

**Joint Introductory Workshop: Cluster
Algebras and Commutative Algebra**

August 27 to September 7, 2012

MSRI, Berkeley, CA, USA

Organizers:

David Eisenbud* (University of California, Berkeley)

Bernhard Keller (Universit´e Paris VII, France)

Karen Smith (University of Michigan)

Alexander Vainshtein* (University of Haifa, Israel)

CLUSTER ALGEBRAS AND COMMUTATIVE ALGEBRAS: JOINT INTRODUCTORY WORKSHOP REPORT

ORGANIZERS:

DAVID EISENBUD (BERKELEY), BERNHARD KELLER (PARIS),
KAREN SMITH (MICHIGAN), ALEK VAINSHTEIN(HAIFA)

1. STRUCTURE OF THE WORKSHOP

Cluster algebras are commutative algebras—subalgebras of a field of rational functions—with a special structure, a set of generators of a very special-looking form. Ignited by work of Fomin and Zelevinsky, there has been an explosion of activity around them. The impetus to study this structure came originally from Lie theory, but it has turned out to be present in an amazing variety of applications, from Teichmüller theory and triangulations of surfaces to representation theory and Poisson geometry, to name just those subjects that were touched upon in the workshop.

Curiously, one way in which Cluster algebras have *not* been studied very much is... as algebras. The theory is hardly known in the commutative algebra community, and those studying cluster algebras have not made much use of the great storehouse of information about commutative algebra. Part of the impetus for the choice of the two programs at MSRI this semester was the opportunity to bring these two fields closer together, and thus it seemed to us particularly appropriate to make a joint introductory workshop, with sequences of lectures that would introduce each side to the other (and also be particularly appropriate for the mathematicians who attend the introductory workshops as relative outsiders to the fields of the programs.

We felt this arrangement was quite successful. Each “side” fielded 6 minicourses starting from quite an elementary point and developing to the frontiers of the field. As an example of successful interaction between the two communities, let us mention that commutative algebraist Karen Smith was able to answer a question raised in the lecture of Sergey Fomin regarding whether suitable cluster algebras are free over the subalgebra generated by their frozen variables. This led to a series of interesting conversations between Smith and Greg Muller, with input from Fomin, Tucker, and Miller, regarding whether or not certain cluster algebras might be F -regular. There is much potential for further collaboration between commutative algebraists and cluster algebraists which could lead to a better understanding of some of the commutative algebraic properties of cluster algebras.

As a mechanism for mentoring and connecting some of the postdocs, commutative algebraists assigned a postdoc “assistant” to each lecturer giving a minicourse. Assistants ran some “tutorial” sessions or assisted in preparation of notes. This gave the assistants a direct collaborative contact with the senior lecturers, and helped them focus on the area of

one of the courses (the organizers were quite careful that the pairings made mathematical sense, but also worked to avoid pairing postdocs with senior mathematicians they already knew well.) Both the postdocs and the senior appreciated these arrangements.

2. MINI-COURSES

2.1. Commutative Algebra.

Craig Huneke (University of Kansas): Introduction to Uniformity in Commutative Algebra. Two of the most important theorems in commutative algebra were proved by Hilbert: the Hilbert Basis Theorem (Frank Schreyer will be giving a proof of this theorem) and the Hilbert Syzygy theorem. Huneke began with the novel point of view on these theorems as avatars of the theme of uniformity in commutative algebra. His first lecture discussed resolutions and some of conjectured uniformity results on regularity and projective dimension.

In his second lecture Huneke shows how uniformity plays an important role in the technique of reduction to characteristic p , and illustrated with a proof of a theorem of Zariski and Nagata concerning multiplicities

Huneke's third lecture was devoted to uniform questions concerning symbolic powers which build on the work of Zariski and Nagata. He discussed problems motivated by combinatorics, geometry and algebra

Karen Smith (University of Michigan): Introduction to Frobenius splitting. Smith began by reviewing the famous Hochster-Roberts theorem, which states that when a linearly reductive group acts linearly on a polynomial ring, the resulting ring of invariants is a Cohen Macaulay ring. The key idea in proof is the idea of splitting. She defined what it means for a homomorphism of rings to split and give many examples of the power of this idea. In characteristic p , the splitting of the Frobenius map has especially nice consequences. The closely related notion of F -regularity is the power behind the proof of the Hochster Roberts theorem.

