MSRI Mathematical Sciences Research Institute

Connections for Women:
Model Theory and Its Interactions with Number Theory and Arithmetic Geometry

February 10 - 11, 2014

MSRI, Berkeley, CA, USA

Organizers:

Kirsten Eisentraeger (Pennsylvania State University)

Julia Gordon (University of British Columbia)

Deirdre Haskell (McMaster University)

Connections for Women Workshop
Model theory, number theory and arithmetic geometry

Final Report

Organizers

Kirsten Eisenträger, Penn State University
Julia Gordon, University of British Columbia
Deirdre Haskell, McMaster University, chair

Speakers

Senior (50 minute talks)

Maria Carrizosa (Université Lyon 1)
Mei-Chu Chang (University of California)
Zoé Chatzidakis (Centre National de la Recherche Scientifique (CNRS))
Kirsten Eisentraeger (Pennsylvania State University)
Ju-Lee Kim (Massachusetts Institute of Technology)
Rachel Pries (Colorado State University)

Junior (40 minute talks)

Nir Avni (Northwestern University)
Holly Krieger (Massachusetts Institute of Technology)
Jennifer Park (Massachusetts Institute of Technology)
Margaret Thomas (Universität Konstanz)

Description and Goals of the Workshop

The development of model theory has always been influenced by its potential applications. Recent years have seen remarkable flowering of that development, with many exciting applications of model theory in number theory and arithmetic geometry. The MSRI program Model Theory and its Interactions with Number Theory and Arithmetic Geometry began with an Introductory Workshop, followed by the Connections for Women workshop.

Our goal was to highlight the contributions of women in the fields by having them present research talks building on the introductory talks from the week before. We also hoped to encourage connections among women, between junior and senior researchers, and between researchers woking in a wide variety of areas which find common ground through model theory. We focused, in particular, on the contributions of women and underrepresented minority mathematicians, to provide role models for junior researchers and examples for everyone. Many people were able to come to both workshops, partly aided by the coordination between us and the organizers of the Introductory Workshop and the decision to share support of participants.

The topics of the workshop and program were very broad, so our speakers represented a wide array of research areas. We were careful to ensure that each junior speaker was

supported by a senior speaker in the same area, although often their talks were extremely different. The research areas were also represented during the Introductory Workshop, so the speakers could assume the audience had had at least some exposure to the topic.

Presentations

Model theory of fields, algebraic dynamics Zoé Chatzidakis, Holly Krieger

Chatzidakis gave a very beautiful talk, explaining the model theoretic notion called the canonical base property in its context in complex manifolds and differential algebraic varieties. Krieger looked at the problem of when a dynamical system on a complex algebraic variety might exhibit interesting behavior.

Definability in number theory Kirsten Eisenträger, Jennifer Park

Eisenträger reviewed the current state of knowledge of undecidability results, and presented a recent theorem which shows that there are large complementary subrings of number fields K for which Hilbert's tenth problem is undecidable. There was some discussion about whether the divisibility sequences coming from elliptic curves that are used in the proof can be replaced with sequences related to dynamical systems, in particular forward orbits.

Jennifer Park explained the central ideas in her recent proof that the ring of integers in a number field is universally definable. There was some discussions about the implications of this result and whether it was possible to use similar methods to show that the integers are universally definable in number fields as well.

Diophantine geometry Maria Carrizosa, Margaret Thomas

Carrizosa and Thomas both spoke about the general area of finding rational points on varieties. Carrizosa spoke about one approach for tackling the Zilber-Pink conjecture, using ideas that tie it to the Lehmer conjecture. There was some discussion about what is known for heights of algebraic numbers in general number fields, which is the original Lehmer Problem, and about approaches by Dobrowolski to prove this conjecture.

Thomas spoke about recent results on bounding the density of the sets of rational and algebraic points on transcendental sets, using properties of sets definable in o-minimal structures.

