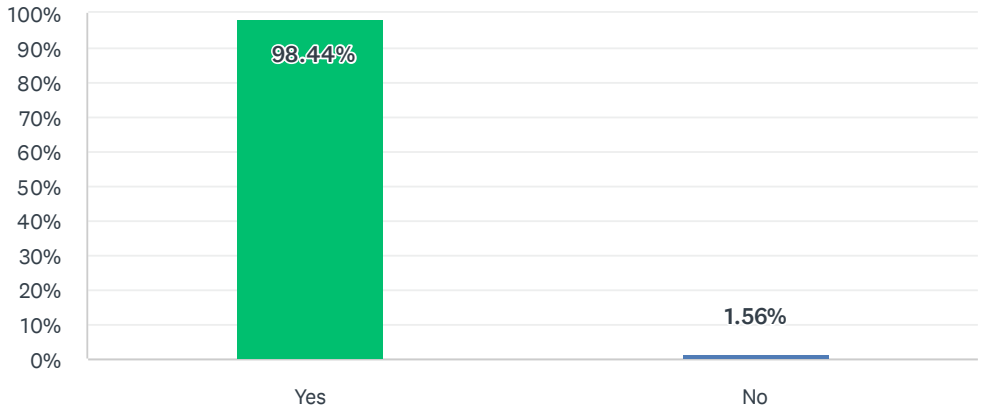
Ethnicity*		163
White	55.21%	90
Asian	24.54%	40
Hispanic	6.13%	10
Pacific Islander	0.61%	1
Black	1.23%	2
Native American	0.00%	0
Mixed	1.84%	3
Declined to state	10.43%	17

* ethnicity specifications are not exclusive

There were 15 unidentifiable participants.

Q1 Did you attend the workshop?

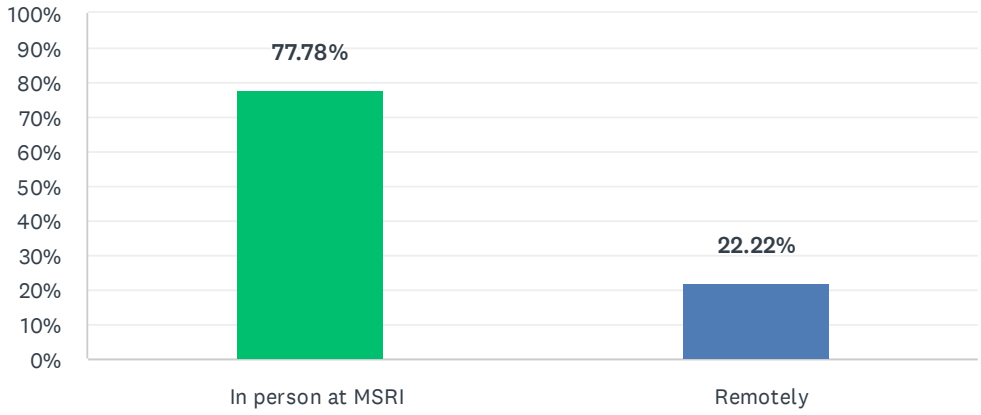
Answered: 64 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	98.44%	63
No	1.56%	1
TOTAL		64

Q2 I primarily participated in the workshop:

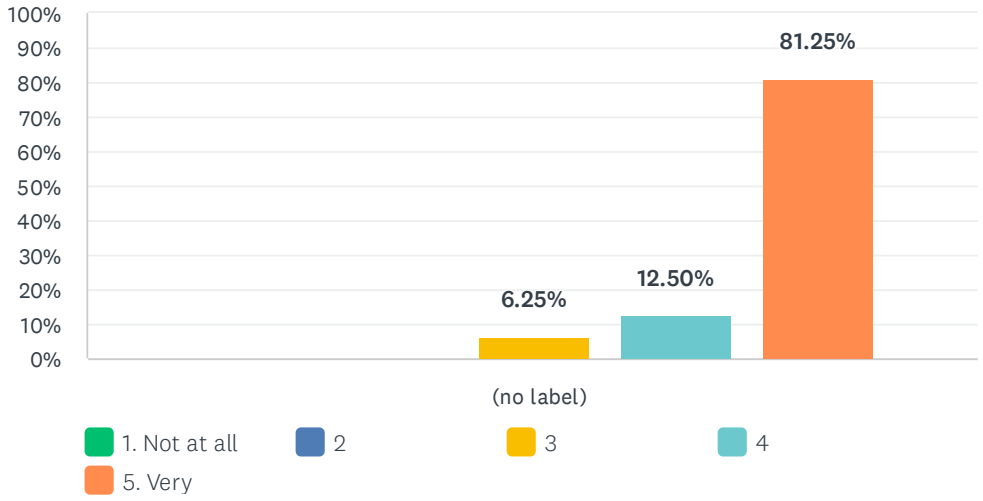
Answered: 63 Skipped: 1



ANSWER CHOICES	RESPONSES	
In person at MSRI	77.78%	49
Remotely	22.22%	14
TOTAL		63

Q3 The workshop was intellectually stimulating

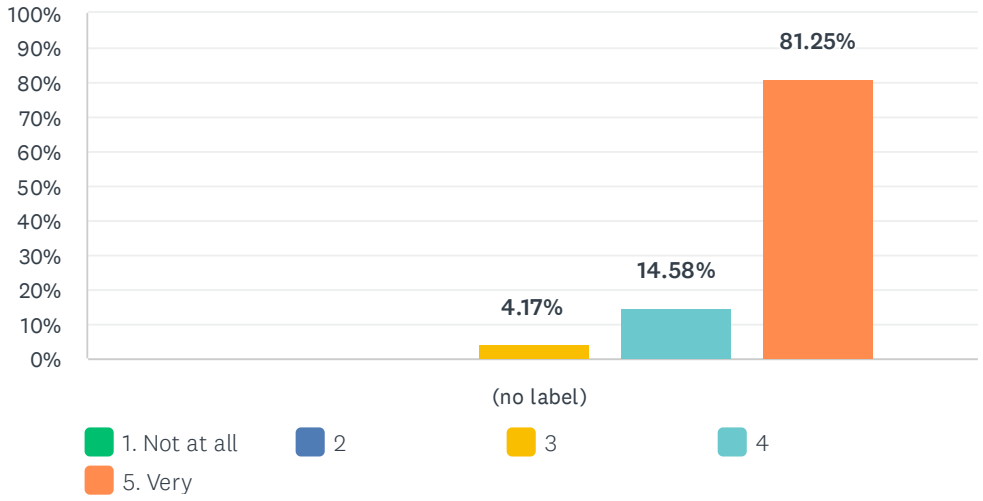
Answered: 48 Skipped: 16



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	6.25% 3	12.50% 6	81.25% 39	48	4.75

Q4 The overall experience of the workshop was worthwhile

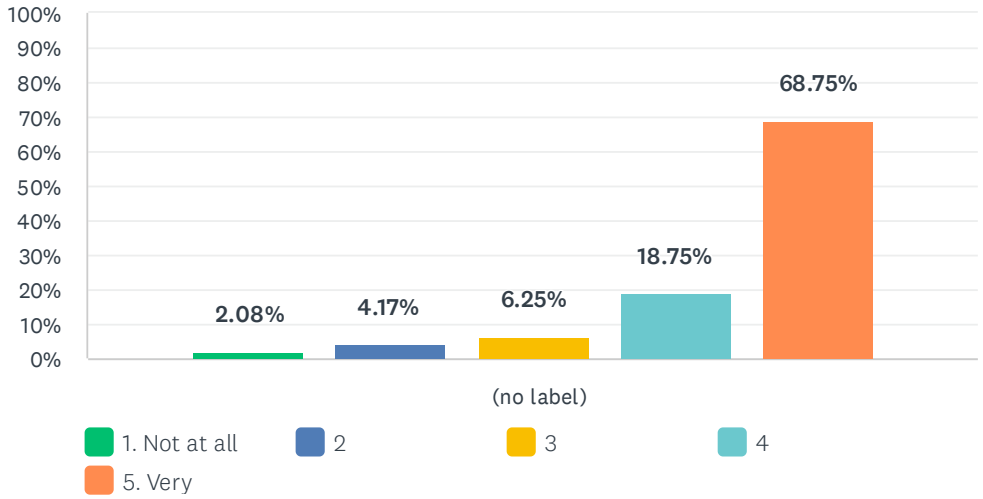
Answered: 48 Skipped: 16



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	4.17% 2	14.58% 7	81.25% 39	48	4.77

Q5 The lectures were at an appropriate level

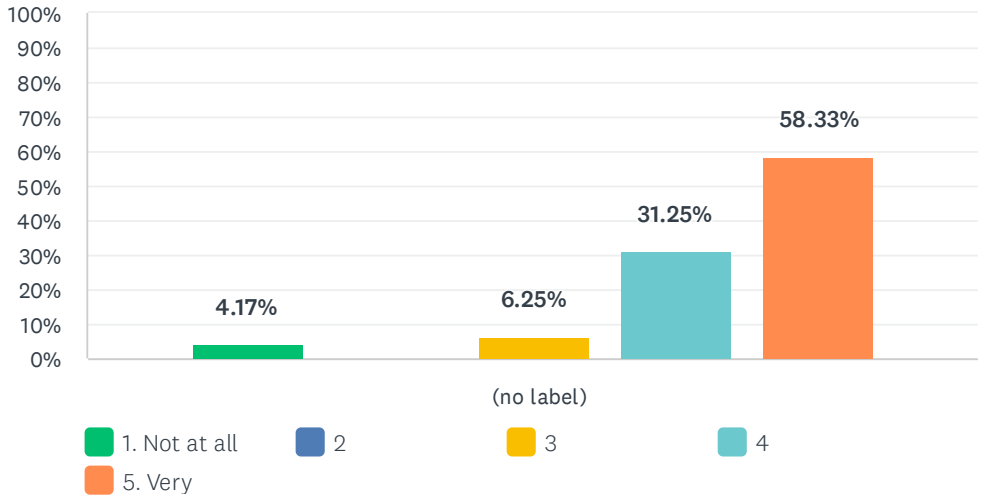
Answered: 48 Skipped: 16



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.08% 1	4.17% 2	6.25% 3	18.75% 9	68.75% 33	48	4.48

Q6 I was well prepared to benefit from the lectures

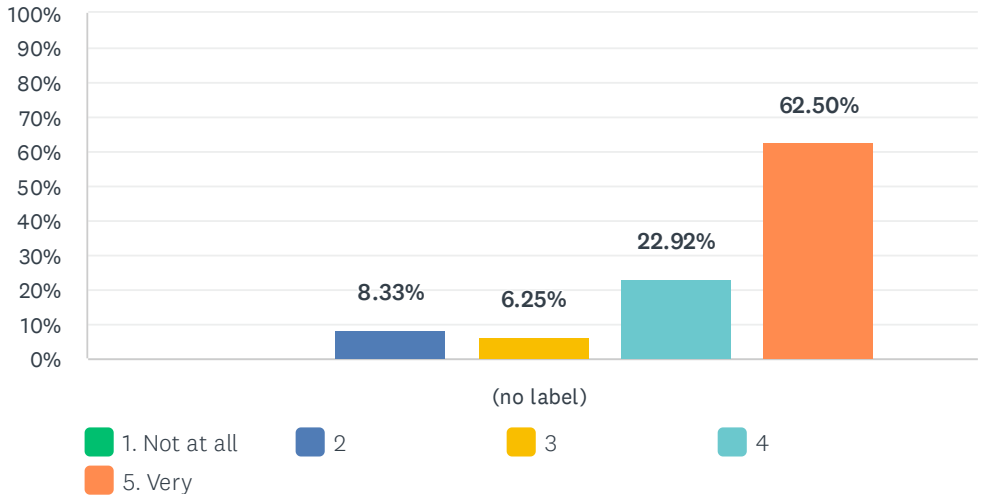
Answered: 48 Skipped: 16



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	4.17% 2	0.00% 0	6.25% 3	31.25% 15	58.33% 28	48	4.40

Q7 My interest in the subject matter was increased by the workshop

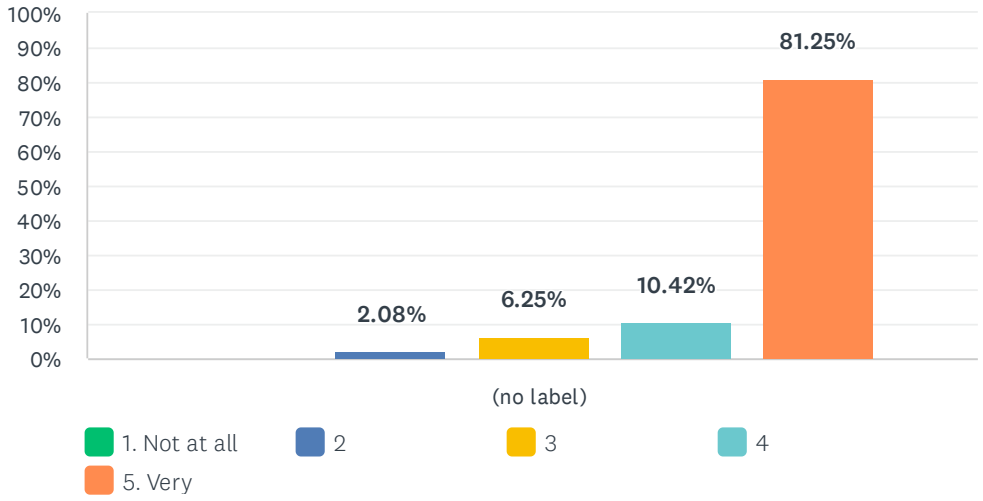
Answered: 48 Skipped: 16



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	8.33% 4	6.25% 3	22.92% 11	62.50% 30	48	4.40

Q8 The workshop helped me meet people with similar scientific interests

Answered: 48 Skipped: 16



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.08% 1	6.25% 3	10.42% 5	81.25% 39	48	4.71

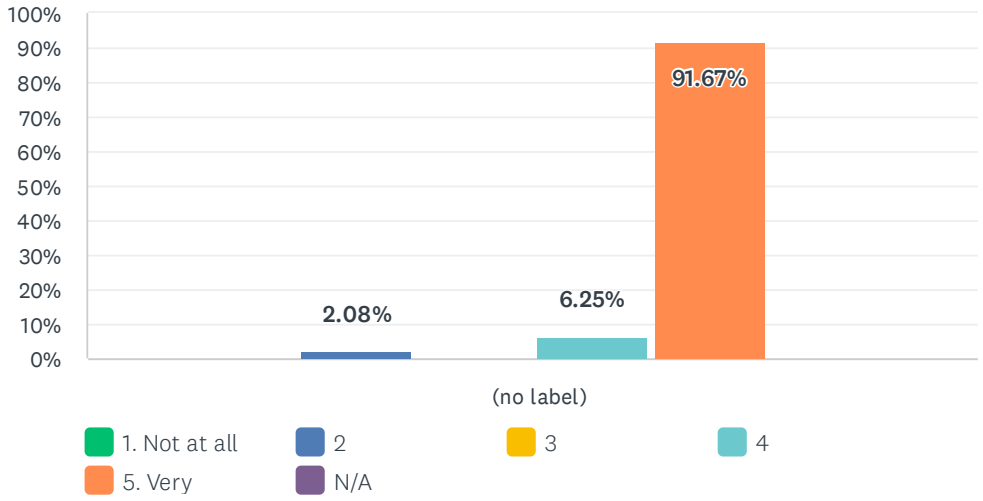
Q9 Additional comments

Answered: 8 Skipped: 56

#	RESPONSES	DATE
1	The talks were too hard. There are researchers with several different threads of background, and the talks were pitched at those who already had the background at one of the threads, but I think very few people had the right background to benefit from more than 3-4 talks.	5/11/2022 4:40 PM
2	MSRI is a wonderful place with a wonderful staff. Thank you very much for having me.	5/11/2022 4:37 PM
3	Some of the talks were difficult to follow, I felt that not all the speakers put enough effort in providing gentle introductions to their talks for non-experts.	5/11/2022 4:19 PM
4	Thank you for a wonderful workshop!	5/9/2022 7:05 AM
5	It has been a really nice workshop; well organized in a wonderful place.	5/9/2022 1:59 AM
6	Really great conf, really great location.	5/6/2022 8:39 PM
7	The organization of the workshop was really very good, both from the practical and from the scientific point of view.	5/6/2022 7:06 PM
8	I would love to come again if MSRI could host another complex dynamics workshop again.	5/6/2022 6:26 PM

Q10 I found the MSRI staff helpful

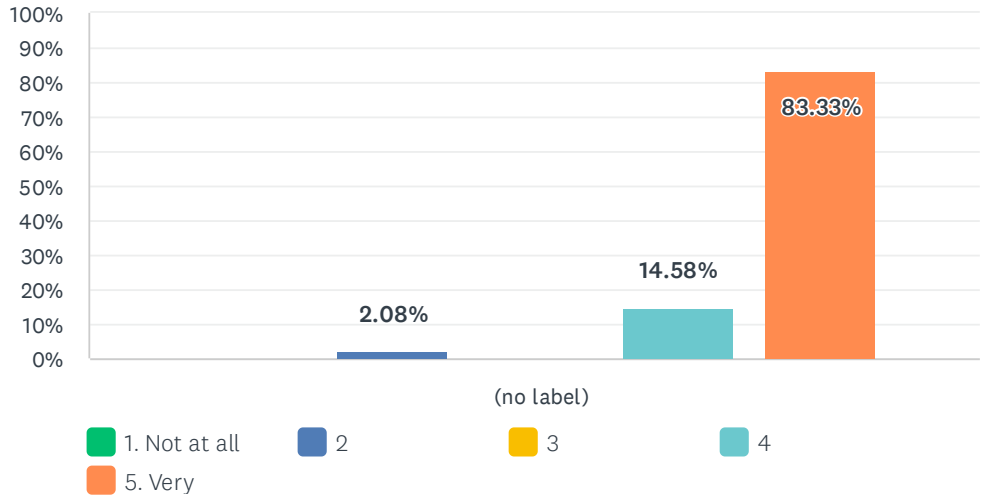
Answered: 48 Skipped: 16



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.08% 1	0.00% 0	6.25% 3	91.67% 44	0.00% 0	48	4.88

Q11 The MSRI facilities were conducive for such a workshop

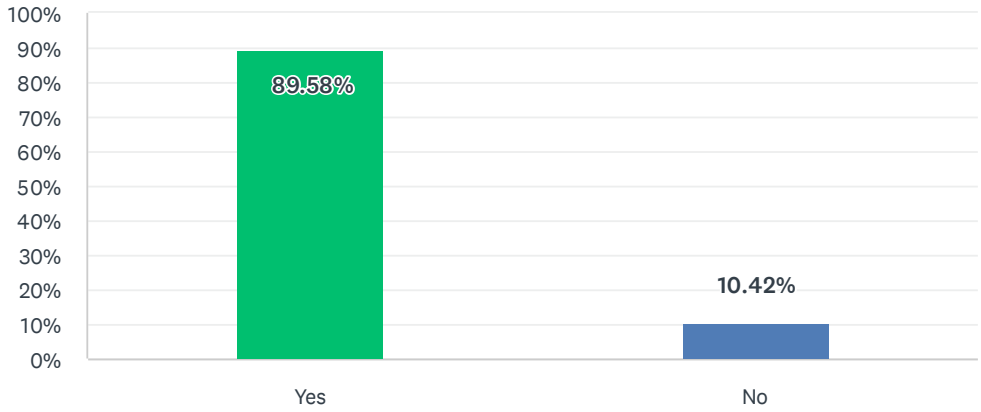
Answered: 48 Skipped: 16



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.08% 1	0.00% 0	14.58% 7	83.33% 40	48	4.79

Q12 Did you use MSRI's wireless network?

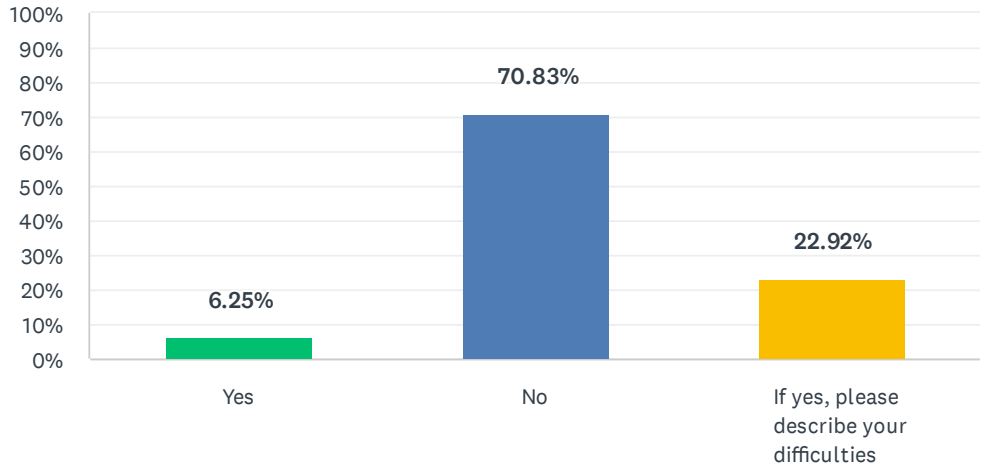
Answered: 48 Skipped: 16



ANSWER CHOICES	RESPONSES	
Yes	89.58%	43
No	10.42%	5
TOTAL		48

Q13 Did you experience any difficulties with the network?

Answered: 48 Skipped: 16

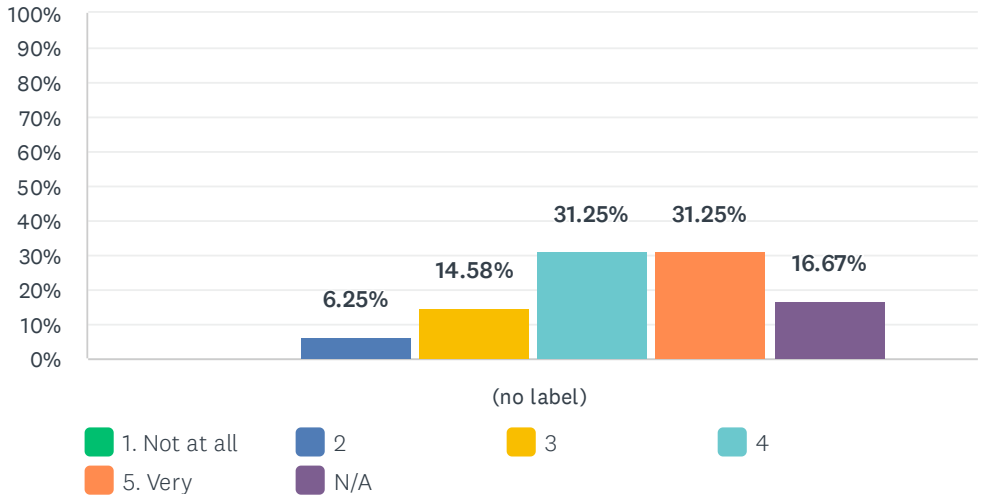


ANSWER CHOICES	RESPONSES	
Yes	6.25%	3
No	70.83%	34
If yes, please describe your difficulties	22.92%	11
TOTAL		48

#	IF YES, PLEASE DESCRIBE YOUR DIFFICULTIES	DATE
1	I sometimes have problems with Wi-Fi in my office	5/17/2022 9:47 PM
2	I could not use Eduroam	5/12/2022 8:26 AM
3	The internet was unstable some times.	5/11/2022 4:42 PM
4	Had trouble connecting at times	5/11/2022 4:29 PM
5	Wireless network in the 3rd floor (where my office is) was often poor, sometimes even unusable	5/11/2022 4:15 PM
6	Occasional disconnects	5/10/2022 6:03 AM
7	slow	5/9/2022 1:32 PM
8	I somewhat frequently didn't work or the connection was very poor.	5/6/2022 11:26 PM
9	A little trouble w. eduroam. MSRIs own network was good.	5/6/2022 8:40 PM
10	Did not connect to eduroam... But I did not try hard enough.	5/6/2022 7:52 PM
11	Intermittent at times but not detrimental.	5/6/2022 6:27 PM

Q14 The MSRI lunch arrangements were satisfactory

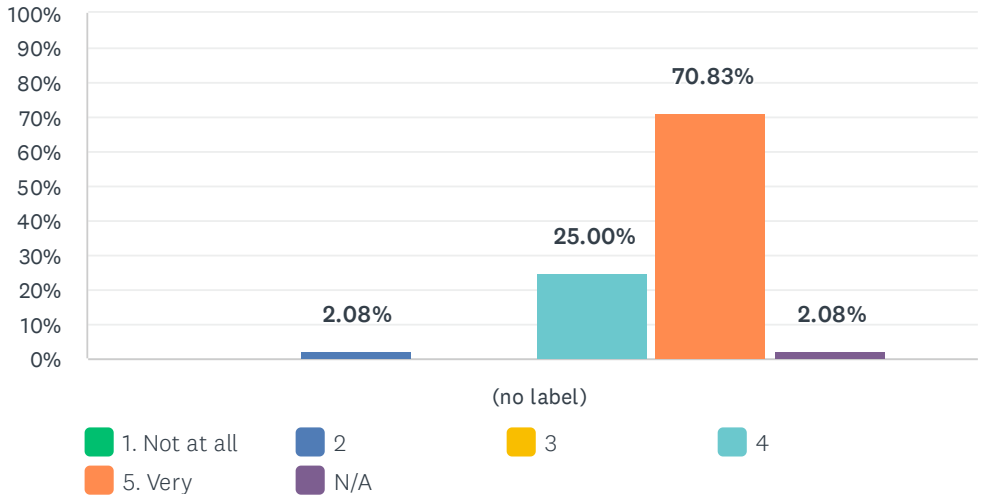
Answered: 48 Skipped: 16



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	6.25% 3	14.58% 7	31.25% 15	31.25% 15	16.67% 8	48	4.05

Q15 The MSRI tea arrangements were satisfactory

Answered: 48 Skipped: 16



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.08% 1	0.00% 0	25.00% 12	70.83% 34	2.08% 1	48	4.68

Q16 Additional comments about the MSRI staff, facilities and food

Answered: 15 Skipped: 49

#	RESPONSES	DATE
1	2 days out of 5 the restaurant did not really propose vegan options.	5/11/2022 11:23 PM
2	All wonderful.	5/11/2022 4:42 PM
3	There was FAR too little food at the reception and the vegetarian/vegan options were lacking.	5/11/2022 4:41 PM
4	The MSRI staff (especially Sierra!) we're extremely kind and helpful.	5/11/2022 4:29 PM
5	Thanks to the great staff, you guys are the best!	5/11/2022 4:15 PM
6	The food at the reception was lacking.	5/10/2022 8:48 AM
7	Reception on Friday is better than on Tuesday.	5/10/2022 6:03 AM
8	The tea of every day was wonderful. Maybe the reception was worse than expected. I arrived 15 minutes late (I was discussing math) and there was nothing left. But it was very enjoyable nevertheless.	5/9/2022 3:13 PM
9	There was not enough food nor drinks at the reception.	5/9/2022 9:25 AM
10	Thank you for your help! MSRI is an ideal place for research, and the staff has a lot to do with that.	5/9/2022 7:06 AM
11	The social party was not properly organized (postponed to Fridaywhich is not the appropriate day and the quantities of food and wine were not properly adapted)	5/9/2022 12:28 AM
12	I think there could be more accommodation for vegan options (both for the benefits of those who are vegan and from an environmental perspective). E.g., there could be some vegan spread provided when there are bagels, clear labelling of foods as to which are vegan, and plant milk available for tea/coffee. But overall everything was great!	5/8/2022 7:28 AM
13	Not so clear on the website you can pay by credit card (rather than paypal)	5/6/2022 8:40 PM
14	The staff are amazing!	5/6/2022 8:06 PM
15	Absolute gems, the entire lot of them.	5/6/2022 6:27 PM

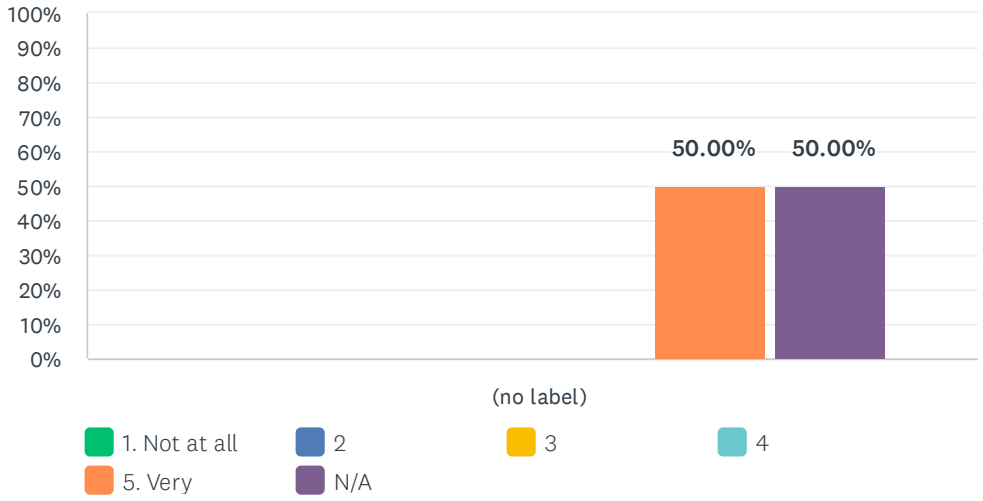
Q17 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 4 Skipped: 60

#	RESPONSES	DATE
1	Ask the restaurants to provide vegan/gluten free/other allergies related options, or at least to indicate what is in each meal.	5/11/2022 11:24 PM
2	Can’t think of anything.	5/11/2022 4:43 PM
3	The catered reception on Friday seemed to have not enough food for the amount of people attending.	5/11/2022 4:16 PM
4	Keep up the good work.	5/6/2022 8:41 PM

Q18 I found the MSRI staff helpful

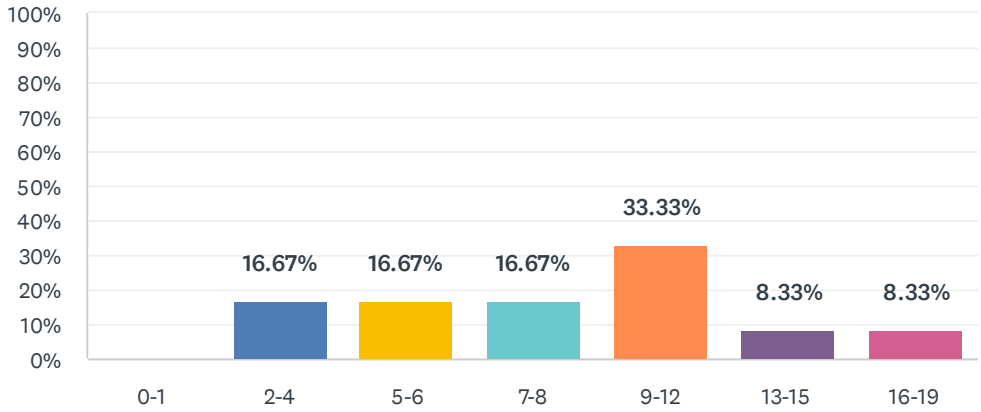
Answered: 12 Skipped: 52



	1. NOT AT ALL	2	3	4	5. VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	0.00% 0	50.00% 6	50.00% 6	12	5.00

Q19 How many talks did you watch live?

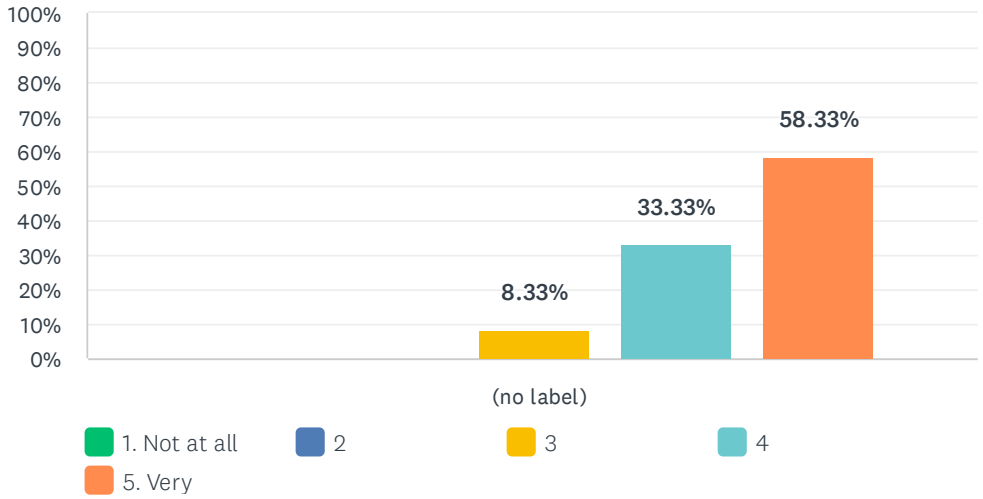
Answered: 12 Skipped: 52



ANSWER CHOICES	RESPONSES	
0-1	0.00%	0
2-4	16.67%	2
5-6	16.67%	2
7-8	16.67%	2
9-12	33.33%	4
13-15	8.33%	1
16-19	8.33%	1
TOTAL		12

Q20 The workshop was intellectually stimulating

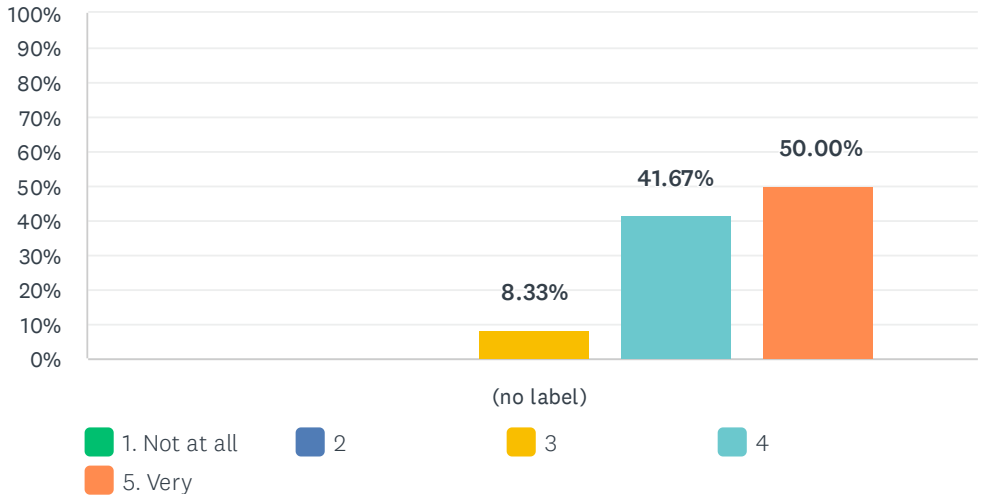
Answered: 12 Skipped: 52



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.33% 1	33.33% 4	58.33% 7	12	4.50

Q21 The overall experience of the workshop was worthwhile

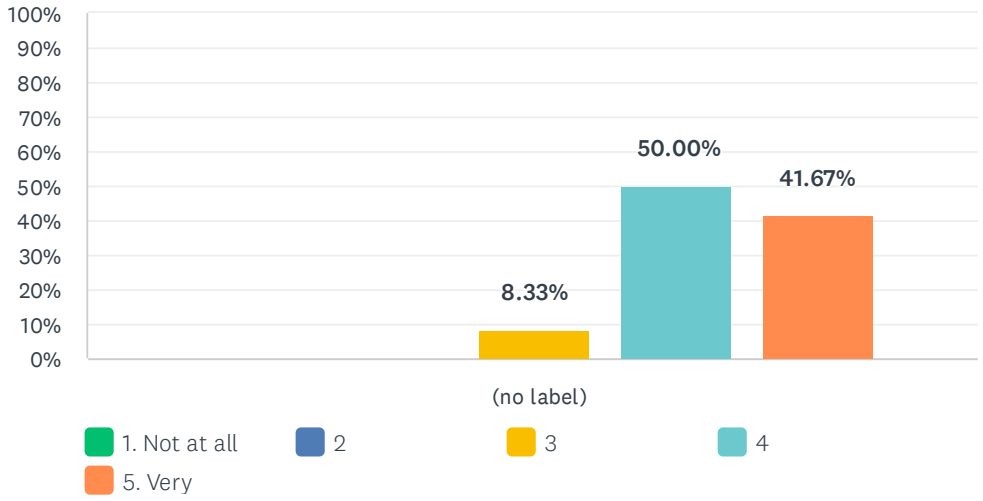
Answered: 12 Skipped: 52



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.33% 1	41.67% 5	50.00% 6	12	4.42

Q22 The lectures were at an appropriate level

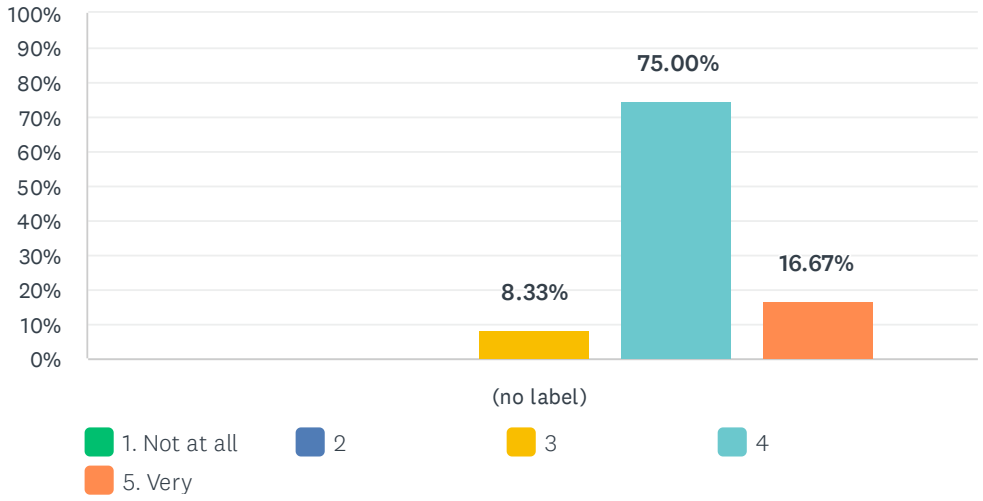
Answered: 12 Skipped: 52



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.33% 1	50.00% 6	41.67% 5	12	4.33

Q23 I was well prepared to benefit from the lectures

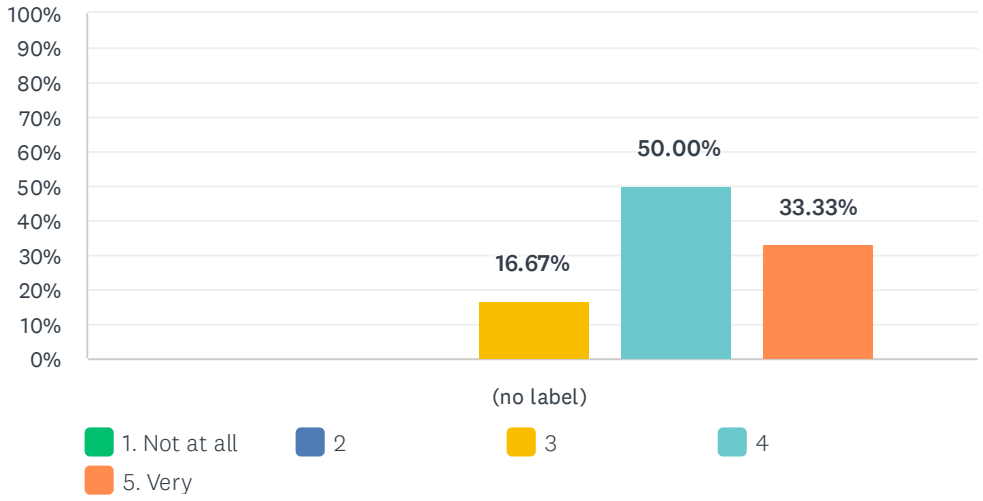
Answered: 12 Skipped: 52



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	8.33% 1	75.00% 9	16.67% 2	12	4.08

Q24 My interest in the subject matter was increased by the workshop

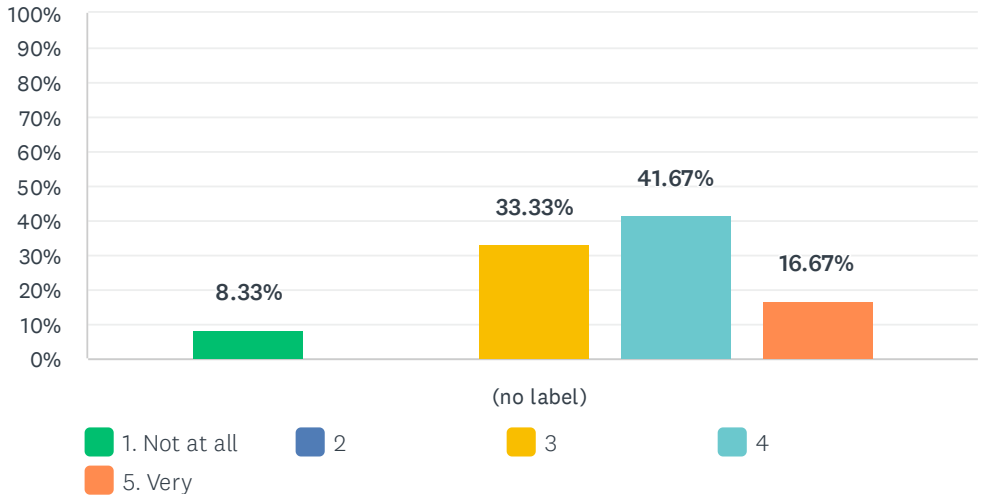
Answered: 12 Skipped: 52



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	16.67% 2	50.00% 6	33.33% 4	12	4.17

Q25 The workshop helped me meet people with similar scientific interests

Answered: 12 Skipped: 52



	1. NOT AT ALL	2	3	4	5. VERY	TOTAL	WEIGHTED AVERAGE
(no label)	8.33% 1	0.00% 0	33.33% 4	41.67% 5	16.67% 2	12	3.58

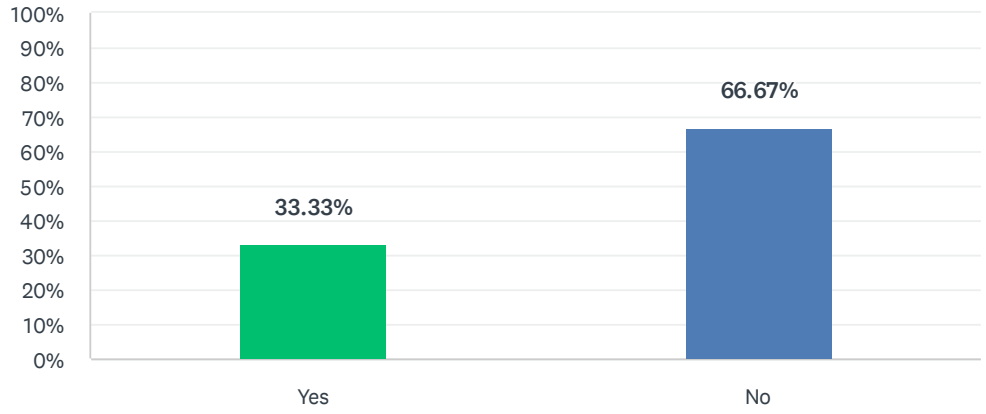
Q26 Additional comments

Answered: 3 Skipped: 61

#	RESPONSES	DATE
1	I would have preferred not to reply on the number of lectures I attended. I did attend more than none, but I chose the maximum choice because that would have been my preference if I had known/been able to attend in person. I'm still unclear if it was an option msri was intending to provide to me, but I do live in Berkeley.	5/12/2022 12:02 AM
2	Some workshops tend to draw its speakers from the same research group of the organizers, which is understandable, but sometimes boring for those outside their group. In this workshop, I very much appreciated the variety of the subjects presented, this has been the most important feature of the workshop.	5/9/2022 10:54 AM
3	The workshop was intellectually very helpful. I thank all the organizers and MSRI staff.	5/6/2022 6:46 PM

Q27 Did you experience any technical difficulties accessing the workshop online?