In the second lecture Smith took a global point of view, exploring what it means for a projective variety to be Frobenius split. Frobenius split varieties include Grassmannians, flag varieties, Schubert varieties, Hilbert schemes of points on the projective plane, and many others that arise naturally in representation theory. She demonstrated some of the very strong and yet remarkably easy to prove consequences of Frobenius splitting, including the fact that the higher cohomology groups of any ample line bundle always vanish.

In her last lecture Smith discussed an obstruction to F -regularity called the test ideal. This is a "characteristic p analog" of the multiplier ideal, an important tool in algebraic geometry that was the subject of introductory talks by Rob Lazarsfeld at the special year in commutative algebra 10 years ago at MSRI. As an application, she proved: If P is a radical ideal in a regular ring of characteristic p and dimension d , then the symbolic powers $P^{(nd)}$ are contained in P^n for all n .

Irena Peeva (Cornell University): Infinite free resolutions. There has been a lot of progress on the structure and properties of finite free resolutions. Much less is known about the properties of infinite free resolutions.

Peeva discussed three classes of rings over which infinite free resolutions have nice structures: Complete Intersections, Koszul Rings, and Golod Rings.

Holger Brenner (Universität Osnabrück): Vector bundles and ideal closure operations. Brenner discussed ideal closure operations from the point of view of the interplay between forcing algebras, vector bundles, their torsors. This interplay works best when the closure operation depends only on a cohomology class, which is true for tight closure, plus closure, and Frobenius closure under mild conditions.

The lectures emphasized the case of graded normal rings of dimension two, which correspond to smooth projective curves. He showed how the theory of curves and their vector bundles was used to obtain results about these closure operations.

Frank-Olaf Schreyer (Universität des Saarlandes): Syzygies, finite length modules, and random curves. In his first lecture, Schreyer reviewed the Gröbner basis proof of Hilbert syzygy theorem, and applied it to prove Petri's Theorem on the structure of the canonical ring of a Riemann surface.

The second lecture explained the theory of Liaison of space curves and the Hartshorne-Rao module. He illustrated how, from this point of view, one can construct space curves explicitly by constructing finite length modules with prescribed syzygies.

In the final lecture Schreyer explained some classical unirationality proofs of moduli spaces that are now greatly simplified by using computer algebra, and showed how experimental methods lead to theorems of theoretical interest.

Michel van den Bergh (Universiteit Hasselt): Noncommutative resolutions. If R is a local Gorenstein ring then a non-commutative crepant resolution for R is a reflexive R -module M such that the endomorphism ring of M is Cohen-Macaulay as an R -module and has finite global dimension. This turns out to be a sensible generalization of the algebraic geometry concept of a crepant resolution of singularities. Van den Bergh gave background on non-commutative resolutions, and surveyed some of the existence/non-existence results.

2.2. Cluster Algebras.

Sergey Fomin (Michigan): Introduction to cluster algebras. The first lecture reviewed the basic notions of cluster algebra theory: its original motivations (total positivity and canonical bases), quiver and seed mutations, cluster algebras of geometric type, and the key example of an affine base space of type A .

The second lecture surveyed the fundamental structural results of cluster theory: the Laurent phenomenon; cluster monomials and additive bases; the cluster complex and the exchange graph; finite type classification; and generalized associahedra.

The third lecture was devoted to two main topics: first, Zamolodchikov periodicity and its proof for the type (A,A) case using cluster structures in Grassmannians; second, the

general setting of cluster algebras over an arbitrary semifield, including general Y-patterns and separation of additions.

Bernhard Keller (Paris 7): Quiver representations and cluster algebras This course began with an introduction to the representation theory of quivers. Keller then introduced the Caldero-Chapoton map, which yields a strong link between cluster variables and the geometry of quiver representations. The further study of this map in more and more general settings naturally led to the introduction of the cluster category and to quivers with potentials following important work by Derksen–Weyman–Zelevinsky.