Motivic integration in representation theory of p-adic groups Ju-Lee Kim, Nir Avni

Kim spoke about the transfer principle, based on model theory and motivic integration, that allows to transfer statements between local fields of characteristic zero and of finite characteristic, and its applications in harmonic analysis of p-adic groups. In particular, this method lead to the transfer of the Fundamental Lemma of the Langlands Program from finite characteristic to characteristic zero by R. Cluckers, T. Hales and F. Loeser.

The subject of Avni's talk was a question that goes back to Frobenius, about the sequence of dimensions of representations of a family of finite groups obtained by taking $\mathbb{Z}/p^n\mathbb{Z}$-points of an algebraic group. Avni spoke about the generating function for the moments of this sequence, which turns out to be a kind of zeta-function, and the new insights that motivic integration provides into the behaviour of these zeta-functions.

Algebraic combinatorics Mei-Chu Chang

Chang spoke about recent results in counting points in varieties over finite fields. Her results were motivated by a conjecture of Poonen about points on subvarieties of a semiabelian variety which are defined over a finite field.

Arithmetic Geometry Rachel Pries

Pries contrasted the case of characteristic 0 with characteristic p for several different properties of curves. She used Artin-Schreier curves to illustrate approaches to dealing with the more difficult characteristic p case.

Other Activities

Non-strictly-mathematical aspects of the program included a panel discussion and a dinner for the female participants. The panel was on the topic of *Transitions*, with panelists Deirdre Haskell (moderator), Rachel Pries, Christelle Vincent and Carol Wood representing a diversity of age and experience. They spoke to the topic of transitions especially at the graduate student to postdoctoral level, but also to transitioning between different aspects of one's career. Since several people in the audience had just started a postdoc or were graduate students about to start a postdoc in the fall, there were many questions and comments from the audience about how best to use those postdoctoral years to be successful when applying for tenure-track positions. Many people commented on finding the panel interesting and useful, and some of the conversations that were started during the panel were continued during the dinner. The dinner was enjoyed by all, and we found it refreshing to attend a dinner with thirty-five women.

Organizers

First	Last	Institutions
Kirsten	Eisentraeger	Pennsylvania State University
Julia	Gordon	University of British Columbia
Deirdre	Haskell	McMaster University

Speakers

First	Last	Institutions
Nir	Avni	Northwestern University
Maria	Carrizosa	Universite Lyon 1
Mei-Chu	Chang	University of California
Zoe	Chatzidakis	Centre National de la Recherche Scientifique (CNRS)
Kirsten	Eisentraeger	Pennsylvania State University
Ju-Lee	Kim	Massachusetts Institute of Technology
Holly	Krieger	Massachusetts Institute of Technology
Jennifer	Park	Massachusetts Institute of Technology
Rachel	Pries	Colorado State University
Margaret	Thomas	Universitat Konstanz
Bianca	Viray	Brown University

MSRI Mathematical Sciences Research Institute

Connections for Women:
Model Theory and Its Interactions with Number Theory and Arithmetic Geometry

February 10-11, 2014

Schedule

Monday, February 10, 2014			
9:00AM - 9:15AM	Simons Auditorium		Welcome
9:15AM - 10:15AM	Simons Auditorium	Rachel Pries	Galois covers in positive characteristic
10:15AM - 10:45AM	Atrium		Tea
10:45AM - 11:45PM	Simons Auditorium	Kirsten Eisentraeger	Hilbert's Tenth Problem and Mazur's conjectures in large subrings of number fields
11:45AM - 12:30PM	Simons Auditorium	Jennifer Park	A universal first-order formula for the ring of integers inside a number field
12:30PM - 2:00PM	Atrium		Lunch
2:00PM - 3:00PM	Simons Auditorium	Maria Carrizosa	Lehmer problem and applications
3:00PM - 3:30PM	Atrium		Tea
3:30PM - 4:15PM	Simons Auditorium	Margaret Thomas	Counting algebraic points on definable sets
4:15PM - 5:15PM	Simons Auditorium		Panel Discussion
6:30PM - 8:30PM			Dinner at "Taste of Himalayas"