Answered: 12 Skipped: 52



ANSWER CHOICES	RESPONSES	
Yes	33.33%	4
No	66.67%	8
TOTAL		12

#	IF YES, PLEASE EXPLAIN THE DIFFICULTIES EXPERIENCED	DATE
1	Difficulty is a bit too strong of a word for the issues I noticed. However, it seemed to me unclear if the question moderators for the online parts were also moderating the questions in the room at msri, or if they were in the msri lecture room at all.	5/12/2022 12:13 AM
2	A minor one: during one of the talks an open microphone was capturing a private conversation that interfered with the main audio from the speaker.	5/9/2022 11:04 AM
3	spotty audio in the first half of the week	5/7/2022 10:20 AM
4	There was network problem	5/6/2022 6:47 PM

Q28 How did having the workshop held online impact your participation? For instance: did personal circumstances due to the pandemic hamper your participation in any way or was there a barrier to participation due to time zone differences?

Answered: 12 Skipped: 52

#	RESPONSES	DATE
1	i would have preferred to attend in person and would have been able to financially and distance wise (I live in berkeley, and I know how to use the berkeley/uc berkeley transportation system to get to MSRI. I do not know what the procedures to enter for the lectures are, and I was not able to figure out if that was an implied option for me at all. I decided that it would not be appropriate to just show up and ask on site, but I will look into this for future lectures I sign up for.	5/12/2022 12:13 AM
2	Indeed, there was a barrier to participation due to time zone differences. But I can watch the replay.	5/11/2022 6:29 PM
3	I would not have been able to participate if it was not online.	5/11/2022 4:16 PM
4	If the workshop had not been online, I would not have been able to attend due to the pandemia.	5/9/2022 11:04 AM
5	Yes because of the time difference I could not attend all the lectures.	5/8/2022 9:03 PM
6	It helped to participate online, because I was not approved for in-person participation.	5/7/2022 10:20 AM
7	I was not going to participate in present, so online transmission gave me the opportunity to participate in real time.	5/7/2022 10:17 AM
8	I preferred participating online.	5/7/2022 7:26 AM
9	I think online is great!	5/7/2022 6:42 AM
10	It was decisive for my participation. Due to my job, I could not attend in person.	5/6/2022 7:02 PM
11	Time zone difference was the main barrier	5/6/2022 6:47 PM
12	The time zone differences was a small dificulty	5/6/2022 4:46 PM

Q29 One important aspect that was missing due to the online format was interaction between all participants. Do you have any suggestions on how we can provide this interaction if we hold future workshops online?

Answered: 4 Skipped: 60

#	RESPONSES	DATE
1	I think that in general, not only at MSRI, there should be a camera that at least once per lecture can point a camera at a section of the audience, not from behind, but from the front. It's a bit ironic that remote participants faces are often more visible, such as on the tv screen thats shown in the videos off to the left in the msri lecture hall, but we don't see the local participants in the audience faces as much. I understand that privacy is something that is very important, so maybe there can be a section of the room that is always out of the camera way, but as I said, remote participants of the audience faces/avatars are often shown, so I don't think it would be that strange to have a camera in the lecture hall facing the audience at times. Alternatively, people in the msri lecture hall audience could be repeatedly recommended the option to also sign into zoom so when they speak, the remote people can see their faces and associate their voices etc accordingly.	5/12/2022 12:13 AM
2	I don't think there is a very good way to solve this at present. We can wait the end of the pandemic and then communicate face to face.	5/11/2022 6:29 PM
3	No.	5/11/2022 4:16 PM
4	You may provide the option of break rooms during coffee breaks, adding a few computers/screens in the coffee room so that participants online & in person can interact with each other.	5/9/2022 11:04 AM

Q30 We welcome any additional comments or suggestions you may haveto improve the overall experience for future participants.

Answered: 3 Skipped: 61

#	RESPONSES	DATE
1	If standardized notation used at MSRI provided on the website, i think it would be good to point that out in each lecture every time they begin, so that that in the future, people will know what was used and how it shifted over time relative to a standard in the moment as well.	5/12/2022 1:37 AM
2	Wonderful job! I hope to be able to visit the MSRI in the near future.	5/9/2022 11:05 AM
3	The lectures we very well presented Thank you	5/8/2022 9:04 PM

May 12, A Celebration for Women in Mathematics, Year 2022Workshop

May 12, 2022

Hybrid Workshop

Organizers:

Ini Adinya (University of Ibadan)

Maria-Grazia ASCENZI (University of California Los Angeles)

Hajer Bahouri (Laboratoire Jacques-Louis Lions; Centre National de la Recherche Scientifique (CNRS)

Hélène Barcelo (MSRI - Mathematical Sciences Research Institute)

Lenore Blum (Carnegie Mellon University)

Donatella Danielli (Arizona State University)

Shanna Dobson (University of California, Riverside)

Malena Espanol (Arizona State University)

Vasiliki Evdoridou (The Open University)

Olubunmi Fadipe-Joseph (University of Ilorin

Anna Fino (Università di Torino)

Adi Glucksam (Northwestern University)

Eriko Hironaka (Florida State University)

M.E. Hogan (Texas Tech University)

Kyounghee Kim (Florida State University)

Kuei-Nuan Lin (Pennsylvania State University)

Liangbing Luo (University of Connecticut)

Ornella Mattei (San Francisco State University)

Betul Orcan-Ekmekci (Rice University)

Leticia Pardo Simon (University of Manchester)

Julia Plavnik (Indiana University)

Palina Salanevich (Universiteit Utrecht)

Awais Shaukat (Government College University Lahore)

Tara Taylor (St. Francis Xavier University)

Organizers

First Name	Last Name	Institution
Ini	Adinya	University of Ibadan
Maria-Grazia	Ascenzi	University of California Los Angeles
Hajer	Bahouri	Laboratoire Jacques-Louis Lions; Centre National de la Recherche Scientifique (CNRS)
Hélène	Barcelo	MSRI - Mathematical Sciences Research Institute
Lenore	Blum	Carnegie Mellon University
Donatella	Danielli	Arizona State University
Shanna	Dobson	University of California, Riverside
Malena	Espanol	Arizona State University
Vasiliki	Evdoridou	The Open University
Olubunmi	Fadipe-Joseph	University of Ilorin
Anna	Fino	Università di Torino
Adi	Glucksam	Northwestern University
Eriko	Hironaka	Florida State University
M.E.	Hogan	Texas Tech University
Kyounghee	Kim	Florida State University
Kuei-Nuan	Lin	Pennsylvania State University
Liangbing	Luo	University of Connecticut
Ornella	Mattei	San Francisco State University
Betul	Orcan-Ekmekci	Rice University
Leticia	Pardo Simon	University of Manchester
Julia	Plavnik	Indiana University
Palina	Salanevich	Universiteit Utrecht
Awais	Shaukat	Government College University Lahore
Tara	Taylor	St. Francis Xavier University

Speakers

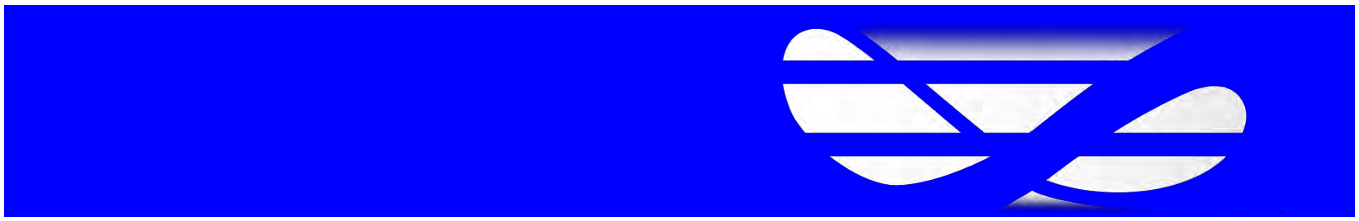
First Name	Last Name	Institution
June	Barrow-Green	The Open University
Elizabeth	Donovan	Murray State University
Yukari	Ito	Kavli Institute for the Physics and Mathematics of the Universe
Andrea	Solotar	Universidad de Buenos Aires
Angela	Tabiri	African Institute for Mathematical Sciences Ghana

Mathematical Sciences Research Institute

May 12, A Celebration for Women in Mathematics, Year 2022 [Hybrid Workshop]

12-May-22

Thursday, May 12		
08:00 AM - 09:30 AM	Elizabeth Donovan, June Barrow-Green, Yukari Ito, Andrea Solotar & Angela Tabiri	Panel Discussion
09:30 AM - 10:45 AM		Break
10:45 AM - 11:45 PM		Social Tea (Virtual)
10:30 AM - 11:30 AM		Breakout Rooms on Various Topics



Participants		
First Name	**Last Name**	**Institution**
Patience	Adama	The Federal Polytechnic Bida
Basirat	Adebisi	University of Ibadan
Ibukun	Ademehin	Federal University of Technology, Akure
Ini	Adinya	University of Ibadan
Kyna	Airriess	University of British Columbia
Ahmed	Alabi	Ekiti State University
Rachael	Alfant	Rice University
Princess	Allotey	Carnegie Mellon University
Helena	Almassy	San Francisco State University
Izar	Alonso Lorenzo	University of Oxford
Zhongshan	An	University of Connecticut
Vinay	Arora	Panjab University, UIET (Pussgrc, Hoshiarpur) India
Nancy	Asare Nyarko	University of Ghana
Maria-Grazia	Ascenzi	University of California Los Angeles
Sakina	Ashraf	Bahauddin Zakariya University
Abigel	Asteraye	Mount Holyoke College
Jessica	Ayala	University of California Los Angeles
Chan	Bae	University of California, Berkeley
Hajer	Bahouri	Laboratoire Jacques-Louis Lions; Centre National de la Recherche Scientifique (CNRS)
Rachel	Bailey	University of Connecticut
Selenne	Banuelos	Institute for Pure and Applied Mathematics
Hélène	Barcelo	MSRI - Mathematical Sciences Research Institute
Manuel	Barcenas	University of California, Riverside
June	Barrow-Green	The Open University
Devjani	Basu	Southern Illinois University
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Lenore	Blum	Carnegie Mellon University
Ashley	Bonner	University of Florida
Neelima	Borade	Princeton University
Mrinal	Bose	IIT ISM Dhanbad
Benjamin	Briggs	MSRI - Mathematical Sciences Research Institute
Juliette	Bruce	University of California, Berkeley
Elyse	Budkie	Florida State University
MacKenzie	Carr	Simon Fraser University
Yu-Chan	Chang	Oxford College of Emory University
Anastasia	Chavez	Saint Mary's College of California
Xiaoou	Cheng	New York University, Courant Institute
Ng	Cherry	University of Colorado
Anna Maria	Cherubini	Università del Salento
Kwok Chi	Chim	Technische Universität Graz
Jaihee	Choi	Rice University
Cara	Costelnock	University of Colorado, Denver
Shelby	Cox	University of Michigan
Xinle	Dai	Harvard University
Donatella	Danielli	Arizona State University
Pragnya	Dascalu	Hokkaido University
Maria	Dascalu	University of Massachusetts Amherst
Emily	Dautenhahn	Cornell University
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Caroline	Davis	Indiana University
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Rianne	de Heide	Vrije Universiteit
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Karan	Dhindsa	California State University, East Bay
Arame	Diaw	Centro de Matemática da Universidade do Porto
Tiffany	Ding	University of California, Berkeley
Shanna	Dobson	University of California, Riverside
Erin	Dolecheck	Iowa State University
Xinghao	Dong	University of California, Los Angeles
Elizabeth	Donovan	Murray State University
Schinella	D'Souza	University of Michigan
Juanita	Duque Rosero	Dartmouth College
Helen	Edogbanya	Federal University Lokoja
Yael	Eisenberg	Cornell University
Monika	Eisenbud	University of Memphis
Moriah	Elkin	University of Minnesota
Malena	Espanol	Arizona State University
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Henry	Garrett	Mercy College
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Yuxi	Han	University of Wisconsin-Madison
Vivian	Healey	Texas State University
Susanna	Heikkilä	University of Helsinki
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Cecelia	Higgins	University of California, Los Angeles
Eriko	Hironaka	Florida State University
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Yijie	Jin	Georgia Institute of Technology
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Lissa	Johns	IISER Trivandrum
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Elizabeth	Kelley	University of Illinois at Urbana-Champaign
Kyounghee	Kim	Florida State University
Nayeong	Kim	San Francisco State University
Hanna	Kim	University of Illinois at Urbana-Champaign
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Dorian	Smith	University of Minnesota
Lucas	Smith	University of Oklahoma
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Tara	Taylor	St. Francis Xavier University
Vladlen	Timorin	HSE University
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Ruixiao	Wang	University of California, Los Angeles
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Adela	Zhang	Massachusetts Institute of Technology
Cong	Zhou	Indiana University
Jennifer	Zhu	University of Waterloo

Identifiable Participants' Information

Participants		280

Gender		280
Male	19.29%	54
Female	78.57%	220
Other	1.43%	4
Declined to state	0.71%	2

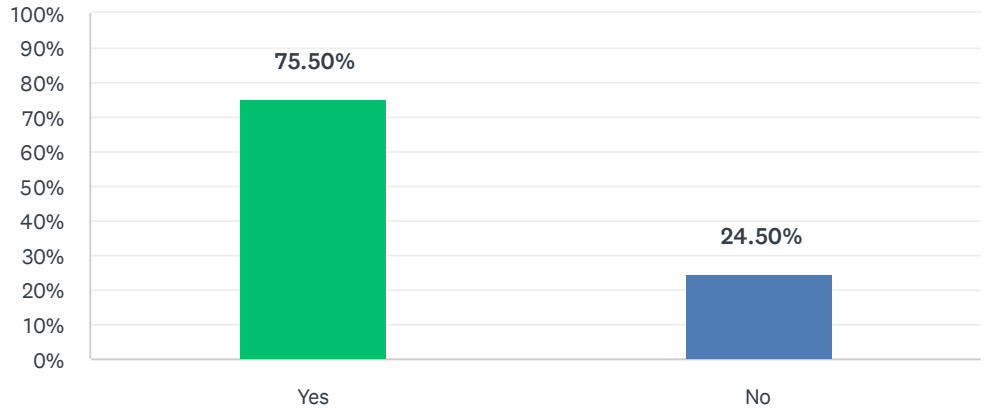
Ethnicity*		309
White	36.25%	112
Asian	30.74%	95
Hispanic	9.39%	29
Pacific Islander	0.00%	0
Black	11.00%	34
Native American	0.65%	2
Mixed	4.53%	14
Declined to state	7.44%	23

* ethnicity specifications are not exclusive

There were 12 unidentifiable participants.

Q1 Did you attend the MSRI May 12 Celebration for Women in Mathematics event?

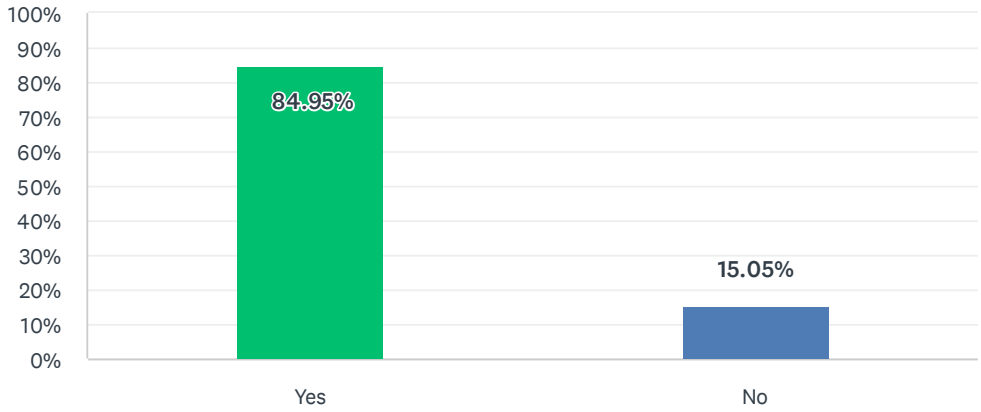
Answered: 151 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	75.50%	114
No	24.50%	37
TOTAL		151

Q2 Was this your first time attending the MSRI May 12 event?

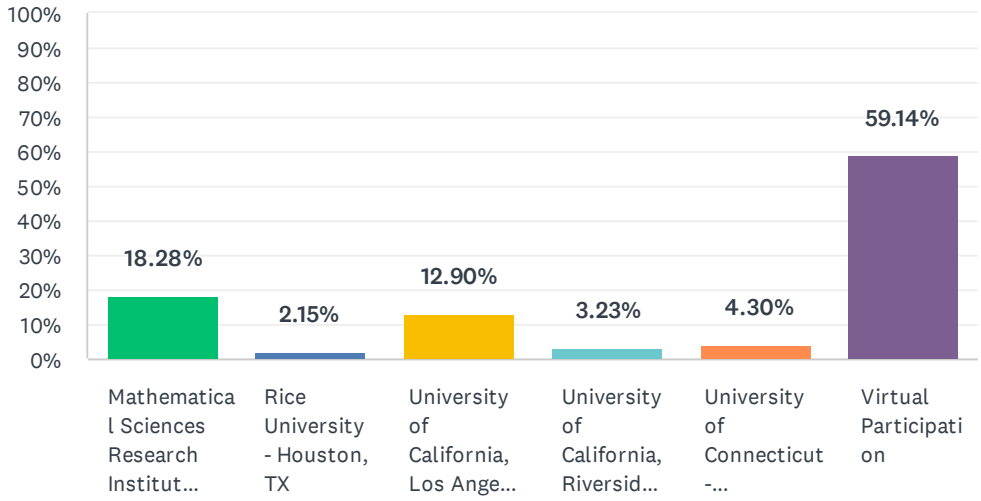
Answered: 93 Skipped: 58



ANSWER CHOICES	RESPONSES	
Yes	84.95%	79
No	15.05%	14
TOTAL		93

Q3 Where did you attend?

Answered: 93 Skipped: 58



ANSWER CHOICES	RESPONSES	
Mathematical Sciences Research Institute (MSRI) - Berkeley, CA	18.28%	17
Rice University - Houston, TX	2.15%	2
University of California, Los Angeles - Los Angeles, CA	12.90%	12
University of California, Riverside - Riverside, CA	3.23%	3
University of Connecticut - Mansfield, CT	4.30%	4
Virtual Participation	59.14%	55
TOTAL		93

Q4 Please provide your feedback on the format of the event, namely (i) panel discussion, (ii) virtual social tea, (iii) breakout rooms or in-person discussion, including any suggestions for improvement.

Answered: 93 Skipped: 58

#	RESPONSES	DATE
1	:)	5/30/2022 2:34 PM
2	I think the event is great.	5/30/2022 9:05 AM
3	everything went smoothly and we connected with each other. I look forward to next meetings/seminars	5/29/2022 12:26 PM
4	I wish our breakout room had only discussed one topic (the one it was labeled by) instead of trying to get through all of them. Otherwise, it was a good event!	5/23/2022 10:50 AM
5	Expectations for in-person sites were a bit unclear. Might be good to have more correspondence with sites.	5/23/2022 8:04 AM
6	I think it was great that there were satellite locations, as well as virtual participants.	5/20/2022 4:03 PM
7	Virtual social tea times were two short and didn't allow even time to communicate with others and explore their experiences in advanced mathematics. Riverside satellite had stuffed animals, we had a great time. We talked about how to find a research mentor, what qualities we would want to see, and some of the research we were all currently engaged with.	5/20/2022 1:02 PM
8	The panel discussion is the only part I could attend. It was very inspiring and useful to hear advices on such common matters.	5/20/2022 8:03 AM
9	It was interesting	5/19/2022 10:46 PM
10	(i) The panel discussion was interesting. The time for each question/ answer session can be increased or improved. (ii) In the virtual social tea there were moments where no one were speaking so there can be a theme for the virtual social tea or some of the MSRI member for a smooth movement of the conversation.	5/19/2022 7:11 PM
11	Everything was super fun and helpful.	5/19/2022 6:19 PM
12	As a virtual program, I did not find it as effective in networking aspects, but it seems to have been a good way to get participants to ask questions of the panelists.	5/19/2022 4:53 PM
13	(i) amazing (ii)good (iii) good	5/19/2022 2:13 PM
14	Very interesting discussions, glad I attended!	5/19/2022 1:57 PM
15	I think it went fine	5/19/2022 12:38 PM
16	Too generic for graduate student. Not as helpful for grad student	5/19/2022 12:34 PM
17	I thought the virtual speed meeting was excellent. The groups of 4-5 people were a nice size and having 7-8 minutes was a good amount of time for us to chat briefly without feeling stuck/out of conversation too much. I do think it might have been nice to have had some suggested questions to discuss during this time. But overall, it was excellent. I think the panalist self introductions could have been slightly shorter. But I really appreciated the diversity in the panelists both demographically and with respect to their career paths.	5/19/2022 12:32 PM
18	The panel discussions were very open and frank about various issues. It was very helpful and I hope to attend one like it again in the future. The social tea was fun, and it was nice to meet a lot of people from diverse backgrounds, however, it would have been better if the virtual breakout rooms had lasted a little longer. The in person discussions were excellent. I thoroughly enjoyed them. The topics were well chosen as well.	5/19/2022 12:29 PM
19	(i) It was great to hear about the panelists experiences and I liked that you were inclusive of	5/19/2022 12:27 PM

	audience questions both in person and over the zoom. (iii) The in-person discussion at UCLA were helpful and informal. It worked out well that we were arranged in smaller groups to discuss and then came together as a large group to share ideas and recap the discussions.	
20	I did enjoy meeting everyone in the break out sessions.	5/19/2022 12:26 PM
21	the breakout room discussions were very insightful. The social hour was also very nice.	5/19/2022 12:19 PM
22	The panel was great, as was the in-person discussion.	5/19/2022 12:14 PM
23	The panel discussion was inspiring; the social tea was also very nice to meet mathematicians from around the world; each segment could be made longer. The breakout room was fine; hopefully the graduate students were getting as much advise as they had hoped for.	5/19/2022 12:14 PM
24	The panel discussion was great as they enlightened us on their journey to mathematics eventually to impact us. Virtual tea was also awesome and the breakout rooms was my novel part with regards to an online activity, it was very interesting and educative.	5/19/2022 12:14 PM
25	The build a bear activities at the UCR site were the most engaging and community building. I enjoyed the panel discussions and the strong women speaking!	5/19/2022 12:12 PM
26	。	5/19/2022 12:10 PM
27	In hybrid mode the host may spend a little time asking satellite places about their comments and questions for the great speakers	5/19/2022 12:06 PM
28	I was only able to attend the in-person discussion; this was very nice.	5/19/2022 12:03 PM
29	really liked it	5/19/2022 12:03 PM
30	(ii) This was pretty neat and allowed me to meet a lot of individuals. I enjoyed this portion. (iii) The breakout rooms were well-run, but I think we got a bit confused. I thought each room was to be themed by topic but we tried to talk about all four topics in one room. Maybe the former would work better as we did not have enough time to delve into four topics.	5/19/2022 9:02 AM
31	(i) While hearing the panelists introduce themselves was interesting, there were a lot of panelists and the introductions went on for quite a while. It became easy to tune out what was going on. I think the time spent would have been more valuable if the panelists had had more time to answer questions. (ii) I really liked this part of the event! It was nice that we didn't stay in any one breakout room for too long and got to chat with other participants. However, having a suggested list of questions to discuss could have been helpful as sometimes no one was sure what to say and it got a bit awkward. For example, there could just be questions like "Who's your favorite woman in math?" or What's your favorite theorem?" or other things one could refer to if the room runs out of conversational steam. (iii) I thought the virtual discussion was nice. I thought we were supposed to choose a breakout room based on which topic we wanted to discuss, but then the breakout room I ended up in discussed all the topics, which was actually great because I had a hard time choosing which topic to attend.	5/19/2022 6:10 AM
32	I really liked the event, it was great to hear from female mathematicians and ask questions at the panel, as well as to discuss with them at the in-person discussions.	5/18/2022 9:30 AM
33	easy to attend	5/18/2022 8:53 AM
34	i. It was nice to hear other women in math paths ii. did not attend iii. there was miss communication but over all great information for getting masters and phds	5/17/2022 11:38 AM
35	I attended in-person workshop. It was an eye opener and a fun way to meet undergrads in our program.	5/17/2022 10:34 AM
36	Very welcoming and enlightening.	5/17/2022 7:58 AM
37	We joinned the panel, but then we run the tea and in-person discussion at our site. It was motivational to join the meeting....	5/17/2022 7:40 AM
38	breakout room -- I enjoyed the discussion	5/17/2022 6:59 AM
39	Everything went well.	5/17/2022 4:19 AM
40	Very insightful session	5/17/2022 12:49 AM
41	The event created an atmosphere of warmth and sharing. We talked about our career	5/17/2022 12:04 AM

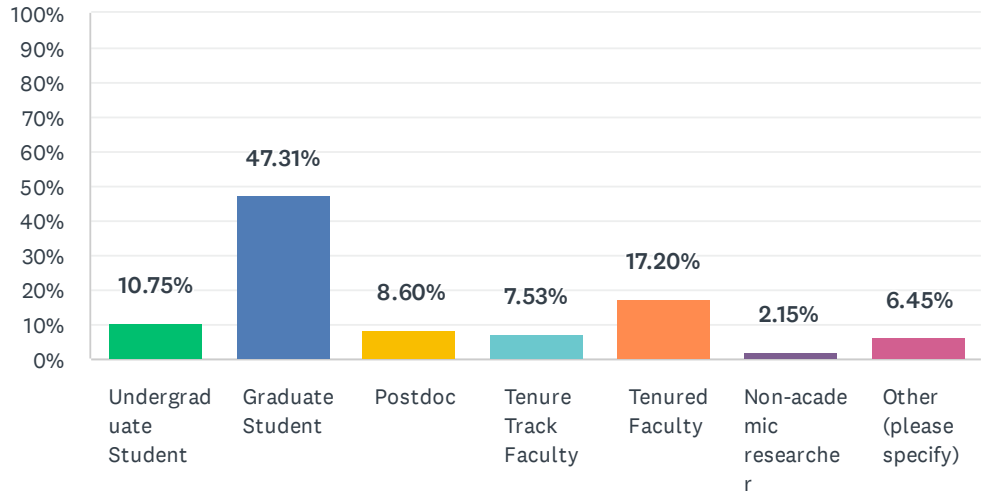
	experiences freely. Maybe a face to face attendance for next event. It was indeed a successful program.	
42	I was only able to attend briefly during the breakout room discussion. I appreciated the flexibility offered by virtual attendance.	5/16/2022 9:41 PM
43	Couldn't attend all the activities but enjoyed the ones I was able to be at.	5/16/2022 9:17 PM
44	It was wonderful even organized by MSRI. The panelist were full of enthusiasm having great expertise in not only mathematics but overall scenario faced by women in at different places over the world. The expressed their point of view for new career sophomores. In breakout rooms it was a good experience to have open friendly discussion about your career or promising career. They answered well about different question like someone asked about changing her field and she was confused, but panelist handled in a good way, also the answer about keeping children with research was satisfactory. Overall I enjoyed the discussion.	5/16/2022 9:13 PM
45	In all aspects, there are good levels of structure to provide environments to achieve the goal of every format of even. The suggestion is to discuss about the research and future of possible ways to collaborate in a detailed-oriented procedures. Providing exact schedule and clear ways to get collaboration are another suggestions. Since collaboration is serious action in the formation of research career.	5/16/2022 8:13 PM
46	Well organised. It was great to find men participate in the programme also.	5/16/2022 7:14 PM
47	it was a good event	5/16/2022 5:44 PM
48	i) Excellent diverse speakers. They participation in the Q&A session was also very good. ii) I really enjoyed meeting people at different locations. It worked out very well electronically. iii) The in-person discussions were very pragmatic and helpful (I was told as well).	5/16/2022 5:17 PM
49	It was great to hear from international women on zoom, and see the folks gathering all over … very cool. The breakouts were ok. Perhaps not as useful as I had hoped, but definitely important topics to discuss. Lunch was great (as always).	5/16/2022 4:33 PM
50	I really enjoyed the event and I think that the hybrid format worked very well.	5/16/2022 4:09 PM
51	(i) Panel discussion was informative (ii) Didn't attend the virtual social tea (iii) Break rooms were nice but more may need to be done to improve use of technology in the future	5/16/2022 3:46 PM
52	I only attended the panel discussion and the breakout room, and I enjoyed them both.	5/16/2022 3:31 PM
53	This was a fantastic conference, and I am grateful for being included. I thought that the social tea was a great idea, although I would have liked a little more time with each group. We had just enough time to introduce ourselves, and then it was time to return. I also thought the break out rooms were extremely valuable. There was a lot of support, good questions, and advice from a wide array of backgrounds.	5/16/2022 3:16 PM
54	(i) panel may have worked better if there was a more streamlined way of submitting questions to panelist during Q&A e.g. a google form (ii) virtual social tea was too short for the number of people in rooms! only introductions were able to be fit in (iii) in-person discussion was great from the UCLA satellite!!	5/16/2022 3:05 PM
55	I could only attend the panel at the beginning due to schedule. Having mathematicians from all continents and different fields was inspiring and I gained another role model. The facilitator did amazing going through the questions. The 2-slide intro at the beginning was nice, but could be a little shorter in some cases.	5/16/2022 3:00 PM
56	1	5/16/2022 2:34 PM
57	I enjoy the panel discussion, gained from how to manage research, career and family ii I had bad network iii Gained a lot from networking	5/16/2022 2:20 PM
58	I really appreciated the panel discussion, the virtual social tea and the breakout rooms (in this order).	5/16/2022 2:14 PM
59	-	5/16/2022 1:58 PM
60	I liked the event very much on the whole. The breakout rooms were quite short and we were a bit lost (I, at least, was), I think, about what their purpose was and how to use the time	5/16/2022 1:55 PM

	efficiently. Come to think of it, perhaps I'm not talking about the breakout rooms: I mean the short, random, zoom subgroups which happened following the 5 talks.	
61	I really appreciated the opportunity to attend in a different location for my home institution, as I was in Berkeley already for other reasons. I very much enjoyed getting to hear from the people in the panel, so neat to hear from people all over the world. I especially appreciated hearing about Yukari's experience and her creative ideas for making departments more friendly to women - her positive can-do spirit was inspiring to me. I had a little trouble with some of the focus of the panel discussion - I was kind of hoping for more celebration and less focus on problems and troubles. I appreciated the opportunity to mingle with people online, but also the flexibility to spend that time connecting with other in-person attendees. Our small group discussions felt a little stilted, again, there was more a focus on problem-solving, when it might have been nice to just get to know each other and celebrate each others' successes. I very much appreciated the delicious food throughout the day - particularly the lunch on the gorgeous porch at MSRI. When you're down in the trenches as a grad student it feels so nice to be treated in that way every once in a while.	5/16/2022 1:53 PM
62	I thought the in-person discussion (and lunch!) was valuable for networking purposes, but the event wasn't that useful for career development, because everyone's background and career trajectory was too different. Especially as a US-based student, the international perspectives (both at the panel and in the in-person discussion) dominated the conversation, and weren't as relevant to me.	5/16/2022 1:35 PM
63	The breakout room discussion was superb. The Coach was so helpful and the participants lovely	5/16/2022 1:23 PM
64	All was interesting.	5/16/2022 1:15 PM
65	The panel was amazing. I am a co-organizer and I felt that the breakout room I facilitated was ok. But was hard to get everyone to participate actively in the discussion. Having 4 topics in an hour also felt rushed.	5/16/2022 1:15 PM
66	The format of the event was well presented overall.	5/16/2022 1:08 PM
67	For the virtual social tea, maybe we should not rely on randomness and create topic based rooms - i.e. areas of math research, and a general room. For the breakout room topics at the last hour, each room should focus on one topic and take notes in a document that can be shared with everyone later. So that each room is a brainstom for each topic, where problems, solutions and resources for each can be discussed/shared.	5/16/2022 1:08 PM
68	I think at MSRI the center should be postdocs and not phd students. Other than that the format was good but I would shift between parts to allow having it start later on the day.	5/16/2022 1:00 PM
69	I was only able to attend the panel discussion. I enjoyed the diversity in the panelists, both in their work and their life. I found some intervention very insightful regarding ally-ship as well as the advice on networking and collaborating (the necessity and the how to) for younger mathematicians.	5/16/2022 12:58 PM
70	I loved the format. Here are my comments and suggestions for future events: (ii) I loved the short networking breakout rooms. It would have been nice to have clear instructions when going into them, because in some people introduced themselves and in some people weren't sure what to talk about. I believe it wasn't clear. I loved how it ended up generating a spreadsheet where we can put our information to keep in touch with the people we met. This was great. (iii) I believe that all the breakout rooms addressed all the topics. However, we were asked to choose which breakout room to join, and all had different names, and this was very confusing. Also, it generated that some rooms had more people than others, despite all of them addressing all topics. It would have been better to assign people randomly. Also, it was nice to address all topics but it was very short time and we couldn't go in depth in any because we had to move on to the next. But the virtual tools like Jamboard and padlet that were used to give all participants access annonimously and so we could keep the resources afterwards were absolutely amazing.	5/16/2022 12:57 PM
71	The overall structure was nice, but the virtual social tea was not very social. We had enough time in each room to introduce ourselves, but not much more.	5/16/2022 12:55 PM
72	Everything was excellent. I really appreciated the virtual option for attendance, and the networking options via the virtual social tea. Thank you!!	5/16/2022 12:46 PM

73	The panel discussion was very insightful on how the panelists during various stages of their academic careers have faced adversity due to their gender. I appreciate them sharing their experiences. While I had some great conversations at virtual social tea, I felt that the amount of time was too short to make a lot of conversations. I think that each session should have been made longer. The breakout rooms were great. I learned a lot from it.	5/16/2022 12:46 PM
74	I attended the panel discussion only. Unfortunately, I was not able to attend the virtual social tea or the breakout rooms. Concerning the panel discussion, I think it was a nice activity and a good starting point for further discussions.	5/16/2022 12:45 PM
75	NA	5/16/2022 12:42 PM
76	(i) Panel discussion was very nice. I didn't attend the other two sessions	5/16/2022 12:39 PM
77	very good virtual tea, I enjoyed meeting academics from all around the world.	5/16/2022 12:39 PM
78	(i) panel discussion, I think, went well. It felt a bit like the time for questions to panelists was a bit tight and not very well structured. One solution would be no give a possibility to the participants to ask their questions ahead of time (e.g., add this to the registration form). Then these "questions in advance" can be categorized and asked in the beginning of Q&A, giving the participant some more time to formulate their "in the process" questions (ii) did not participate in social tea (iii) breakout rooms went well at MSRI	5/16/2022 12:38 PM
79	I was only able to attend the panel. I've enjoyed it very much. I liked that the presenters had very different backgrounds.	5/16/2022 12:36 PM
80	It would be great if not-female participation is encouraged.	5/16/2022 12:36 PM
81	I only attended the panel discussion and I thought it was very good. The sound quality could have been better but that is my only complaint.	5/16/2022 12:34 PM
82	I did not attend the virtual social tea or breakout rooms, but the in-person discussion was great! I met grad students from other math-related departments across campus and we had very personal discussions about our journeys as women in math. It was really inspiring to meet such accomplished women, and I feel more motivated after hearing their stories.	5/16/2022 12:34 PM
83	The panel discussion was great, insightful and interesting. The virtual social tea was as good as it can get, but of course with virtual social events the issue is that it cannot substitute real life interaction. The in-person discussions were engaging, but I would have loved to have more than just 15 minutes per topic.	5/16/2022 12:32 PM
84	The whole event was impactful and educative. I really enjoyed the programme.	5/16/2022 12:32 PM
85	I very much enjoyed the panel discussion. I enjoyed the 2slides from the panelists and questions. Thank you! This was the only component I attended.	5/16/2022 12:30 PM
86	I know the event was for women. In one of the meetings of virtual social tea, no one spoke first so I brought up a topic that was discussed during panel discussion. I said that male mathematicians have the same issue. While talking about it, I was interrupted by a panel. She said that this event is for women, so I did not finish what I wanted to say. If MSRI agrees with her, please do not engage males. If MSRI decides to let males join an event, please encourage male's speech.	5/16/2022 12:30 PM
87	(i) this was a nice way to hear stories (ii) i did not attend, as I'm a bit over with doing zoom stuff. (iii) I think more small group discussions (e.g. ~5 people) would've been nice.	5/16/2022 12:29 PM
88	I specially liked the social tea, people were very friendly! I would suggest ensuring that two people don't join the same breakout room more than once.	5/16/2022 12:27 PM
89	(i) was lovely (iii) sessions were too short to get into anything deeper or interesting.	5/16/2022 12:25 PM
90	I could only attend for the first 45 minutes, and I enjoyed hearing about other mathematicians' journeys and successes.	5/16/2022 12:23 PM
91	(I) Panel discussion was awesome. I felt similar things and had had similar questions with other people who asked questions in the event. The advice was helpful.	5/16/2022 12:23 PM
92	It could be interesting to have a panelist from a non-academic setting (e.g., a national lab or in industry)	5/16/2022 12:22 PM
93	more structured discussion in breakout rooms	5/16/2022 12:22 PM

Q5 Your status or position at the time of the conference:

Answered: 93 Skipped: 58



ANSWER CHOICES	RESPONSES	
Undergraduate Student	10.75%	10
Graduate Student	47.31%	44
Postdoc	8.60%	8
Tenure Track Faculty	7.53%	7
Tenured Faculty	17.20%	16
Non-academic researcher	2.15%	2
Other (please specify)	6.45%	6
TOTAL		93

#	OTHER (PLEASE SPECIFY)	DATE
1	Lecturer	5/30/2022 2:34 PM
2	Non-Tenure Track Faculty	5/23/2022 8:04 AM
3	both graduate student and staff/faculty position	5/18/2022 8:53 AM
4	Assistant Teaching Professor	5/17/2022 7:40 AM
5	Emerita faculty	5/17/2022 6:59 AM
6	Adjunct Full Professor and Researcher	5/16/2022 5:17 PM

Séminaire de Mathématiques Supérieures 2021: Microlocal Analysis: Theory and Applications

May 3, 2021 – August 13, 2021

Virtual Summer Graduate School

Organizers:

Suresh Eswarathasan (Dalhousie University)

Dmitry Jakobson (McGill University)

Katya Krupchyk (University of California, Irvine)

Stephane Nonnenmacher (Université de Paris XI)

Séminaire de Mathématiques Supérieures
Microlocal Analysis: Theory and Applications

May 3 - August 13, 2021

1 Organizers

- Suresh Eswarathasan (Dalhousie University)
- Dmitry Jakobson (McGill University)
- Katya Krupchyk (University of California, Irvine)
- Stéphane Nonnenmacher (Univsersit'e de Paris-Saclay)

2 Invited Speakers

2.1 Core course speakers

- Hamid Hezari (University of California, Irvine): *Basics of semiclassical microlocal analysis*
- Asma Hassannezhad (University of Bristol): *Spectral theory of Hilbert spaces*
- Melissa Tacy (University of Auckland): *Eigenfunction bounds and asymptotics*
- Kiril Datchev (Purdue University): *Scattering theory*
- Mikko Salo (University of Jyväskylä): *Inverse problems*

2.2 Specialized course speakers

- Semyon Dyatlov (Massachusetts Institute of Technology): *The Fractal uncertainty principle*
- Allan Greenleaf (University of Rochester): *Fourier integral operators and applications*
- David Borthwick (Emory University): *Scattering theory on infinite-volume surfaces*
- Tobias Weich (U. Paderborn): *The Faure-Sjöstrand Method*

2.3 Plenary speakers

- Malabika Pramanik (University of British Columbia): *A few problems at the interface of Harmonic and Microlocal Analysis*
- Gabriel Rivière (Université de Nantes): *Counting geodesic arcs via microlocal analysis*
- Michael Hitrik (University of California, Los Angeles): *Toeplitz operators and Bergman kernel asymptotics*
- Maciej Zworski (University of California, Berkeley): *An introduction to non-selfadjoint operators: A case study using a model of twisted bilayer graphene*
- Euan Spence (University of Bath): *Applying semiclassical analysis to the numerical analysis of Helmholtz equations*
- John Toth (McGill University): *Lower bounds for eigenfunction restrictions in lacunary regions*
- Gunther Uhlmann (University of Washington): *Journey to the center of the Earth*

2.4 Teaching assistants

- Amir Vig (University of Michigan): Basics of semiclassical microlocal analysis
- Matteo Capoferri (Cardiff University): Spectral theory of Hilbert spaces
- Blake Keeler (CRM/McGill University): Eigenfunction bounds and asymptotics
- Perry Kleinhenz (Stanford University/Michigan State University): Scattering theory
- Tony Liimatainen (University of Jyväskylä): Inverse troblems

3 Summary of activities

One of the most extensive schools in microlocal analysis in terms of breadth of material and duration, this event brought together (mostly) graduate students and researchers of high international reputation. A feature of this SMS, in addition to its completely Zoom-based delivery due the COVID-19 pandemic, was that graduate students in Canada could use this summer-long program as credit towards their doctoral requirements through the institutes of PIMS, Fields, CRM and AARMS. The aim was to expose a new generation of researchers to the ever-evolving list of applications of microlocal analysis, some of which have gained wide exposure in the overall mathematical community. In fact, Nalini Anantharaman is a member of the 2022 ICM Structure Committee while two young microlocal analysts have been invited as 2022 ICM sectional speakers (with Dyatlov being one).

The school consisted of a number of components: 1) five core courses covering the fundamentals of developed areas that strongly use microlocal analysis, each running two weeks at a time and complemented by tutorial sessions run by up-and-coming postdoctoral fellows, 2) four specialized courses covering more nuanced research topics (some connected with recent breakthroughs) that strategically built off the core courses, each running one week at a time, and 3) seven plenary lectures covering more recent results in an accessible manner. Note that five of our speakers have been previous, or are current, invitees to the International Congress of Mathematicians.

The core courses covered the basics of microlocal analysis, the fundamentals of spectral theory frequently used in microlocal problems, eigenfunction analysis on compact manifolds, scattering theory on Euclidean spaces, and inverse problems of a more geometric nature including the X-ray transforms and the Calderón problem. The specialized courses covered the fractal uncertainty principle and its applications to eigenfunction concentration, the basics of Fourier integral operators, some core results on the theory of resonances on infinite-volume hyperbolic surfaces, and the Faure-Sjöstrand method which has been powerful in its applications towards problems in dynamical systems.

4 Record of activities

Given the length of the 2021 SMS, it is best to recount its individual activities on scales of one or two weeks. It should be mentioned that all lecture materials (all of which were professionally prepared) and the lectures themselves were uploaded onto the SMS webpage. This proved to be of great assistance for students attending from Europe or continents outside of North and South America. It can be assumed that thanks to the schedule being strategically distributed across Summer 2021, students were able to comfortably digest material and actively participate in each lecture despite the Zoom format.

A special emphasis should be placed on the work of the teaching assistants, who played an important role for us. In terms of student participation, the chat feature was heavily used in each core course with the TAs themselves answering questions as the lectures progressed. Note also that each core course had two tutorial sessions, one occurring each week of its two-week period. The tutorials (or problems sessions) were an integral and crucial portion of the SMS, considering the lengths of each course.

4.1 Week 1-2: May 3 - May 14, 2021

Initiating the program, Hamid Hezari gave a history of quantum mechanics, itself beginning with a description of the ultraviolet catastrophe, resolved by Planck who introduced the constant carrying his namesake. Many students had not been exposed to these valuable facts. After this excellent exposition, Hezari covered workhorse concepts in basic microlocal analysis, ranging from tempered distributions to the semiclassical Fourier transform. Week 1 continued with basic equations such as the quantum harmonic oscillator and the Coulomb potential which models the hydrogen atom along with a detailed discussion of their explicit solutions. The first week concluded with a proof of the (arguably) most foundational lemma in the field: stationary phase. Amir Vig conducted a tutorial on Friday.