Bernard Leclerc (Caen): Preprojective algebras and Lie theory. Many interesting and motivating examples of cluster algebras appear in Lie theory as coordinate rings of classical varieties attached to Lie groups and Kac-Moody groups (e.g. Grassmannians, flag varieties, double Bruhat cells, etc.). Some of these examples can be understood by relating them to certain categories of modules over a preprojective algebra. Leclerc explained this mechanism of ‘additive categorification’ and illustrated it on concrete examples.

Idun Reiten (Trondheim): Cluster categories. by Idun Reiten: After a brief introduction to tilting theory and its links to cluster algebras, Reiten introduced cluster categories, which belong to the class of Hom-finite triangulated 2-Calabi-Yau categories that admit a cluster-tilting object. This class also contains stable categories of Cohen–Macaulay modules over certain singularities. Reiten sketched the main results of the theory developed for this class in work by herself, Amiot, Buan, Iyama and many others.

Alek Vainshtein (Haifa): Cluster algebras and Poisson geometry. In the first lecture, Vainshtein introduced Poisson structures compatible with a cluster structure of geometric type and provided a complete characterization of compatible Poisson structures in the case of full rank. As a corollary, he deduced several results on the structure of the exchange graph. He also explained that when the rank is not full, one should consider compatible pre-symplectic structures instead of Poisson ones.

In the second lecture, he described in detail how one recovers a cluster structure on a Grassmannians starting from the standard R-matrix Poisson bracket. A different way to recover this cluster structure is based on Postnikov’s perfect planar networks in a disk.

In the last lecture, Vainshtein extended previous results to perfect planar networks in an annulus. As a corollary, he obtained the full integrability of the generalized pentagram map.

Dylan Thurston (Columbia): Cluster algebras and triangulated surfaces. In the first lecture, Thurston introduced the cluster algebras associated to surfaces, starting from the motivation from hyperbolic geometry.

In the second lecture, he explained how to extend the combinatorics slightly to get a mutationally finite cluster algebra. In fact, such an extension gives all but finitely many mutationally finite cluster algebras of rank > 2 .

In the third lecture, Thurston showed how to get a canonical basis for surface cluster algebras. This basis is conjecturally strongly positive, in the sense that the structure constants for multiplication are all positive.

Organizers

First Name	Last Name	Institution
David	Eisenbud	University of California, Berkeley
Bernhard	Keller	Université de Paris VII (Denis Diderot)
Karen	Smith	University of Michigan
Alek	Vainshtein	University of Haifa

Speakers

First Name	Last Name	Institution
Holger	Brenner	Universitaet Osnabrueck
Bernhard	Keller	Université de Paris VII (Denis Diderot)
Bernard	Leclerc	Université de Caen
Irena	Peeva	Cornell University
Frank	Schreyer	Universität des Saarlandes
Karen	Smith	University of Michigan



Joint Introductory Workshop: Cluster Algebras and Commutative Algebra

August 27 - September 7, 2012

Week One Schedule

Monday, August 27, 2012			
8:45AM - 9:00AM	Simons Auditorium		Welcome
9:00AM - 10:00AM	Simons Auditorium	Sergey Fomin	Introduction to cluster algebras #1
10:00AM - 10:30AM	Atrium		Tea
10:30AM - 11:30AM	Simons Auditorium	Craig Huneke	Introduction to Uniformity in Commutative Algebra #1
11:30AM - 12:30PM	Simons Auditorium	Sergey Fomin	Introduction to cluster algebras #2
12:30PM - 2:00PM	Atrium		Lunch
2:00PM - 3:00PM	Simons Auditorium	Karen Smith	Introduction to Frobenius splitting #1
3:00PM - 3:30PM	Atrium		Tea
3:30PM - 5:00PM	Simons Auditorium		Cluster Algebras Tutorial Session