Tuesday, February 11, 2014			
9:00AM - 10:00AM	Simons Auditorium	Ju-Lee Kim	Model theory and harmonic analysis on p-adic groups
10:00AM - 10:30AM	Atrium		Tea
10:30AM - 11:15AM	Simons Auditorium	Nir Avni	Uniformity in representation theory
11:15AM - 12:15PM	Simons Auditorium	Zoé Chatzidakis	Around the Canonical Base Property
12:15PM - 2:15PM	Atrium		Lunch
2:15PM - 3:00PM	Simons Auditorium	Holly Krieger	The geometry of algebraic dynamical systems
3:00PM - 3:30PM	Atrium		Tea
3:30PM - 4:30PM	Simons Auditorium	Mei-Chu Chang	Multiplicative orders on varieties

Participants		
First	**Last**	**Institutions**
Uri	Andrews	University of Wisconsin
Francesca	Balestrieri	University of Oxford
Eliana	Barriga Turriago	Universidad de los Andes
Jennifer	Berg	University of Texas
Julie	Bergner	University of California
Ozlem	Beyarslan	Bogazici University (University of the Bosphorus)
Anton	Bobkov	University of California, Los Angeles
Santiago	Camacho	University of Illinois at Urbana-Champaign
Juan Diego	Caycedo	Albert-Ludwigs-Universitat Freiburg
Artem	Chernikov	Institut de Mathematiques de Jussieu - Paris Rive Gauche
Derya	Ciray	Universitat Konstanz
Georges	Comte	Universite de Savoie (Chambery)
Gabriel	Conant	University of Illinois
Annalisa	Conversano	Massey University
Gregory	Cousins	University of Notre Dame
Reid	Dale	University of Washington
Paola	D'Aquino	Seconda Universita di Napoli
Francoise	Delon	Centre National de la Recherche Scientifique
Antoine	Ducros	Universite Paris VI
Taylor	Dupuy	University of California, Los Angeles
ESTHER	ELBAZ	Universite de Paris VII (Denis Diderot)
Arthur	Forey	Ecole Normale Superieure
James	Freitag	University of California, Berkeley
Natalia	Garcia	Queen's University
Alia	Hamieh	Queen's University
Gwyneth	Harrison-Shermoen	UC Berkeley Math Faculty
Nadja	Hempel	Universite Claude-Bernard (Lyon I)
Martin	Hils	Universite de Paris VII (Denis Diderot)
Meng-Che	Ho	University of Wisconsin
Franziska	Jahnke	Westfalische Wilhelms-Universitat Munster
Alena	Jassova	University of Liverpool
Seongmin	Jeong	Yonsei University
Mary	Karker	Wesleyan University
Charlotte	Kestner	University of Central Lancashire
Hirotaka	Kikyo	Kobe University
Alex	Kruckman	University of California, Berkeley
Therese	Landry	San Francisco State University
Eva	Leenknegt	Purdue University
Francois	Loeser	Universite de Paris VI (Pierre et Marie Curie)
Yun	Lu	Kutztown University of PA
Maryanthe	Malliaris	University of Chicago
Jana	Marikova	Western Illinois University
David	Marker	University of Illinois
Florent	Martin	Universite de Lille I (Sciences et Techniques de Lille Flandres Artois)
Jean-Francois	MARTIN	Ecole Normale Superieure
Niki Myrto	Mavraki	University of British Columbia
Samaria	Montenegro-Guzman	Universite de Paris VII (Denis Diderot)
Victoria	Noquez	University of Illinois