The second week commenced with a discussion of various quantization formulas via the Fourier transform and their corresponding properties (i.e. compositions, boundedness, et cetera) and continued from there. Hezari finished his course with the notion of wavefront set, arguably one of microlocal analysis' key ideas, accompanied by a gallery of examples.

Malabika Pramanik, known for her excellent lectures, delivered the first plenary of the SMS, speaking about how oscillatory integrals (and associated operators) appear at the intersection of harmonic analysis and microlocal analysis, with some of her examples being the half-wave propagator and the Radon transform. Weeks 1-2 was concluded by another TA session from Vig.

4.2 Week 2-4: May 17 - May 28, 2021

Asma Hassannezhad reviewed crucial material on the spectral theory of unbounded operators in anticipation of Tacy and Datchev's course. Week 1 was spent on the following topics: resolvents, spectrum, Sobolev spaces, and extensions of symmetric operators. While many of the students had some exposure to these ideas, her exercises were not trivial and resulted in an active tutorial session held by Matteo Capoferri. His notes are available on the SMS page.

The second week had more of a rapid pace, considering that in three lectures over three hours, Hassannezhad discussed three versions of the spectral theorem for unbounded operators and their proofs. The Zoom sessions themselves appeared to be more active, thanks partially to the students recognition of the material's importance for later courses. While the course itself was short, Hassannezhad's notes were actually extensive and well-written. One organizer received emails praising Hassannezhad's lecturing style and her use of the Padlet app to field detailed questions.

The second plenary talked occurred on that Monday with Gabriel Rivière discussing his joint work with Nguyen Viet Dang on how the Faure-Sjöstrand method (not discussed with much technicality as Tobias Weich would cover this more completely in July) could be used to shed light on the following classical problem: given two distinct points on a compact surface of negative curvature, how many geodesic arcs connect them? Again, students were enthusiastic given the interesting blend of topics presented, especially ones coming from applied mathematics and dynamical systems.

4.3 Week 5: May 31 - June 4, 2021

Students next saw an application of the material covered in Hezari's course in Semyon Dyatlov's lecture series on the fractal uncertainty principle (FUP), a concept he developed in pursuit of improved gaps for resonances in negatively curved settings. Dyatlov carefully motivated the FUP via his control result for eigenfunctions on compact hyperbolic surfaces by not overemphasizing the semiclassical analysis used for quantum limits et cetera. Despite the course being inherently technical, the last lecture placed a strong emphasis on the FUP on $\mathbb{Z}/N\mathbb{Z}$ to place the more technical results in a largely accessible context.

The third plenary lecture by Michael Hitrik, delivered that Wednesday, introduced students to the broad strokes of complex microlocal analysis through the example of Toeplitz quantizations and its connections to the Weyl quantization (as discussed in Week 1). A highlight of his lecture was a review of results by Sjöstrand and Boutet de Monvel on Bergman kernel asymptotics that allowed a simplification of the seminal work of Charles Fefferman on biholomorphic maps of pseudo-convex domains.

4.4 Week 6: June 7 - June 11, 2021

Allan Greenleaf took on a formidable task of exposing students to Lars Hörmander's technical theory of Fourier Integral Operators (FIOs). Spread over three lectures, he covered the necessary symplectic geometry, phase functions parametrizing Lagrangians, composition calculus, and the symbol calculus. Despite the heavily geometric machinery on which the theory depends, the lectures again experienced lots of student participation. While the group of students who participated across the SMS's duration changed depending on the course, it was a pleasant surprise to see so many students from applied mathematics (in particular, students of JC Nave at McGill University) attending Greenleaf's course and actually asking questions. Greenleaf's course finished with a series of examples of FIOs that appear frequently in inverse problems, setting up students for Salo's core course.

This week saw no plenary speaker.

4.5 Week 7-8: June 14 - June 25, 2021

The next core course brought students closer to current research problems of interest and was taught asynchronously by Melissa Tacy (based in New Zealand). The focus of the two-week period was to apply tools presented by Hezari and Hassannezhad to problems surrounding eigenfunctions in compact geometries. Tacy began with an excellent introduction on why eigenfunctions are of interest and also what it intuitively means to be localized in space or in frequency (to further motivate the semiclassical wave front set). The remainder of Week 7 saw a discussion of the TT^* method (made popular in harmonic analysis) applied to eigenfunction growth. One original feature of her course was her videos that annotated classical papers in microlocal analysis, such as Hörmander's beautiful work on the spectral function for elliptic operators, in real-time: this gave students an example of how to read articles in a non-linear yet effective fashion. Blake Keeler, a postdoctoral fellow at CRM and AARMS, held the corresponding tutorial sessions. Note that Tacy's exercises had a strong basis in the research she presented.

Week 8 saw an important comparison between so-called "smooth" microlocal analysis and semiclassical analysis in the context of eigenfunction analysis. This led into a discussion of a now-fundamental work by Koch-Tataru-Zworski on the estimation of quasimodes. The course ended with Tacy discussing some recent work of hers on estimates for joint quasimodes for operators that exhibit controllable singularities, extending work of Simon Marshall who himself extended work of Peter Sarnak. A novel feature of this work was the use of wavelets in understanding the relevant FIOs.

The next plenary lecture occurred on the Wednesday in Week 7 was delivered by Maciej Zworski. He presented joint work with Simon Becker, Jens Wittsten, and Mark Embree that developed some mathematics behind "twistronics" in physics, a type of superconductor generated by special twists of two sheets of graphene. His talk generated a large audience, partially thanks to his stature in the field, and cleverly combined spectral theory, representation theory, and theta functions all in microlocal problem.

4.6 Week 9

This was a break period.

4.7 Week 10-11: July 5 - July 16, 2021

Kiril Datchev delivered the penultimate core course that focused largely on scattering theory on $\mathbb{R}^n$. His course was neatly divided into topics as follows: free waves, perturbed waves and resonances, stronger perturbations, and complex scaling. These were spread out across his two weeks.

The first set of lectures emphasized Huygen's principle and the structure of the convolution kernel for the solution operator. The second set focused on the wave equation with a compactly supported potential, the use of ODE techniques, and how estimates on the free resolvent translate into those for the perturbed equation. The third set continued the perturbations now being variable wavespeeds, a concept arising in many inverse problems including some discussed in Uhlmann's later plenary talk. The level of technicality rose quite a bit here and Kiril's TA, Perry Kleinhenz, did an excellent job fielding questions during the lecture. Kleinhenz made a special effort to use the graphing software Desmos to help students visualize semiclassical rescaling. The last set of lectures focused on how the robust technique of complex scaling is used in establishing resonance free regions not on Euclidean space but in more complicated geometries, motivating the next course by David Borthwick.

The fifth plenary lecture took place on the Monday in Week 10 and was delivered by Euan Spence. He presented joint work with David Lafontaine and Jared Wunsch on how Hezari's course material can be used to generate valuable numerics for spectral scattering problem for the Helmholtz equation, a topic of great interest in the British school of PDEs. His plenary lecture was clearly one of the most popular as it received arguably the most student participation. The excitement behind this novel blend of applied math and pure math bodes well for the future generation of research in microlocal analysis. The sixth plenary took place on the Wednesday in Week 10 and was delivered by John Toth. Building on Tacy's core course, Toth presented recent joint work Canzani on restrictions of eigenfunctions (which satisfied a specific localization assumption) that utilized Carleman estimates and complexification.

4.8 Week 12: July 19 - July 23, 2021

David Borthwick gave the penultimate specialized course, the topic being the distribution of resonances on infinite-volume hyperbolic surfaces. The first day reviewed necessary facts from hyperbolic geometry and spectral theory (bolstered by Hassannezhad's and Datchev's course) and the second day dove into the meromorphic continuation of the resolvent, reviewing the fundamental work of Mazzeo-Melrose, Guillarmou, and Guillopé-Zworski (Vasy's method, which plays a huge role in current microlocal analysis especially in its appearances in general relativity, was briefly covered). The third day was dedicated to resonance counting and the corresponding fundamental results of Zworski, Melrose, Guillopé-Zworski, and his own with Guillarmou. The lecture series concluded with a discussion of how the fractal structure of trapped sets influences resonance counting, an instance of classical chaos entering the quantum world.

Borthwick's lecture notes incorporated many pictures that were effective in conveying the correct intuitions and were not overly technical, which was a wise choice. The panoply of results and open problems presented gave students a clear vision of future research directions in the field.

4.9 Week 13: July 26 - July 30, 2021

The fourth and final specialized course of the 2021 SMS was on the "Faure-Sjöstrand Method" and was delivered by Tobias Weich. The set of ideas generated by the seminal 2011 CMP paper of Faure and Sjöstrand has been one of the most powerful in microlocal analysis the last ten years, partially thanks to work of Guillarmou, Dyatlov, Nonnenmacher, Zworski amongst other tremendous mathematician. Essentially, the theory of pseudodifferential operators and FIOs combined with the spectral theory for certain non-selfadjoint first order operators can be used to prove a variety of results in dynamical systems, some of which closed

open problems including those in Bowen's notebook and Smale's Conjecture on Axiom A flows. Over three lectures, Weich discussed how such ideas could be applied to decay of correlations for Anosov diffeomorphisms and flows. The last lecture covered a recent joint result with Guedes-Bonthonneau that generalized Pollicott-Ruelle resonances to non-compact surfaces with cusps, thus providing a slew of research problems for the current younger generation.

An impressive feature of Weich's course was the use of videos displaying clouds of particles that evolved under certain flows and how these videos themselves informed the proofs of some of his own results with Guillarmou and Guedes-Bonthonneau. Rarely do we see researchers presenting their own research methodologies like this!

4.10 Week 14-15: August 2 - August 13, 2021

The fifth and final core course of the 2021 SMS, devoted to Inverse Problems, was delivered by Mikko Salo.Inverse problems lie at the heart of contemporary scientific inquiry and technological development, while also being genuinely mathematically challenging and profound. The following three principal topics were discussed in the course: the geodesic X-ray transform, inverse boundary value problems for the wave equation (the Gelfand problem), and the Calderón problem.

The geodesic X-ray transform of a function on a compact Riemannian manifold with boundary is defined essentially by integrating the function over the set of non-tangential geodesics, and the first set of lectures focused on the fundamental (linear) inverse problem of the invertibility of the geodesic X-ray transform, under suitable geometric assumptions on the manifold. The attention in Salo's course next turned to the Gelfand problem, where one wishes to determine a scalar potential on a compact Riemannian manifold with boundary from the knowledge of the hyperbolic Dirichlet-to-Neumann map for the wave equation with the potential, measured on the lateral boundary of the corresponding space-time cylinder. The final portion of the course was devoted to the celebrated Calderón problem, which in its purest form, seeks to determine the electrical conductivity of a region in the Euclidean space by making voltage and current measurements on its boundary. Salo drew some necessary tools from Hezari's and Greenleaf's course, specifically, in order to display the effectiveness of microlocal methods.

Salo's TA Tony Liimatainen did a fantastic job during his two hours tutorial solving some important and interesting problems in the field of inverse problems, illustrating the material developed in the lectures.

The seventh and final plenary talk of the 2021 SMS was delivered by Gunther Uhlmann. Relying crucially on Salo's core course, Uhlmann discussed the inverse problem of determining the sound speed and index of refraction of a medium by measuring the travel times of waves going through the medium, in turn drawing from Datchev's lectures on stronger perturbations to waves. In particular, his breakthrough recent joint work with Stefanov and Vasy was discussed, showing that the boundary distance function, known locally in a neighborhood of a boundary point, determines the metric in a suitable neighborhood of the point, up to the natural diffeomorphism invariance of the problem, provided that the boundary is strictly convex.

5 Organization

The school featured about 120 participants (including speakers and the students) from five continents, many of whom attended directly from their respective countries thanks to the online format. The list of speakers could be considered a "Who's who?" in microlocal analysis, including five who have been or are currently invited as ICM sectional speakers. The non-local junior participants were selected mainly on the basis of the relevance of their research background to the topic of the school, with only few being rejected thanks to this rather open criterion. Note that two women were core lecturers and one woman was a plenary speaker. Our five teaching assistants were postdoctoral fellows and played an active role in the engagement with the graduate student participants.

Organizers		
First Name	**Last Name**	**Institution**
Dmitry	Jakobson	McGill University
Katya	Krupchyk	University of California, Irvine
Suresh	Eswarathasan	Dalhousie University
Stephane	Nonnenmacher	Université de Paris XI

Students		
First Name	**Last Name**	**Institution**
Manas	Bhatnagar	Iowa State University
Andrea	Bisterzo	Università di Milano - Bicocca
Madelyne	Brown	University of North Carolina
Christopher	DuPre	Georgia Institute of Technology
Antonio	Farah	University of Texas at Austin
Peter	Graziano	University of Connecticut
Amin	Idelhaj	University of Wisconsin-Madison
Collin	Kofroth	University of North Carolina
Neeraja	Kulkarni	California Institute of Technology
Daniel	Leyva	Purdue University
Changchang	Liu	Northeastern University
Xuezhu	Lu	Southeastern University
Jared	Marx-Kuo	Stanford University
Michael	McNulty	University of California, Riverside
Gary	Moon	University of North Carolina
Angel Alfredo	Moran Ledezma	Centro de Investigacion y Estudios Avanzados (CINVESTAV)
Thialita	Moura do Nascimento	University of Central Florida
Jacob	Ogden	University of Washington
Sayantan	Sarkar	University at Buffalo (SUNY)
Jieun	Seong	Georgia Institute of Technology
Xin	Shen	Northeastern University
Laura	Shou	Princeton University
William	Trad	University of Sydney
Ruoyu	Wang	Northwestern University
Matthew	West	University of California, Irvine
Michael	Womack	San Francisco State University
Lili	Yan	University of California, Irvine
Mengxuan	Yang	Northwestern University

Officially Registered Participant Information

Participants		28

Gender		28
Male	71.43%	20
Female	28.57%	8
Declined to state	0.00%	0

Ethnicity*		28
White	35.71%	10
Asian	39.29%	11
Hispanic	7.14%	2
Pacific Islander	0.00%	0
Black	0.00%	0
Native American	0.00%	0
Mixed	7.14%	2
Declined to state	10.71%	3

* ethnicity specifications are not exclusive

Financial Summary

MSRI Summer Graduate School

Séminaire de Mathématiques Supérieures 2021: Microlocal Analysis: Theory and Applications

May 03, 2021 - August 13, 2021

Virtual Summer School

	Academic Sponsors	Total
Other	$ 1,858.76	**$ 1,858.76**
Total	**$ 1,858.76**	**$ 1,858.76**

	Stipend	Other	Totals
	Academic Sponsors	Academic Sponsors	
Computer Software/Equipment		$ 1,858.76	**$ 1,858.76**
Subtotals (Other)	$ -	$ 1,858.76	**$ 1,858.76**
Totals	**$ -**	**$ 1,858.76**	**$ 1,858.76**

A post-program survey was not sent out to the students, neither from MSRI or SMS.

CRM-PIMS Summer School in Probability

May 24, 2021 – June 18, 2021

Virtual Summer Graduate School

Organizers:

Louigi Addario-Berry (McGill University)

Omer Angel (University of British Columbia)

Alexander Fribergh (University of Montreal)

Mathav Murugan (University of British Columbia)

Edwin Perkins (University of British Columbia)

Organizers		
First Name	**Last Name**	**Institution**
Louigi	Addario-Berry	McGill University
Omer	Angel	University of British Columbia
Alexander	Fribergh	University of Montreal
Mathav	Murugan	University of British Columbia
Edwin	Perkins	University of British Columbia
Speakers		
First Name	**Last Name**	**Institution**
Louigi	Addario-Berry	McGill University
Jean-Christophe	Mourrat	New York University, Courant Institute
Teaching Assistants		
First Name	**Last Name**	**Institution**
Elias	Hess-Childs	New York University, Courant Institute
Xiangying	Huang	Duke University

Mathematical Sciences Research Institute

CRM-PIMS Summer School in Probability

May 24 to June 18, 2021

Monday, May 24		
08:00 AM - 09:30 AM	Jean-Christophe Mourrat	A PDE Approach to Mean-Field Disordered Systems: Lecture 1
09:30 AM - 11:00 AM		Lunch Break
11:00 AM - 12:30 PM	Louigi Addario-Berry	Optimization in Random Discrete Systems: Lecture 1
12:30 PM - 01:00 PM		Break
01:00 PM - 03:00 PM		Exercise Session

Tuesday, May 25		
08:00 AM - 09:30 AM	Jean-Christophe Mourrat	A PDE Approach to Mean-Field Disordered Systems: Lecture 2
09:30 AM - 11:00 AM		Lunch Break
11:00 AM - 12:30 PM	Louigi Addario-Berry	Optimization in Random Discrete Systems: Lecture 2
12:30 PM - 01:00 PM		Break
01:00 PM - 03:00 PM		Exercise Session

Thursday, May 27		
08:00 AM - 09:30 AM	Jean-Christophe Mourrat	A PDE Approach to Mean-Field Disordered Systems: Lecture 3
09:30 AM - 11:00 AM	Louigi Addario-Berry	Optimization in Random Discrete Systems: Lecture 3
12:30 PM - 01:00 PM		Break
01:00 PM - 03:00 PM		Exercise Session

Friday, May 28		
08:00 AM - 09:30 AM	Jean-Christophe Mourrat	A PDE Approach to Mean-Field Disordered Systems: Lecture 4
09:30 AM - 11:00 AM		Lunch Break
11:00 AM - 12:30 PM	Louigi Addario-Berry	Optimization in Random Discrete Systems: Lecture 4
12:30 PM - 01:00 PM		Break
01:00 PM - 03:00 PM		Exercise Session

Monday, May 31		
08:00 AM - 09:30 AM	Jean-Christophe Mourrat	A PDE Approach to Mean-Field Disordered Systems: Lecture 5
09:30 AM - 11:00 AM		Lunch Break
11:00 AM - 12:00 PM	Louigi Addario-Berry	Optimization in Random Discrete Systems: Lecture 5
12:00 PM - 12:30 PM		Break
12:30 PM - 02:00 PM		Lecture
02:00 PM - 04:00 PM		Exercise Session

Tuesday, June 1		
08:00 AM - 09:30 AM	Jean-Christophe Mourrat	A PDE Approach to Mean-Field Disordered Systems: Lecture 6
09:30 AM - 11:00 AM		Lunch Break
11:00 AM - 12:00 PM	Sarah Penington	Free Boundary Problems and Branching Particle Systems
12:00 PM - 12:30 PM		Break
12:30 PM - 02:00 PM	Louigi Addario-Berry	Optimization in Random Discrete Systems: Lecture 6
02:00 PM - 04:00 PM		Exercise Session

Thursday, June 3		
08:00 AM - 09:30 AM	Jean-Christophe Mourrat	A PDE Approach to Mean-Field Disordered Systems: Lecture 7
09:30 AM - 11:00 AM		Lunch Break
11:00 AM - 12:00 PM	Sarah Penington	Free Boundary Problems and Branching Particle Systems: Lecture 2
12:00 PM - 12:30 PM		Break
12:30 PM - 02:00 PM	Louigi Addario-Berry	Optimization in Random Discrete Systems: Lecture 7
02:00 PM - 04:00 PM		Exercise Session

Friday, June 4		
08:00 AM - 09:30 AM	Jean-Christophe Mourrat	A PDE Approach to Mean-Field Disordered Systems: Lecture 8
09:30 AM - 11:00 AM		Lunch Break
11:00 AM - 12:00 PM	Sarah Penington	Free Boundary Problems and Branching Particle Systems: Lecture 3
12:00 PM - 12:30 PM		Break
12:30 PM - 02:00 PM	Louigi Addario-Berry	Optimization in Random Discrete Systems: Lecture 8
02:00 PM - 04:00 PM		Exercise Session

Monday, June 7		
08:00 AM - 09:30 AM	Jean-Christophe Mourrat	A PDE Approach to Mean-Field Disordered Systems: Lecture 9
09:30 AM - 11:00 AM		Lunch Break
11:00 AM - 12:00 PM	Kavita Ramanan	Asymptotics of Interacting Stochastic Processes on Sparse Graphs
12:00 PM - 12:30 PM		Break
12:30 PM - 02:00 PM	Louigi Addario-Berry	Optimization in Random Discrete Systems: Lecture 9
02:00 PM - 04:00 PM		Exercise Session

Tuesday, June 8		
08:00 AM - 09:30 AM	Jean-Christophe Mourrat	A PDE Approach to Mean-Field Disordered Systems: Lecture 10
09:30 AM - 11:00 AM		Lunch Break
11:00 AM - 12:00 PM	Kavita Ramanan	Asymptotics of Interacting Stochastic Processes on Sparse Graphs: Lecture 2
12:00 PM - 12:30 PM		Break
12:30 PM - 02:00 PM	Louigi Addario-Berry	Optimization in Random Discrete Systems: Lecture 10
02:00 PM - 04:00 PM		Exercise Session

Thursday, June 10		
08:00 AM - 09:30 AM	Jean-Christophe Mourrat	A PDE Approach to Mean-Field Disordered Systems: Lecture 11
09:30 AM - 11:00 AM		Lunch Break
11:00 AM - 12:00 PM	Kavita Ramanan	Asymptotics of Interacting Stochastic Processes on Sparse Graphs: Lecture 3
12:00 PM - 12:30 PM		Break
12:30 PM - 02:00 PM	Louigi Addario-Berry	Minimum Spanning Trees 1
02:00 PM - 04:00 PM		Exercise Session

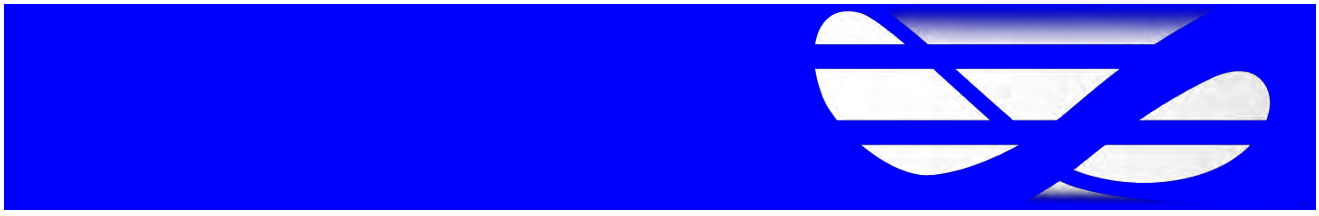
Friday, June 11		
08:00 AM - 09:30 AM	Jean-Christophe Mourrat	A PDE Approach to Mean-Field Disordered Systems: Lecture 12
09:30 AM - 11:00 AM		Lunch Break
11:00 AM - 12:00 PM	Louigi Addario-Berry	Minimum Spanning Trees 2
12:00 PM - 12:30 PM		Break
12:30 PM - 02:00 PM		Lecture
02:00 PM - 04:00 PM		Exercise Session

Monday, June 14		
08:00 AM - 09:30 AM	Jean-Christophe Mourrat	A PDE Approach to Mean-Field Disordered Systems: Lecture 13
09:30 AM - 11:00 AM		Lunch Break
11:00 AM - 12:30 PM	Louigi Addario-Berry	Minimum Spanning Trees 3
12:30 PM - 01:00 PM		Break
01:00 PM - 03:00 PM		Exercise Session

Tuesday, June 15		
08:00 AM - 09:30 AM	Louigi Addario-Berry	Minimum Spanning Trees 4
09:30 AM - 11:00 AM		Lunch Break
11:00 AM - 12:30 PM		Lecture
12:30 PM - 01:00 PM		Break
01:00 PM - 03:00 PM		Exercise Session

Thursday, June 17		
08:00 AM - 09:30 AM	Jean-Christophe Mourrat	A PDE Approach to Mean-Field Disordered Systems: Lecture 14
09:30 AM - 11:00 AM		Lunch Break
11:00 AM - 12:30 PM	Louigi Addario-Berry	Minimum Spanning Trees 5
12:30 PM - 01:00 PM		Break
01:00 PM - 03:00 PM		Exercise Session

Friday, June 18		
08:00 AM - 09:30 AM	Jean-Christophe Mourrat	A PDE Approach to Mean-Field Disordered Systems: Lecture 15
09:30 AM - 11:00 AM		Lunch Break
11:00 AM - 12:30 PM	Louigi Addario-Berry	Minimum Spanning Trees 6
12:30 PM - 01:00 PM		Break
01:00 PM - 03:00 PM		Exercise Session



Students		
First Name	**Last Name**	**Institution**
Ander	Aguirre	University of California, Davis
Mohammad	Amirian	Dalhousie University
Ryan	Brill	University of Pennsylvania
Fei	Cao	Arizona State University
I-Hsun	Chen	Academia Sinica
Alexander	Christie	Pennsylvania State University
Francesca	Cottini	Università di Milano - Bicocca
Emily	Crawford Das	University of Georgia
Daniel	Fletcher	Northwestern University
Haotian	Gu	Duke University
Chengkun	Guo	Lehigh University
Zoe	Himwich	Columbia University
Connor	Kennedy	University of Massachusetts Amherst
Kecheng	Li	Tufts University
Meichen	Liu	University of Alberta
Barbara	Maldonado	Louisiana State University
Milo	Marsden	Stanford University
Joseph	Miller	University of Texas, Austin
Nikiforos	Mimikos-Stamatopoulos	University of Chicago
Sebastian	Munoz	University of Chicago
Kathryn	OConnor	Cornell University
William	Roberson-Vickery	University of Illinois, Chicago
Sang Woo	Ryoo	Princeton University
Xiao	Shen	University of Utah
Ahmed	Sid-Ali	Carleton University
Raghavendra	Tripathi	University of Washington
Tejaswi	Tripathi	University of Michigan
Carlos	Villanueva	University of Oklahoma
Te-Chun	Wang	Academia Sinica
Chutong	Wu	University of California, Davis
Chi-Hao	Wu	University of Maryland
Tingzhou	Yu	University of Victoria
Antonios	Zitridis	University of Chicago

Officially Registered Participant Information

Particpiants		33

Gender		33
Male	78.79%	26
Female	21.21%	7
Other	0.00%	0
Declined to state	0.00%	0

Ethnicity*		39
White	41.03%	16
Asian	41.03%	16
Hispanic	10.26%	4
Pacific Islander	0.00%	0
Black	0.00%	0
Native American	0.00%	0
Mixed	7.69%	3
Declined to state	0.00%	0

* ethnicity specifications are not exclusive

Financial Summary

MSRI Summer Graduate School

2021 CRM-PIMS Summer School in Probability

May 24, 2021 - June 18, 2021

Virtual Summer School

	Academic Sponsors	Total
Stipend	$ 4,000.00	**$ 4,000.00**
Other	$ 2,114.62	**$ 2,114.62**
Total	**$ 6,114.62**	**$ 6,114.62**

	Stipend	Other	Totals
	Academic Sponsors	Academic Sponsors	
Organizers, Speakers, TAs			
Hess Childs, Elias (TA)	$ 4,000.00		**$ 4,000.00**
Subtotals (Funded Participants)	$ 4,000.00	$ -	**$ 4,000.00**
Office Space Rental		$ 660.42	**$ 660.42**
Computer Software/Equipment		$ 1,232.22	**$ 1,232.22**
Shipping and Postage		$ 221.98	**$ 221.98**
Subtotals (Other)	$ -	$ 2,114.62	**$ 2,114.62**
Totals	**$ 4,000.00**	**$ 2,114.62**	**$ 6,114.62**

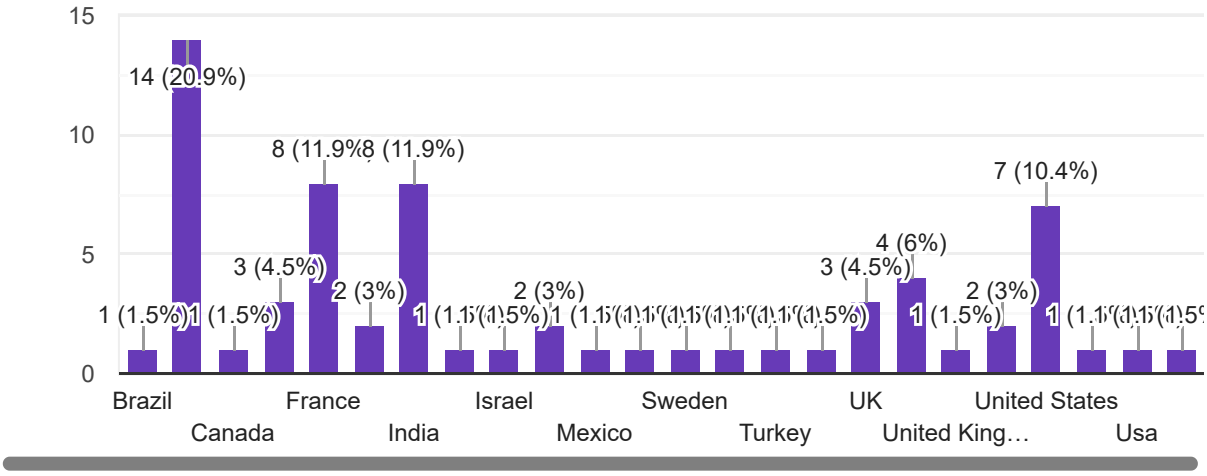
CRM-PIMS probability summer school - participant survey

67 responses

Publish analytics

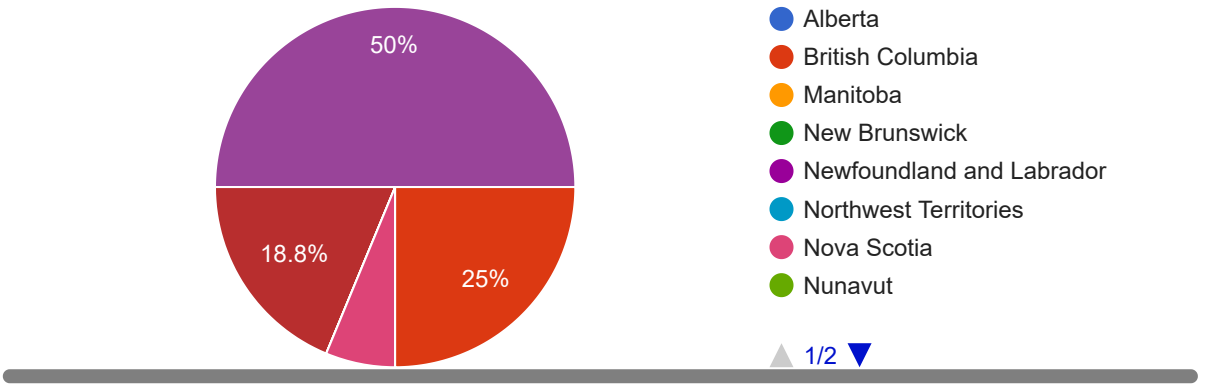
1. Country of residence

67 responses



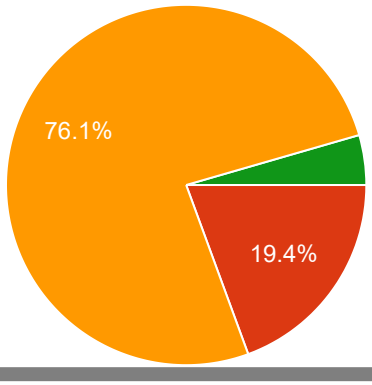
2. Province/territory of residence (if Canadian)

16 responses



3. Gender

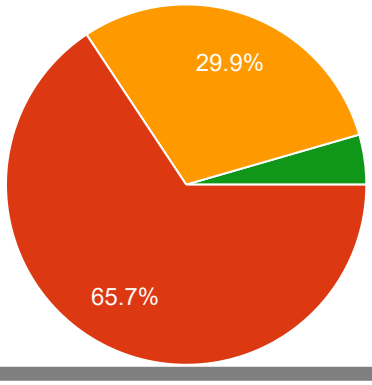
67 responses



- Non-binary
- Female
- Male
- Prefer not to say

4. Age

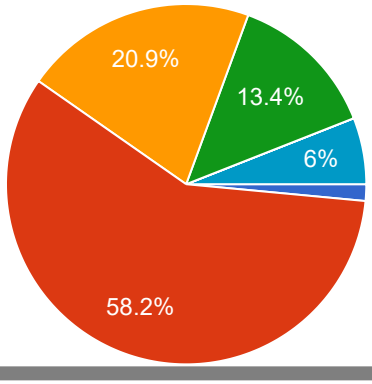
67 responses



- <20
- 20-29
- 30-39
- 40-49
- 50-59
- 60-69
- 70-79
- 80+
- Prefer not to say

5. Career stage

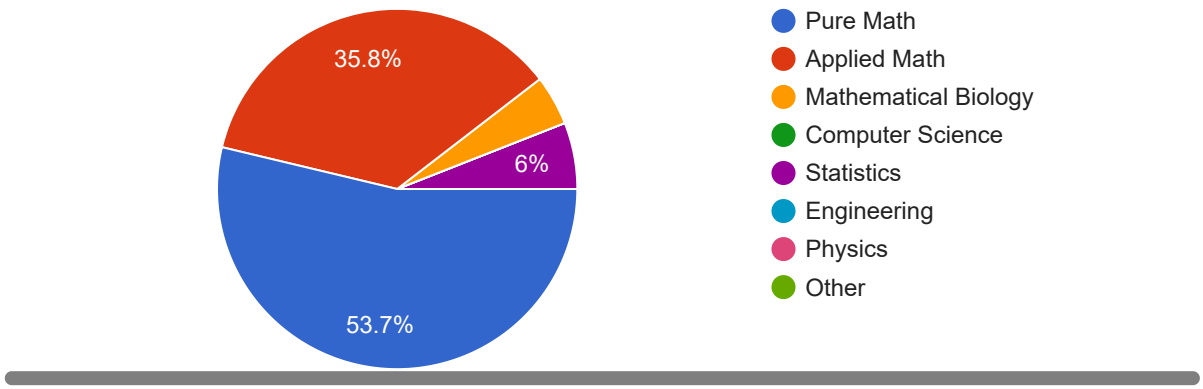
67 responses



- Undergraduate student
- Graduate student
- Postdoc
- Professor/lecturer
- Retired/emerita/emeritus
- Other

6. Primary research field

67 responses



7. Do you have any comments, suggestions or other feedback?

23 responses

I really like the series of courses, and the notes/slides are also super useful. Personally I can't digest so much information and new knowledge in short time span, but with these notes I will be visit to revisit some lectures that I didn't understand. I can also read the notes of the courses which are super interesting, but was too late for me to participate live.

A small suggestion of JC Mourrat's lecture notes: maybe it would be more natural if the notes are divided by chapters instead of lectures. People can just sign their name at the sections/paragraphs, and that is enough to recognize their contributions.
I am looking forward to see the final version of the lecture note comes out!

In the end, I want to thank the lecturers and the organizers for this wonderful online summer school!

I would like to stress out that the course was very nicely presented and organized. The only suggestion I would make is that the mini courses could have been after Lougi's class. Here in Europe, Lougi's course being after the mini course made it a little bit difficult to follow up live (class from 21:30 to 23:00 in my time zone). Anyway, apart from that small suggestion I really would like to congratulate all the professors and

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Answers to the question “Do you have any comments, suggestions or other feedback?”

I really like the series of courses, and the notes/slides are also super useful. Personally I can't digest so much information and new knowledge in short time span, but with these notes I will be visit to revisit some lectures that I didn't understand. I can also read the notes of the courses which are super interesting, but was too late for me to participate live.

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I am looking forward to see the final version of the lecture note comes out!

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The conference went well!

Thanks for organizing and recording the seminar. I'm in China and the time is not very friendly to me, but the recordings are very helpful!

The summer school was very long (a full month), so it often clashed with other obligations that I had. However it was great to have recordings available on youtube, it allowed me to stay on track whenever I missed a lecture.

Great school, I enjoyed it a lot!

Great Summer School!

Good job!

great courses, I am grateful for all the consideration towards the alumni

and to make it as enjoyable as it was

The lectures could have started an hour or so earlier and may be the duration of each lecture could have been reduced to 1 hour.

Thanks for running the school! Glad it was online, since I wouldn't've made it otherwise. It is above my level, but I learned much from the preliminaries and background lectures. I loved Dr. Mourrat's course : the learning curve was steep, but well-worth it. Dr. Addario-Berry's course was a breeze of fresh air after the morning's hard work, and (maybe) relevant to my research. (Not a fan of gather.town, though. All-zoom socials would be preferred.) Merci! Have a great summer!
Very valuable summer school. Let me learn a lot. Thanks to the two main professors for the short course. Thanks to the professors for their careful lectures and attached exercises.

The programme was excellent. Expecting more lectures on Applied Probability especially Queueing Theory/Stochastic Control Theory

I think Dr. Addario-Berry's moving personal statement at the start of his May 31 lecture deserves particular mention, both for what was said and what was not said. Part of academic freedom is the right to talk about worthy topics, and at the same time we shouldn't use the stage for political purposes. Canadians (and anyone interested in what being "Canadian" can mean) might want to listen to him, but from an administrative point of view agencies and organizations should use this for an example of how a speaker can give a personal perspective on a difficult and possibly divisive issue (not so much in this instance, but often that's the case) without using the platform to advance personal causes.

[I'm not commenting on the substance of the presentation not because I disagree with it, but because I'm trying to draw a lesson for event organizations that's independent of the particular presentation]

I am a PhD student at Caltech. My primary research area, as yet , is Number Theory , more specifically Analytic, Combinatorial and Probabilistic Number Theory . But these lectures were really enthralling for me and has generated some interest for me to pursue additionally several questions /research problems in the course-related areas of the school or in the subject in general, if I get the opportunity . Thanks for organizing this school and I wished it would have extended for a bit more time and have incorporated some more topics or elaborated more some

of the covered topics (especially in the Mini-Courses).

No

Great school!

Great lectures! Enjoyed it a lot

It is nice to have courses lasting for one or two months.

Some problem sessions would be very heplful on exercises

The summer school was great! :-D

It was wonderful, I very much hope to have the opportunity to participate next year as well.

I tried to attend some of Louigi's course, although the time difference proved a harder constraint than I'd anticipated. In any case, I really enjoyed the sections I watched. I also thought it was great that people were asking so many questions in the Zoom chat. It feels like a genuine issue in general at introductory-level workshop courses that the lecturer can say "all questions welcome, however obvious they may seem" but in practice the audience is intimidated from asking these. However in this course, the chat was brimming with such questions and, even better, it was possible for other audience members to offer answers without disrupting the flow of the lectures when appropriate.

Louigi, of course, by his engaging lecturing style encouraged an atmosphere where such questions were welcome and natural. The lecture notes are a superb resource for current and future students (and non-students).

I also strongly appreciated the inclusivity statement on the summer school website.

(One constructive criticism: maybe trim the Youtube versions of the videos to just the lectures themselves? Eg the chat before the start of Sarah P's first lecture is quite awkward for eternal preservation.)

Thank you for all your hard work in arranging this summer school and I'm sorry I wasn't able to attend more of the lectures.

Sparsity of Algebraic Points

June 7, 2021 – June 18, 2021

Virtual Summer Graduate School

Organizers:

Philipp Habegger (University of Basel)

Hector Pasten (Pontificia Universidad Católica de Chile)

REPORT ON THE MSRI SUMMER GRADUATE SCHOOL
"Sparsity of Algebraic Points"
June 07 –18, 2021

Organizers

- Philipp Habegger (University of Basel)
- Hector Pasten (Pontificia Universidad Católica de Chile)

Description

The theory of Diophantine equations is understood today as the study of algebraic points in algebraic varieties, and it is often the case that algebraic points of arithmetic relevance are expected to be sparse.

This summer school introduced the participants to two of the main techniques in the subject: (i) the filtration method to prove algebraic degeneracy of integral points by means of the subspace theorem, leading to special cases of conjectures by Bombieri, Lang, and Vojta, and (ii) unlikely intersections through o-minimality and bi-algebraic geometry, leading to results in the context of the Manin-Mumford conjecture, the André-Oort conjecture, and generalizations. This summer school provided an entry point to a very active research area in modern number theory.

Highlights of the School

The first week was focused on Unlikely Intersections and the lectures were delivered by Philipp Habegger. The second week was about Integral and Rational Points, and the instructor was Hector Pasten. During these two weeks the lecturers highlighted the analogies and connections between both subjects, such as the parallel between the Pila-Wilkie theorem and the Bombieri-Lang conjecture.

The lectures included several carefully selected problems, intended to reinforce some key concepts that were essential for understanding the material. In addition, each day had a list of problems for the TA sessions, which were led by Yunqing Tang and Borys Kadets. Students formed groups and worked on some of these exercises in a very focused way, making considerable progress and sometimes proposing complete solutions.

Each day started with a R&D session. These virtual meetings by Zoom gave the students the opportunity to communicate their ideas form the TA session of the previous day. The R&D sessions were very successful in the aspect of engagement of students; most of the time, the students spent almost the whole session explaining their ideas and asking questions on material related to the lectures and problem sets.

A wonderful feature of the group was its diversity. The groups during TA sessions faithfully reflected this background diversity, which gave an opportunity for fruitful collaborations.