Tuesday, August 28, 2012			
9:00AM - 10:00AM	Simons Auditorium	Irena Peeva	Infinite free resolutions #1
10:00AM - 10:30AM	Atrium		Tea
10:30AM - 11:30AM	Simons Auditorium	Bernhard Keller	Quiver representations and cluster algebras #1
11:30AM - 12:30PM	Simons Auditorium	Craig Huneke	Introduction to Uniformity in Commutative Algebra #2
12:30PM - 2:00PM	Atrium		Lunch
2:00PM - 3:00PM	Simons Auditorium	Sergey Fomin	Introduction to cluster algebras #3
3:00PM - 3:30PM	Atrium		Tea
3:30PM - 5:00PM	Simons Auditorium		Commutative Algebra Tutorial Session
5:00PM - 7:00PM	Atrium		Reception

Wednesday, August 29, 2012			
9:00AM - 10:00AM	Simons Auditorium	Irena Peeva	Infinite free resolutions #2
10:00AM - 10:30AM	Atrium		Tea
10:30AM - 11:30AM	Simons Auditorium	Bernhard Keller	Quiver representations and cluster algebras #2
11:30AM - 12:30PM	Simons Auditorium	Karen Smith	Introduction to Frobenius splitting #2

Thursday, August 30, 2012			
9:00AM - 10:00AM	Simons Auditorium	Bernhard Keller	Quiver representations and cluster algebras #3
10:00AM - 10:30AM	Atrium		Tea
10:30AM - 11:30AM	Simons Auditorium	Irena Peeva	Infinite free resolutions #3
11:30AM - 12:30PM	Simons Auditorium	Bernard Leclerc	Preprojective algebras and Lie theory #1
12:30PM - 2:00PM	Atrium		Lunch
2:00PM - 3:00PM	Simons Auditorium	Karen Smith	Introduction to Frobenius splitting #3
3:00PM - 3:30PM	Atrium		Tea
3:30PM - 5:00PM	Baker Board Room		Tutorial Session
3:30PM - 5:00PM	Simons Auditorium		Tutorial Session

Friday, August 31, 2012			
9:00AM - 10:00AM	Simons Auditorium	Bernard Leclerc	Preprojective algebras and Lie theory #2
10:00AM - 10:30AM	Atrium		Tea
10:30AM - 11:30AM	Simons Auditorium	Holger Brenner	Vector bundles and ideal closure operations #1
11:30AM - 12:30PM	Simons Auditorium	Bernard Leclerc	Preprojective algebras and Lie theory #3
12:30PM - 2:00PM	Atrium		Lunch
2:00PM - 3:00PM	Simons Auditorium	Frank-Olaf Schreyer	Szygies, finite length modules, and random curves #1
3:00PM - 3:30PM	Atrium		Tea
3:30PM - 5:00PM	Baker Board Room		Tutorial Session
3:30PM - 5:00PM	Simons Auditorium		Tutorial Session



Mathematical Sciences Research Institute

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August 27 - September 7, 2012

Week Two Schedule

Monday, September 03, 2012		LABOR DAY
12:00PM - 4:00PM	Barbeque at Codornices Park	

Tuesday, September 04, 2012			
9:00AM - 10:00AM	Simons Auditorium	Idun Reiten	Cluster categories #1
10:00AM - 10:30AM	Atrium		Tea
10:30AM - 11:30AM	Simons Auditorium	Holger Brenner	Vector bundles and ideal closure operations #2
11:30AM - 12:30PM	Simons Auditorium	Alek Vainshtein	Cluster algebras and Poisson geometry #1
12:30PM - 2:00PM	Atrium		Lunch
2:00PM - 3:00PM	Simons Auditorium	Craig Huneke	Introduction to Uniformity in Commutative Algebra #3
3:00PM - 3:30PM	Atrium		Tea
3:30PM - 4:30PM	Simons Auditorium	Alek Vainshtein	Cluster algebras and Poisson geometry #2