Paige	North	University of Cambridge
Marina	Papkovich	Polotsk State University
Rehana	Patel	Olin College of Engineering
Kripalini	Pillai	Cochin University of Science and Technology
Francoise	Point	Universite de Mons
Nathalie	Regnault	Universite Libre de Bruxelles
Silvain	Rideau	Ecole Normale Superieure
Harry	Schmidt	Universitat Basel
Dr. Abha	Singhal	University of Rajasthan
Suresh	Srinivasamurthy	Kansas State University
Sergei	Starchenko	University of Notre Dame
Caroline	Terry	University of Illinois at Chicago
Ha	Tran	Universita degli Studi di Roma "Tor Vergata"
Christelle	Vincent	Stanford University
Somayeh	Vojdani	University of Notre Dame
Paul	Vojta	University of California, Berkeley
Michael	Wan	University of California, Berkeley
Carol	Wood	Wesleyan University

Officially Registered Participant Information

Participants		**68**

Gender		**68**
Male	39.71%	27
Female	60.29%	41
Declined to state	0.00%	0

Ethnicity*		**68**
White	63.24%	43
Asian	16.18%	11
Hispanic	5.88%	4
Pacific Islander	0.00%	0
Black	0.00%	0
Native American	0.00%	0
Mixed	2.94%	2
Declined to state	11.76%	8

* ethnicity specifications are not exclusive

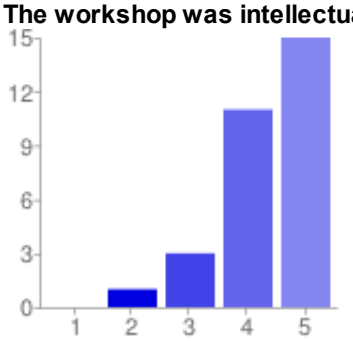
This form will soon be upgraded to the new version of Google Forms. Learn more.

30 responses

Summary See complete responses

Workshop assessment

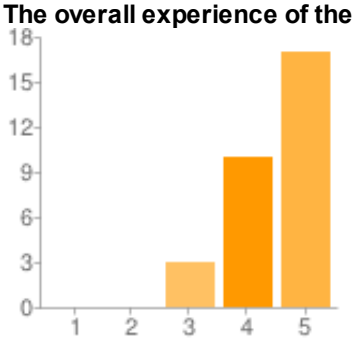
The workshop was intellectually stimulating



Not at all Very

1 -	Not at all	**0**	0%
2		**1**	3%
3		**3**	10%
4		**11**	37%
5 -	Very	**15**	50%

The overall experience of the workshop was worthwhile

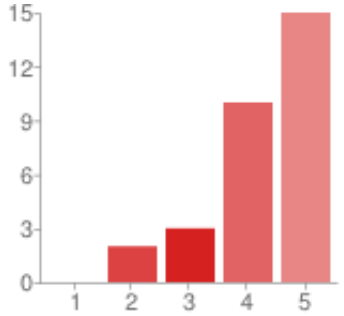


Not at all Very

1 -	Not at all	**0**	0%
2		**0**	0%
3		**3**	10%
4		**10**	33%
5 -	Very	**17**	57%

The time between lectures was adequate for discussion

1 -	Not al all	**0**	0%
2		**2**	7%
3		**3**	10%
4		**10**	33%
5 -	Very	**15**	50%



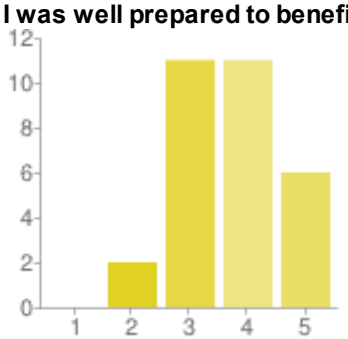
Not al all Very

Additional comments on the workshop organization

fabulous coming after the intro workshop it was good to see areas of application of model theory Excellent Compared to last week conference, I felt there could have been more unity in the subjects. May ...