Organizers

First Name	Last Name	Institution
Philipp	Habegger	University of Basel
Hector	Pasten	Pontificia Universidad Católica de Chile

Speakers

First Name	Last Name	Institution
Philipp	Habegger	University of Basel
Hector	Pasten	Pontificia Universidad Católica de Chile

Teaching Assistants

First Name	Last Name	Institution
Borys	Kadets	University of Georgia
Yunqing	Tang	Université Paris-Sud

Mathematical Sciences Research Institute

Sparsity of Algebraic Points

June 7 to June 18, 2021

Monday, June 7, 2021		
09:30 AM - 10:15 AM		Meet and Greet
10:30 AM - 11:30 AM	Philipp Habegger	Sparsity of Algebraic Points: Part 1
11:30 AM - 12:30 PM		Break
12:30 PM - 01:30 PM	Philipp Habegger	Sparsity of Algebraic Points: Part 2
01:30 PM - 02:00 PM		Coffee Break
02:00 PM - 04:00 PM		TA Session

Tuesday, June 8, 2021		
09:30 AM - 10:15 AM		Reports and discussion
10:30 AM - 11:30 AM	Philipp Habegger	0-Minimal Geometry Part 1
11:30 AM - 12:30 PM		Break
12:30 PM - 01:30 PM	Philipp Habegger	0-Minimal Geometry Part 2
01:30 PM - 02:00 PM		Coffee Break
02:00 PM - 04:00 PM		TA Session

Wednesday, June 9, 2021		
09:30 AM - 10:15 AM		Reports and discussion
10:30 AM - 11:30 AM	Philipp Habegger	Pila-Wilkie Theorem and Transcendence
11:30 AM - 12:30 PM		Break
12:30 PM - 01:30 PM		TA Session

Thursday, June 10, 2021		
09:30 AM - 10:15 AM		Reports and discussion
10:30 AM - 11:30 AM	Philipp Habegger	Manin-Mumford and André Oort Part 1
11:30 AM - 12:30 PM		Break
12:30 PM - 01:30 PM	Philipp Habegger	Manin-Mumford and André Oort Part 2
01:30 PM - 02:00 PM		Coffee Break
02:00 PM - 04:00 PM		TA Session

Friday, June 11, 2021		
09:30 AM - 10:15 AM		Reports and discussion
10:30 AM - 11:30 AM	Philipp Habegger	Unlikely Intersections
11:30 AM - 12:30 PM		Break
12:30 PM - 01:30 PM	Philipp Habegger	The Legendre Family of Elliptic Curves
01:30 PM - 02:00 PM		Coffee Break
02:00 PM - 04:00 PM		TA Session

Monday, June 14, 2021		
09:30 AM - 10:15 AM		Reports and discussion
10:30 AM - 11:30 AM	Hector Pasten	Lecture 1- From Rational Approximations to Diophantine Equations
11:30 AM - 12:30 PM		Break
12:30 PM - 01:30 PM	Hector Pasten	Lecture 2- From Rational Approximations to Diophantine Equations
01:30 PM - 02:00 PM		Coffee Break
02:00 PM - 04:00 PM		TA Session

Tuesday, June 15, 2021		
09:30 AM - 10:15 AM		Reports and discussion
10:30 AM - 11:30 AM	Hector Pasten	Lecture 3- Reminder of Algebraic Geometry- Sheaves and Divisors
11:30 AM - 12:30 PM		Break
12:30 PM - 01:30 PM	Hector Pasten	Lecture 4- Heights and Weil Functions
01:30 PM - 02:00 PM		Coffee Break
02:00 PM - 04:00 PM		TA Session

Wednesday, June 16, 2021		
09:30 AM - 10:15 AM		Reports and discussion
10:30 AM - 11:30 AM	Hector Pasten	Lecture 5- Integral Points in Higher Dimensional Varieties
11:30 AM - 12:30 PM		Break
12:30 PM - 01:30 PM		TA Session

Thursday, June 17, 2021		
09:30 AM - 10:15 AM		Reports and discussion
10:30 AM - 11:30 AM	Hector Pasten	Lecture 6: The Main Conjectures
11:30 AM - 12:30 PM		Break
12:30 PM - 01:30 PM	Hector Pasten	Lecture 7: Bűchis Problem: a Case Study
01:30 PM - 02:00 PM		Coffee Break
02:00 PM - 04:00 PM		TA Session

Friday, June 18, 2021		
09:30 AM - 10:15 AM		Reports and discussion
10:30 AM - 11:30 AM	Hector Pasten	Lecture 8: The Filtration Method
11:30 AM - 12:30 PM		Break
12:30 PM - 01:30 PM	Hector Pasten	Lecture 9: Further Applications of the Subspace Theorem
01:30 PM - 02:00 PM		Coffee Break
02:00 PM - 04:00 PM		TA Session

Students		
First Name	**Last Name**	**Institution**
Prerna	Agarwal	Louisiana State University
Sarah	Čoupek	Purdue University
Poornima	Arpin	University of Colorado
Yasmeen	B	University of California, San Diego
Irmak	Baki	University of California, Irvine
Deewang	Balcik	University of Southern California
Neer	Bhamidipati	University of California, Santa Cruz
Bartu	Bhardwaj	University of Illinois at Urbana-Champaign
Simone	Bingol	University of Massachusetts Amherst
Pavel	Coccia	University of British Columbia
Alexis	Dasher	University of Minnesota, Twin Cities
Sarah	Days-Merrill	University of Vermont
Marta	Dujella	Universität Basel
Juanita	Duque Rosero	Dartmouth College
Yu	Fu	University of Wisconsin-Madison
Xu	Gao	University of California, Santa Cruz
Qi	Ge	University of Alberta
Doron	Grossman-Naples	University of Illinois at Urbana-Champaign
Anton	Hilado	University of Vermont
Alexandra	Hill	Northern Illinois University
Chun-Hsien	Hsu	Duke University
Austen	James	Rice University
Aashraya	Jha	Boston University
Ryan	Kannanaikal	Northeastern University
John	Lentfer	Harvey Mudd College
Chifan	Leung	Oregon State University
Jessie	Loucks	University of Washington
Genevieve	Maalouf	McMaster University
Soheil	Memariansorkhabi	University of Toronto
Sam	Miller	University of California, Santa Cruz
George	Mitchell	CUNY, Graduate Center
Sanat	Mulay	University of Southern California
James	Myer	City University of New York (CUNY)
Lauren	Nowak	San Francisco State University
Chatchai	Noytaptim	Oregon State University
Gyujin	Oh	Princeton University
Tristan	Phillips	University of Arizona
Gabriel	Raposo	University of Wisconsin-Madison
Hasan	Saad	University of Virginia
Gerold	Schefer	Universität Basel
Zac	Spaulding	Rice University
Jakob	Streipel	Washington State University
Vladislav	Taranchuk	University of Delaware
Tian	Wang	University of Illinois at Chicago
Haiyang	Wang	University of Georgia

Students		
First Name	**Last Name**	**Institution**
Matthew	Williams	Colorado State University
Samantha	Wyler	Kent State University
Zheng	Xiao	Michigan State University
Daodao	Yang	TU Graz
Jianing	Yang	University of Pennsylvania
Roy	Zhao	University of California, Berkeley
Kenneth	Zheng	Rice University

Officially Registered Participant Information

Particpiants		52

Gender		52
Male	63.46%	33
Female	32.69%	17
Other	0.00%	0
Declined to state	3.85%	2

Ethnicity*		60
White	36.67%	22
Asian	36.67%	22
Hispanic	5.00%	3
Pacific Islander	0.00%	0
Black	1.67%	1
Native American	0.00%	0
Mixed	6.67%	4
Declined to state	13.33%	8

* ethnicity specifications are not exclusive

Financial Summary

MSRI Summer Graduate School

Sparsity of Algebraic Points

June 07, 2021 - June 18, 2021

Virtual Summer School

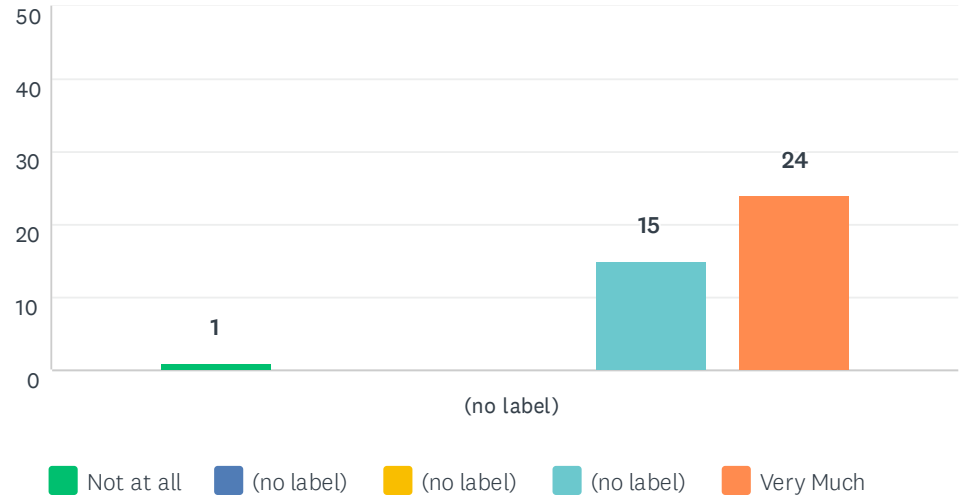
	NSF 5059	Total
Stipend	$ 10,000.00	**$ 10,000.00**
Other	$ 3,153.40	**$ 3,153.40**
Total	**$ 13,153.40**	**$ 13,153.40**

	Stipend	Other	Totals
	NSF 5059	NSF 5059	
Organizers, Speakers, TAs			
Habegger, Philipp (O/S)	$ 3,000.00		**$ 3,000.00**
Kadets, Borys (TA)	$ 2,000.00		**$ 2,000.00**
Pasten, Hector (O/S)	$ 3,000.00		**$ 3,000.00**
Tang, Yunqing (TA)	$ 2,000.00		**$ 2,000.00**
Subtotals (Funded Participants)	$ 10,000.00	$ -	**$ 10,000.00**
Computer Software/Equipment		$ 2,085.82	**$ 2,085.82**
Shipping and Postage		$ 1,067.58	**$ 1,067.58**
Subtotals (Other)	$ -	$ 3,153.40	**$ 3,153.40**
Totals	**$ 10,000.00**	**$ 3,153.40**	**$ 13,153.40**

40 responses out of 52 students = 77% response rate

Q1 The various topics within the summer school integrated into a coherent picture

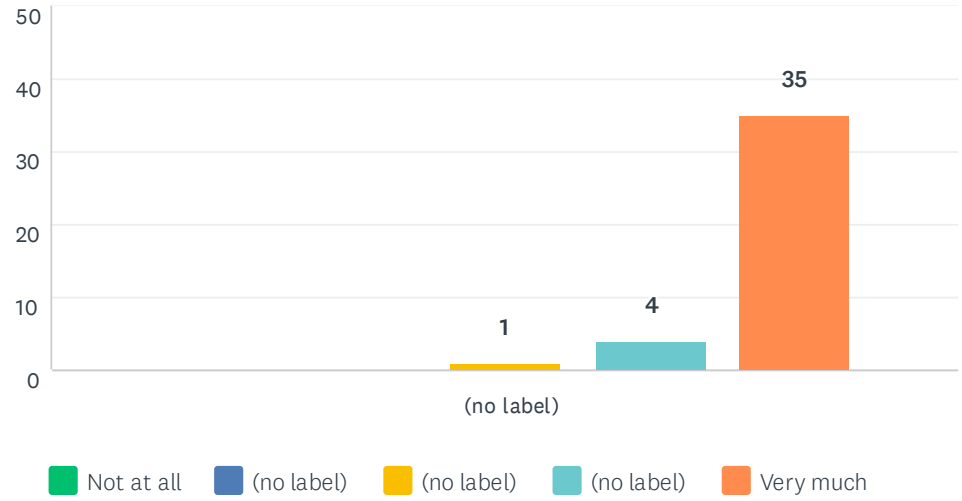
Answered: 40 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	2.50% 1	0.00% 0	0.00% 0	37.50% 15	60.00% 24	40	4.53

Q2 The speakers were generally clear and well organized in their presentation

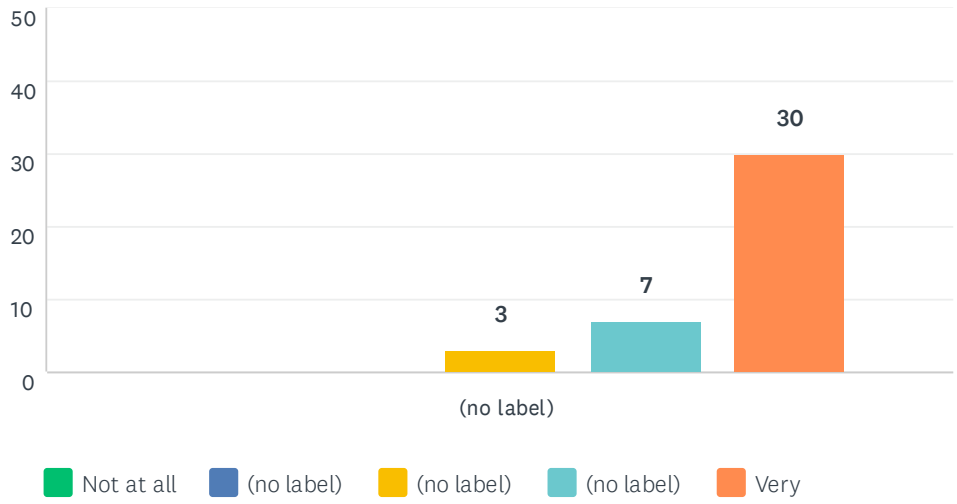
Answered: 40 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.50% 1	10.00% 4	87.50% 35	40	4.85

Q3 The school was intellectually stimulating

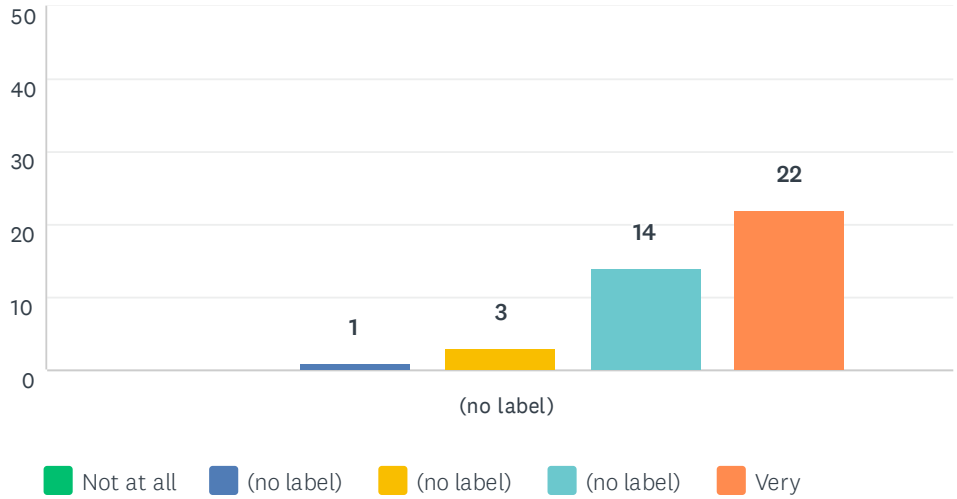
Answered: 40 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	7.50% 3	17.50% 7	75.00% 30	40	4.67

Q4 My fellow students were appropriately selected to make the event interesting

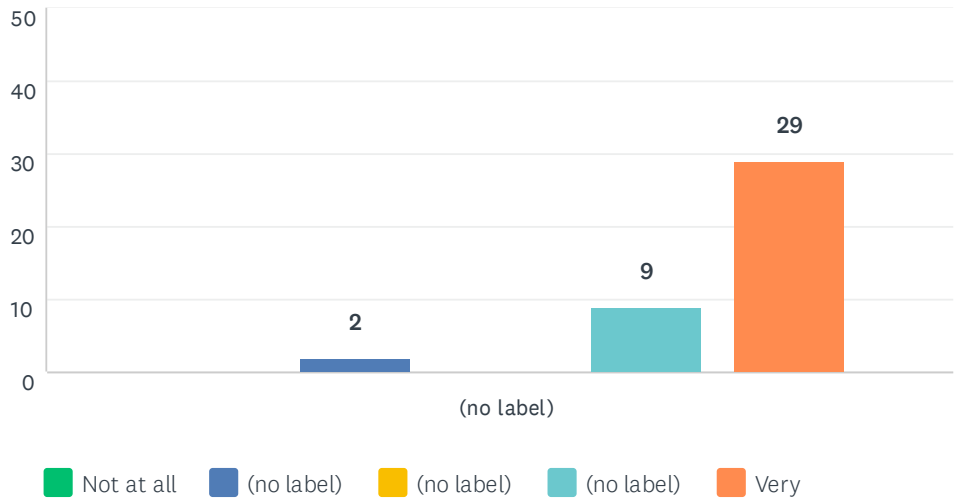
Answered: 40 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.50% 1	7.50% 3	35.00% 14	55.00% 22	40	4.42

Q5 The overall experience of the school was worthwhile

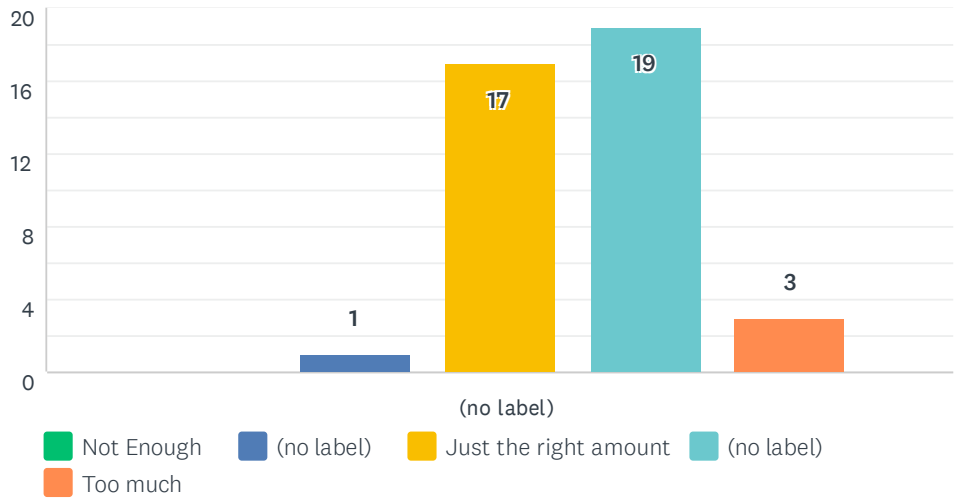
Answered: 40 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.00% 2	0.00% 0	22.50% 9	72.50% 29	40	4.63

Q6 The amount of material presented was:

Answered: 40 Skipped: 0



	NOT ENOUGH	(NO LABEL)	JUST THE RIGHT AMOUNT	(NO LABEL)	TOO MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.50% 1	42.50% 17	47.50% 19	7.50% 3	40	3.60

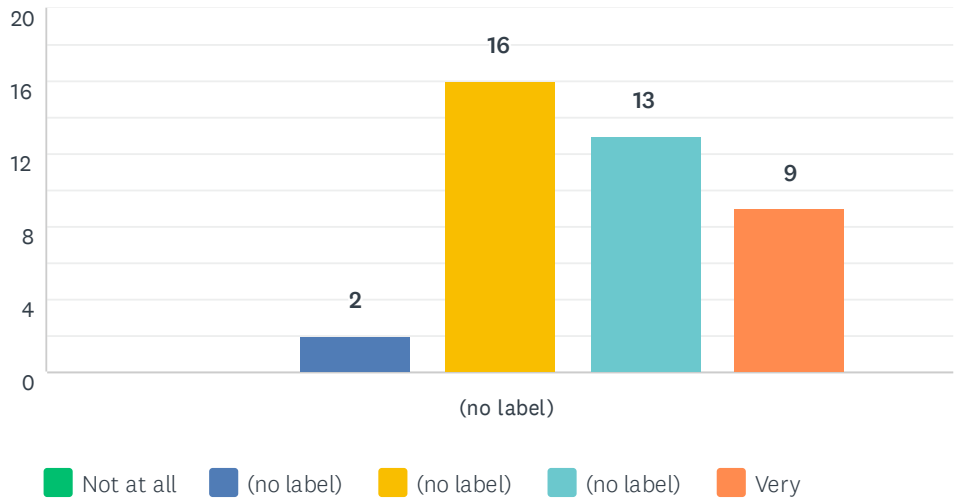
Q7 Additional comments on the topic presentation and organization

Answered: 6 Skipped: 34

#	RESPONSES	DATE
1	The lecturers and assistants were all very helpful and motivating, especially during the problem solving sessions.	7/17/2021 12:20 PM
2	I think emphasizing more about how the two topics interacted would have been nice. Speakers did often go over time in lectures; this sometimes worsened my Zoom fatigue and made lunch more rushed. By the middle of the second week, I was pretty exhausted from the summer school's intensity.	6/28/2021 7:42 AM
3	Even though it was the best virtual summer school that I have attended, I hope that I will be able to get another chance in the future to experience MSRI atmosphere in person.	6/25/2021 1:21 PM
4	The execution of TA session was especially great, considering we had to do it online. We still got a chance to know each other and collaborate on problems. The only thing I would maybe prefer is if the talks were more of a "blackboard" format, and in general if there was more integration of virtual whiteboards (or some other execution of digital writing) from the side of the speakers and TAs.	6/23/2021 11:11 AM
5	Key ideas in each topic are nicely explained. The problem sets are so much fun.	6/23/2021 5:34 AM
6	Hope to cone back for another MSRI summer school!	6/22/2021 11:36 AM

Q8 I was well prepared to benefit from the school

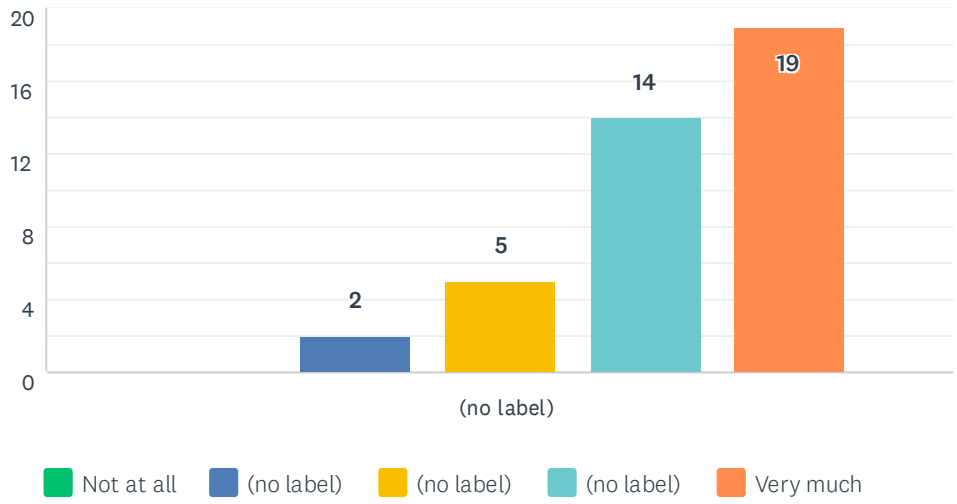
Answered: 40 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.00% 2	40.00% 16	32.50% 13	22.50% 9	40	3.73

Q9 My interest in the subject matter was increased by the school

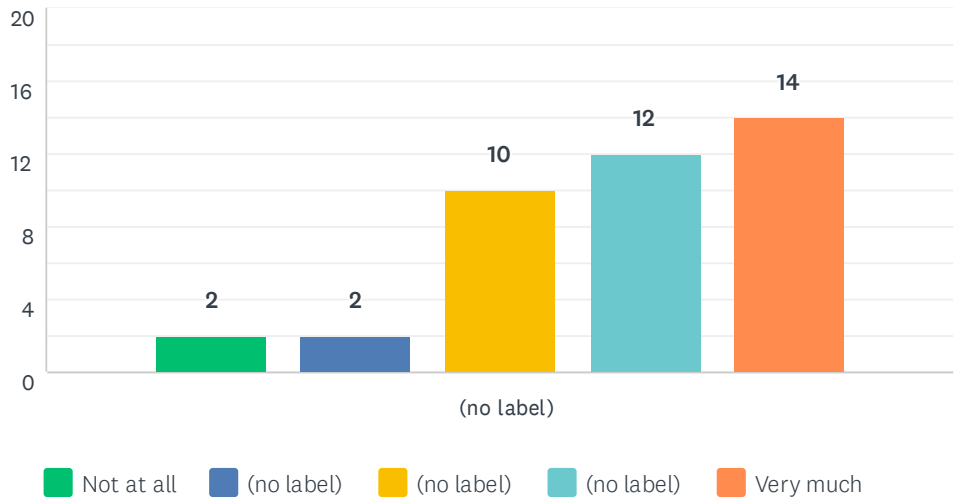
Answered: 40 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.00% 2	12.50% 5	35.00% 14	47.50% 19	40	4.25

Q10 The school helped me meet people with similar scientific interests

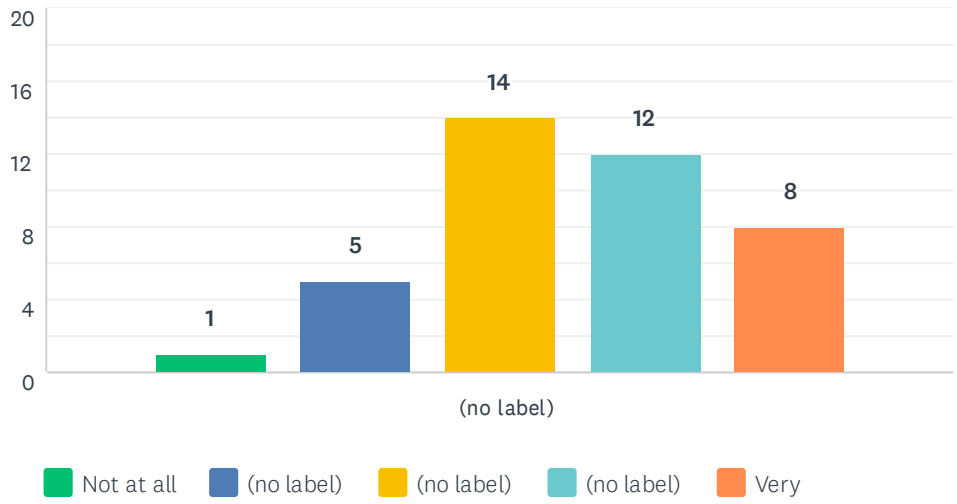
Answered: 40 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	5.00% 2	5.00% 2	25.00% 10	30.00% 12	35.00% 14	40	3.85

Q11 It is likely that I will work in the area of the school subject in the future

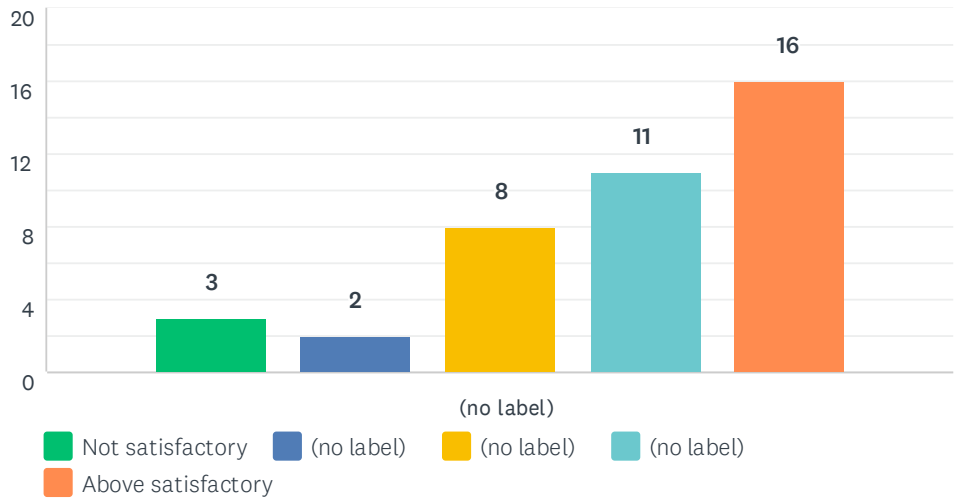
Answered: 40 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.50% 1	12.50% 5	35.00% 14	30.00% 12	20.00% 8	40	3.52

Q12 How would you evaluate your interaction with other participants?

Answered: 40 Skipped: 0



	NOT SATISFACTORY	(NO LABEL)	(NO LABEL)	(NO LABEL)	ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	7.50% 3	5.00% 2	20.00% 8	27.50% 11	40.00% 16	40	3.88

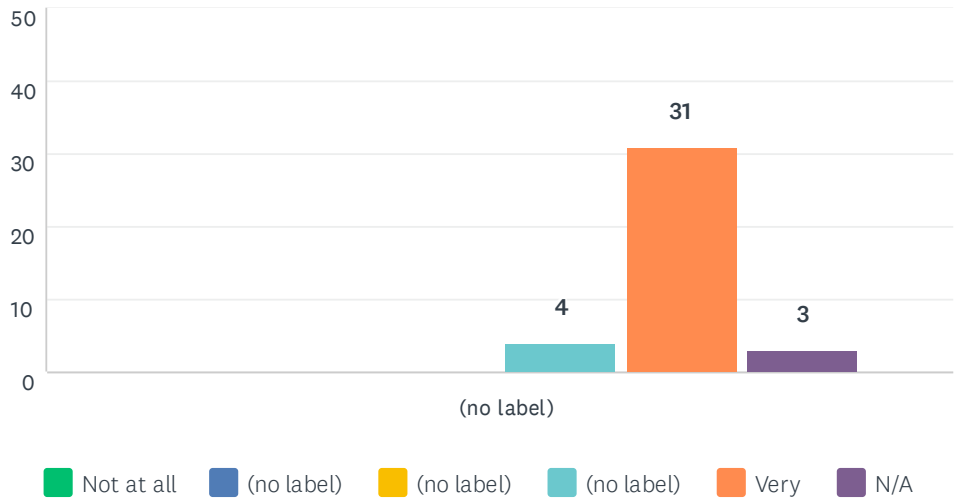
Q13 Additional comments on your personal assessment

Answered: 2 Skipped: 38

#	RESPONSES	DATE
1	Being somebody who identifies as an algebraic geometer rather than a number theorist, I felt out of place. The other participants seemed very number theoretically motivated and their research interests showed it. Nonetheless, I always felt like I was surrounded by very sharp people. Even when I was too shy or drained to speak, they often had ideas which propelled our problem group forward.	6/28/2021 7:54 AM
2	Except the trouble I sometimes had with my internet connection, it was (even virtually) so worth being there. Thank you everyone for your hard work.	6/25/2021 1:25 PM

Q14 I found the MSRI staff helpful

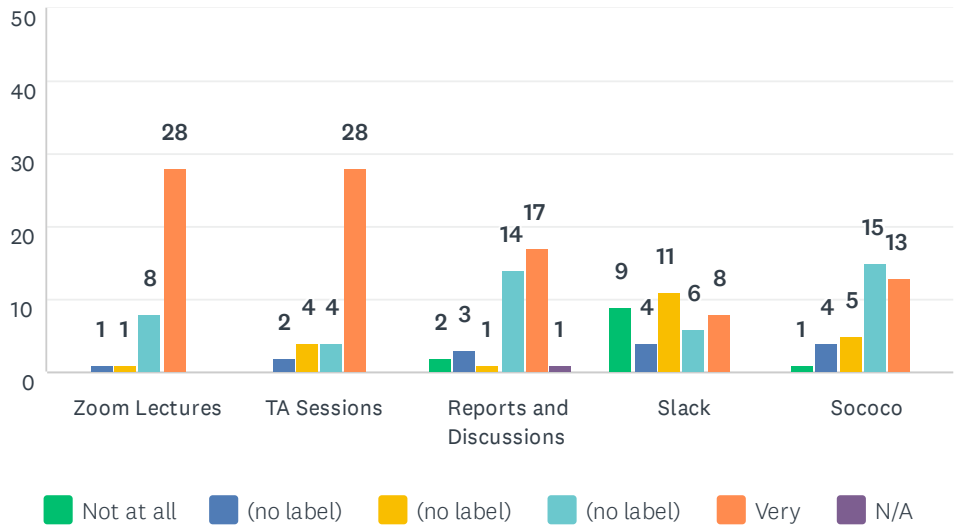
Answered: 38 Skipped: 2



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	0.00% 0	10.53% 4	81.58% 31	7.89% 3	38	4.89

Q15 How helpful did you find each of these collaboration tools

Answered: 38 Skipped: 2

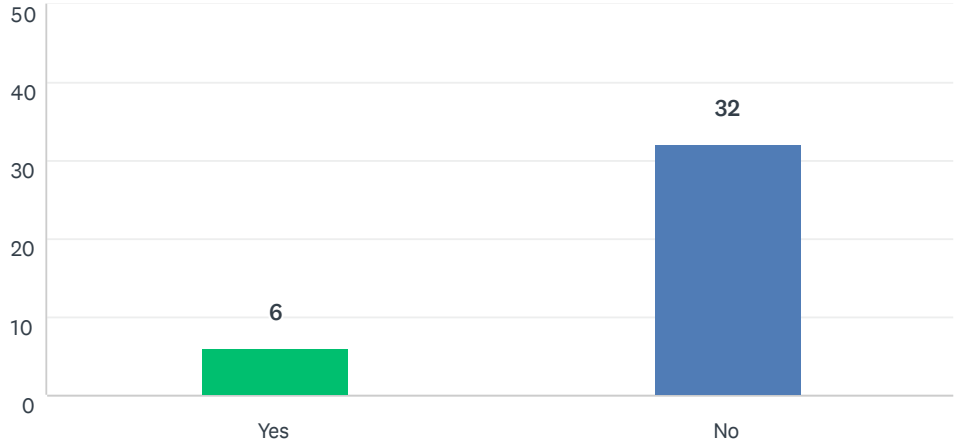


	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	N/A	TOTAL	WEIGHTED AVERAGE
Zoom Lectures	0.00% 0	2.63% 1	2.63% 1	21.05% 8	73.68% 28	0.00% 0	38	4.66
TA Sessions	0.00% 0	5.26% 2	10.53% 4	10.53% 4	73.68% 28	0.00% 0	38	4.53
Reports and Discussions	5.26% 2	7.89% 3	2.63% 1	36.84% 14	44.74% 17	2.63% 1	38	4.11
Slack	23.68% 9	10.53% 4	28.95% 11	15.79% 6	21.05% 8	0.00% 0	38	3.00
Sococo	2.63% 1	10.53% 4	13.16% 5	39.47% 15	34.21% 13	0.00% 0	38	3.92

#	COMMENTS	DATE
1	Sococo's video conferencing is hard to work with, so embedding zoom links worked much better.	7/2/2021 11:20 PM
2	While in the TA sessions my group found it easier to work in Zoom than Sococo.	6/28/2021 8:14 AM

Q16 Did you experience any technical difficulties accessing the online summer school?

Answered: 38 Skipped: 2



ANSWER CHOICES	RESPONSES	
Yes	15.79%	6
No	84.21%	32
TOTAL		38

#	IF YES, PLEASE EXPLAIN	DATE
1	Same as above comment - couldn't share files easily / see everybody with the Sococo built-in video	7/2/2021 11:20 PM
2	I had internet issues throughout the first week. Zoom and Sococo meetings would pause for 20sec-2min for me around every 15 minutes. I also had to install Chrome to use Sococo; I use Linux, which the Sococo desktop app does not support.	6/28/2021 8:33 AM
3	Due to my weak internet connection	6/25/2021 1:39 PM
4	Zoom on Linux doesn't work terribly well. Not MSRI's fault at all.	6/23/2021 1:39 PM
5	Sococo	6/22/2021 2:52 PM
6	Unfortunately I had serious internet issues	6/22/2021 1:23 PM

Q17 How did having the summer school held online impact your participation?

Answered: 38 Skipped: 2

#	RESPONSES	DATE
1	I think I would have been slightly more engaged if it were in person, but I still think that I got a lot out of it being virtual.	7/17/2021 12:28 PM
2	Focusing online to such a heavy material was extremely tough during the summer heat	7/16/2021 3:08 PM
3	i wish it was in person, it would be more interesting, but of course the circumstances demanded otherwise	7/16/2021 10:29 AM
4	The online experience is great for me. However Talking over Zoom and Sococo is a little less engaging than personal meeting.	7/15/2021 1:19 PM
5	made me possible to attend outside the country	7/14/2021 9:40 PM
6	Focusing on lectures became a bit tiring because of the format and it is easier to sometimes "stay in the background" when working in bigger groups online.	7/14/2021 10:54 AM
7	I couldn't participate a lot due to some other matters which are unrelated to it being held online.	7/14/2021 10:30 AM
8	It forces the time schedule being a little compact, leaving few time for lunch and limiting the sociality.	7/14/2021 9:25 AM
9	- I really appreciated that the lectures were recorded. I have a hard time with live lectures, and spent some time re-watching the recordings when I felt lost. I wish they had captions/transcripts (accessibility) - Zoom does have a way to automatically generate this. - I found a core group of people I felt comfortable working with, but screen fatigue makes unscheduled socializing much harder to have happen - I was able to still attend and take care of family things at the same time, which wouldn't have been possible in person. - I kept my camera on for breakout sessions and most lectures, but had a hard time participating when things were unstructured or groups were broken up suddenly (suggestions in q18)	7/2/2021 11:20 PM
10	Having the summer school online did not impact my participation too much. I was already very comfortable taking classes and collaborating over Zoom, so it all felt normal.	6/28/2021 11:02 AM
11	The timing was difficult sometimes.	6/28/2021 10:08 AM
12	I was more likely to work on my own for the TA sections.	6/28/2021 8:45 AM
13	time difference	6/28/2021 8:37 AM
14	It negatively affected my participation. I'm already a shy person. Having the ability to hide my face and mute my mic only made things worse. Also my internet issues made contributing to conversations awkward sometimes; for instance, I might suggest something which had just been suggested when my internet connection was stuttering.	6/28/2021 8:33 AM
15	I feel like the TA sessions worked well being online. However, the presentations seemed to go at a faster pace than what some of us were understanding. Many times my group would spend time re-working through places in the lecture notes to understand what was rushed through.	6/28/2021 8:14 AM
16	I would have liked to attend the event in person, but was happy to attend it online.	6/28/2021 8:12 AM
17	Not much, I would say. It decreased the possibility for spontaneous discussion of the topics, but the discussions (TA sessions) helped. It being online also allowed me to attend the second week despite being ill.	6/25/2021 4:39 PM
18	I was having hard time to be organized for Zoom meetings. I kinda wasted the short breaks between the sessions.	6/25/2021 1:39 PM
19	What was probably missing were the post-school activities: I guess that when the daily	6/25/2021 12:40 PM

	activities end, people still gather together and discuss more math.	
20	It made it more challenging to interact with the other participants.	6/24/2021 6:25 AM
21	It makes it harder to be immersed.	6/23/2021 1:39 PM
22	I was in a time zone with a significant time difference (9 hours), so I was sometimes very tired at the time of the TA sessions (which already require high level of concentration since they start soon after the lecture ends and include the material from that lecture). And I was missing a bit of interaction outside of the TA sessions	6/23/2021 11:20 AM
23	Did not impact it.	6/23/2021 10:23 AM
24	Not really. I don't have the experience for personal meeting either.	6/23/2021 5:36 AM
25	It was harder to focus for a long period of time, but the breaks helped.	6/22/2021 4:56 PM
26	I personally like the environment when people get together in person to work on maths. Online school is great but sitting in front of computer screen for the whole day, we get easily tired. I have to admit that MSRI (virtual) school is my best online school/workshop so far.	6/22/2021 3:17 PM
27	Probably less interested	6/22/2021 2:52 PM
28	Less chance for collaboration through online.	6/22/2021 2:33 PM
29	It is very difficult to participe and approach people in an online setting. Being everything online and in my house I had perssonal where I was living and problems with internet connection. Besides all of this I really think this school helped me to have a better view on this area and relate it to my interests.	6/22/2021 1:23 PM
30	Probably only for coffee break. Since usually we don’t talk to each other during the break.	6/22/2021 11:38 AM
31	It's difficult to stay on camera throughout the entirety of the summer school's event, and so whereas in the in-person setting, we would "stay on camera" between lectures and interact, in this setting, we would immediately leave the Zoom meeting and not see each other again until the next lecture. There was also next-to-no interaction with others outside of the scheduled events, whereas we would likely interact before and after the lectures and TA sessions, etc. Summarizing, I think there is certainly less interpersonal interaction in this style, which is a shame. Of course, there are also quality of audio issues and it's generally more difficult to learn in this style. Perhaps the most apparent issue (which is quite specific to mathematical discourse) is the lack of easy "on the chalkboard" interaction. In person, we would likely stand around a chalkboard and have discourse, which is much more effective and fun.	6/22/2021 11:05 AM
32	It had to work at a unusual time	6/22/2021 10:54 AM
33	The working groups are a little awkward. There would be 8 or 9 avatars in our room, but only four or five would turn their cameras on. I was one of the people who turned my camera on, and it felt like people were eavesdropping or something - it was weird to have so many people "there" who did not introduce themselves or anything. Also, I really only got to know the four other particpants in my room. Normally at in-person conferences and workshops, I feel like it's easier to get to know everyone. I know we were a large group, but it would have helped me to have done introductions in the large group, so I would know who had similar research interests to me.	6/22/2021 10:33 AM
34	I participated fully (in all the session including the discussion sessions) and tried to be as active as possible. However, admittedly, being present in person would probably lead to a higher level of engagement (for psychological and sociological reasons).	6/22/2021 10:22 AM
35	It was very hard to communicate in an effective way.	6/22/2021 10:18 AM
36	Online was actually convenient for me as I do not have to deal with travel, which as much as I would like to see new places and interact in person, can sometimes be a hassle to manage. While I would really like to visit MSRI in person someday I hope some sort of online/hybrid component stays in the future to accommodate future participants who may have difficulties with travel.	6/22/2021 10:04 AM
37	As far as I can tell, my own participation was not impacted by the online format. I was very used to remote collaboration after a year of virtual academia, and I did not find this hindered me. However, I did notice that some of my peers were inclined to skip sessions, which I believe is an easier decision to make in a remote setting. Many things worked very well; the	6/22/2021 9:14 AM

	only thing I would note that is sorely lacking in online gatherings is that there is little opportunity for the sorts of spontaneous, organic interactions that occur under normal circumstances. I have found that chance encounters have far more frequently had profound consequences than organized activities, and so I think it would be disappointing if mathematics were to become a predominantly remote activity.	
38	Made it easier to plan around other research activities.	6/22/2021 8:56 AM

Q18 One important aspect that may have been missing due to the online format was interaction between participants. Do you have any suggestions on how we can improve this interaction if we hold future summer schools online?

Answered: 14 Skipped: 26

#	RESPONSES	DATE
1	I do wish I had a chance to meet more of the participants. Maybe a daily time where students are randomly put into groups to meet each other would have been beneficial.	7/17/2021 12:28 PM
2	Maybe schedule more discussion sections?	7/14/2021 9:25 AM
3	(1) Include a space in Slack or in Sococo for people to post written introductions. This way folks can have a way to reach out to each other and start conversation. (2) Establishing some fun channels in slack (ie. memes, hobbies, pet pictures, etc) may also encourage interaction and community-building (3) A little more structure ahead of time for the TA breakout sessions would help. Going from no information about them, to free-form, to assigned-groups, back to free form was difficult in an online format. I think either free-form or assigning groups can go well, but more facilitation/structure from the start can make a big difference. I appreciated the getting-to-know-you breakout rooms on the first day and it helped me find a great group that we connected with. Talking about not-math with strangers allowed us to build trust before diving into the math, especially since we were all from very different backgrounds and experience levels. Providing participants with a list of questions can sometimes help smoothing that getting-to-know-you time. Alternately, maybe on some days having groups form based on which questions they're interested in ("Q1-4, go to room 1, Q5-8, room 2, etc") or level of experience ("Beginners, rooms 1&2, etc") would have been nice. This is essentially what our group ended up doing, but I think it could have been nice to connect with others who are ready for a similar level of challenge (or who are feeling equally overwhelmed!) Also, if groups are free-form, posted biographies and an explicit understanding that groups will form ahead of time may also help folks from underrepresented communities connect/network with others with whom feeling included / sense of safety is easier than a random group. Overall, my sense is that I felt very lucky to eventually happen into a group that was super accepting and wonderful to work with, but navigating online spaces makes group formation much more difficult than in-person interactions and so benefits from extra structure / pre-planning.	7/2/2021 11:20 PM
4	First idea: place social events at the start of the day instead of at the end. For a staunch introvert like me, I just won't interact with others if I don't have the energy. Second idea: encourage more non-speaking communication. AGITTOC seemed to do this well on Zulip somehow. A key component seems to smaller groups within these text channels. Third idea: smaller problem groups (3-4 people) that get shuffled around. The smaller group size forces people to interact more. Shuffling groups forces more networking and more socialization practice. I'm sure people will dislike this idea because it pushes them out of their comfort zone.	6/28/2021 8:33 AM
5	I think it would be a good idea to have some sessions in which students are assigned to different rooms, rather than just the TA sessions where they stay with the same people the whole time. (Although that consistency is also helpful.)	6/25/2021 4:39 PM
6	On Sococo, it was a bit time consuming to try to find other participants with their tiny avatar logo.	6/25/2021 1:39 PM
7	Organize some randomized meeting sessions, for example at the end of the day when all the math activities are finished.	6/25/2021 12:40 PM
8	It might be nice after the initial meet and great day 1 to allot time for students to meet each other as well before the first lecture.	6/24/2021 6:25 AM
9	I think mathematical discourse was still quite good. The bit that was missing was the social interaction. Not sure how to make that happen without coffee breaks and such.	6/23/2021 1:39 PM

10	Maybe I would like some sort of interaction session that is not explicitly tied to TA session. But if these were held in the afternoon, for example, in this case I couldn't really participate in them, which would have made it worse. Also: it would have been great to have more people closer to my time zone, because then it would have been easier to organize some discussions and online activities outside of TA sessions with them.	6/23/2021 11:20 AM
11	See my comments above about chalkboards. Google JamBoard is just not as good as a chalkboard. It seems challenging to replicate the "chalkboard" interactions we have in the mathematics community while working together in person.	6/22/2021 11:05 AM
12	Mixing up the groups for the second week might have been helpful. Or having the groupwork a little spread out - maybe groupwork before the reports, so that people might have more to talk about in the report hour?	6/22/2021 10:33 AM
13	It is difficult, but maybe some explicit (Zoom-type) coffee breaks might help.	6/22/2021 10:22 AM
14	I guess this is the best one can hope for, but still it's very unsatisfactory.	6/22/2021 10:18 AM

Q19 We welcome any additonal comments or suggestions you may have to improve the overall experience for future participants.

Answered: 0 Skipped: 40

#	RESPONSES	DATE
	There are no responses.	

Mathematics of Big Data: Sketching and (Multi-) Linear Algebra

June 21, 2021 – July 2, 2021

Virtual Summer Graduate School

Organizers:

Kenneth Clarkson (IBM Research Division)
Lior Horesh (IBM Thomas J. Watson Research Center)
Misha Kilmer (Tufts University)
Tamara Kolda (Sandia National Laboratories; MathSci.ai)
Shashanka Ubaru (IBM Thomas J. Watson Research Center)

Organizers		
First Name	**Last Name**	**Institution**
Kenneth	Clarkson	IBM Research Division
Lior	Horesh	IBM Thomas J. Watson Research Center
Misha	Kilmer	Tufts University
Tamara	Kolda	MathSci.ai
Shashanka	Ubaru	IBM Thomas J. Watson Research Center
Speakers		
First Name	**Last Name**	**Institution**
Kenneth	Clarkson	IBM Research Division
Lior	Horesh	IBM Thomas J. Watson Research Center
Misha	Kilmer	Tufts University
Tamara	Kolda	MathSci.ai
Shashanka	Ubaru	IBM Thomas J. Watson Research Center
Teaching Assistants		
First Name	**Last Name**	**Institution**
Brett	Larsen	Stanford University
Bhaskar	Roberts	University of California, Berkeley
Elizabeth	Yang	University of California, Berkeley

Mathematical Sciences Research Institute

Mathematics Of Big Data: Sketching And (Multi-) Linear Algebra

June 21 to July 2, 2021

Monday, June 21, 2021		
09:00 AM - 10:15 AM□	Kenneth Clarkson	Introduction, Algorithmic Motivation
10:15 AM - 10:30 AM		Break
10:30 AM - 12:00 PM		Working Groups
12:00 PM - 01:00 PM		Break
01:00 PM - 02:15 PM	Kenneth Clarkson	Oblivious Subspace Embeddings
02:15 PM - 02:30 PM		Break
02:30 PM - 04:00 PM		Working Groups

Tuesday, June 22, 2021		
09:00 AM - 10:15 AM□	Kenneth Clarkson	Mathematics of Big Data- Sketching and (Multi-) Linear Algebra- Lecture 2
10:15 AM - 10:30 AM		Break
10:30 AM - 12:00 PM		Working Groups
12:00 PM - 01:00 PM		Break
01:00 PM - 02:15 PM	Kenneth Clarkson	Mathematics of Big Data- Sketching and (Multi-) Linear Algebra- Lecture 3
02:15 PM - 02:30 PM		Break
02:30 PM - 04:00 PM		Working Groups

Wednesday, June 23, 2021		
09:00 AM - 10:15 AM□	Kenneth Clarkson	Mathematics of Big Data- Sketching and (Multi-) Linear Algebra- Lecture 4
10:15 AM - 10:30 AM		Break
10:30 AM - 12:00 PM		Working Groups
12:00 PM - 01:00 PM		Break
01:00 PM - 02:15 PM	Kenneth Clarkson	Mathematics of Big Data- Sketching and (Multi-) Linear Algebra- Lecture 5
02:15 PM - 02:30 PM		Break
02:30 PM - 04:00 PM		Working Groups

Thursday, June 24, 2021		
09:00 AM - 10:15 AM□	Kenneth Clarkson	Mathematics of Big Data- Sketching and (Multi-) Linear Algebra- Lecture 6
10:15 AM - 10:30 AM		Break
10:30 AM - 12:00 PM		Working Groups
12:00 PM - 01:00 PM		Break
01:00 PM - 02:15 PM	Kenneth Clarkson	Mathematics of Big Data- Sketching and (Multi-) Linear Algebra- Lecture 7
02:15 PM - 02:30 PM		Break
02:30 PM - 04:00 PM		Working Groups

Friday, June 25, 2021		
09:00 AM - 10:15 AM□	Shashanka Ubaru	Mathematics of Big Data- Sketching and (Multi-) Linear Algebra- Lecture 8
10:15 AM - 10:30 AM		Break
10:30 AM - 12:00 PM		Working Groups
12:00 PM - 01:00 PM		Break
01:00 PM - 02:15 PM	Shashanka Ubaru	Mathematics of Big Data- Sketching and (Multi-) Linear Algebra- Lecture 9
02:15 PM - 02:30 PM		Break
02:30 PM - 04:00 PM		Working Groups

Monday, June 28, 2021		
09:00 AM - 10:15 AM□	Tamara Kolda	CP Tensor Decomposition
10:15 AM - 10:30 AM		Break
10:30 AM - 12:00 PM		Working Groups
12:00 PM - 01:00 PM		Break
01:00 PM - 02:15 PM	Tamara Kolda	CP Tensor Decomposition 2
02:15 PM - 02:30 PM		Break
02:30 PM - 04:00 PM		Working Groups

Tuesday, June 29, 2021		
09:00 AM - 10:15 AM□	Tamara Kolda	Kronecker FJLT
10:15 AM - 10:30 AM		Break
10:30 AM - 12:00 PM		Working Groups
12:00 PM - 01:00 PM		Break
01:00 PM - 02:15 PM	Tamara Kolda	Sketching for Sparse CP & Efficient Computations
02:15 PM - 02:30 PM		Break
02:30 PM - 04:00 PM		Working Groups

Wednesday, June 30, 2021		
09:00 AM - 10:15 AM□	Lior Horesh, Misha Kilmer	Lecture 1
10:15 AM - 10:30 AM		Break
10:30 AM - 12:00 PM		Working Groups
12:00 PM - 01:00 PM		Break
01:00 PM - 02:15 PM	Lior Horesh, Misha Kilmer	Lecture 2
02:15 PM - 02:30 PM		Break
02:30 PM - 04:00 PM		Working Groups

Thursday, July 1, 2021		
09:00 AM - 10:15 AM□	Lior Horesh, Misha Kilmer	Matrix Mimetic Tensor Algebra Applications & M-Matrix Mimetic Tensor Algebra
10:15 AM - 10:30 AM		Break
10:30 AM - 12:00 PM		Working Groups
12:00 PM - 01:00 PM		Break
01:00 PM - 02:15 PM	Lior Horesh, Misha Kilmer	Matrix Mimetic Tensor Algebra Applications 2
02:15 PM - 02:30 PM		Break
02:30 PM - 04:00 PM		Working Groups

Friday, July 2, 2021		
09:00 AM - 10:15 AM□	Kenneth Clarkson	Lecture 9 Dimensionality Reduction for Tukey Regression Sub-Gaussians
10:15 AM - 10:30 AM		Break
10:30 AM - 12:00 PM		Working Groups

Students		
First Name	**Last Name**	**Institution**
Abdullah	Aurko	Florida State University
Shantanu	Awasthi	North Dakota State University
Zhe	Bai	Lawrence Berkeley National Laboratory
Stavros	Birmpilis	University of Waterloo
Tianna	Burke	Auburn University
Jan Tracy	Camacho	San Francisco State University
Daan	Camps	Lawrence Berkeley National Laboratory
George	Chumbipuma	San Jose State University
Charles	Clum	Ohio State University
Priyadarshi	Dey	University of Memphis
Kathryn	Dover	University of California, Irvine
Patrick	Dynes	University of Oklahoma
Miandra	Ellis	Arizona State University
Nuha	Futa	University of Massachusetts, Amherst
Nina	Garcia-Montoya	Baylor University
Wesley	Hamilton	University of North Carolina
Erin	Hausmann	University of Oklahoma
Benjamin	Jany	University of Kentucky
Kathryn	Linehan	University of Virginia
Juliana	Londono Alvarez	Pennsylvania State University
Jesus	Lopez	Washington State University
Scott	Mahan	University of California, San Diego
Jorge	Marchena-Menéndez	Baylor University
Stewart	McGinnis	University of Oregon
Harley	Meade	Colorado State University
Kateryna	Melnyk	Freie Universität Berlin
Anastasiia	Minenkova	University of Connecticut
Amaury	Miniño	Colorado State University
Angela	Monti	Università del Salento
Marissa	Morado	California State University, Fresno
dwight	nwaigwe	University of Arizona
Joel	Ornstein	University of Colorado
Adriana	Ortiz-Aquino	Kansas State University
Xiaofeng	Ou	Purdue University
Matthew	Overduin	University of California, Riverside
Jorge	Peña	Claremont Graduate University
Ian	Pelakh	Iowa State University
Adhish	Rele	University at Buffalo (SUNY)
Christina	Rigsby	Colorado State University
Nicholas	Salmon	North Dakota State University
Shivam	Sharma	University of Missouri
Jim	Shaw	University of Toronto
Kashvi	Srivastava	University of Michigan
Taiyo	Terada	Portland State University
Hung	Tong	San Jose State University
Ralihe	Villagran Olivas	Centro de Investigacion y Estudios Avanzados (CINVESTAV)
Qianhui	Wan	University of California, Davis
Shuoyang	Wang	Auburn University
Junyi	Wei	University of Wisconsin-Madison
Arachchilage Dhanushka Madumali	Welagedara	Southern Illinois University

Students		
First Name	**Last Name**	**Institution**
Boyang	Xu	University of Delaware
Yiming	Xu	University of Utah
Tharana	Yosprakob	University of Alberta
Feng	Yu	University of Central Florida
Shiqi	Zhang	Purdue University
Zirui	Zhang	University of California, San Diego
Xiaoyu	Zhou	University of Maryland

Officially Registered Student Information

Students		57

Gender		57
Male	57.89%	33
Female	38.60%	22
Other	0.00%	0
Declined to state	3.51%	2

Ethnicity*		73
White	30.14%	22
Asian	31.51%	23
Hispanic	16.44%	12
Pacific Islander	0.00%	0
Black	6.85%	5
Native American	1.37%	1
Mixed	10.96%	8
Declined to state	2.74%	2

* ethnicity specifications are not exclusive

Financial Summary

MSRI Summer Graduate School

Mathematics of Big Data: Sketching and (Multi-) Linear Algebra

June 21, 2021 - July 02, 2021

Virtual Summer School

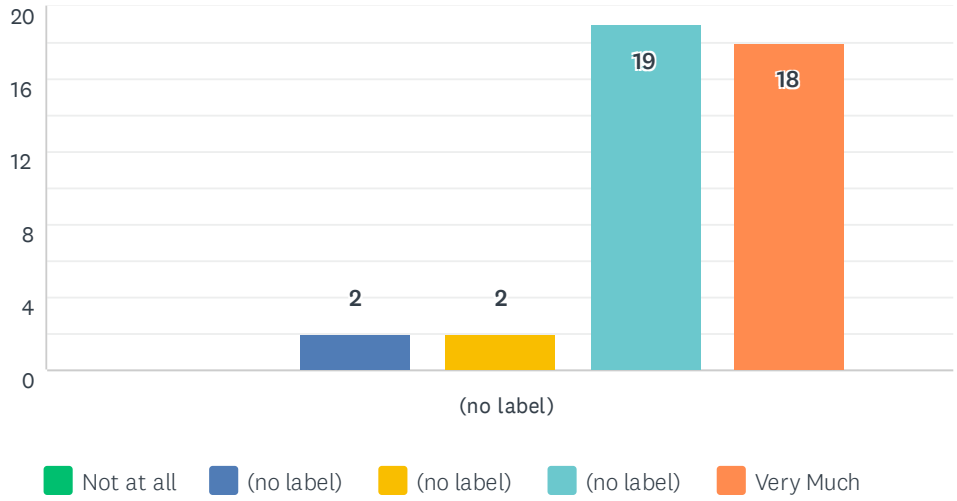
	Academic Sponsors	NSF 5059	Total
Stipend	$ 4,500.00	$ 4,000.00	**$ 8,500.00**
Other	$ 16.10	$ 4,219.64	**$ 4,235.74**
Total	**$ 4,516.10**	**$ 8,219.64**	**$ 12,735.74**

	Stipend		Other		Totals
	Academic Sponsors	NSF 5059	Academic Sponsors	NSF 5059	
Organizers, Speakers, TAs					
Kilmer, Misha (O/S)	$ 1,500.00				**$ 1,500.00**
Kolda, Tamara (O/S)	$ 3,000.00				**$ 3,000.00**
Larsen, Brett (TA)		$ 2,000.00			**$ 2,000.00**
Roberts, Bhaskar (TA)		$ 2,000.00			**$ 2,000.00**
Subtotals (Funded Participants)	$ 4,500.00	$ 4,000.00	$ -	$ -	**$ 8,500.00**
Computer Software/Equipment				$ 3,102.56	**$ 3,102.56**
Shipping and Postage			$ 16.10	$ 1,117.08	**$ 1,133.18**
Subtotals (Other)	$ -	$ -	$ 16.10	$ 4,219.64	**$ 4,235.74**
Totals	**$ 4,500.00**	**$ 4,000.00**	**$ 16.10**	**$ 4,219.64**	**$ 12,735.74**

41 responses out of 58 participants = 71% response rate

Q1 The various topics within the summer school integrated into a coherent picture

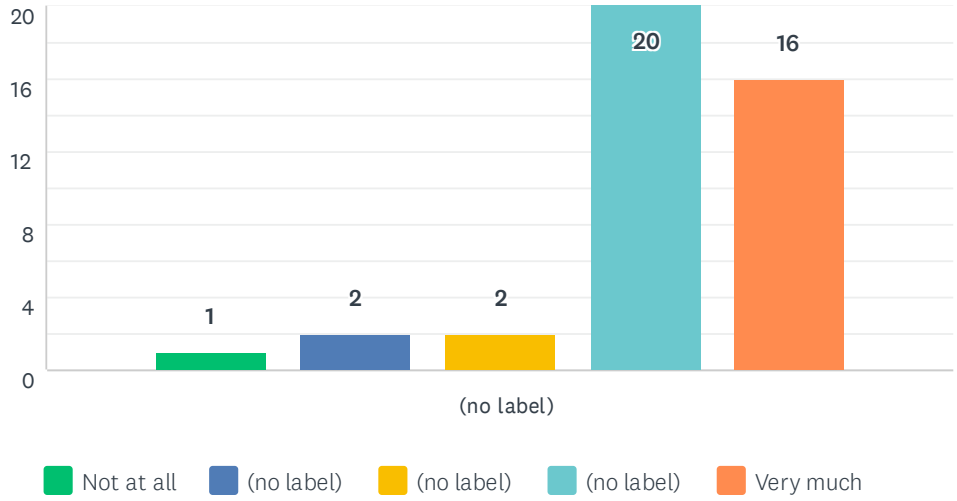
Answered: 41 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.88% 2	4.88% 2	46.34% 19	43.90% 18	41	4.29

Q2 The speakers were generally clear and well organized in their presentation

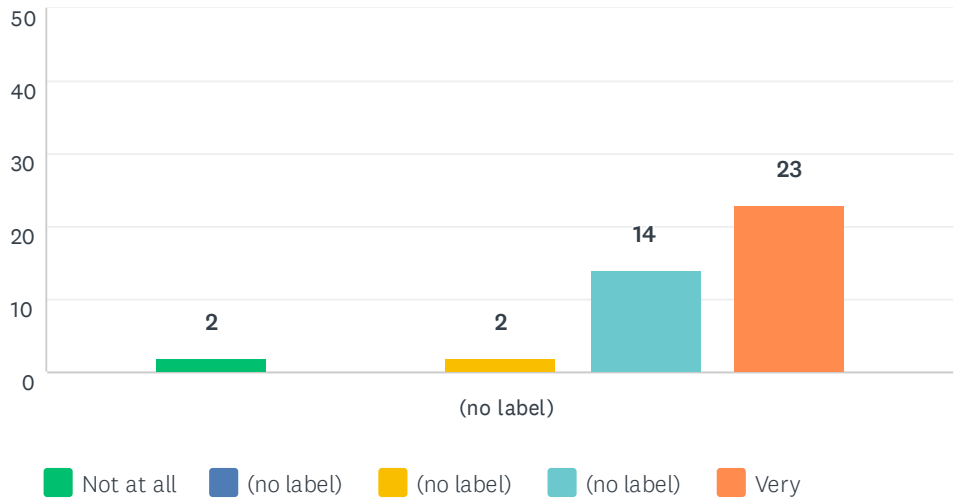
Answered: 41 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	2.44% 1	4.88% 2	4.88% 2	48.78% 20	39.02% 16	41	4.17

Q3 The school was intellectually stimulating

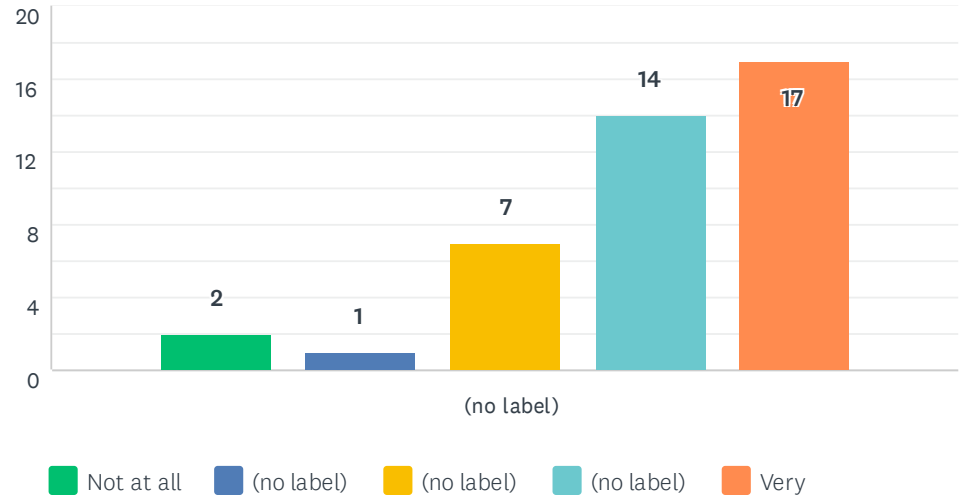
Answered: 41 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	4.88% 2	0.00% 0	4.88% 2	34.15% 14	56.10% 23	41	4.37

Q4 My fellow students were appropriately selected to make the event interesting

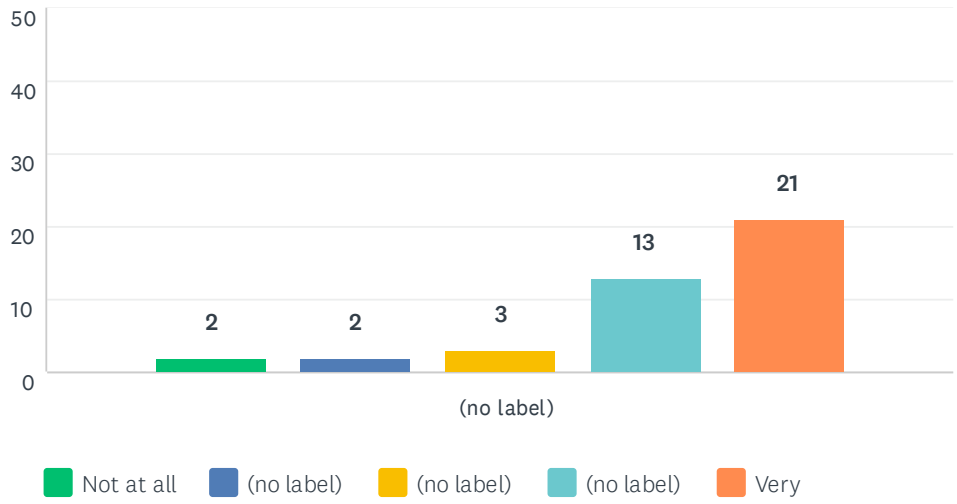
Answered: 41 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	4.88% 2	2.44% 1	17.07% 7	34.15% 14	41.46% 17	41	4.05

Q5 The overall experience of the school was worthwhile

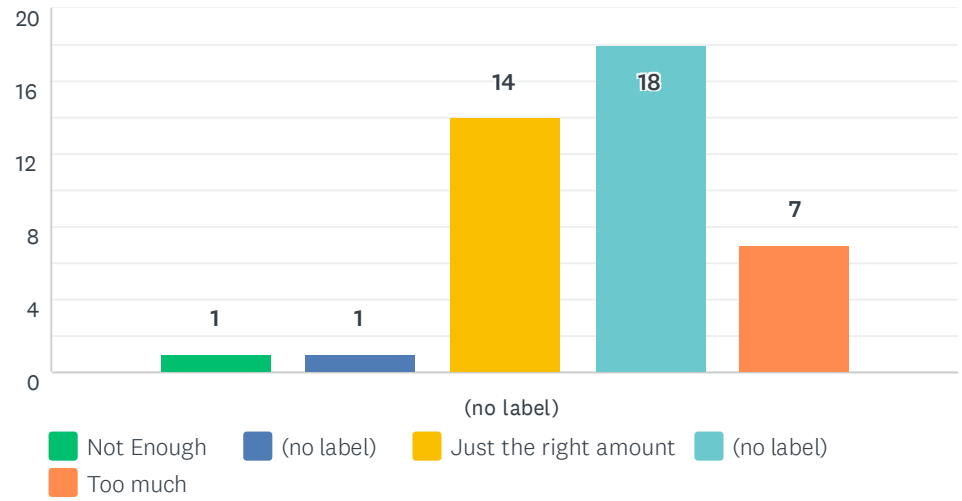
Answered: 41 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	4.88% 2	4.88% 2	7.32% 3	31.71% 13	51.22% 21	41	4.20

Q6 The amount of material presented was:

Answered: 41 Skipped: 0



	NOT ENOUGH	(NO LABEL)	JUST THE RIGHT AMOUNT	(NO LABEL)	TOO MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	2.44% 1	2.44% 1	34.15% 14	43.90% 18	17.07% 7	41	3.71

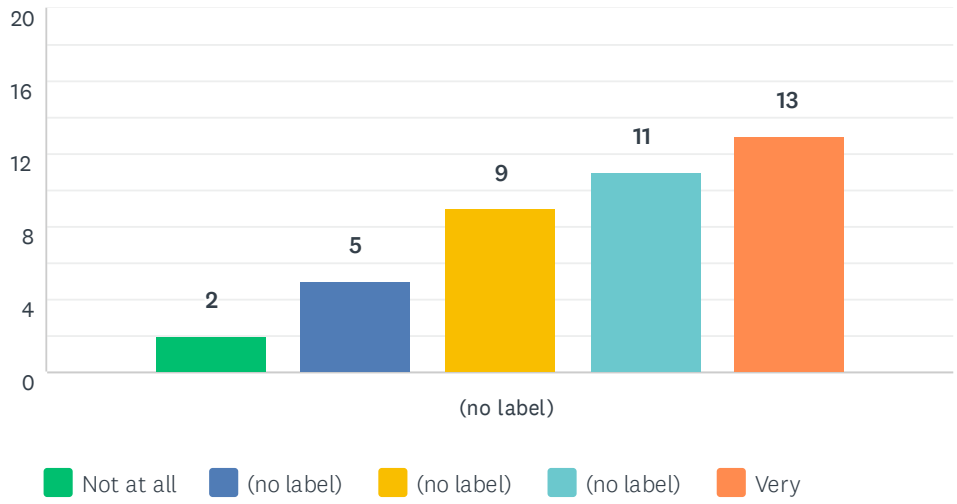
Q7 Additional comments on the topic presentation and organization

Answered: 13 Skipped: 28

#	RESPONSES	DATE
1	Given the circumstances, I believe the summer school was designed well due to it being fully online. I think it would have helped having more time to go to office hours of the speakers and the TA's, as I sometimes felt that I needed extra help outside of my group	7/19/2021 8:33 PM
2	I think switching around the order of the presenters could have helped ease students into the program.	7/19/2021 3:54 PM
3	Awesome environment	7/15/2021 6:00 AM
4	I liked that the information presented mainly came from current research papers. There was a good mix of theory and applications.	7/12/2021 7:40 AM
5	Ken Clarkson's slides seemed to need better layout/presentation	7/11/2021 9:48 PM
6	Like Ken’s taste very much	7/9/2021 6:14 PM
7	Attending zoom lectures with power point presentations is very challenging. I would not recommend virtual summer schools.	7/4/2021 6:15 AM
8	Very nice staffs and TAs. The instructors are knowledgeable and friendly.	7/3/2021 9:44 AM
9	I think we should have done the social/gather town portion earlier so that folks can have the chance to mingle a bit more. Perhaps this would have contributed to more folks showing up to the working group sessions.	7/2/2021 6:33 PM
10	The material was readily uploaded and available. The lecture videos and other IT help were also very accessible.	7/2/2021 6:07 PM
11	The workshop was amazing. Although I missed some of them because I had some job interviews, but overall it was an amazing area of research I was exposed to. Looking forward to have more.	7/2/2021 5:12 PM
12	Really enjoyed the school, I really wish it were an in-person summer school and Not virtual.	7/2/2021 4:35 PM
13	It was very inspiring! And the things I learned will be useful in my future research. Also the ideas I was introduced to are useful to keep in mind in many of the things I study. I really enjoyed my group mates and I think they were selected well to match with each other in terms of skill sets. But unfortunately, three of them simply had other engagements so could rarely attend. And two of them were so busy they only could come to the first two days, otherwise I would have said "very" to the question about fellow students being appropriately selected.	7/2/2021 4:25 PM

Q8 I was well prepared to benefit from the school

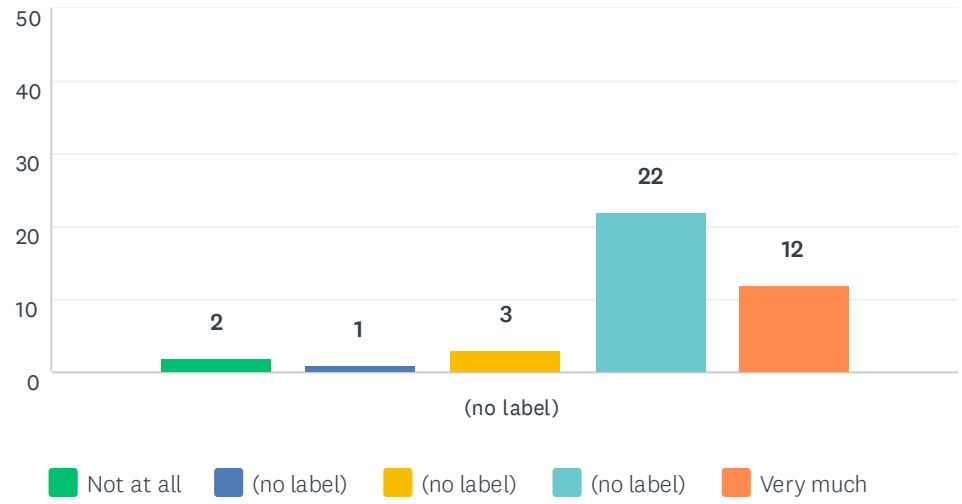
Answered: 40 Skipped: 1



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	5.00% 2	12.50% 5	22.50% 9	27.50% 11	32.50% 13	40	3.70

Q9 My interest in the subject matter was increased by the school

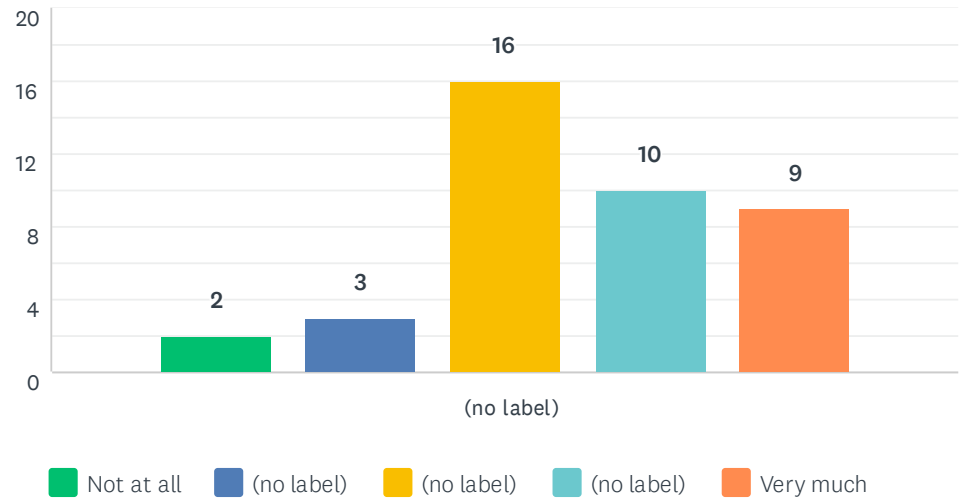
Answered: 40 Skipped: 1



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	5.00% 2	2.50% 1	7.50% 3	55.00% 22	30.00% 12	40	4.03

Q10 The school helped me meet people with similar scientific interests

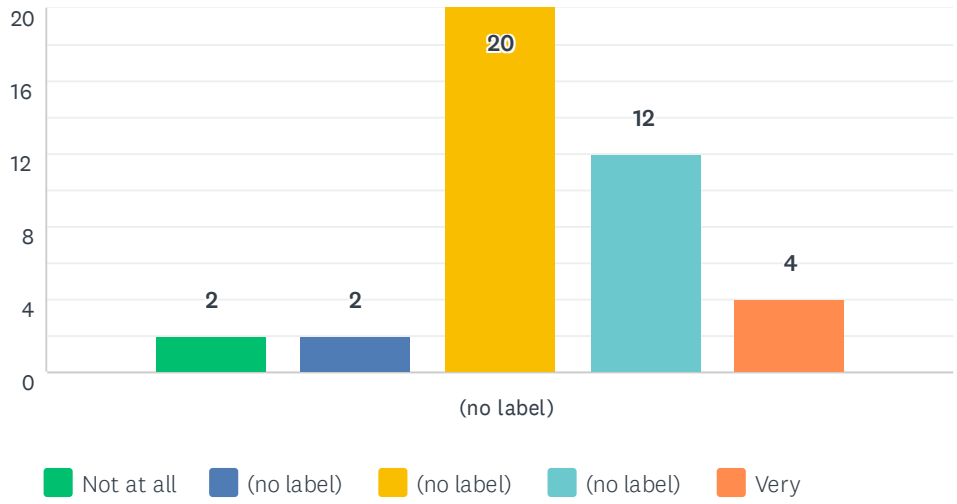
Answered: 40 Skipped: 1



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	5.00% 2	7.50% 3	40.00% 16	25.00% 10	22.50% 9	40	3.52

Q11 It is likely that I will work in the area of the school subject in the future

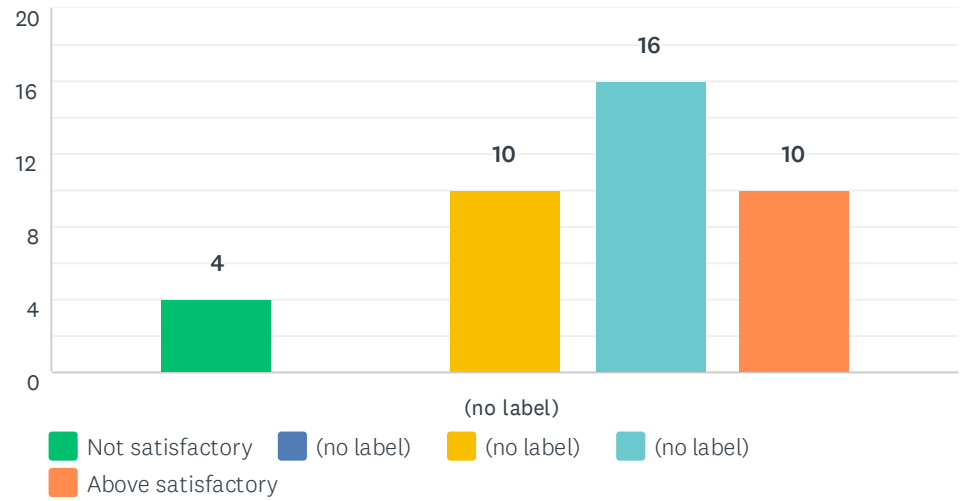
Answered: 40 Skipped: 1



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	5.00% 2	5.00% 2	50.00% 20	30.00% 12	10.00% 4	40	3.35

Q12 How would you evaluate your interaction with other participants?

Answered: 40 Skipped: 1



	NOT SATISFACTORY	(NO LABEL)	(NO LABEL)	(NO LABEL)	ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	10.00% 4	0.00% 0	25.00% 10	40.00% 16	25.00% 10	40	3.70

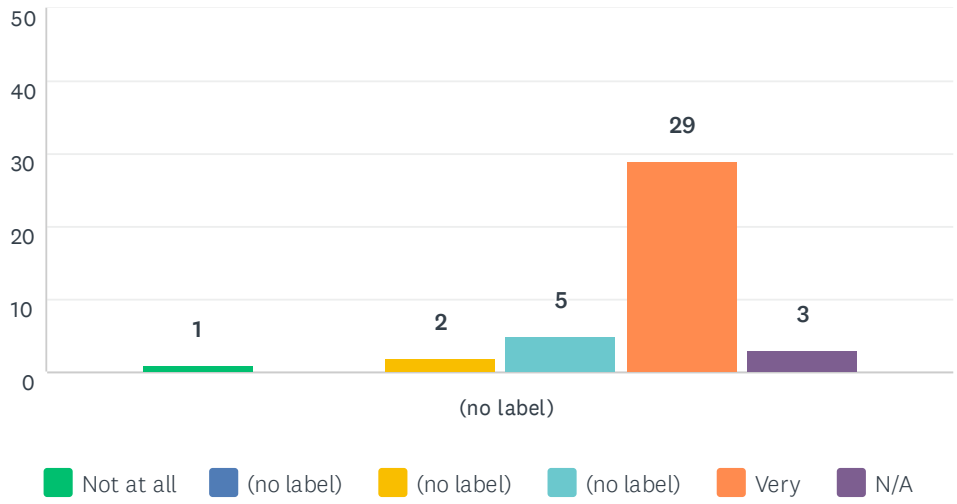
Q13 Additional comments on your personal assessment

Answered: 6 Skipped: 35

#	RESPONSES	DATE
1	I liked my team members very much, I just wasn't able to contribute since I didn't know enough background information.	7/19/2021 3:55 PM
2	I loved my group: Teddy bears	7/15/2021 6:01 AM
3	I was slightly lacking in my probability background coming into the school, but my group was helpful to me in understanding the probability material. My group really worked well together and the discussion and problem solving together was a really excellent part of the summer school.	7/12/2021 7:44 AM
4	I did not benefit from it but it was because of my own commitment, I had several deadlines and many other events going on. I think fully committing to a virtual summer school is just not possible for me.	7/4/2021 6:17 AM
5	The folks in my working group dropped off from the sessions pretty early on. At the very least, the one person who was still consistently showing up was patient and receptive during the group work session.	7/2/2021 6:35 PM
6	I had a wonderful time!	7/2/2021 4:26 PM

Q14 I found the MSRI staff helpful

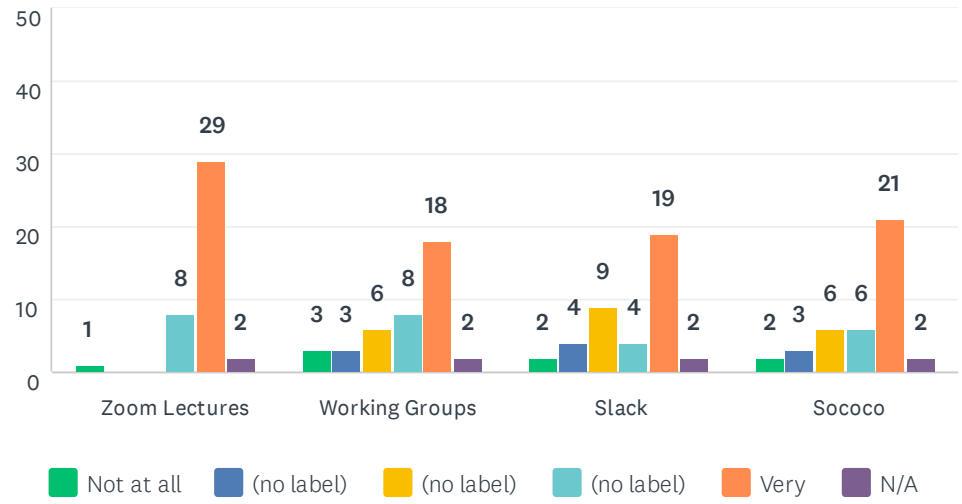
Answered: 40 Skipped: 1



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	2.50% 1	0.00% 0	5.00% 2	12.50% 5	72.50% 29	7.50% 3	40	4.65

Q15 How helpful did you find each of these collaboration tools

Answered: 40 Skipped: 1

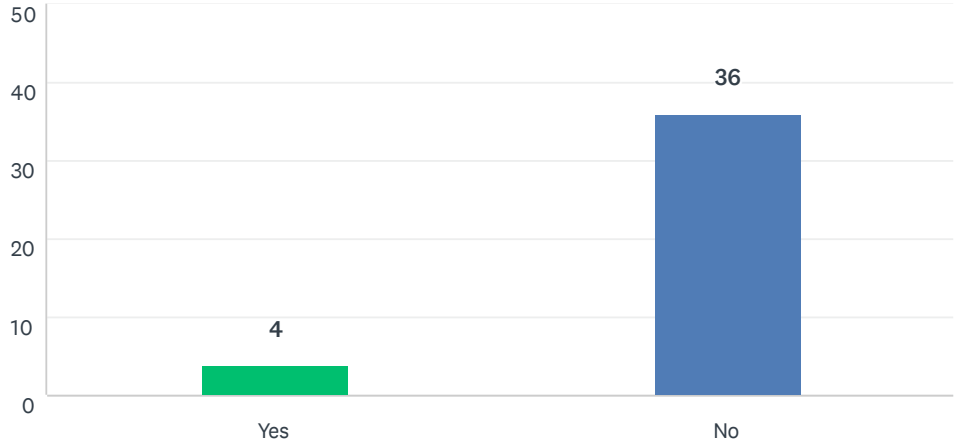


	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	N/A	TOTAL	WEIGHTED AVERAGE
Zoom Lectures	2.50% 1	0.00% 0	0.00% 0	20.00% 8	72.50% 29	5.00% 2	40	4.68
Working Groups	7.50% 3	7.50% 3	15.00% 6	20.00% 8	45.00% 18	5.00% 2	40	3.92
Slack	5.00% 2	10.00% 4	22.50% 9	10.00% 4	47.50% 19	5.00% 2	40	3.89
Sococo	5.00% 2	7.50% 3	15.00% 6	15.00% 6	52.50% 21	5.00% 2	40	4.08

#	COMMENTS	DATE
1	Slack was useful for announcements to the whole school, but when I wanted to chat 1-1 with someone I used Sococo.	7/12/2021 7:50 AM
2	Sococo had some connection issues, but was otherwise good. I kind of think it would have been good to do a "gather.town" meeting earlier in the session and then again later. I think it would have helped some people feel comfortable collaborating accross working groups who wouldn't have otherwise.	7/2/2021 4:31 PM

Q16 Did you experience any technical difficulties accessing the online summer school?

Answered: 40 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	10.00%	4
No	90.00%	36
TOTAL		40

#	IF YES, PLEASE EXPLAIN	DATE
1	Mostly with zoom. I had issues with the server crashing	7/19/2021 8:34 PM
2	Depending on the user, setting up private zoom meetings in the working groups was sometimes inconsistent.	7/13/2021 12:19 PM
3	There was some weirdness with the msri email. Occasionally I couldn't log on.	7/4/2021 1:02 PM

Q17 How did having the summer school held online impact your participation?

Answered: 40 Skipped: 1

#	RESPONSES	DATE
1	It sometimes made collaboration with my working group difficult	7/20/2021 1:34 PM
2	Minimally.	7/20/2021 11:50 AM
3	No impact.	7/20/2021 6:41 AM
4	It definitely impacted how many questions I asked and changed the way that I sought out help.	7/19/2021 8:34 PM
5	It was good, no travelling , easy with my schedule.	7/19/2021 6:04 PM
6	It made rimes a little more flexible which was nice.	7/19/2021 3:55 PM
7	I enjoyed the online summer school.	7/19/2021 3:29 PM
8	It’s always a balance act at home whether you want it to be or not.	7/15/2021 6:05 AM
9	It made it more accessible for me. I probably wouldn't have done it if it required travel.	7/13/2021 12:19 PM
10	It didn't. I participated as I would have if it had been in-person.	7/12/2021 7:50 AM
11	i participated less as it was easier to withdraw	7/11/2021 9:48 PM
12	It’s a pity that I cannot visit Berkerley in person, but overall the summer school did a good job to keep people engaged.	7/9/2021 6:23 PM
13	Socializing is definitely more difficult. In general, every interaction is a bit harder.	7/9/2021 6:00 PM
14	a little hard to follow	7/9/2021 5:58 PM
15	Difficulty of communication within the working group.	7/9/2021 5:06 PM
16	I would have liked to be in California, but due to the Covid pandemic situation I felt relaxed to partecipate online.	7/9/2021 9:05 AM
17	There was some internet issues from my side.	7/7/2021 11:54 AM
18	I think an in-person summer school would have been a more immersive experience, but I made sure to attend every lecture and problem session during this online summer school.	7/6/2021 1:48 PM
19	It was very helpful for me to be able to review the videos of the lectures.	7/6/2021 1:01 PM
20	I was able to properly absorb the material.	7/5/2021 6:33 PM
21	The lectures felt a little less engaging, but it was not too bad. I think a bigger issue is that the working groups is a lot less effective online. While my group was quite successful at working together, working on material in online groups is a lot less engaging than in person.	7/4/2021 1:02 PM
22	no significant impact	7/4/2021 11:19 AM
23	Severly, it was very hard to remain engaged.	7/4/2021 6:19 AM
24	None	7/3/2021 5:17 PM
25	No impact.	7/3/2021 3:51 PM
26	I prefer in person actually, the biggest influence is that I lived in eastern time zone and the daily schedule does not match pacific time zone which causes some inconvenience	7/3/2021 11:14 AM
27	I find it difficult to focus during online classes, and these lectures are very fast paced, so I felt lost some times and couldn't feel like I could participate because of it.	7/3/2021 10:13 AM

28	No, it did not have any impact.	7/3/2021 9:49 AM
29	The interaction might be better if it were in person	7/2/2021 7:41 PM
30	It makes it hard to communicate in person with people who are also interested in the same topics.	7/2/2021 6:58 PM
31	Not much. I had plenty of opportunities to interact with the speakers and participants.	7/2/2021 6:49 PM
32	I believe that the online format removed a bit of the intimidation factor of the summer school.	7/2/2021 6:37 PM
33	Online working group is not effective as much as in-person.	7/2/2021 6:17 PM
34	I was able to participate without having to figure out funding and other logistics. The lecture notes and videos were made readily available which made the online mode easier.	7/2/2021 6:10 PM
35	It was good and we were used to it. But still I feel face-to-face would have been much interactive. Mostly our discussion was confined to our working groups, so not much interactions with the other groups. But overall, it was pretty good!	7/2/2021 5:14 PM
36	An online school has some advantages, but I will always choose the in-person summer school over a virtual one.	7/2/2021 4:38 PM
37	I think i would have been able to participate a little more in person, but overall it was very good and I thought it was productive.	7/2/2021 4:31 PM
38	I think MSRI should have just waited until they could do in-person schools, this was literally awful	7/2/2021 4:25 PM
39	Not being able to take notes efficiently.	7/2/2021 4:22 PM
40	A little bit less involved with the school and harder to meet people virtually.	7/2/2021 4:18 PM

Q18 One important aspect that may have been missing due to the online format was interaction between participants. Do you have any suggestions on how we can improve this interaction if we hold future summer schools online?