Personal assessment

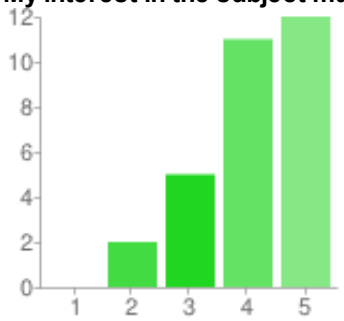
I was well prepared to benefit from the lectures



Not at all Very

1 -	Not at all	**0**	0%
2		**2**	7%
3		**11**	37%
4		**11**	37%
5 -	Very	**6**	20%

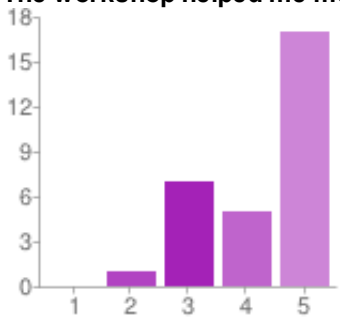
My interest in the subject matter was increased by the workshop



1 -	Niot at all	**0**	0%
2		**2**	7%
3		**5**	17%
4		**11**	37%
5 -	Very	**12**	40%

Niot at all Very

The workshop helped me meet people with similar scientific interests



Not at all Very Much

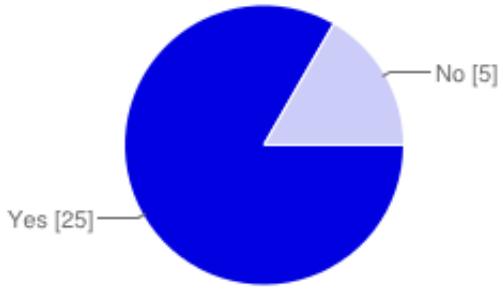
1 -	Not at all	**0**	0%
2		**1**	3%
3		**7**	23%
4		**5**	17%
5 -	Very Much	**17**	57%

Additional comments on your personal assessment

The subject material was broad and it did not seem easy to make scientific connections between the model theory and the number theory (and model theorists and number theorists). This workshop was muc ...

Additional Activities

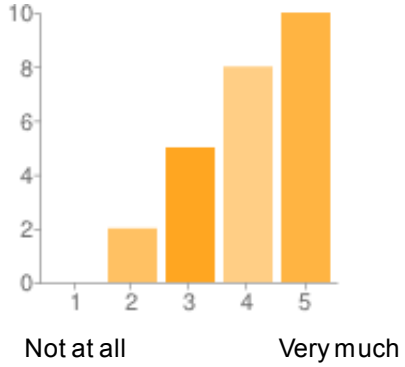
Did you attend the panel discussion?



Yes	**25**	83%
No	**5**	17%

If you did attend the panel discussion, did you find it worthwhile?

1 -	Not at all	**0**	0%
2		**2**	7%
3		**5**	17%

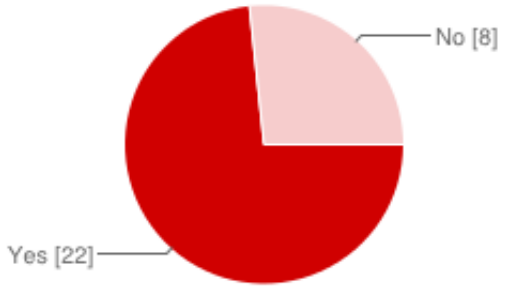


4		**8**	27%
5 -	Very much	**10**	33%

What other subjects should be addressed in future panel discussions?

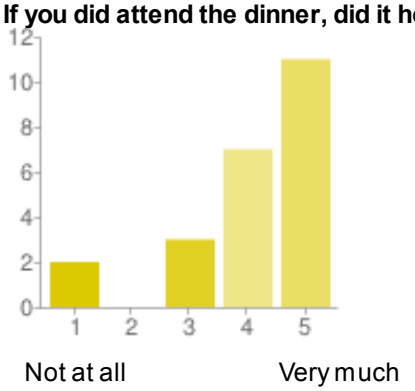
Contributions between mathematicians The emphasis was on north amercican women mathematical experience; it could have been more balanced with other continents. Also the fact that these women did math ...