Answered: 12 Skipped: 29

#	RESPONSES	DATE
1	I think making it mandatory to attend would be very useful. I had team members who would frequently not participate or show up with made collaboration very difficult	7/19/2021 8:34 PM
2	I did not find interaction hard.	7/19/2021 6:04 PM
3	I wish I could have met my group in person, but zoom was sufficient to learn who they were as people as well as who they were as mathematicians.	7/15/2021 6:05 AM
4	Maybe once or twice during the week there could be social lunches on zoom with small groups that are different from the working groups to meet new people.	7/13/2021 12:19 PM
5	I do not.	7/12/2021 7:50 AM
6	We can assign some goal which involve group project development or group presentation.	7/9/2021 6:23 PM
7	I think it's better to have in-person school other than online.	7/7/2021 11:54 AM
8	I enjoyed interacting with my working group, but was only able to interact with them and none of the other students. Maybe the groups can be switched around every couple of days or for the second week of lectures. Maybe host some 30 minute meetings where there's a specific topic (not math related) to talk about and "hang out". For example: a meeting for people that have pets to introduce them to everyone else, or a meeting to talk about books we've read, movies we've seen, etc. It may sound silly, but it helps get a more casual conversation going.	7/3/2021 10:13 AM
9	I find it helpful to know the reading materials in advance. A detailed list of prerequisites and some practice problems will help, if they are not too hard to make. I would like to have at least one week before the summer school starts to work on that. The topic was interesting, but quite advanced for me, so I did feel like I was not up to the pace of my peers.	7/3/2021 9:49 AM
10	I found the gather.town session at the conclusion of the summer school fun. It had a more organic feeling when you encounter other participants. Perhaps instead of the Sococo environment, gather.town should be considered.	7/2/2021 6:37 PM
11	More introductory based events in the beginning can help. I would have liked to know participants outside my own working group as well. Organizing some ice-breakers in the first class could be helpful. It could have a similar format to the gather town on the last day to know each other better.	7/2/2021 6:10 PM
12	I think having a "gather.town" event once or twice during the first week, even after hours would have been good. Most people wouldn't be able to attend, but those who could might make some connections.	7/2/2021 4:31 PM

Q19 We welcome any additonal comments or suggestions you may have to improve the overall experience for future participants.

Answered: 0 Skipped: 41

#	RESPONSES	DATE
	There are no responses.	

Gauge Theory in Geometry and Topology

July 5, 2021 – July 16, 2021

Virtual Summer Graduate School

Organizers:

Lynn Heller (Universität Hannover)

Francesco Lin (Columbia University)

Laura Starkston (University of California, Davis)

Boyu Zhang (Princeton University)

REPORT ON THE MSRI SUMMER GRADUATE SCHOOL
"Gauge Theory in Geometry and Topology"
July 05 –16, 2021

Organizers

- Lynn Heller (Universität Hannover)
- Francesco Lin (Columbia University)
- Laura Starkston (University of California, Davis)
- Boyu Zhang (Princeton University)

Description

Gauge theory is a geometric language used to formulate many fundamental physical phenomena, which has also had profound impact on our understanding of topology. The main idea is to study the space of solutions to partial differential equations admitting a very large group of local symmetries. Starting in the late 1970s, mathematicians began to unravel surprising connections between gauge theory and many aspects of geometric analysis, algebraic geometry and low-dimensional topology. This influence of gauge theory in geometry and topology is pervasive nowadays, and new developments continue to emerge.

The goal of the summer school was to introduce students to the foundational aspects of gauge theory, and explore their relations to geometric analysis and low-dimensional topology. By the end of the two-week program, the students understood the relevant analytic and geometric aspects of several partial differential equations of current interest (including the Yang-Mills ASD equations, the Seiberg-Witten equations, and the Hitchin equations) and some of their most impactful applications to problems in geometry and topology.

Highlights of the School

Even in the virtual setting, one could really feel that the participants were very excited and engaged. During lectures, the students could ask quick questions or clarification they had in the chat, so that the teaching assistant could answer them in real time for everyone and make the learning experience smoother and more interactive. This turned out to be extremely popular: many people asked plenty of great questions, and at times the teaching assistant had a hard time keeping up with the chat given how busy it was! During problem sessions, many students worked very hard with other students to learn the material more deeply. Some students even stayed after the designated time for problem sessions to further discuss the questions, and a few students have made additional appointments with the lecturers to better understand the course material. Participants were also often excited to ask questions beyond the problems, and to discuss how the material relates to current research.

Organizers

First Name	Last Name	Institution
Lynn	Heller	Universität Hannover
Francesco	Lin	Columbia University
Laura	Starkston	University of California, Davis
Boyu	Zhang	Princeton University

Speakers

First Name	Last Name	Institution
Lynn	Heller	Universität Hannover
Francesco	Lin	Columbia University
Laura	Starkston	University of California, Davis
Boyu	Zhang	Princeton University

Teaching Assistants

First Name	Last Name	Institution
Langte	Ma	State University of New York, Stony Brook
Tetsuya	Nakamura	University of Massachusetts Amherst
Thomas	Raujouan	Leibniz Universität Hannover
Sumeyra	Sakalli	University of Arkansas
Piotr	Suwara	Polish Academy of Sciences
Joshua	Wang	Harvard University

Mathematical Sciences Research Institute

Gauge Theory In Geometry And Topology

July 5 to July 16, 2021

Monday, July 5, 2021		
08:50 AM - 09:00 AM		Welcome
09:00 AM - 10:15 AM	Laura Starkston	4-manifold Intro
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Boyu Zhang	Principle Bundles
12:00 PM - 01:00 PM		Break
01:00 PM - 02:15 PM		Problem session 1
02:45 PM - 04:00 PM		Problem session 2

Tuesday, July 6, 2021		
09:00 AM - 10:15 AM	Francesco Lin	Functional Analysis
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Lynn Heller	Riemann Surfaces
12:00 PM - 01:00 PM		Break
01:00 PM - 02:15 PM		Problem session 1
02:45 PM - 04:00 PM		Problem session 2

Wednesday, July 7, 2021		
09:00 AM - 10:15 AM	Boyu Zhang	Yang-Mills
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Francesco Lin	Seiberg-Witten
12:00 PM - 01:00 PM		Break
01:00 PM - 02:15 PM		Problem session 1
02:45 PM - 04:00 PM		Problem session 2

Thursday, July 8, 2021		
09:00 AM - 10:15 AM	Boyu Zhang	Yang-Mills
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Francesco Lin	Seiberg-Witten

Friday, July 9, 2021		
09:00 AM - 10:15 AM	Boyu Zhang	Yang-Mills
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Francesco Lin	Seiberg-Witten
12:00 PM - 01:00 PM		Break
01:00 PM - 02:15 PM		Problem session 1
02:45 PM - 04:00 PM		Problem session 2

Monday, July 12, 2021		
09:00 AM - 10:15 AM	Boyu Zhang	Yang-Mills
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Francesco Lin	Seiberg-Witten
12:00 PM - 01:00 PM		Break
01:00 PM - 02:15 PM		Q & A Session

Tuesday, July 13, 2021		
09:00 AM - 10:15 AM	Lynn Heller	Harmonic maps
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Laura Starkston	Constructions
12:00 PM - 01:00 PM		Break
01:00 PM - 02:15 PM		Problem session 1
02:45 PM - 04:00 PM		Problem session 2

Wednesday, July 14, 2021		
09:00 AM - 10:15 AM	Lynn Heller	Harmonic maps
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Laura Starkston	Constructions
12:00 PM - 01:00 PM		Break
01:00 PM - 02:15 PM		Problem session 1
02:45 PM - 04:00 PM		Problem session 2

Thursday, July 15, 2021		
09:00 AM - 10:15 AM	Lynn Heller	Harmonic maps
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Laura Starkston	Constructions
12:00 PM - 01:00 PM		Break
01:00 PM - 02:15 PM		Problem session 1
02:45 PM - 04:00 PM		Problem session 2

Friday, July 16, 2021		
09:00 AM - 10:15 AM	Lynn Heller	Harmonic maps
10:15 AM - 10:45 AM		Break
10:45 AM - 12:00 PM	Laura Starkston	Constructions
12:00 PM - 01:00 PM		Break
01:00 PM - 02:15 PM		Q & A Wrap Up

Students		
First Name	**Last Name**	**Institution**
Milica	Đukić	Humboldt University of Berlin
Reginald	Anderson	Kansas State University
Jose	Aranda Cuevas	University of Iowa
Shamuel	Auyeung	State University of New York, Stony Brook
Balázs	Békési	Leibniz Universität Hannover
Swapnanil	Banerjee	University of Georgia
Holt	Bodish	University of Oregon
Joseph	Boninger	CUNY, Graduate Center
Eric	Boulter	University of Waterloo
Haley	Bourke	University of Portland
Karim	Boustany	University of Notre Dame
Zachary	Bradshaw	Tulane University
Victor	Carmona	University of Sevilla
Diego	Castedo Pena	North Carolina State University
Eric	Chen	Princeton University
Nestor	Colin	Centro de Investigacion y de Estudios Avanzados del IPN
Nestor	Diaz Morera	Tulane University
Tavish	Dunn	Baylor University
Ahmed	Ellithy	University of Toronto
Parker	Evans	Rice University
Joseph	Frias	George Mason University
Sudipta	Ghosh	Louisiana State University
Sien	Gong	University of Kansas
Sebastian	Haney	Columbia University
Thomas	Harris	University of Arizona
Ming-Wei	Kuo	National Taiwan University
Sze Hong	Kwong	University of Maryland
Jiakai	Li	Harvard University
Max	Lipton	Cornell University
Vishnu	Mangalath	University of Sydney
Nicholas	Meyer	University of Nebraska
Marc	Muhleisen	University of Pennsylvania
Anubhav	Mukherjee	Georgia Institute of Technology
Minh	Nguyen	University of Arkansas
Trent	Osland	San Jose State University
Natalia	Pacheco-Tallaj	Massachusetts Institute of Technology
Fabio	Paradiso	University of Turin
Devin	Patterson	University of Alberta
Riccardo	Pedrotti	University of Texas, Austin

Students		
First Name	**Last Name**	**Institution**
Jun	Peng	University at Buffalo (SUNY)
Puttipong	Pongtanapaisan	University of Iowa
Sriram	Raghunath	Rutgers University
Braeden	Reinoso	Boston College
Mark	Ronnenberg	Indiana University
Shanon	Rubin	University of California, Davis
Jesus	Sanchez	Pennsylvania State University
Ellie	Thieu	Amherst
Kai	Toyosawa	Vanderbilt University
Brian	Tran	University of California, San Diego
Samuel	Tripp	Dartmouth College
Nathapon	Udomlertsakul	University of Missouri
Junming	Xie	Lehigh University
Alex	Xu	Columbia University
Xiaohan	Yan	University of California, Berkeley
Jiajun	Yan	University of Virginia
Bowen	Yang	California Institute of Technology
Chen	Zhang	Michigan State University

Officially Registered Student Information

Students		57

Gender		57
Male	87.72%	50
Female	8.77%	5
Other	1.75%	1
Declined to state	1.75%	1

Ethnicity*		65
White	33.85%	22
Asian	40.00%	26
Hispanic	12.31%	8
Pacific Islander	0.00%	0
Black	1.54%	1
Native American	0.00%	0
Mixed	6.15%	4
Declined to state	6.15%	4

* ethnicity specifications are not exclusive

Financial Summary

MSRI Summer Graduate School

Gauge Theory in Geometry and Topology

July 05, 2021 - July 16, 2021

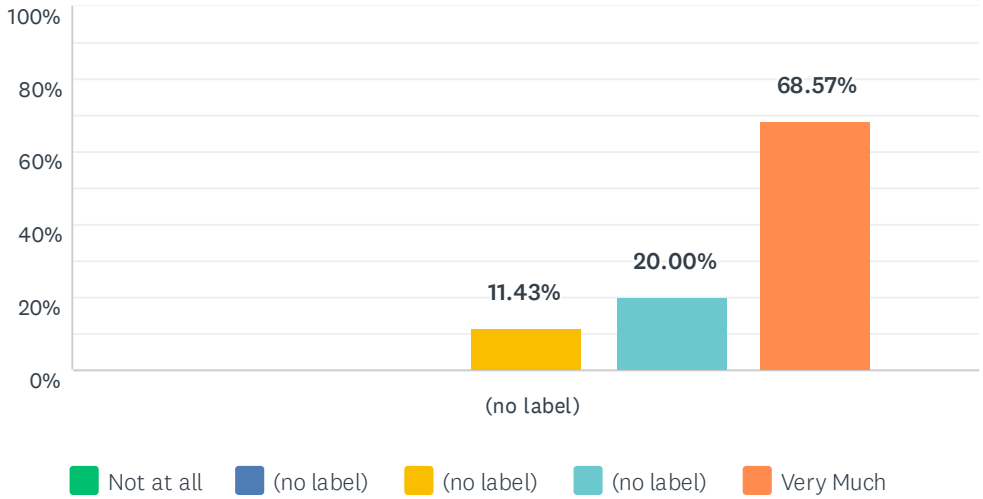
Virtual Summer School

	NSF 5059	Total
Stipend	$ 12,000.00	**$ 12,000.00**
Other	$ 3,343.33	**$ 3,343.33**
Total	**$ 15,343.33**	**$ 15,343.33**

	Stipend	Other	Totals
	NSF 5059	NSF 5059	
Organizers, Speakers, TAs			
Heller, Lynn (O/S)	$ 3,000.00		**$ 3,000.00**
Ma, Langte (TA)	$ 1,000.00		**$ 1,000.00**
Nakamura, Tetsuya (TA)	$ 1,000.00		**$ 1,000.00**
Raujouan, Thomas (TA)	$ 1,000.00		**$ 1,000.00**
Sakalli, Sumeyra (TA)	$ 1,000.00		**$ 1,000.00**
Starkston, Laura (O/S)	$ 3,000.00		**$ 3,000.00**
Suwara, Piotr (TA)	$ 1,000.00		**$ 1,000.00**
Wang, Joshua (TA	$ 1,000.00		**$ 1,000.00**
Subtotals (Funded Participants)	$ 12,000.00	$ -	**$ 12,000.00**
Computer Software/Equipment		$ 2,170.69	**$ 2,170.69**
Shipping and Postage		$ 1,172.64	**$ 1,172.64**
Subtotals (Other)	$ -	$ 3,343.33	**$ 3,343.33**
Totals	**$ 12,000.00**	**$ 3,343.33**	**$ 15,343.33**

Q1 I came to see connections between the various topics within the summer school

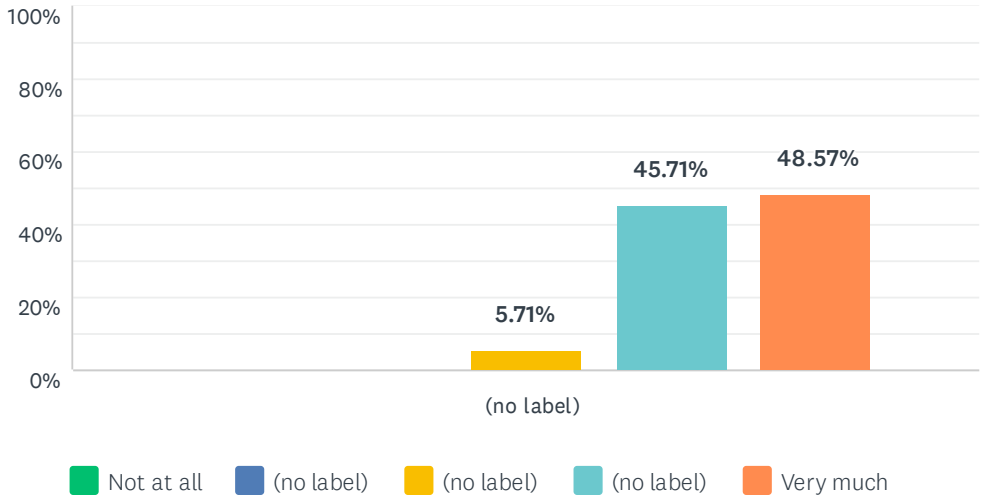
Answered: 35 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	11.43% 4	20.00% 7	68.57% 24	35	4.57

Q2 The speakers were generally clear and well organized in their presentation

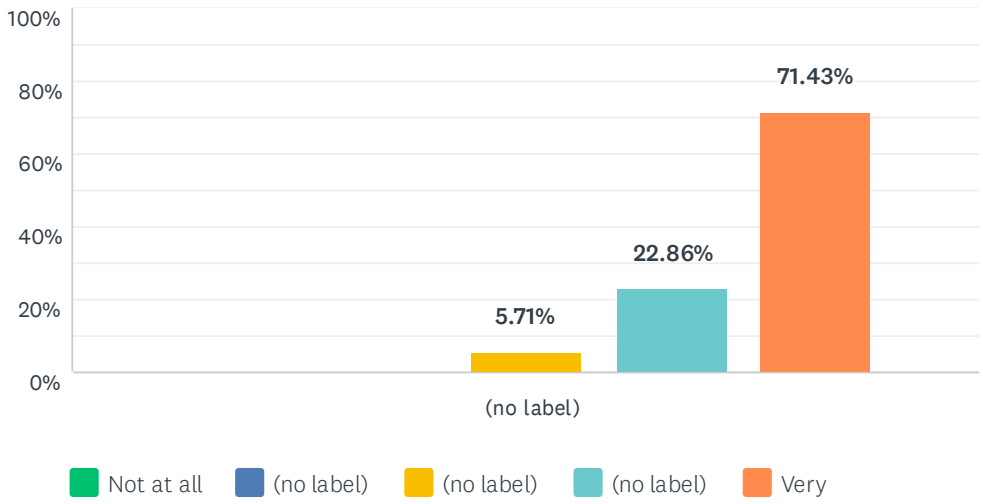
Answered: 35 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.71% 2	45.71% 16	48.57% 17	35	4.43

Q3 The school was intellectually stimulating

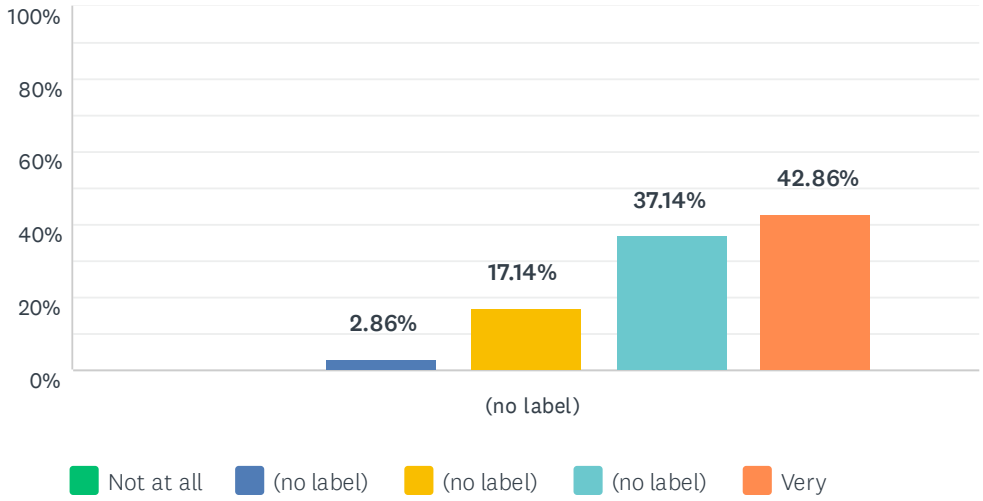
Answered: 35 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.71% 2	22.86% 8	71.43% 25	35	4.66

Q4 My fellow students were appropriately selected to make the event interesting

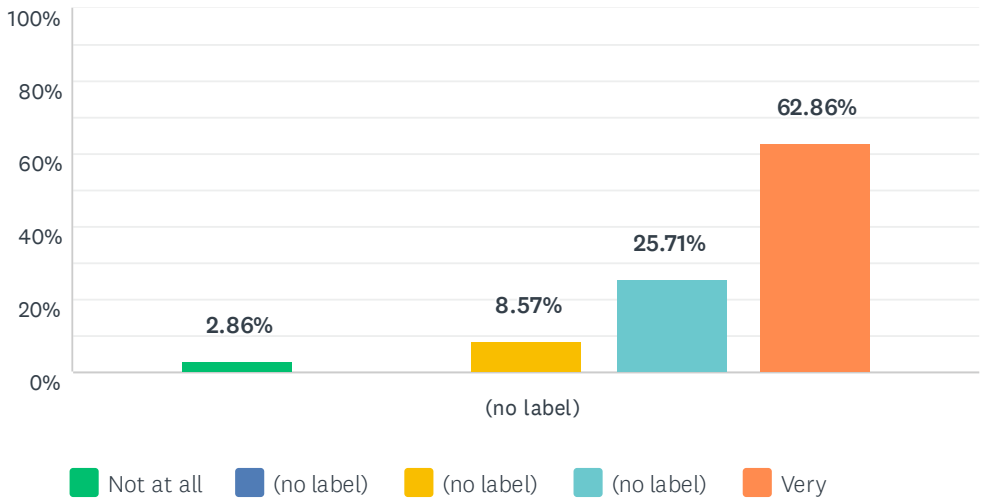
Answered: 35 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.86% 1	17.14% 6	37.14% 13	42.86% 15	35	4.20

Q5 The overall experience of the school was worthwhile

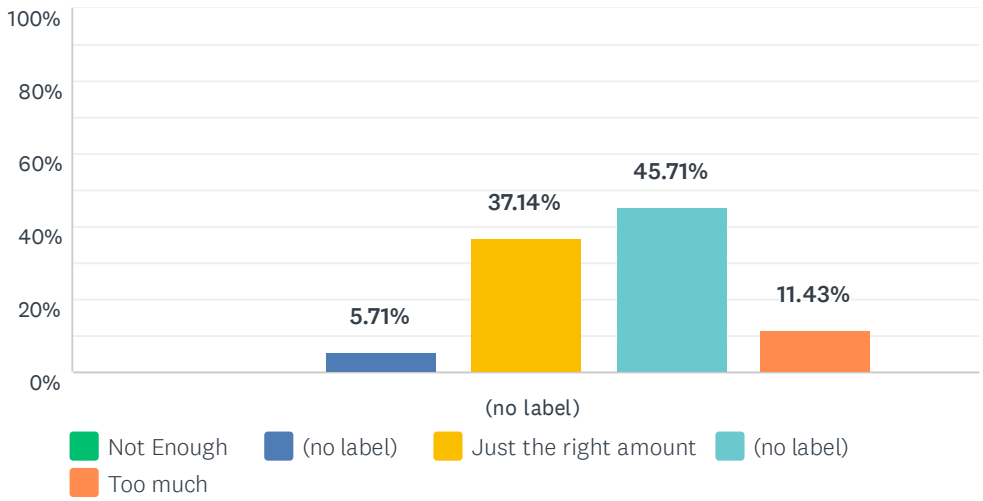
Answered: 35 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.86% 1	0.00% 0	8.57% 3	25.71% 9	62.86% 22	35	4.46

Q6 The amount of material presented was:

Answered: 35 Skipped: 0



	NOT ENOUGH	(NO LABEL)	JUST THE RIGHT AMOUNT	(NO LABEL)	TOO MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	5.71% 2	37.14% 13	45.71% 16	11.43% 4	35	3.63

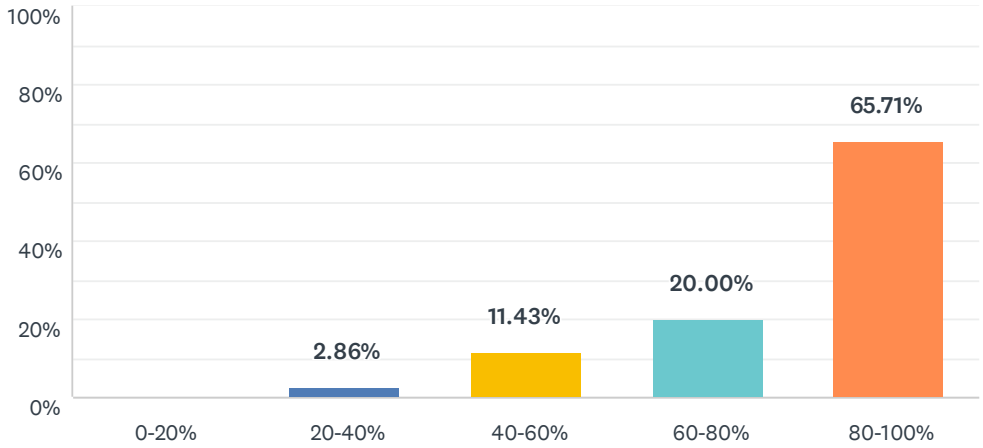
Q7 Additional comments on the topic presentation and organization

Answered: 5 Skipped: 30

#	RESPONSES	DATE
1	Good selection of topics and good co-ordination between the different mini-courses.	7/31/2021 3:05 PM
2	Thanks to the organizers/lecturers and TAs!	7/18/2021 5:56 PM
3	I thought that the order of the lectures was well-planned.	7/18/2021 5:00 PM
4	I found the school overwhelming at first. Partly because my group was super nice but there was a fair bit of friendly competition and people talking over each other and every problem I felt it was hard to follow because they were off to the races and it was hard to get a word in edgewise, it was an intimidating environment for me. Once we switched groups and I chose a "beginner" group I had a much better time. I loved this experience so much. I'm so grateful and glad I took the time off from work and did this. My primary feedback is: There was so much recommended reading. I don't think someone could reasonably cover so much dense material unless they made it a full-time job to prepare for this, or if they already had taken a year of algebraic or diff topology perhaps. I had not so I was struggling to keep up. At first I thought it was too much and maybe I should give up because I had no idea what was going on. But I am glad I didn't because once we switched groups there was a 1000% improvement for me, the second week I felt like I (kind of) knew what was going on and I got a lot out of it. I'd also say people should be matched with beginner groups earlier on.	7/18/2021 8:15 AM
5	I really appreciated that the lectures brought us up to current work on the topics. The last couple days of Week 1 were too past-paced for me, personally. The material of the Harmonic Maps lectures seemed to assume more than the prerequisites, so it was hard for me to follow and appreciate those lectures. But the Problems for that mini-course were really instructive, and I appreciated how they didn't assume much content, if any, from the course.	7/17/2021 9:15 PM

Q8 What percentage of scheduled activities (lecture, problem sessions, Q&A) did you participate in?

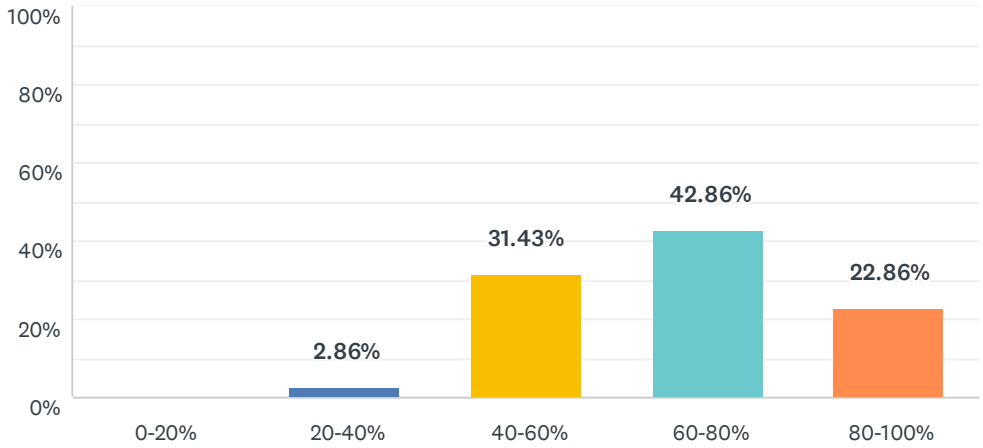
Answered: 35 Skipped: 0



ANSWER CHOICES	RESPONSES	
0-20%	0.00%	0
20-40%	2.86%	1
40-60%	11.43%	4
60-80%	20.00%	7
80-100%	65.71%	23
TOTAL		35

Q9 What percentage of the prerequisites did you master prior to attending the school?

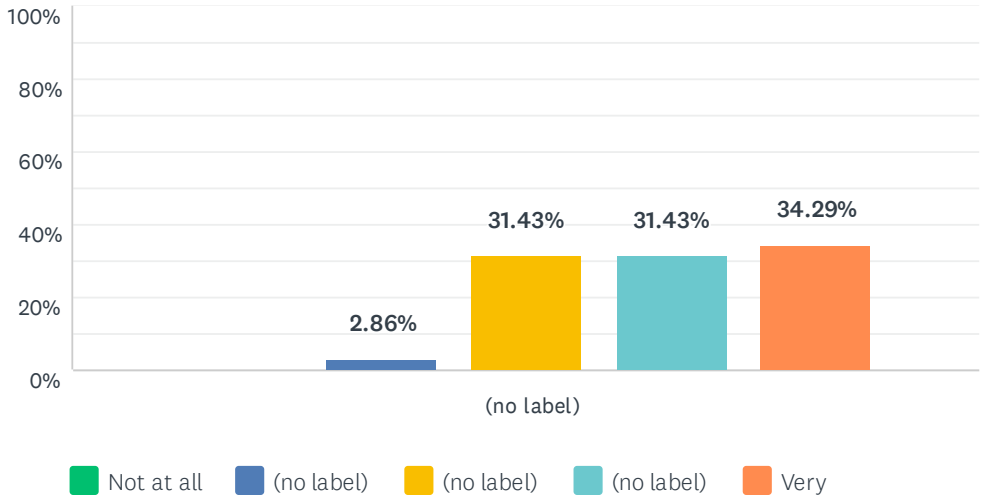
Answered: 35 Skipped: 0



ANSWER CHOICES	RESPONSES	
0-20%	0.00%	0
20-40%	2.86%	1
40-60%	31.43%	11
60-80%	42.86%	15
80-100%	22.86%	8
TOTAL		35

Q10 Was the list of suggested readings helpful to prepare for the actual lectures?

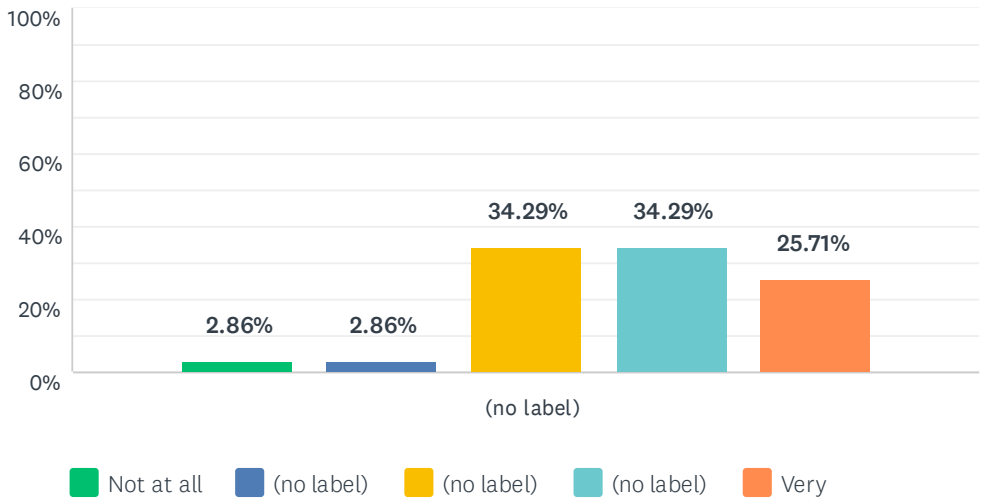
Answered: 35 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.86% 1	31.43% 11	31.43% 11	34.29% 12	35	3.97

Q11 I was well prepared to benefit from the school

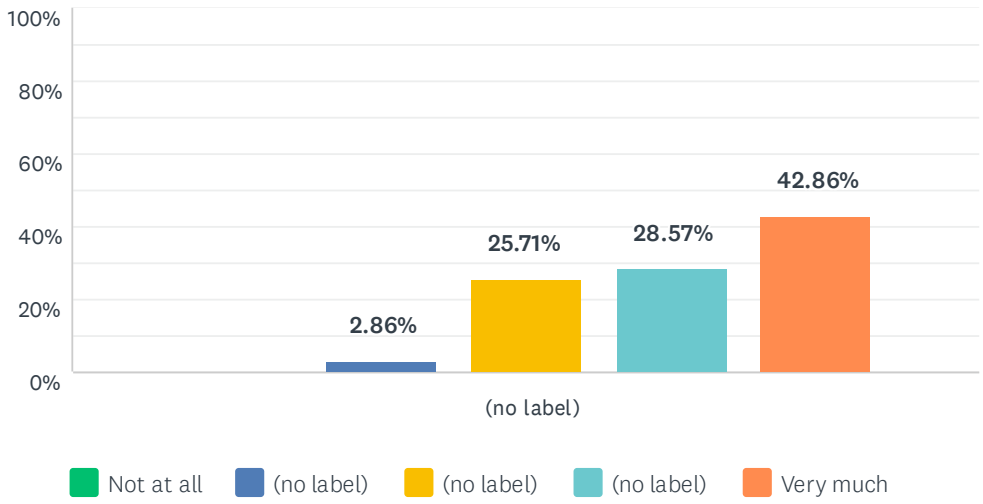
Answered: 35 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	2.86% 1	2.86% 1	34.29% 12	34.29% 12	25.71% 9	35	3.77

Q12 My interest in the subject matter was increased by the school

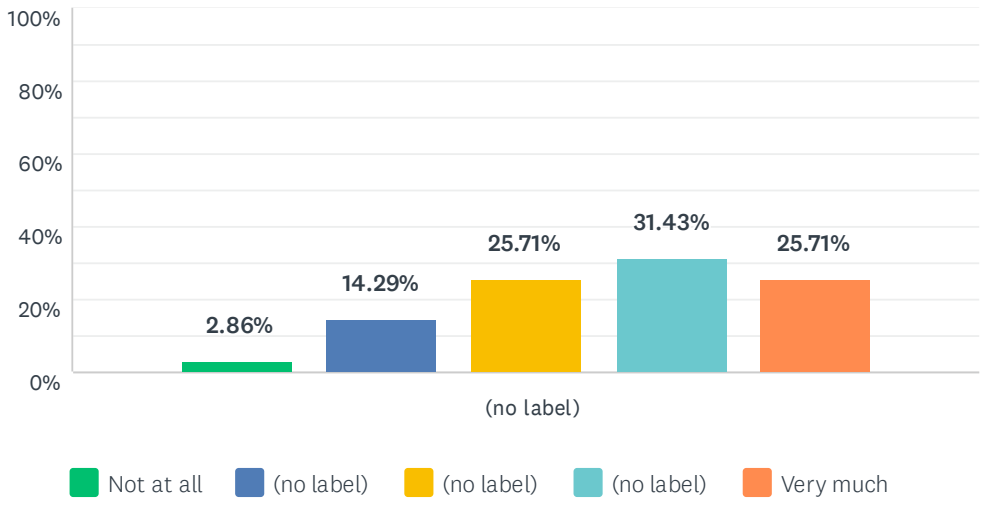
Answered: 35 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	2.86% 1	25.71% 9	28.57% 10	42.86% 15	35	4.11

Q13 The school helped me meet people with similar scientific interests

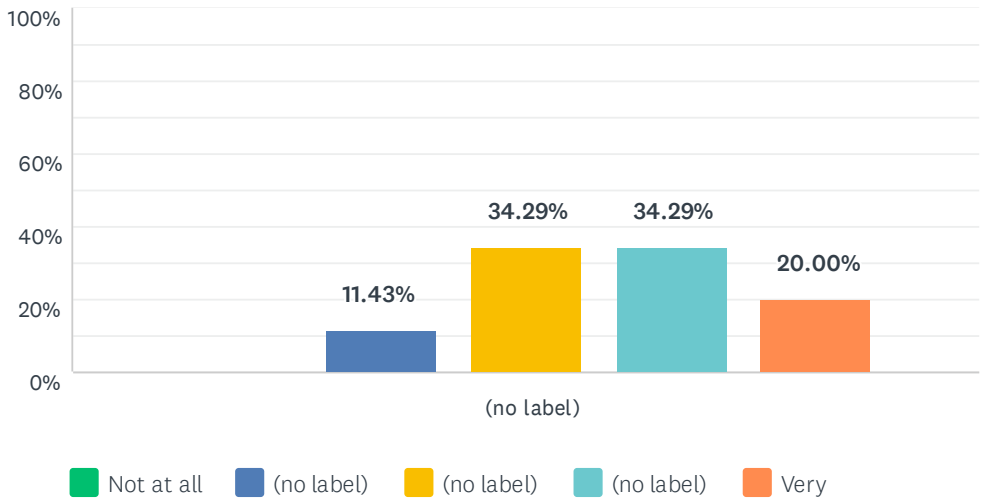
Answered: 35 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	2.86% 1	14.29% 5	25.71% 9	31.43% 11	25.71% 9	35	3.63

Q14 It is likely that I will work in the area of the school subject in the future

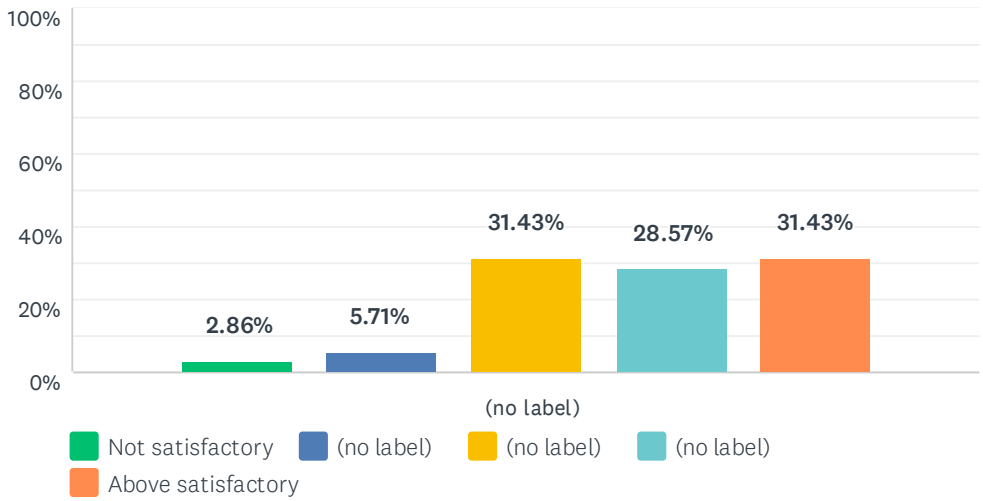
Answered: 35 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	11.43% 4	34.29% 12	34.29% 12	20.00% 7	35	3.63

Q15 How would you evaluate your interaction with other participants?

Answered: 35 Skipped: 0



	NOT SATISFACTORY	(NO LABEL)	(NO LABEL)	(NO LABEL)	ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	2.86% 1	5.71% 2	31.43% 11	28.57% 10	31.43% 11	35	3.80

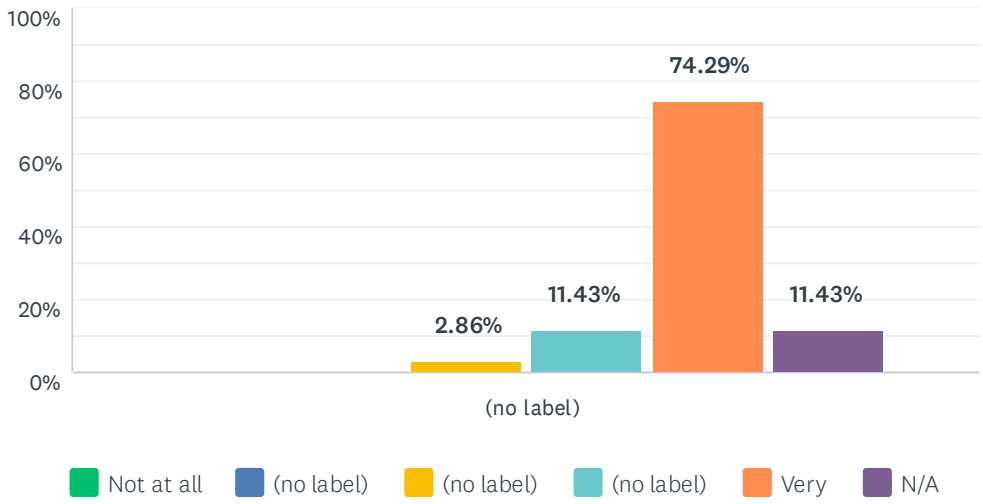
Q16 Additional comments on your personal assessment

Answered: 3 Skipped: 32

#	RESPONSES	DATE
1	People were great. I was completely unprepared, but I put in a lot of longgg weekends the month before the school, and lots of late nights during. I had none of the prerequisite coursework at all, except for one quarter in func analysis! But I managed to get a lot out of it by grinding through as much as I could and preparing a day at a time during the school. I easily put in 60-80+ hours in addition to the school itself, perhaps a lot more than that, preparing and reviewing.	7/18/2021 8:18 AM
2	Before preparing for the summer school, I had a strong understanding of differential and algebraic topology, and I had an introductory understanding of the first few chapters of Donaldson's "Riemann Surfaces". I read through the remaining prerequisites, but I definitely did not master these topics. Since the first week built on those new topics for me, I was a bit shaky through those lectures. I appreciated that these prerequisite topics were covered in the first couple lectures. Personally, my interactions could have been better, which I take responsibility for. I'm a night owl who hasn't had to wake up early in a while, so there were some days over the last couple of weeks during which I was tired and a little cranky. Working over Zoom is also a big social drain that I still haven't gotten used to after more than a year.	7/17/2021 9:22 PM
3	Many evaluations above are affected by the fact that the summer school is held virtually.	7/17/2021 11:57 AM

Q17 I found the MSRI staff helpful

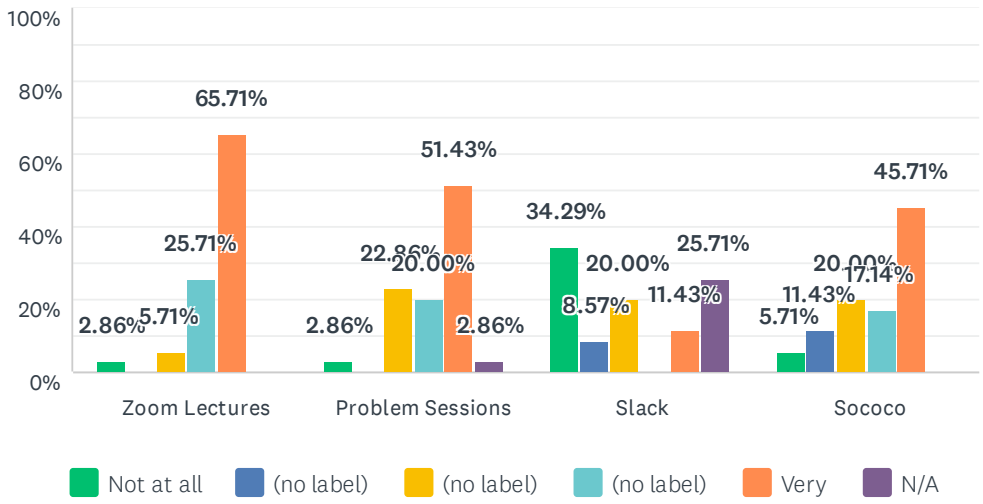
Answered: 35 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	2.86% 1	11.43% 4	74.29% 26	11.43% 4	35	4.81

Q18 How helpful did you find each of these collaboration tools

Answered: 35 Skipped: 0

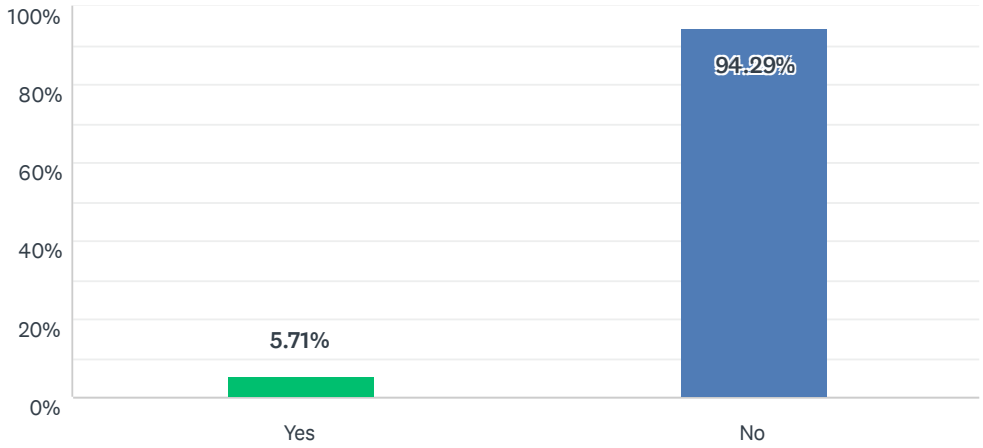


	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	N/A	TOTAL	WEIGHTED AVERAGE
Zoom Lectures	2.86% 1	0.00% 0	5.71% 2	25.71% 9	65.71% 23	0.00% 0	35	4.51
Problem Sessions	2.86% 1	0.00% 0	22.86% 8	20.00% 7	51.43% 18	2.86% 1	35	4.21
Slack	34.29% 12	8.57% 3	20.00% 7	0.00% 0	11.43% 4	25.71% 9	35	2.27
Sococo	5.71% 2	11.43% 4	20.00% 7	17.14% 6	45.71% 16	0.00% 0	35	3.86

#	COMMENTS	DATE
1	Slack was not used much	7/31/2021 3:08 PM
2	Conducting the problem sessions virtually was challenging. We spent a lot of time dealing technical issues (e.g., Sococo lagging) and trying to figure out the best software.	7/27/2021 2:44 PM
3	I'm not really a fan of the Sococco interface. This could just be me, because I have a hard time getting into the swing of new online systems in general, but the video and chat features of Sococco were tricky to manage. I personally prefer Zoom, but maybe just because I've had more experience with it.	7/17/2021 9:27 PM

Q19 Did you experience any technical difficulties accessing the online summer school?

Answered: 35 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	5.71%	2
No	94.29%	33
TOTAL		35

#	IF YES, PLEASE EXPLAIN	DATE
1	I was once logged out from Sococco and could not remember the password to log back in. I was able to log back in through "forgot password".	7/30/2021 12:59 PM
2	on a few days the zoom links for the lectures were password-locked until after the lecture had started	7/17/2021 11:14 AM

Q20 How did having the summer school held online impact your participation?

Answered: 35 Skipped: 0

#	RESPONSES	DATE
1	It did not impact my participation.	8/3/2021 7:34 AM
2	I feel not really motivate by online version.	8/2/2021 11:14 AM
3	It made it much harder to meet people and collaborate on the problems effectively. I still got a lot out of the experience, but I do think it have been much more beneficial for me if it had been in-person (though I of course understand that given the covid situation it was the right decision to make it virtual).	8/2/2021 10:39 AM
4	Did not get to interact much with participants other than in my working group. Social interaction was more limited.	7/31/2021 3:08 PM
5	I would have had more communication with other students if I had participated in person.	7/31/2021 7:36 AM
6	There was a more disconnect between participants and lecturers.	7/30/2021 4:55 PM
7	Definitely harder to stay focused through lectures and meet other students.	7/30/2021 3:23 PM
8	I would have spent more time with my peers in extra activities. After the lectures and problem sessions I needed to take a break from the pc so I was logging out at the end of the activities	7/30/2021 2:22 PM
9	Online was great actually.	7/30/2021 12:59 PM
10	The problem session is less effective.	7/30/2021 12:24 PM
11	Definitely impacted it negatively, decreasing my ability to interact with the other people.	7/27/2021 2:44 PM
12	I felt it was hard to form connections. Limited social activities were offered.	7/26/2021 10:25 AM
13	Less involvement and attention. However, having records is a great companion when working again the material.	7/26/2021 3:11 AM
14	I would have preferred in person participation because it would facilitate communication.	7/19/2021 8:23 PM
15	It was convenient so that I did not have to travel to California. It was easy to access, and comfortable to work from home. I would probably have attended if it had been in person, but I preferred it this way.	7/19/2021 12:57 PM
16	Collaboration was a bit difficult in the problem sessions. Sometimes we needed a blackboard that could be used by everyone at the same time to understand an idea and work on it. Despite everything, the online school was really great, the only problem is that you don't have the possibility to talk with as many people as in a face-to-face event even with the use of Sococo.	7/19/2021 10:13 AM
17	The virtual problem sessions were not as useful to me as in previous summer schools.	7/19/2021 9:00 AM
18	Not really.	7/18/2021 8:52 PM
19	I thought I would feel a bit removed compared to an in person school, but the sococo and problem sessions helped it feel lively and collaborative.	7/18/2021 5:57 PM
20	I imagine I would have been more engaged if it were in person.	7/18/2021 5:02 PM
21	It was a bit more difficult to form a personal connection with the other participants as well as the TA's and the instructors, but overall I felt the online format was handled about as well as it could have been.	7/18/2021 9:40 AM
22	Yes, It made it much harder to meet and engage with all the participants. It also made the aspect of attending lectures for two weeks a bit harder to engage fully in.	7/18/2021 8:25 AM
23	It was harder, obviously	7/18/2021 8:19 AM

24	More flexibility but harder to fully concentrate and meet people	7/18/2021 4:25 AM
25	Not at all	7/18/2021 3:54 AM
26	I did not participate in office hours. Due to social drain from Zoom, I only wanted to work on problems during the exact time slots given for the Problem Sessions. In an in-person setting, I think I would have been more passionate about working hard on problems.	7/17/2021 9:27 PM
27	Reduce the interaction between students.	7/17/2021 7:21 PM
28	Not much really, my connection was unstable mostly time : (	7/17/2021 2:17 PM
29	Time zone; communication with other people	7/17/2021 2:17 PM
30	The online format is terrible and nearly completely ruined the experience.	7/17/2021 1:08 PM
31	I personally felt less comfortable initiating interactions with other participants.	7/17/2021 1:04 PM
32	I learned a lot.	7/17/2021 12:01 PM
33	It would definitely be more interactive and engaging if it is held in person.	7/17/2021 12:01 PM
34	It’s harder to focus.	7/17/2021 11:34 AM
35	difficult to interact with people outside the assigned study groups	7/17/2021 11:14 AM

Q21 One important aspect that may have been missing due to the online format was interaction between participants. Do you have any suggestions on how we can improve this interaction if we hold future summer schools online?

Answered: 16 Skipped: 19

#	RESPONSES	DATE
1	Maybe offering some more non-math times to mingle with others over zoom, possibly structured around questions or activities of some sort. Using sococo for this could be very convenient with the ability to shuffle between several rooms at the participants' leisure.	8/2/2021 10:39 AM
2	Maybe you can have coffee\lunch breaks online where participants get to socialize and discuss math. There can also be optional social events in the evenings or weekends.	7/31/2021 3:08 PM
3	Not really. It's a great question. I think my problem was that I needed to take breaks from the screen. So I'm not sure how to increase the interaction.	7/30/2021 2:22 PM
4	Not really, honestly	7/27/2021 2:44 PM
5	SOCIAL ACTIVITIES DURING CONFERENCES ARE IMPORTANT	7/26/2021 10:25 AM
6	More opportunities for nonmathematical social interactions.	7/19/2021 8:23 PM
7	Maybe have a hang out session, but to be fair, after a whole day of classes and problem sessions, I just wanted to leave the computer and relax.	7/19/2021 12:57 PM
8	None come mind. One thing about being in person is that spontaneous conversations can occur since we're all together. And this can lead to fruitful discussions about mathematics.	7/18/2021 5:02 PM
9	It might be nice to set aside time for online meet & greet before the summer school. I imagine this taking place in a virtual room where each person's avatar has a name-tag indicating their name, field, and university. Also, having some sort of virtual coffee time to chat each day during the summer school could be nice. I found it hard to have the time to talk casually with other participants outside of the problem sessions.	7/18/2021 9:40 AM
10	The sococo space, although functioning, was for me not the ideal open engagement platform. Further, I think that participants should be shuffled more during the problem sessions.	7/18/2021 8:25 AM
11	Don't hold future summer schools online!	7/18/2021 8:19 AM
12	I unfortunately think there is no great solution. Sococo was already very helpful.	7/18/2021 4:25 AM
13	• The groups could be mixed more often. • The participants should be encouraged to interact more. I think most of them did not take into consideration that they could find some co-authors for the future. • A time slot could be introduced where the participants introduce themselves and their research area. • By asking the research interests of the participants beforehand, you could direct the participants to interesting "matches" (in the sense of matching interests).	7/18/2021 3:54 AM
14	it isn't gonna be the same as in person	7/17/2021 2:17 PM
15	Maybe holding social hours/activities.	7/17/2021 1:04 PM
16	have rotating groups for the problem sessions	7/17/2021 11:14 AM

Q22 We welcome any additonal comments or suggestions you may have to improve the overall experience for future participants.

Answered: 0 Skipped: 35

#	RESPONSES	DATE
	There are no responses.	

Random Conformal Geometry

July 19, 2021 – July 30, 2021

Virtual Summer Graduate School

Organizers:

Mario Bonk (University of California, Los Angeles)

Steffen Rohde (University of Washington)

Fredrik Viklund (Royal Institute of Technology)

REPORT ON THE MSRI SUMMER GRADUATE SCHOOL
"Random Conformal Geometry"
July 19 – July 30, 2021

Organizers

- Mario Bonk (University of California, Los Angeles)
- Steffen Rohde (University of Washington)
- Fredrik Viklund (Royal Institute of Technology)

Description

This Summer Graduate School covered basic topics that are important in Random Conformal Geometry (the investigation of analytic and geometric objects that arise from natural probabilistic constructions, often motivated by models in mathematical physics). The topics chosen are at the foundation of the subsequent semester-long program "The Analysis and Geometry of Random Spaces".

Highlights of the School

The Summer School took place during the second half of July for a two-week period. All activities were via Zoom. It was attended by about 30 students. They were mostly from the U.S. with a few international students mixed in. The students were mostly on the early graduate level.

The Summer School consisted of four courses with several lectures (of about 50-60 minutes) each: Conformal and Quasiconformal Mappings (Bonk, Rohde, Viklund, two lectures each), Conformal Field Theory (Hongler, two lectures), Brownian Loops Soups (Wei Qian, three lectures), Invariant Processes in the Plane (Lawler, 5 lectures), and Loewner Energy (Yilin Wang, 3 lectures). The lectures were geared towards a graduate student audience with no prior in-depth knowledge of the topics discussed. The main organizers Bonk, Rohde, and Viklund were present during the whole Summer School and supervised the activities.

Each day there were two lectures in the morning (PST) with an opportunity for questions and discussions after each lecture. The lectures from the different courses were interrelated. For example, in the course on Conformal and Quasiconformal Mapping, Brownian motion was introduced. This was then used in other courses.

After a lunch break, each day the Summer School resumed for afternoon activities for about 2-3 hours. During this time, the students worked on problem sets that the lecturers for each course had prepared in advance and made accessible to the students. During the first week, the students were assigned to small groups (3-5 students) chosen at the beginning of the Summer School. Each group discussed problems of their choice in a breakout room. In the second week the format was changed and specific problems from the worksheets were chosen by the lecturers and were assigned to breakout rooms. The students could then join the breakout room were a problem was discussed they found interesting. The lecturers hopped around breakout rooms to answer questions and give

hints when the students did not make progress with the problems they were working on. After about an hour of group work, all participants reconvened for some quick progress report from the groups and short presentations if solutions to problems had been found. This was followed by another session of group work for about an hour. A final wrap-up with all participants concluded each day.

On the last day the organizers asked the participants for feedback about strengths and weaknesses of the program. To ensure a frank discussion, the participants were split into small groups in breakout rooms were they could discuss this among themselves. A speaker for each group then summarized what emerged from these deliberations.

The choice and variety of topics in the different courses was praised. A suggestion for improvement was a better setup for work groups to ensure that each students gets to know all other students. Overall, it seems the students had a positive experience with the Summer School.

Organizers		
First Name	**Last Name**	**Institution**
Mario	Bonk	University of California, Los Angeles
Steffen	Rohde	University of Washington
Fredrik	Viklund	Royal Institute of Technology
Speakers		
First Name	**Last Name**	**Institution**
Mario	Bonk	University of California, Los Angeles
Clément	Hongler	École Polytechnique Fédérale de Lausanne (EPFL)
Gregory	Lawler	University of Chicago
Wei	Qian	Université Paris-Saclay
Steffen	Rohde	University of Washington
Fredrik	Viklund	Royal Institute of Technology
Yilin	Wang	Massachusetts Institute of Technology

Mathematical Sciences Research Institute

Random Conformal Geometry (Virtual School)

July 19 to July 30, 2021

Monday, July 19, 2021		
07:15 AM - 07:30 AM		Welcome
07:30 AM - 08:30 AM	Mario Bonk, Steffen Rohde, Fredrik Viklund	Geometric function theory and quasiconformal maps: Lecture 1
08:30 AM - 09:00 AM		Break
09:00 AM - 10:00 AM	Mario Bonk, Steffen Rohde, Fredrik Viklund	Geometric function theory and quasiconformal maps: Lecture 2
10:00 AM - 11:00 AM		Break
11:00 AM - 12:00 PM		Exercise session 1
12:00 PM - 01:00 PM		Exercise session 2

Tuesday, July 20, 2021		
07:30 AM - 08:30 AM	Clément Hongler	Planar lattice models and Conformal Field Theory: Lecture 1
08:30 AM - 09:00 AM		Break
09:00 AM - 10:00 AM	Mario Bonk, Steffen Rohde, Fredrik Viklund	Geometric function theory and quasiconformal maps: Lecture 3
10:00 AM - 11:00 AM		Break
11:00 AM - 12:00 PM		Exercise session 1
12:00 PM - 01:00 PM		Exercise session 2

Wednesday, July 21, 2021		
07:30 AM - 08:30 AM	Clément Hongler	Planar lattice models and Conformal Field Theory: Lecture 2
08:30 AM - 09:00 AM		Break
09:00 AM - 10:00 AM	Wei Qian	Lectures on the Brownian loop-soup: Lecture 1
10:00 AM - 11:00 AM		Break
11:00 AM - 12:00 PM		Exercise session 1
12:00 PM - 01:00 PM		Exercise session 2

Thursday, July 22, 2021		
07:30 AM - 08:30 AM	Mario Bonk, Steffen Rohde, Fredrik Viklund	Geometric function theory and quasiconformal maps: Lecture 4
08:30 AM - 09:00 AM		Break
09:00 AM - 10:00 AM	Wei Qian	Lectures on the Brownian loop-soup: Lecture 2
10:00 AM - 11:00 AM		Break
11:00 AM - 12:00 PM		Exercise session 1
12:00 PM - 01:00 PM		Exercise session 2

Friday, July 23, 2021		
07:30 AM - 08:30 AM	Wei Qian	Lectures on the Brownian loop-soup: Lecture 3
08:30 AM - 09:00 AM		Break
09:00 AM - 10:00 AM	Mario Bonk, Steffen Rohde, Fredrik Viklund	Geometric function theory and quasiconformal maps: Lecture 5
10:00 AM - 11:00 AM		Break
11:00 AM - 12:00 PM		Exercise session 1
12:00 PM - 01:00 PM		Exercise session 2

Monday, July 26, 2021		
07:30 AM - 08:30 AM	Mario Bonk, Steffen Rohde, Fredrik Viklund	Geometric function theory and quasiconformal maps: Lecture 6
08:30 AM - 09:00 AM		Break
09:00 AM - 10:00 AM	Gregory Lawler	The TLAs of the Conformally Invariant World: Lecture 1
10:00 AM - 11:00 AM		Break
11:00 AM - 12:00 PM		Exercise session 1
12:00 PM - 01:00 PM		Exercise session 2

Tuesday, July 27, 2021		
07:30 AM - 08:30 AM	Gregory Lawler	The TLAs of the Conformally Invariant World: Lecture 2
08:30 AM - 09:00 AM		Break
09:00 AM - 10:00 AM	Gregory Lawler	The TLAs of the Conformally Invariant World: Lecture 3
10:00 AM - 11:00 AM		Break
11:00 AM - 12:00 PM		Exercise session 1
12:00 PM - 01:00 PM		Exercise session 2

Wednesday, July 28, 2021		
07:30 AM - 08:30 AM	Yilin Wang	Around the Loewner energy: Lecture 1
08:30 AM - 09:00 AM		Break
09:00 AM - 10:00 AM	Gregory Lawler	The TLAs of the Conformally Invariant World: Lecture 4
10:00 AM - 11:00 AM		Break
11:00 AM - 12:00 PM		Exercise session 1
12:00 PM - 01:00 PM		Exercise session 2

Thursday, July 29, 2021		
07:30 AM - 08:30 AM	Yilin Wang	Around the Loewner energy: Lecture 2
08:30 AM - 09:00 AM		Break
09:00 AM - 10:00 AM	Gregory Lawler	The TLAs of the Conformally Invariant World: Lecture 5
10:00 AM - 11:00 AM		Break
11:00 AM - 12:00 PM		Exercise session 1
12:00 PM - 01:00 PM		Exercise session 2

Friday, July 30, 2021		
07:30 AM - 08:30 AM	Yilin Wang	Around the Loewner energy: Lecture 3
08:30 AM - 011:00 AM		Break
11:00 AM - 12:00 PM		Exercise session 1
12:00 PM - 01:00 PM		Exercise session 2

Students		
First Name	**Last Name**	**Institution**
Mitchell	Bast	Rutgers University
Jack	Burkart	State University of New York, Stony Brook
Marco	Carfagnini	University of Connecticut
Alexander	Clow	St. Francis Xavier University
Lingyun	Ding	University of North Carolina
Muhammed	Guelen	ETH Zurich
Sharmila	Gunasekaran	University of Alberta
Vladislav	Guskov	Royal Institute of Technology
Nathan	Hayford	University of South Florida
Will	Hoffer	University of California, Riverside
Mitul	Islam	University of Michigan
Tzu-Mo	Kuo	University of California, Santa Cruz
Therese	Landry	University of California, Riverside
Liangbing	Luo	University of Connecticut
Víctor	Maciá Medina	Washington University
Apala	Mandal	University of Nebraska
Pratyush	Mishra	North Dakota State University
Ajith	Nair	CUNY, Graduate Center
Muhammad Anadil Saeed	Rao	Northeastern University
Zachary	Smith	University of California, Los Angeles
Jin Woo	Sung	University of Chicago
Georgios	Tsikalas	Washington University
Brad	Turow	Northeastern University
Catherine	Wolfram	Massachusetts Institute of Technology
Da	Wu	University of Pennsylvania
You	Wu	National Taiwan University
Stephen	Yearwood	University of Illinois, Chicago
Yizheng	Yuan	TU Berlin

Officially Registered Student Information

Students		28

Gender		28
Male	82.14%	23
Female	17.86%	5
Declined to state	0.00%	0

Ethnicity*		30
White	40.00%	12
Asian	43.33%	13
Hispanic	3.33%	1
Pacific Islander	0.00%	0
Black	3.33%	1
Native American	0.00%	0
Mixed	3.33%	1
Declined to state	6.67%	2

* ethnicity specifications are not exclusive

Financial Summary

MSRI Summer Graduate School

Random Conformal Geometry

July 19, 2021 - July 30, 2021

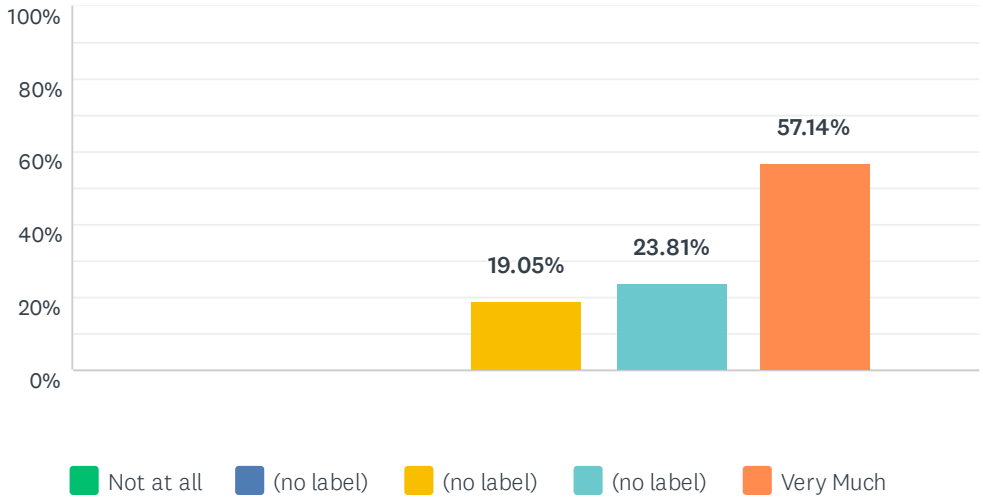
Virtual Summer School

	NSF 5059	NSF 5061	Total
Stipend	$ 7,900.00		**$ 7,900.00**
Other	$ 2,992.60	$ 69.49	**$ 3,062.09**
Total	**$ 10,892.60**	**$ 69.49**	**$ 10,962.09**

	Stipend	Other		Totals
	NSF 5059	NSF 5059	NSF 5061	
Organizers, Speakers, TAs				
Bonk, Mario (O/S)	$ 1,000.00			**$ 1,000.00**
Hongler, Clement (S)	$ 800.00			**$ 800.00**
Lawler, Gregory (S)	$ 1,700.00			**$ 1,700.00**
Qian, Wei (S)	$ 600.00			**$ 600.00**
Rohde, Steffen (O/S)	$ 1,700.00			**$ 1,700.00**
Viklund (O/S)	$ 1,000.00			**$ 1,000.00**
Wang, Yilin (S)	$ 1,100.00			**$ 1,100.00**
Subtotals (Funded Participants)	$ 7,900.00	$ -		**$ 7,900.00**
Computer Software/Equipment		$ 2,721.90		**$ 2,721.90**
Shipping and Postage		$ 270.70	$ 69.49	**$ 340.19**
Subtotals (Other)	$ -	$ 2,992.60	$ 69.49	**$ 3,062.09**
Totals	**$ 7,900.00**	**$ 2,992.60**	**$ 69.49**	**$ 10,962.09**

Q1 The various topics within the summer school integrated into a coherent picture

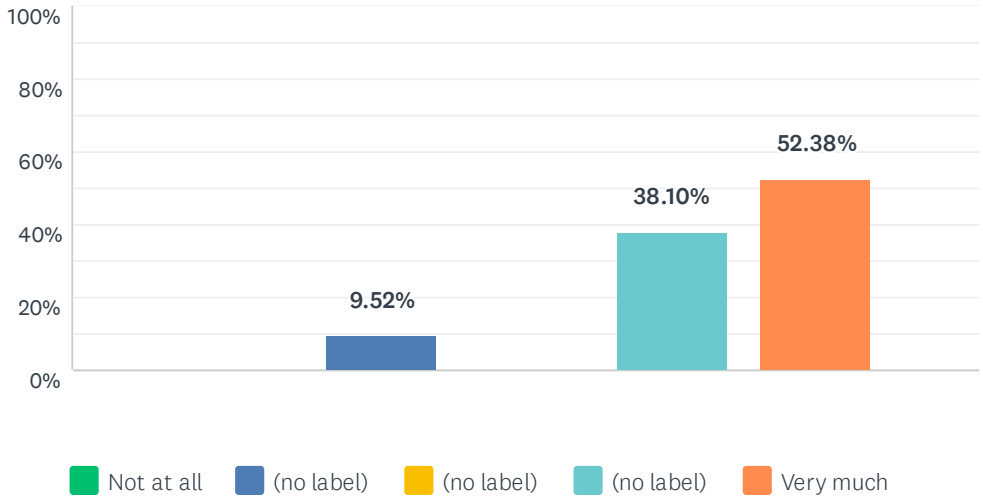
Answered: 21 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	19.05% 4	23.81% 5	57.14% 12	21	4.38

Q2 The speakers were generally clear and well organized in their presentation

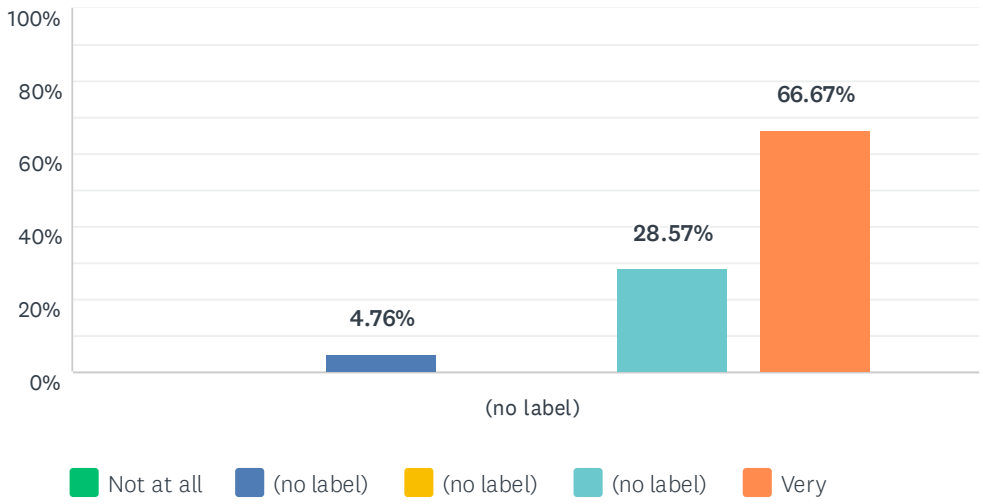
Answered: 21 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	9.52% 2	0.00% 0	38.10% 8	52.38% 11	21	4.33

Q3 The school was intellectually stimulating

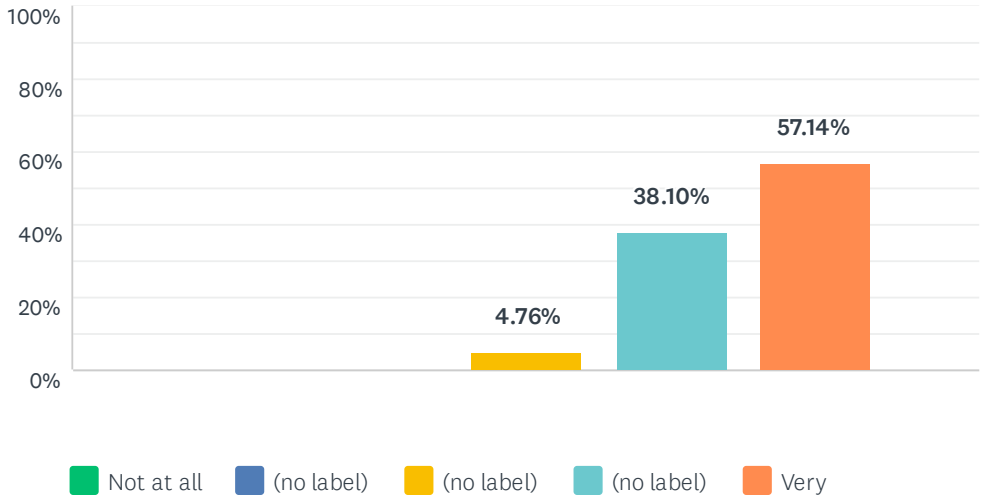
Answered: 21 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.76% 1	0.00% 0	28.57% 6	66.67% 14	21	4.57

Q4 My fellow students were appropriately selected to make the event interesting

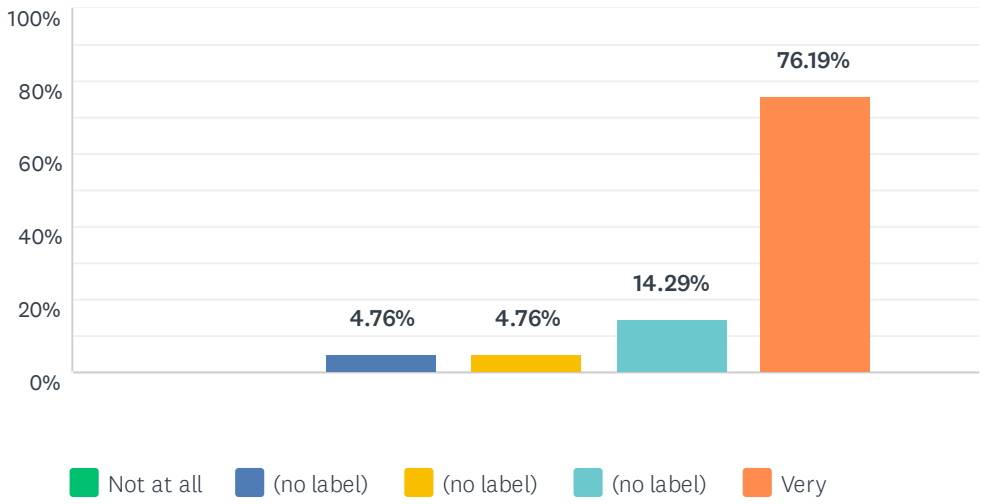
Answered: 21 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	4.76% 1	38.10% 8	57.14% 12	21	4.52

Q5 The overall experience of the school was worthwhile

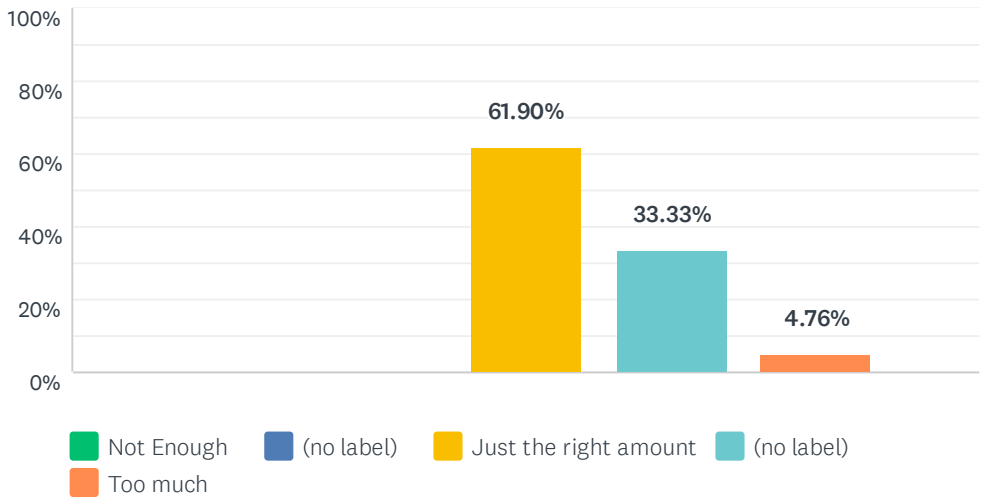
Answered: 21 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.76% 1	4.76% 1	14.29% 3	76.19% 16	21	4.62

Q6 The amount of material presented was:

Answered: 21 Skipped: 0



	NOT ENOUGH	(NO LABEL)	JUST THE RIGHT AMOUNT	(NO LABEL)	TOO MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	61.90% 13	33.33% 7	4.76% 1	21	3.43

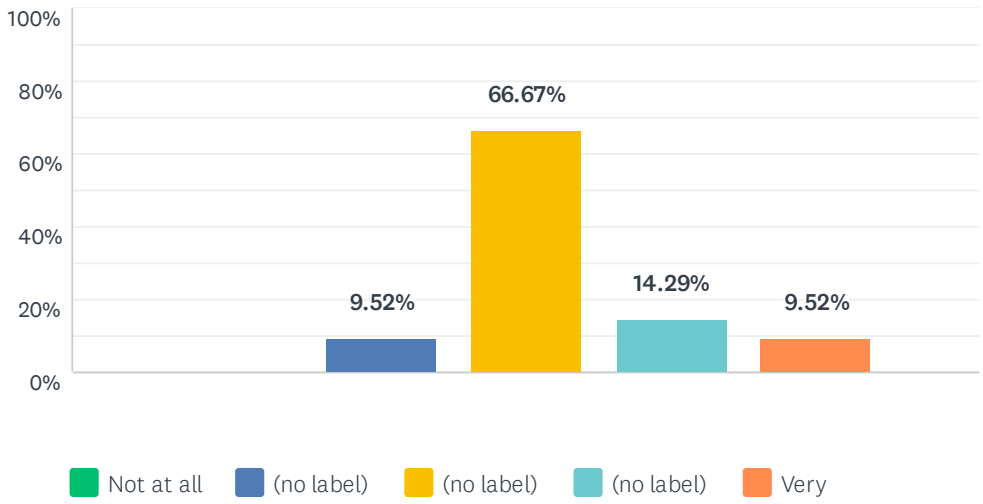
Q7 Additional comments on the topic presentation and organization

Answered: 4 Skipped: 17

#	RESPONSES	DATE
1	This was my first online summer school, and I think the format does not work. The online format does not make networking possible. Moreover, having to work on problems an hour after learning the material and then presenting solutions is very challenging (and stressful). It would have worked in an in-person format since we would have had all day to network and discuss problems in person, but online it just does not work.	8/12/2021 11:25 AM
2	I thought that the topics could have been better integrated. There was some level of disjunction between the geometric material and the probabilistic material.	8/9/2021 2:05 PM
3	I wish lecture notes were uploaded before problem solving sessions for some of the lectures.	8/4/2021 2:29 PM
4	Most of what I didn't like about the school could be attributed to the fact that it was online; it would have been nice to be able to talk to people face to face, because you have more time to discuss then, but I suspect this shortcoming was just a consequence of the format. I really enjoyed the summer school, and got a lot out of it. Thanks to everyone involved in organizing this!	7/30/2021 12:09 PM

Q8 I was well prepared to benefit from the school

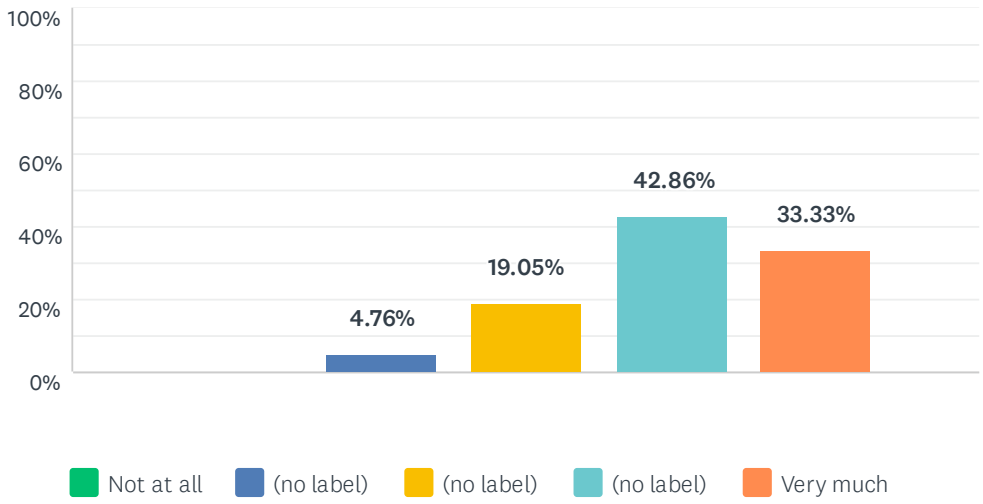
Answered: 21 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	9.52% 2	66.67% 14	14.29% 3	9.52% 2	21	3.24

Q9 My interest in the subject matter was increased by the school

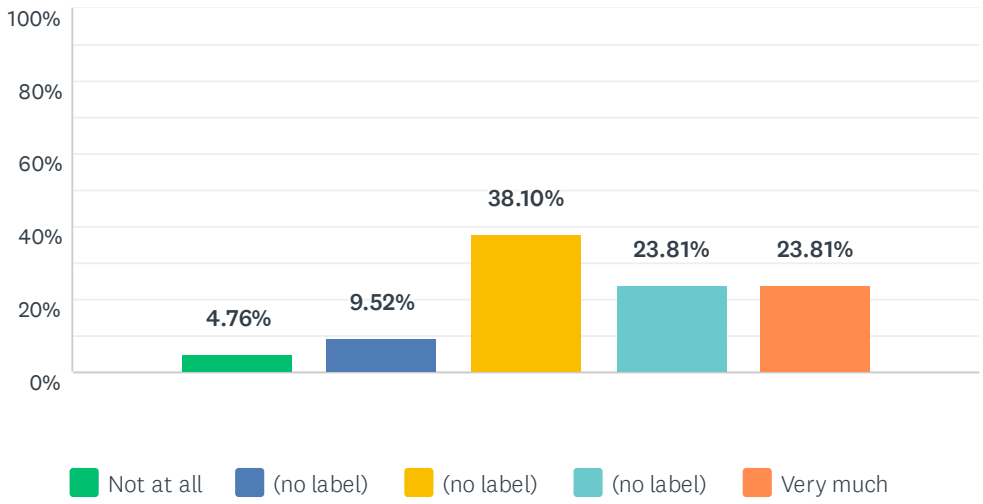
Answered: 21 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	4.76% 1	19.05% 4	42.86% 9	33.33% 7	21	4.05

Q10 The school helped me meet people with similar scientific interests

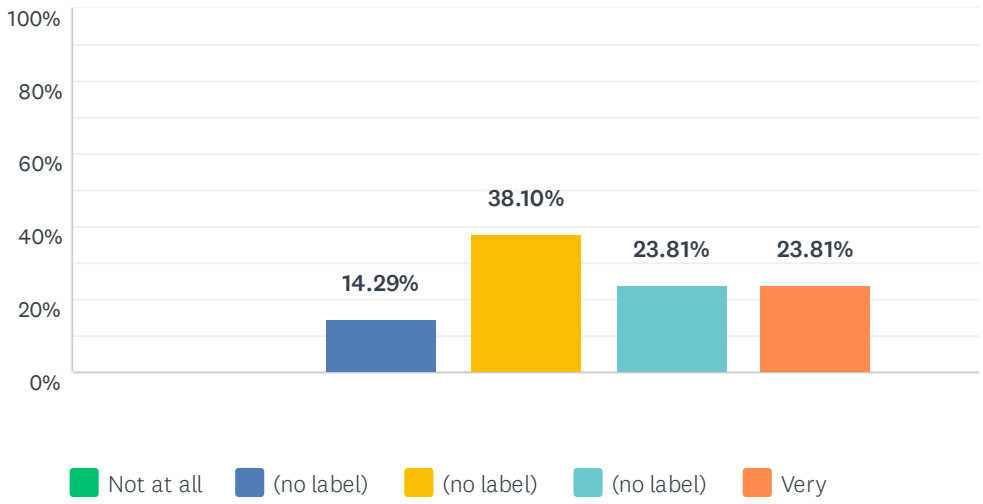
Answered: 21 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY MUCH	TOTAL	WEIGHTED AVERAGE
(no label)	4.76% 1	9.52% 2	38.10% 8	23.81% 5	23.81% 5	21	3.52

Q11 It is likely that I will work in the area of the school subject in the future

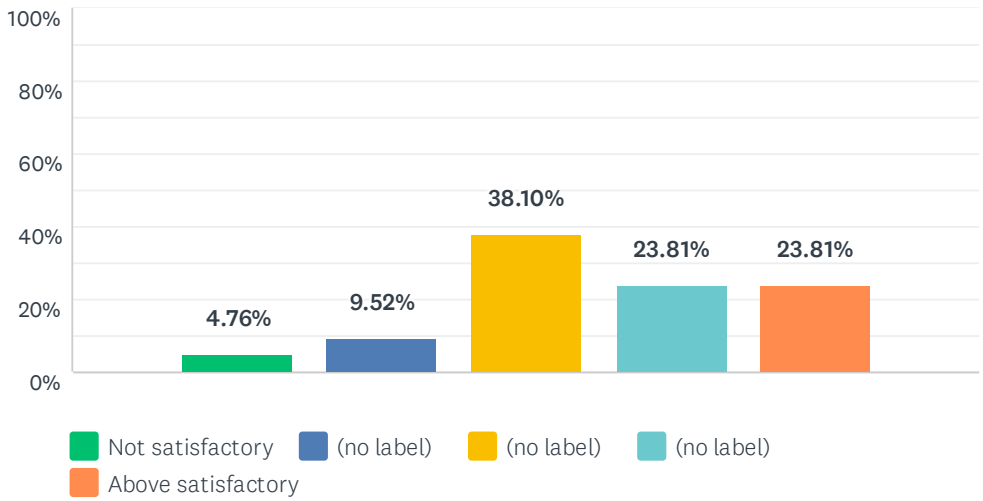
Answered: 21 Skipped: 0



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	14.29% 3	38.10% 8	23.81% 5	23.81% 5	21	3.57

Q12 How would you evaluate your interaction with other participants?

Answered: 21 Skipped: 0



	NOT SATISFACTORY	(NO LABEL)	(NO LABEL)	(NO LABEL)	ABOVE SATISFACTORY	TOTAL	WEIGHTED AVERAGE
(no label)	4.76% 1	9.52% 2	38.10% 8	23.81% 5	23.81% 5	21	3.52

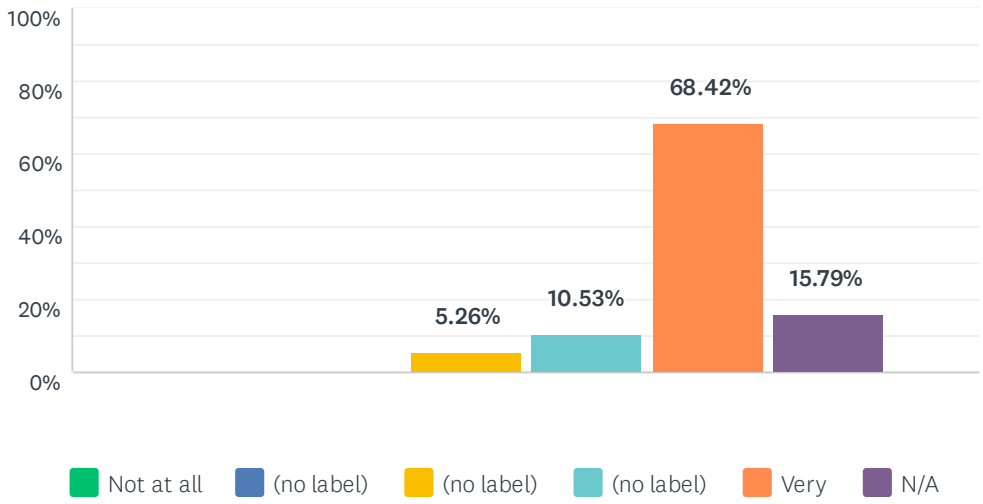
Q13 Additional comments on your personal assessment

Answered: 3 Skipped: 18

#	RESPONSES	DATE
1	Groups were pre-made and they were not changed thought the first week-ten days and it made it impossible to get to know other participants.	8/12/2021 11:28 AM
2	I really liked the material on conformal field theory and the little bit about Teichmuller theory. I would have liked for more students to have had a more geometric leaning focus.	8/9/2021 2:10 PM
3	N/A	8/4/2021 2:30 PM

Q14 I found the MSRI staff helpful

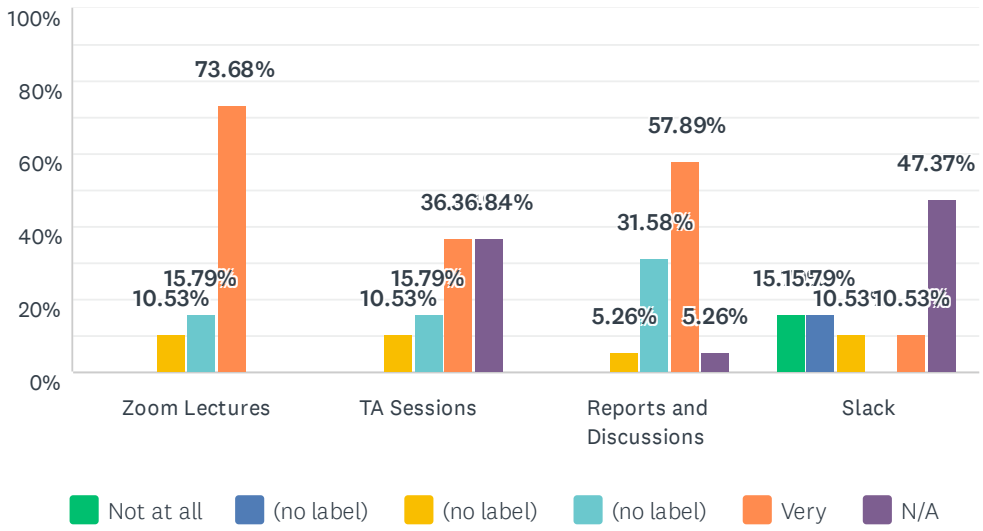
Answered: 19 Skipped: 2



	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	N/A	TOTAL	WEIGHTED AVERAGE
(no label)	0.00% 0	0.00% 0	5.26% 1	10.53% 2	68.42% 13	15.79% 3	19	4.75

Q15 How helpful did you find each of these collaboration tools

Answered: 19 Skipped: 2

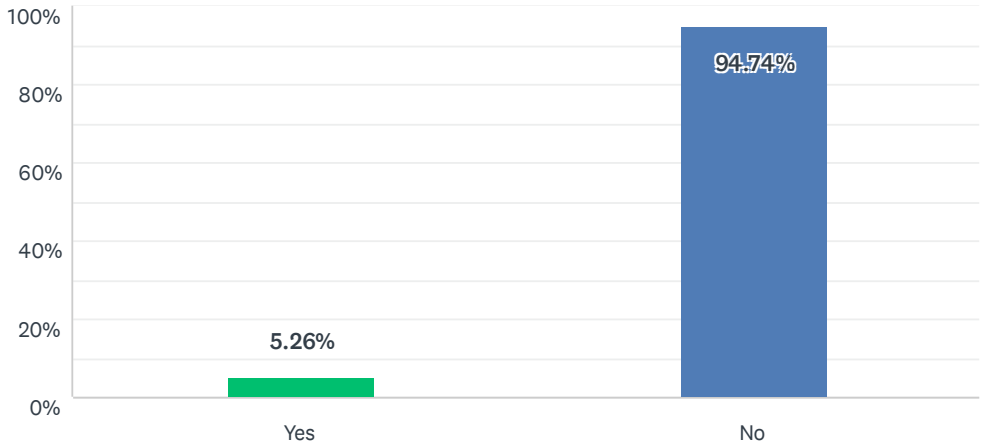


	NOT AT ALL	(NO LABEL)	(NO LABEL)	(NO LABEL)	VERY	N/A	TOTAL	WEIGHTED AVERAGE
Zoom Lectures	0.00% 0	0.00% 0	10.53% 2	15.79% 3	73.68% 14	0.00% 0	19	4.63
TA Sessions	0.00% 0	0.00% 0	10.53% 2	15.79% 3	36.84% 7	36.84% 7	19	4.42
Reports and Discussions	0.00% 0	0.00% 0	5.26% 1	31.58% 6	57.89% 11	5.26% 1	19	4.56
Slack	15.79% 3	15.79% 3	10.53% 2	0.00% 0	10.53% 2	47.37% 9	19	2.50

#	COMMENTS	DATE
1	Lectures are better in person, but the lectures were really good. the presenters were friendly and introduced great material	8/9/2021 2:10 PM

Q16 Did you experience any technical difficulties accessing the online summer school?