Did you attend the dinner?



Yes	**22**	73%
No	**8**	27%

If you did attend the dinner, did it help to solidify the contacts you made in the workshop?



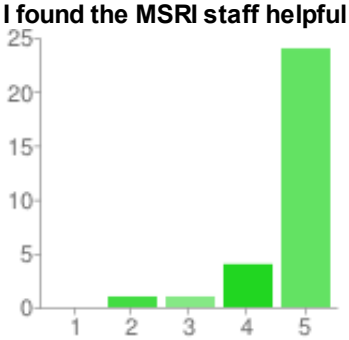
1 -	Not at all	**2**	7%
2		**0**	0%
3		**3**	10%
4		**7**	23%
5 -	Very much	**11**	37%

Please provide any comments on the dinner

too little food for so many Excellent Food was not the best... The "only women" dinner was unnecessary. Excellent the atmosphere was convivial The restaurant was very average and not well equipped to han ...

Venue

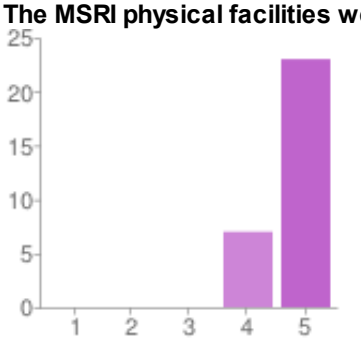
I found the MSRI staff helpful



Not at all Very

1 -	Not at all	**0**	0%
2		**1**	3%
3		**1**	3%
4		**4**	13%
5 -	Very	**24**	80%

The MSRI physical facilities were conducive for such a workshop

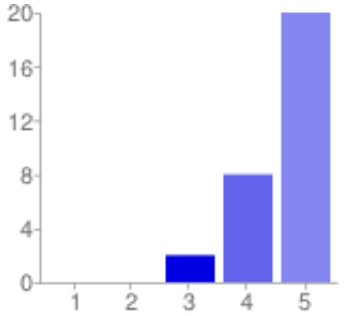


Not at all Very

1 -	Not at all	**0**	0%
2		**0**	0%
3		**0**	0%
4		**7**	23%
5 -	Very	**23**	77%

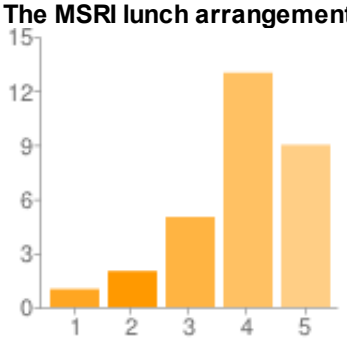
The MSRI computer facilities were adequate for such a workshop

1 -	Not at all	**0**	0%
2		**0**	0%
3		**2**	7%
4		**8**	27%
5 -	Very	**20**	67%



Not at all Very

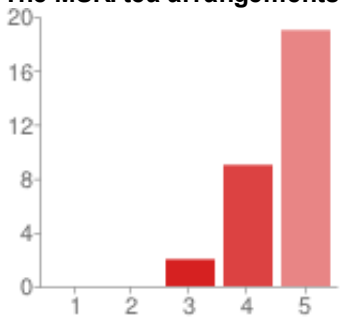
The MSRI lunch arrangements were satisfactory



Not at all Very

1 -	Not at all	**1**	3%
2		**2**	7%
3		**5**	17%
4		**13**	43%
5 -	Very	**9**	30%

The MSRI tea arrangements were satisfactory



Not at all Very

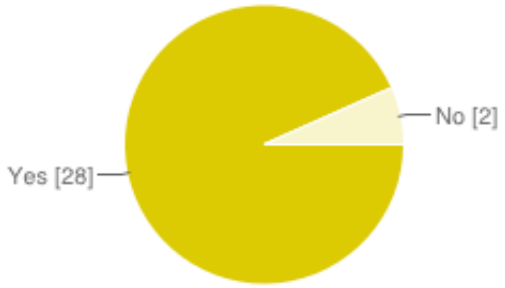
1 -	Not at all	**0**	0%
2		**0**	0%
3		**2**	7%
4		**9**	30%
5 -	Very	**19**	63%

Additional comments on the venue

Heating was a problem. The lunch caterers are not very good. Thanks a lot not enough vegetarian sandwiches It is a pleasure to be at MSRI.