Answered: 19 Skipped: 2



ANSWER CHOICES	RESPONSES	
Yes	5.26%	1
No	94.74%	18
TOTAL		19

#	IF YES, PLEASE EXPLAIN	DATE
	There are no responses.	

Q17 How did having the summer school held online impact your participation?

Answered: 19 Skipped: 2

#	RESPONSES	DATE
1	It was horrible. I am sure it would have been an amazing experience if it was held in-person	8/12/2021 11:29 AM
2	As most people will say, I felt distant from a lot of the other participants. Didn't really make any new friends or connections. Made me less engaged with the mathematics as well since we all weren't at MSRI working together.	8/9/2021 2:10 PM
3	Not at all.	8/9/2021 1:45 PM
4	Generally speaking, the online lectures made it somewhat difficult for me to concentrate fully. But the online problem sessions didn't offer much trouble. I would say that my participation would have been slightly higher if the summer school were in-person.	8/5/2021 8:23 AM
5	Not much.	8/4/2021 4:54 PM
6	Not enough space or time to get to know other participants or get deeper into the course material.	8/4/2021 2:32 PM
7	As a parent, it made coordinating my responsibilities as both a student and a mother easier.	8/4/2021 11:33 AM
8	I live in Asia (UTC+8 time zone), so it was from midnight to early moring during the lectures and exercise sections. I had spent few days to get adapted to the regular routine.	8/2/2021 5:42 PM
9	It was difficult to meet everyone if the participants.	8/2/2021 3:24 PM
10	The online nature stymied most of the interpersonal interactions/ability to make new friends/colleagues. I think my engagement with the material was about the same, but I do not feel as though I have made new relationships that will last beyond the program.	8/2/2021 12:26 PM
11	The lectures were of similar quality to in-person ones, but group work was much more difficult due to the lack of collaborative tools that can replace a physical blackboard.	8/1/2021 1:22 PM
12	Working group benefits very much	7/30/2021 6:48 PM
13	I was in India and had a hard time attending it because of the time difference	7/30/2021 6:00 PM
14	The online format is good. I also like to attend the summer school in person.	7/30/2021 2:12 PM
15	Not significantly	7/30/2021 12:56 PM
16	It made it difficult to work on problems together.	7/30/2021 12:43 PM
17	Harder to concentrate	7/30/2021 12:39 PM
18	It kind of limited the interaction of different groups with each other, but I believe that the in-group discussions were carried out effectively.	7/30/2021 12:24 PM
19	It generally had a negative impact, although I tried to participate as much as possible. I asked questions on occasion, but found it hard to have really fruitful discussions.	7/30/2021 12:11 PM

Q18 One important aspect that may have been missing due to the online format was interaction between participants. Do you have any suggestions on how we can improve this interaction if we hold future summer schools online?

Answered: 10 Skipped: 11

#	RESPONSES	DATE
1	Perhaps shuffle the groups more often, like every other day or something like that.	8/12/2021 11:29 AM
2	Don't hold summer schools online. I know it doesn't answer the question, but there is no single better way to fix this problem. I'm aware of the political situation, but I think it would be a pity if people continue to just go along with this instead of actively pushing for normality at every step in which it is possible.	8/9/2021 2:10 PM
3	One suggestion might be to shuffle the participants in different working groups. For example, in the second week there could be a different set of working groups.	8/5/2021 8:23 AM
4	I think online schools will inherently have certain limitations and the school did the best it could. The only improvement is to have school on site, in-person.	8/4/2021 2:32 PM
5	assigning people randomly to different breakout rooms during the breaks	8/4/2021 11:33 AM
6	Maybe you can add some contact list of participants or chatting room for each group by using some social media, so that we can connect to other people and discuss easier. And you may consider to divide people who are in adjacent time zone in to a group. Then we could be more probably to discuss simultaneously not only on class time.	8/2/2021 5:42 PM
7	I would suggest building time dedicated to small interactions into the program. For example, having small breakout rooms after the talks during breaks for chatting. The exercise sessions were great, but I felt as though we were always pushed to work on problems the whole time instead of meeting the other participants. Setting aside some discussion time (to meet, talk about the day's lectures, etc.) during the sessions would also be nice.	8/2/2021 12:26 PM
8	Sufficiently long hours (~20 hours) of group sessions seem to be able to replace a day or two of in-person interactions.	8/1/2021 1:22 PM
9	Maybe create random breakout room in the breaks between the lectures?	7/30/2021 12:24 PM
10	Sort of a difficult problem, and I don't really know if there's a good solution. Maybe just incorporate zoom sessions with breakout rooms just for people to talk, and cycle people through these breakout rooms every day.	7/30/2021 12:11 PM

Q19 We welcome any additonal comments or suggestions you may have to improve the overall experience for future participants.

Answered: 0 Skipped: 21

#	RESPONSES	DATE
	There are no responses.	

Foundations and Frontiers of Probabilistic Proofs

July 26, 2021 – August 6, 2021

Virtual Summer Graduate School

Organizers:

Alessandro Chiesa (University of California, Berkeley)

Tom Gur (University of Warwick)

Report on the MSRI Summer School
Foundations and Frontiers of Probabilistic Proofs
(July 26 – August 6, 2021)

Staff

Professors:

- Alessandro Chiesa (UC Berkeley)
- Tom Gur (University of Warwick)

Teaching assistants:

- Gal Arnon (Weizmann Institute)
- Marcel Dall'Agnol (University of Warwick)
- Inbal Livni Navon (Weizmann Institute)
- Nick Spooner (Boston University)

Description

This summer school introduced students to the field of probabilistic proofs and the beautiful mathematics behind it. This field is concerned with contemporary reenvisionings of mathematical proofs, viewed through the lens of theoretical computer science. Prominent examples include: (1) *probabilistically checkable proofs* (PCPs), which admit local-to-global structure that allows verifying a proof by reading only a minuscule portion of it; (2) *interactive proofs* (IPs), which allow for verification via a conversation between a prover and a verifier, instead of the traditional static sequence of logical statements; and (3) *interactive oracle proofs* (IOPs), which combine features of PCPs and IPs. The study of such proof systems has drawn upon deep mathematical tools to derive numerous applications to the theory of computation and beyond, as well as to the design of protocols for delegation of computation (super-fast verification of long computations). Probabilistic proofs have been realized within recently-deployed technology, for example, as part of cryptographic constructions known as succinct non-interactive arguments of knowledge (SNARKs).

Format

This school was held virtually due to the ongoing pandemic. Zoom was used for lectures and recitations (with breakout rooms used for working groups). Slack was the main communication tool, and Sococo was used for office hours (and generally by those who were online and available

to interact). The virtual format enabled the school to scale somewhat beyond the usual 40-student format since there were no hotel or catering costs (which scale linearly with students). We had 75 students sign up for the school, and among these 57 students attended the full two weeks (with the others either not showing up or dropping out after a few days). There were 21 women among the 57 students, and the geographical make up was roughly 50% from the US and 50% from Europe/Israel. We scheduled the lectures and recitations so that most people would be able to attend lectures live, and we had two sets of recitations to serve the different US and Europe/Israel time zones.

Highlights of the school

The summer graduate school offered two complementary courses.

- **Course A (Interactive Proofs):** This course covered the basics of the theory of interactive proofs, landmark results, and cutting-edge research results on new forms of interactive proofs (interactive oracle proofs) crucial to recent real-world applications of the theory.
- **Course B (Probabilistically Checkable Proofs):** This course started by establishing the mathematical foundations of the theory of PCPs by covering property testing of linear functions and low-degree polynomials. Subsequently, several celebrated constructions of PCPs were shown. Finally, several application of the theory were discussed.

Each day included one 1.5h lecture and one 1.0 recitation per course (for a total of two lectures and two recitations per day), as well as two office-hour slots.

- Alessandro taught lectures for Course A and Tom taught lectures for Course B. Lectures were designed to bring the students to the frontiers of the field and prepare them for research. Lectures' recordings and slides were made available online directly after they took place, to enable students to review material.
- Gal and Nick taught recitations for Course A, and Marcel and Inbal taught recitations for Course B. Each recitation had a corresponding worksheet, and students were encouraged to actively collaborate in recitation to solve problems.
- Professors and teaching assistants were present in office hours to answer questions, during two 1h slots each day.

The organizers were delighted to see the extent of engagement and passion that the students displayed. The problem solving sessions were vibrant, and the forum was used extensively. In the end-of-course survey, the students expressed overwhelmingly positive feedback on the lectures, recitations, and organization of the course. Example of such feedback is available below.

- *Well organised, lectures were very clear, good that we would later have access to the slides so no need to take exhaustive notes, could just focus on the speakers. Motivating exercise sessions with enthusiastic and entertaining organisers.*
- *(I enjoyed the) topic, small groups, communication skills of TAs, variety o materials availible online. The best online event I have attended.*

- *Intense but exhaustive and exciting program. Very well organized. Very interesting to start from the foundations and have a glimpse of current constructions. Lecturers and TAs were very available and helpful.*
- *The topics were extremely interesting and relevant, the material was presented in an extremely compelling way, and the working groups were interesting and really fun.*

Organizers

First Name	Last Name	Institution
Alessandro	Chiesa	University of California, Berkeley
Tom	Gur	University of Warwick

Speakers

First Name	Last Name	Institution
Gal	Arnon	Weizmann Institute
Alessandro	Chiesa	University of California, Berkeley
Marcel	Dall'Agnol	University of Warwick
Tom	Gur	University of Warwick
Inbal	Livni Navon	Weizmann Institute
Nick	Spooner	Boston University

Teaching Assistants

First Name	Last Name	Institution
Gal	Arnon	Weizmann Institute
Marcel	Dall'Agnol	University of Warwick
Inbal	Livni Navon	Weizmann Institute
Nick	Spooner	Boston University

Mathematical Sciences Research Institute

Foundations and Frontiers of Probabilistic Proofs

July 26 to August 6, 2021

Monday, July 26, 2021		
09:15 AM - 09:30 AM	Alessandro Chiesa	Welcome: Introduction to the summer school
09:30 AM - 10:30 AM	Alessandro Chiesa	Lecture A.1: Intro to IPs
11:00 AM - 11:30 AM		Break
11:30 AM - 12:30 PM	Tom Gur	Lecture B.1: Intro to PCPs
12:30 PM - 01:00 PM		Break
02:00 PM - 03:00 PM	Gal Arnon, Nick Spooner	Recitation A.0: Warm-Up
03:00 PM - 04:00 PM	Marcel Dall'Agnol, Inbal Livni Navon	Recitation B.0: Warm-Up

Tuesday, July 27, 2021		
09:30 AM - 10:30 AM	Alessandro Chiesa	Lecture A.2: Sumcheck Protocol
11:00 AM - 11:30 AM		Break
11:30 AM - 12:30 PM	Tom Gur	Lecture B.2: Linearity Testing
12:30 PM - 01:00 PM		Break
02:00 PM - 03:00 PM	Gal Arnon, Nick Spooner	Recitation A.1: Intro to IPs
03:00 PM - 04:00 PM	Marcel Dall'Agnol, Inbal Livni Navon	Recitation B.1: Intro to PCPs

Wednesday, July 28, 2021		
09:30 AM - 10:30 AM	Alessandro Chiesa	Lecture A.3: IP for PSPACE
11:00 AM - 11:30 AM		Break
11:30 AM - 12:30 PM	Tom Gur	Lecture B.3: Low-Degree Testing
01:00 PM - 02:00 PM		Break
02:00 PM - 03:00 PM	Gal Arnon, Nick Spooner	Recitation A.2: Sumcheck Protocol
03:00 PM - 04:00 PM	Marcel Dall'Agnol, Inbal Livni Navon	Recitation B.2: Linearity Testing

Thursday, July 29, 2021		
09:30 AM - 10:30 AM	Alessandro Chiesa	Lecture A.4: Doubly-Efficient IPs
11:00 AM - 11:30 AM		Break
11:30 AM - 12:30 PM	Tom Gur	Lecture B.4: FRI Protocol
01:00 PM - 02:00 PM		Break
02:00 PM - 03:00 PM	Gal Arnon, Nick Spooner	Recitation A.3: IPs for PSPACE
03:00 PM - 04:00 PM	Marcel Dall'Agnol, Inbal Livni Navon	Recitation B.3: Low-Degree Testing

Friday, July 30, 2021		
09:30 AM - 10:30 AM	Alessandro Chiesa	Lecture A.5: Zero-Knowledge IPs
11:00 AM - 11:30 AM		Break
11:30 AM - 12:30 PM	Tom Gur	Lecture B.5: Analysis of FRI
01:00 PM - 02:00 PM		Break
02:00 PM - 03:00 PM	Gal Arnon, Nick Spooner	Recitation A.4: Doubly-Efficient IPs
03:00 PM - 04:00 PM	Marcel Dall'Agnol, Inbal Livni Navon	Recitation B.4: Intro to FRI Protocol

Monday, August 2, 2021		
09:30 AM - 10:30 AM	Alessandro Chiesa	Lecture A.6: Limitations of IPs
11:00 AM - 11:30 AM		Break
11:30 AM - 12:30 PM	Tom Gur	Lecture B.6: Exp-size PCP
01:00 PM - 02:00 PM		Break
02:00 PM - 03:00 PM	Gal Arnon, Nick Spooner	Recitation A.5: Zero-Knowledge IPs
03:00 PM - 04:00 PM	Marcel Dall'Agnol, Inbal Livni Navon	Recitation B.5: Analysis of FRI Protocol

Tuesday, August 3, 2021		
09:30 AM - 10:30 AM	Alessandro Chiesa	Lecture A.7: Intro to IOPs
11:00 AM - 11:30 AM		Break
11:30 AM - 12:30 PM	Tom Gur	Lecture B.7: Poly-size PCP
01:00 PM - 02:00 PM		Break
02:00 PM - 03:00 PM	Gal Arnon, Nick Spooner	Recitation A.6: Limitations of IPs
03:00 PM - 04:00 PM	Marcel Dall'Agnol, Inbal Livni Navon	Recitation B.6: Exponential-Size PCPs

Wednesday, August 4, 2021		
09:30 AM - 10:30 AM	Alessandro Chiesa	Lecture A.8: Linear-size IOP for Circuits
11:00 AM - 11:30 AM		Break
11:30 AM - 12:30 PM	Tom Gur	Lecture B.8: PCPs with Sublinear Verification
01:00 PM - 02:00 PM		Break
02:00 PM - 03:00 PM	Gal Arnon, Nick Spooner	Recitation A.7: Intro to IOPs
03:00 PM - 04:00 PM	Marcel Dall'Agnol, Inbal Livni Navon	Recitation B.7: Polynomial-Size PCPs

Thursday, August 5, 2021		
09:30 AM - 10:30 AM	Alessandro Chiesa	Lecture A.9: Linear-Size IOP for Machines
11:00 AM - 11:30 AM		Break
11:30 AM - 12:30 PM	Tom Gur	Lecture B.9: Proof Composition
01:00 PM - 02:00 PM		Break
02:00 PM - 03:00 PM	Gal Arnon, Nick Spooner	Recitation A.8: Linear-Size IOPs for Circuits
03:00 PM - 04:00 PM	Marcel Dall'Agnol, Inbal Livni Navon	Recitation B.8: PCPs with Sublinear Verification

Friday, August 6, 2021		
09:30 AM - 10:30 AM	Alessandro Chiesa	Lecture A.10: Limitations of PCPs and IOPs
11:00 AM - 11:30 AM		Break
11:30 AM - 12:30 PM	Tom Gur	Lecture B.10: Applications of PCPs
01:00 PM - 02:00 PM		Break
02:00 PM - 03:00 PM	Gal Arnon, Nick Spooner	Recitation A.9: Linear-Size IOPs for Machines
03:00 PM - 04:00 PM	Marcel Dall'Agnol, Inbal Livni Navon	Recitation B.9: Proof Composition

Students		
First Name	**Last Name**	**Institution**
Anastasia	Adriano	Portland State University
Amit	Agarwal	University of Illinois Urbana Champaign
Bogdan	Chornomaz	Vanderbilt University
Katie	Cones	Washington and Lee University
AJ	Davenoprt	National Security Agency - NSA
David	Galban	University of Georgia
Rashmika	Goswami	Rutgers University
Julissa	Hutchison-Ybarra	University of Oklahoma
Qianhan	Liu	Boston University
Tuto	LopezGonzalez	University of California, San Francisco
Duong	Nguyen	University of Louisiana--Lafayette
Jennifer	Pi	University of California, Irvine
Morgan	Sinclaire	New Mexico State University
Jagdeep	Singh	Louisiana State University
Fabrice	Ulysse	University of Notre Dame
Brinda	Venkataramani	McMaster University
Yufei	Zhang	University of Notre Dame

Officially Registered Student Information

Students		17

Gender		17
Male	41.18%	7
Female	58.82%	10
Declined to state	0.00%	0

Ethnicity*		22
White	22.73%	5
Asian	36.36%	8
Hispanic	13.64%	3
Pacific Islander	0.00%	0
Black	4.55%	1
Native American	4.55%	1
Mixed	9.09%	2
Declined to state	9.09%	2

* ethnicity specifications are not exclusive

Financial Summary

MSRI Summer Graduate School

Foundations and Frontiers of Probabilistic Proofs

July 26, 2021 - August 06, 2021

Virtual Summer School

	Academic Sponsors	Total
Stipend	$ 14,000.00	**$ 14,000.00**
Other	$ 689.54	**$ 689.54**
Total	**$ 14,689.54**	**$ 14,689.54**

	Stipend	Other	Totals
	Academic Sponsors	Academic Sponsors	
Organizers, Speakers, TAs			
Arnon, Gal (TA)	$ 2,000.00		**$ 2,000.00**
Chiesa, Alessandro (O/S)	$ 3,000.00		**$ 3,000.00**
Dall'Agnol, Marcel (TA)	$ 2,000.00		**$ 2,000.00**
Gur, Tom (O/S)	$ 3,000.00		**$ 3,000.00**
Livni Navon, Inbal (TA)	$ 2,000.00		**$ 2,000.00**
Spooner, Nick (TA)	$ 2,000.00		**$ 2,000.00**
Subtotals (Funded Participants)	$ 14,000.00	$ -	**$ 14,000.00**
Computer Software/Equipment		$ 689.54	**$ 689.54**
Subtotals (Other)	$ -	$ 689.54	**$ 689.54**
Totals	**$ 14,000.00**	**$ 689.54**	**$ 14,689.54**

Mid-Course Survey
20 respondents

1. What, in your opinion, is going well in the courses?

- Lectures and asking questions - very good explanations by both professors. Very happy to have the course recorded.
- Lecturers and TAs are insanely helpful for all kinds of question
- I think everything's allright. The school is great.
- The lectures and OHs; I love the discussion in the recitations and in our breakout rooms! Thank you all :))
- I'm really enjoying the lectures, and I think Alessandro and Tom are doing a fantastic job of covering an incredible amount of information in such a small amount of time. I personally don't retain information very well from lectures (I'm much better with textbook/reading material), but the lectures provide a great introduction to the topics and include intuition that is helpful to already have listened to when going back and reading the lecture notes.
- Everything! Thank you so much!!
- Lectures are great, exercises are interesting/give useful insights
- The lectures are going very well (although a bit intense but that was the purpose of the school I suppose). The lecturers give detailed answers and they try to make everything as clear as possible.
- Things seem good on the whole, working in small groups in recitations is nice
- Everything is very well organised!
- The recitation questions are good, and the lectures are fairly comprehensive
- I am really enjoying working on the problem sheets and I think the collaborative nature works very well for these sorts of problems.
- The lectures are well structured and the professors are available to answer questions and discuss about related topics
- Exercises complementing the different lectures
- Lectures, recitals
- I think the course is going very well! The lectures are well planned out and the videos are up very soon so that we can go through the material once more before the next class. I am very happy with the lecture notes. They are quite rigorous and detailed. The recitations are quite nice. Working in groups is very motivating. This ensures that I do all the exercises and as a consequence I have a better understanding of the material.
- Lectures and discussions. Recitations and exercises are very helpful. Office hours too.
- The two courses are very good. I feel I'm learning a lot.
- I am learning a lot from the lectures. Having them online is a plus.

2. What, in your opinion, is *not* going well?

- Too intensive. Not enough time to go over material before the next day. Also, sometimes I get too tired to attend yet another necessary lecture after such a long day. Also, Recitations are too short for working groups to discuss thoroughly the solutions imo. Because of the short time sometimes I feel the answers are too rushed and I don't truly understand the solutions.
- I am struggling to follow or thinker about most of the exercies.
- I cannot see Alps from my window
- The worksheets have many interesting questions but we do not have enough time to tackle them, and many times I am still unsure about the solutions.
- I'm not getting a whole lot out of the worksheets in recitation sections. I don't feel I have the time necessary to fully grasp the materials discussed in lecture to then apply them to solving

problems. Even if my group solves the problem, I can't relate it back to what was discussed in lecture because I just haven't had the time to properly digest everything. I feel that the time Nick/Marcel spend refreshing the material is more useful as it allows me to see the material for the second time and follow along better than the first.

- I wish I could know better the people
- Not everyone is joining the exercise sessions so groups are getting smaller
- The recitations are not that great. Firstly, because the groups are formed of people with diverse backgrounds it makes it interesting to chat with others, but sometimes it is not possible to make any meaningful progress towards the solution of the exercises. And even if we would solve them, we do not write the proofs down clearly due to time constraints. What would be really nice is if the tutors also upload the formal and worked out solutions to the exercises after the recitation, so we can go over them and study them in more detail.
- It would be nice to have more clarity on how much time we have to discuss in recitations before we get returned to the main call
- The course materials are sometimes too much and need more than 1 day preparation for being able to catch up with the school.
- Perhaps some formal solutions to the exercises would help. Without having had much exposure to certain of the treated topics, the examples in the lectures might not be enough to create fully formal answers to the questions. There are a lot of subtleties that an inexperienced person might not realize about.
- Some parts of the lectures are a little hard to follow, although this just means spending a little time outside lectures going over material
- Nothing -- I'm happy with the school so far
- Not too much time for the exercises and no discussion about solutions
- This may be specific to my group, but I feel like groups don't hang around after the recitals to try and finish the exercise sheets together, which is a bit of a shame. Of course, there is always a teaching assistant around to help, so it is no big deal at all. But is the only negative side i see at the moment. Also, I don't feel there is much socialising between participants, but this is somewhat related to us not really using sococo as much as it was intended. And I don't have any ideas for how to solve this.
- Track B is quite intense and often there isn't enough time to go through the material in order to catch up. However, on the other hand, I do think that the sections covered in this track are very interesting!
- The schedule is a bit annoying, but that's the price for world-wide access.
- :)
- I feel I cannot take the most out of the recitation sessions

3. Please give any suggestions that you believe would improve your experience.

- I would really like to receive the exercise solutions when the course ends. So that we can still check our understanding. We can learn about what we don't understand in an exercise during office hours but having a concrete rigorous answer would help a lot.
- IDK
- Maybe provide some hints about the worksheet solutions?
- This wouldn't not be possible to implement now and wouldn't really apply to future offerings of the course that are in person, but I think a style of the virtual offering of this course that would be beneficial is to make the course 1 month long and have lectures every other day. This gives a buffer to be able to review, and digest the material before immediately moving on to the next topic and feeling like you're constantly behind. Perhaps office hours could also be moved to the "off" days for when students are looking closer at course material.

- Maybe a ted session about the research of the participants, or a social activity
- Maybe shuffling groups or merging groups with two or less participants could be good, also to work with other people
- Detailed proofs to the exercises in the recitation.
- Giving clear instructions as to how long we have before breakout rooms end at the start (e.g. "10 minutes before the end of the session") or at least a message 5-10 minutes before ending the breakout rooms that warns us. The 1-minute countdown so far has always been sudden and not enough warning if we started discussing too late
- can you provide some summary of what's been done in the first week?
- Complete solutions to the problem sheets would be good.
- The lecture notes do go into a little more detail in some places but potentially marking which sections correspond to which lectures might be useful if there was something to follow along with the lectures.
- For some of the lectures of course A, in particular the analysis of Shamir's protocol, I think it would have been helpful if we had the slides beforehand, so that we could have on one screen the overview, and on another the zoom window with Alessandro explaining the analysis. In hindsight I could have taken a screenshot, but I got quite lost in the analysis without being able to keep an eye on the high level idea of the protocol.
- Maybe a solution sheet consisting of just hints and possible approaches to the problem (instead of the whole formal solution) would be nice. It takes time to solve all the exercises and the TAs will not be available to discuss with after the school ends.
- Most improvement would have come from the participants' side, e.g. self-organizing studying/discussion groups. The "online separation" is a surprisingly big barrier
- Perhaps solutions (or sketches) to the worksheets.
- I would appreciate if we had a solution sheet for the recitations once the course finishes, to make sure we were on the right track and help lay down the foundations

End of Course Survey
24 respondents

1. What did you like about this summer school?

- helped me to understand and link the concepts, but you probably already know this.In terms of content, the school was great. The way it is structured
- For all the professors, the passion you put into teaching was notable at every step. All of you were patient and made us (at least me) feel comfortable with participating even with a bit lost.
- I feel very lucky I could take a course of this level, taught by such experts. It is hard but not that much to understand why you do it so thanks for giving us this opportunity.
- The lecture content was really interesting, as well as the recitation problems
- The topics that were covered were wonderful
- T.A was super useful, good questions, and help to understand better the lectures
- Everything
- The way PCP theorem is proved (linearity testing -> low degree -> composition) is easier to understand.
- How the material was prepared/organised
- Topic, small groups, communication skills of TAs, variety o materials availible online. The best online event I have attended
- The topics were interesting, the lectures were clear, and the problem sheets were well designed I thought
- Doing two parallel tracks was a great idea. The recitations (and their recapitulations) were very helpful. Not all technical details were skipped. Everyone was clearly motivated and prepared (students included)!
- I really liked how the recitations gave us an opportunity to discuss the material from lecture and check our understanding. It was especially helpful when a topic we saw in recitation was used in a later lecture (such as R1CS), because then lecture was easier to follow (since I didn't need the extra time to process the definition). I also appreciated how easy it was to access course materials and ask questions through slack.
- The topics were extremely interesting and relevant, the material was presented in an extremely compelling way, and the working groups were interesting and really fun
- I liked the course material.
- It was good that the lessons wdre recorded and available. I used it to review lessons and to watch ones that I had to miss.
- The recitation format was nice; I think that the fact that we had to dedicate two hours to review the material through questions daily was good.
- Intense but exhaustive and exciting program. Very well organized. Very interesting to start from the foundations and have a glimpse of current constructions. Lecturers and TAs were very available and helpful.
- Helped me lay the foundations for my work. Really appreciate the lecture notes for offline read.
- Fixed small groups in recitations were nice - working on Zoom with complete strangers can be a bit awkward sometimes but the fact that it was the same people every day meant that we actually got to know each other a bit and it didn't feel as awkward. It was also good to have those people to chat to.
- Having all links and people on Slack was great, and Sococo made link finding extra easy + I think it's a good idea to have one space like that to facilitate all summer school related Zoom things.
- Recordings of lectures were also very nice because on days when the Internet at home was playing up during the lecture, I could actually go and catch up later. Speaking of which, it was

good that the recitations were for the previous day's lectures, because that actually gave a little bit of time to absorb stuff (and catch up if need be!) before working on problem sheets.
- All the prepared lecture slides, valuable worksheets, and sococo
- Well organised, lectures were very clear, good that we would later have access to the slides so no need to take exhaustive notes, could just focus on the speakers.
- Motivating exercise sessions with enthusiastic and entertaining organisers.
- The recitations with TA's helping to explain how best to think about the questions on the problem sheet and with collaborative work with other students
- The format. No homework, but solving together.
- High quality lectures and exercisis
- organization and planning, chance to ask lots of questions during the lectures
- Fast availability of materials and videos
- The lectures were amazingly helpful, accessible to non-experts in the field

2. What did you not like about this summer school?

- Felt all the time in a rush or behind, plus the pressure to know there were few days to fix it.
- I felt the preparation that was posted on the slack wasnt entirely sufficient, it maybe could have been more comprehensive
- I believe it was very intense to cover all these materials in just two weeks
- I didn't know and meet the people, in addition, it will be good to have one short day for break
- I've mentioned the absence of Alps in the windo before, haven't I? (It was a common point anyways)
- Some advanced topics are hard to digest in such a short notice.
- Maybe posting the solutions to all problems would be plausible?
- Too many “very important” organizational posts, mails etc. Soccoco. But this is just blah blah complaining
- I struggled a bit to keep up, slightly fast perhaps.
- Too virtual :(In a less virtual school, more time to work on (more) exercises may be good, though with easier teamwork, things might go faster non-virtually too. Generally, virtual lectures/discussion etc, feel more tiring.
- Having it online definitely made me feel more disconnected from the program, but of course, it couldn't be helped. I also did feel that the recitations were a bit short in the sense that it usually felt like we ran out of time. Finally, I ended up using a fair number of outside resources to help my understanding of the material - I think having some listed external resources for each topic would be helpful.
- I wish I could have gotten the opportunity to meet and work with more people (if only they showed up to the working groups :)
- * I had a lot of problems with logging in to Sococo, and it prevented me from being more active in office hours.
- I think that shifting between work groups is better than maintaining one work group since you can be exposed to other people and ideas.
- Also, I think it is good to take a couple of minutes per recitation to review answers to the questions in class format. Some of the questions were hard and I feel that a class debate cpuld have helped us.
- Maybe too much content in a short period of time for an online school, knowing that staying focused in front of a screen is more difficult.
- At the beginning we didn't have solutions for the recitations, but luckily now we have lots of materials

- Not sure anything specific comes to mind. Obviously, would've been nice to be in person but in a way, online stuff did make other aspects easier (like no need to travel, and lecture recordings being easily available).
- I wonder perhaps if some of the more technical analysis could reduced/left to lecture notes to allow for more time to think about the ""big picture"" of what it is we are doing.
- Another suggestion is to perhaps compile a list of open problems for us to potentially look at. Maybe could even be done for this year still? I'm just aware there were quite a few open problems we've mentioned in lectures and recitations but I ended up not noting them down at the time, and now wishing that I had! Feel like that could generally encourage more people to start research in this area
- The worksheets many times left a mystery; wish we could work on it more.
- As it was all very condensed, I think I got some things mixed up and found it difficult to keep a high level view of what we had seen throughout the course, and a high level picture of how the different proofs/protocols relate, and the correspondance to coding theory.
- The first week I found it slightly frustrating that the recitals were not clearly corrected (another student may give a high level intuition of the solution, which was not always sufficient for me to solve them properly). But this improved a lot the second week.
- the difficulty explaining my work over zoom and jamboard
- The introductions to lecture topic was too long. I feel that some cuted material could be covered. I thnik that technical part would be easier to understand when on lecture the high level proof is presented and discussed in detail (lemmas and how they give conclusion) and lemmas with hints will be worked on recitations.
- Recitations has been without break (15 min will help) and short - after 15 min introduction only 45 min has been spent working with sheet. 1h15 min recitations will be better.
- too many exercises to solve in one hour via zoom
- Too intense: 5 hours a day for 2 weeks in remote, it is too much.
- It was very dense and challenging. Spreading the lectures a little would give more time to digest the material

3. Any thoughts/comments/suggestions on Course A for Ale?

- None
- Very well delivered
- Nope, it was very good!
- To add the high level of the proof before the full details, to ask us more questions
- Everything was fine
- It's generally a great course. But it'll be great if the pace can be a little bit slower
- No, I prefer reading, so I didn’t attend lectures, just read lecture notes - thanks for them
- Liked it a lot! Not much to say.
- It clearly showed that these were well prepared lectures.
- I felt that the course could have been more cohesive - a lot of the time it seemed as if we were covering a different topic everyday and I didn't see how these topics naturally led to one another (but maybe this was due to a flaw in my understanding). It also would have helped if the parameters of each problem were repeated/placed in context more throughout lecture, because I personally had a hard time keeping track. But the notes made it a lot easier to catch up afterwards on the things that confused me; I really appreciated having those available.
- It was a well run course, it just had the misfortune of being the earliest,
- It was clear and very enlightening.
- Very good speaker, hoped we could have met in person. Great professor, willing to solve any questions.

- No specific suggestions, enjoyed the course :) Well, maybe don't restart your computer before the first lecture next year, haha (thinking back to the initial microphone troubles)
- Tbh, I was keeping track in week 1, but got totally lost starting Day 7. Partly because of my lack of background, and partly because I do not get the motivation behind all these hierarchy computation. It was my bad though; Ale definitely is a fantastic instructor.
- This holds for both courses, but I think it would be neat to have a big diagram (kind of tree?) which shows that among probabilistic proofs we have: IPs which are a subset of PCPs, which are a subset of IOPs. And then to build exponential size PCPs one uses Hadamard (linear) codes, and for poly-size PCPs we need Reed Muller (low degree) codes....
- I guess a concise way of saying the above would be a cheat sheet.
- Also I really liked how in both courses you showed 'attempts' to solve problems, and then explained why they fail to meet our goals
- none
- having access to slides before the lectures would be helpful (to take notes)
- It was very detailed, with a nice pace, very insightful.
- Excellent teaching style, very accessible and open to questions (sometimes too much, it was a bit distracting sometimes have constantly questions by participants that were "out of context" in a sense). It is clear that a lot of time was devoted for the preparation of the course.

4. Any thoughts/comments/suggestions on Course B for Tom?

- None
- Very well delivered
- Nope, it was very good!
- It helps us to follow when you ask questions, and that you say "now we will see a useful trick" also super important
- Everything was fine. Maybe one thing to mention is that notation L^{2^r} in FRI lectures was a bit confusing, as well as the fact that we require that the domain should remain closed under taking negatives after squaring. This all probably should be covered by the fact that we take L to be smooth multiplicative subgroup, but it wasn't very clear from the start, and I think it would be good to say what is that we require of L, and that such L can indeed be chosen. As far as I remember, those points were also missing in the lecture notes.
- It's generally a great course.
- No, I prefer reading, so I didn’t attend lectures, just read lecture notes - thanks for them
- This one I found harder to follow for some reason, but I cannot really say why - somehow the arguments seemed less natural/intuitive.
- The pre-lecture comments were interesting. Tom was more visibly excited about his topics, and enjoyed talking about it. But perhaps due to that, it also seemed to go a bit faster. (At times too fast for me, especially the robuts PCP and PCPP parts.) Asking the audience questions helped slow down, but often answers directly jumped to the final result and the "naive" answers had to be squeezed in.
- I liked the emphasis on trying to build up to the material following intuition. However, sometimes I felt this came at the cost of concrete examples and definitions. I think being more clear about the notation and the different quantities begin analyzed might have helped me follow better. I also would have liked to have a more detailed overview of what the different lectures covered and how they would fit together at the beginning. But overall I really enjoyed this class!
- the real world examples and connections were great
- Very interesting. One suggestion: spend less time on basic notions (like univariate polynomials) and more time on advanced concepts, technical proofs etc.
- Very motivating. He looked very humble yet full of wisdom. Good communicator.
- Same here, enjoyed the lectures!

- I really enjoyed it!
- same as course A
- none
- A bit cumbersome explanations.
- Technical parts (FRI, low degree testing) have benn fast. You spent a lot (too much in my opinion) time explaining high level overview of intuition and short time explaining high level proof overview (for example how 3 lemma from linearity testing lecure gives final conclusion).
- not really
- There were too many times where Tom spent too much time explaining some really basic things. More than 30 minutes to say that a polynomial of degree d is determined by d+1 values.... Come on.
- Besides, we dived into horrible technicalities regarding soudness.
- I seemed to me very unbalanced to me.
- Excellent communicator and teaching style. The love for the field from Tom was crystal clear and this excitement was transmitted to the participants during the lectures. Makes the "magic" of the field shine.

5. Who were the TAs in your recitations?

- Nick and Marcel - 12
- Gal and Inbal - 12

6. Any thoughts/comments/suggestions for Gal or Nick (recitations for Course A)?

- Nick: When a group gave an answer that was natural to you and them, sometimes you move through it a bit fast or in a vague manner (some others you realized and went back), and then it became difficult to follow you. But is a minor thing, you help was super useful and you did a great job.
- Well delivered
- Nick was awesome. I learned a lot from him during recitations
- Excellent!
- Nope. Separate thanks for PZKIPCP problem from A7 worksheet, it was interesting to think on.
- Gal is a good TA.
- It was great. The last recitation could be more interactive
- Gal was good, perhaps sometimes the explanations were slightly obscure for the ones without much background.
- The refreshers were really useful and necessary. Announcing breakout-room-time-left and not cancelling the countdowns in the second week was very helpful too.
- I liked the format of recitations and found it very helpful!
- No
- Give some corrections of the problems a few day after?
- Right to the point, helpful.
- A suggestion to let the breakout 1-minute closing timer to run its course - it's good to have even that 1-minute warning before the breakout rooms closing, and especially at the start, I think you (Nick) may have chosen an option that just closes the rooms without timer (I'm assuming) which was a little abrupt.
- I also felt that working through a problem as one big group that we did in the last recitation was harder to engage with somehow - though that may have been partially that it was my last ever recitation and a Friday. Still, I feel like working in our small groups tends to put us under more pressure (of a positive kind) to fully engage with a problem.

- But other than these things, it was all good. Thought asking different groups in turns to provide an answer to a problem was a good idea!
- Nick is really helpful, just the presentation part is a bit scary and if we do not have a solution we are all quite upset.
- It would have been nice if there were solutions written out on the TAs ipad, so that at the end of the session, after a group has provided a candidate solution, they can show a clean (and less hand-wavy) formulation of the solution, without spending too much time on it (then those who want a solution can take a screenshot I guess)
- none
- Great
- nothing to suggest
- It was nice.
- Absolutely amazing. Very helpful, communicated much enough to guide/help but not too much to spoil solutions.

7. Any thoughts/comments/suggestions for Inbal or Marcel (recitations for Course B)?

- Marcel: In some explanations, you move back and forward a lot when you think something new should be said or could be related. It creates a bit of confusion and sometimes made me missed the point. Again, is a small thing (that comes from nothing but super good intentions) compared to how good your help was.
- The questions were really hard!
- Marcel was very nice and energetic
- Excellent!
- It would be nice to have written definitions of PCPP and stuff in B9 worksheet. Marcel had said in the beginning of a recitation what they are, but it was a little hard to catch by ear. This been said, it was a lovely section, thanks.
- Inbal is a good TA :)
- You are very open and friendly, it’s great
- Inbal was great, nothing else to say.
- The refreshers were really useful and necessary. Having some written solutions/sketches is great too.
- I found recitations very useful and liked how the atmosphere made it easy to ask questions!
- They were great! engaging and helpful
- Give some corrections of the problems a few day after?
- She gave us good directions for our exercises.
- Can't think of anything, it all seemed good :)
- Marcel is clearly very passionate and I definitely enjoyed his office hours!
- Similar to the above, but during the second week our TA kind of did it anyhow.
- none
- Great
- nothing to suggest
- It was nice.
- Same answer. Absolutely amazing. Very helpful, communicated much enough to guide/help but not too much to spoil solutions.

8. What did you learn that was most interesting to you?

- I think the entire story line in general terms: where different systems come from, which issues they overcome and how they relate to each other. I was familiarized with some parts of the

syllabus and the school made me asked new questions and settle previous knowledge. In particular, the recitations were especially helpful for the former.

- The IP for checking that an automata outputs a certain value, right at the end of course A
- There are so many options, but if I have to choose one, I'll choose the sumcheck protocol.
- linearity testing
- Hard to tell, I don't have much background knowledge in the area. For me simply learning IP's and PCP's, and stuff like ZP was quite interesting. It was also good to have, albeit cursory, transition to the research frontier problems. I was mentioning this in the slack, but just once again, I, and I suppose others as well, would appreciate if you would be able to make a short list of semi-research problems, in case we want to try ourselves in this area.
- PCP theorem
- The theory of PCP / IOP
- Hard to say… the whole course was very interesting. I liked that you said so much about complexity classes, not only protocols and technicalities
- General understanding of the complexity classes and the relationships between each other.
- The magic of low degree polynomials and its ramifications especially sumcheck and delegation of computation.
- The idea of using polynomials to "compress" information in various contexts (like using a small amount of randomness to combine equations for the low-degree extension pcp) was really cool!
- My study buddies and I used to call the homework we turned in our "zero knowledge proofs" so sharing what I learned in the course with them was my pet project and favorite part
- I think that the basic building blocks were the most interesting to me. For example, I feel that the whole two weeks were worth it just because now I understand ths sumcheck and FRI protocols.
- Don't take this as a discouragement for teaching the less badic things - this is important and interesting as well!
- Relations with cryptography
- Think I still need to fully process the material because it was obviously quite intense and all new to me. I felt that I've generally learnt the way of thinking about these sorts of things, and it was definitely great to have this exposure. Currently considering going over the lectures again and seeing if there's an open problem I'd like to pick up and have a bit of a go at
- All Tom's lectures!
- understanding the relation between coding theory and probabilistic proofs, and also understanding the 'recipe' for building PCPs
- Zero knowledge proofs
- Recent IoP (like FRI), technicalities of linearity testing, understanding complexity theory landscape od IP/PCP/IoP.
- Background about PCPs and arithmetization techniques.
- A glimpse to PCP constructions (which before I only knew in very high level) and appreciation of formal models: being more into crypto it was very insightful to see the information theoretic part of known constructions and understand how much this separation helps progress the field.