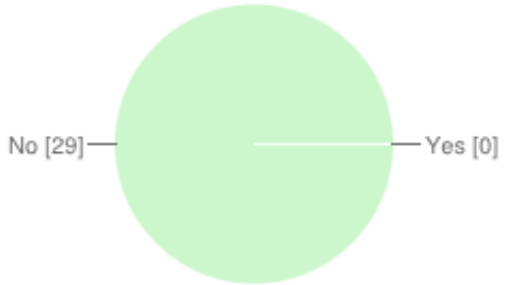
MSRI Wireless Network

Did you use MSRI's wireless network?



Yes	**28**	93%
No	**2**	7%

Did you experience any difficulties with the network?



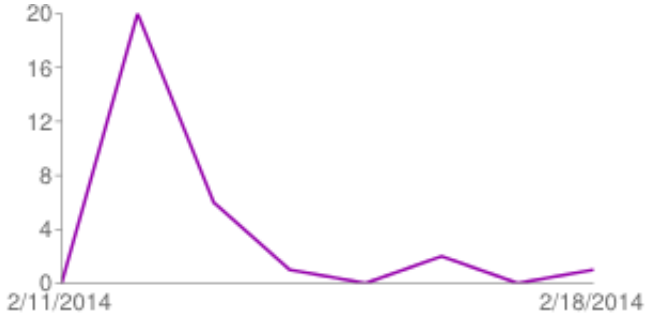
Yes	**0**	0%
No	**29**	97%

If you did experience difficulties with the network, please explain:

Thank you for completing this survey

We welcome any additional comments or suggestions you may have to improve the overall experience for future participants.

Number of daily responses


20
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February 10 - 11, 2014

Additional Survey Responses

Additional comments on your personal assessment

- The subject material was broad and it did not seem easy to make scientific connections between the model theory and the number theory (and model theorists and number theorists).
- This workshop was much more heavily focused on number theory and arithmetic geometry than model theory (in contrast with the previous week, which focused more on model theory). As a "pure" model theorist, I didn't get as much out of the talks.
- Excellent
- I did know some of the subjects but some talks were a bit too technical for me.

Additional comments on the venue

- Heating was a problem.
- The lunch caterers are not very good.
- Thanks a lot
- not enough vegetarian sandwiches
- It is a pleasure to be at MSRI.

We welcome any additional comments or suggestions you may have to improve the overall experience for future participants.

- none

If you did experience difficulties with the network, please explain:

- none

What other subjects should be addressed in future panel discussions?

- Contributions between mathematicians
- The emphasis was on north amercican women mathematical experience; it could have been more balanced with other continents. Also the fact that these women did mathematics and something else wasn't clear from the discussion.
- Funding for young researchers

Please provide any comments on the dinner

- too little food for so many
- Excellent
- Food was not the best...
- The "only women" dinner was unnecessary.
- Excellent
- the atmosphere was convivial
- The restaurant was very average and not well equipped to handle the crowd
- It is offensive that the one male speaker was not invited to the diner.

Additional comments on the workshop organization

- Fabulous
- coming after the intro workshop it was good to see areas of application of model theory
- Excellent
- Compared to last week conference, I felt there could have been more unity in the subjects. Maybe it would have been better to extract the talks wich could have fitted with last week conference and inserted within last week schedule.
- It was a bit tiring to have two workshops back to back, though this had obvious advantages for shorter term visitors.
- It would be much better if the workshop were held on the weekend before after the introductory workshop. It is very difficult for anyone to get away for a week and a half at the beginning of the semester.