Wednesday, September 05, 2012			
9:00AM - 10:00AM	Simons Auditorium	Holger Brenner	Vector bundles and ideal closure operations #3
10:00AM - 10:30AM	Atrium		Tea
10:30AM - 11:30AM	Simons Auditorium	Idun Reiten	Cluster categories #2
11:30AM - 12:30PM	Simons Auditorium	Frank-Olaf Schreyer	Syzygies, finite length modules, and random curves #2
12:30PM - 2:00PM	Atrium		Lunch
2:00PM - 3:00PM	Simons Auditorium	Alek Vainshtein	Cluster algebras and Poisson geometry #3
3:00PM - 3:30PM	Atrium		Tea
3:30PM - 5:00PM	Baker Board Room		Tutorial Session
3:30PM - 5:00PM	Simons Auditorium		Tutorial Session

Thursday, September 06, 2012			
9:00AM - 10:00AM	Simons Auditorium	Frank-Olaf Schreyer	Syzygies, finite length modules, and random curves #3
10:00AM - 10:30AM	Atrium		Tea
10:30AM - 11:30AM	Simons Auditorium	Idun Reiten	Cluster categories #3
11:30AM - 12:30PM	Simons Auditorium	Michel van den Bergh	Non-commutative resolutions #1
12:30PM - 2:00PM	Atrium		Lunch
2:00PM - 3:00PM	Simons Auditorium	Dylan Thurston	Cluster Algebras and Triangulated Surfaces #1
3:00PM - 3:30PM	Atrium		Tea
3:30PM - 5:00PM	Baker Board Room		Tutorial Session
3:30PM - 5:00PM	Simons Auditorium		Tutorial Session

Friday, September 07, 2012			
9:00AM - 10:00AM	Simons Auditorium	Dylan Thurston	Cluster Algebras and Triangulated Surfaces #2
10:00AM - 10:30AM	Atrium		Tea
10:30AM - 11:30AM	Simons Auditorium	Michel van den Bergh	Non-commutative resolutions #2
11:30AM - 12:30PM	Simons Auditorium	Dylan Thurston	Cluster Algebras and Triangulated Surfaces #3
12:30PM - 2:00PM	Atrium		Lunch
2:00PM - 3:00PM	Simons Auditorium	Michel van den Bergh	Non-commutative resolutions #3
3:00PM - 3:30PM	Atrium		Tea

Participants		
First Name	Last Name	Institution
Ali	Alilooee Dolatabad	Dalhousie University
Kathleen	Ansaldi	University of Notre Dame
Federico	Ardila	San Francisco State University
Spencer	Backman	Georgia Institute of Technology
Karin	Baur	Karl-Franzens-Universität Graz
Arkady	Berenstein	University of Oregon
Christine	Berkesch Zamaere	Duke University
Florian	Block	University of California
Mats	Boij	Royal Institute of Technology (KTH)
Holger	Brenner	Universitaet Osnabrueck
Giulio	Caviglia	Purdue University
Yi-Chang	Chen	University of California
Man-Wai	Cheung	University of California, San Diego
sangmin	chun	Seoul National University
Aldo	Conca	Università di Genova
Amanda	Croll	University of Nebraska
Emanuele	Delucchi	Universität Bremen
Philippe	Di Francesco	Centre d'Etudes Nucleaires de Saclay
David	Eisenbud	University of California
Idan	Eisner	University of Haifa
Juan	Elias	University of Barcelona
Laura	Escobar	Cornell University
Sergio	Estrada	University of Murcia
Sara	Faridi	Dalhousie University
Jiarui	Fei	University of California
Anna	Felikson	Jascobs University Bremen
Xiao	Feng	Michigan State University
Alex	Fink	North Carolina State University
Sergey	Fomin	University of Michigan
Bruce	Fontaine	MSRI - Mathematical Sciences Research Institute
Louiza	Fouli	New Mexico State University
Alexander	Garver	University of Minnesota Twin Cities
Michael	Gekhtman	University of Notre Dame
Courtney	Gibbons	University of Nebraska
Sira	Gratz	Universität Hannover
Stephen	Griffeth	Universidad de Talca
Emily	Gunawan	University of Minnesota Twin Cities
Kangjin	Han	Korea Institute for Advanced Study (KIAS)
Raymond	Heitmann	University of Texas
Aloysius	Helminck	North Carolina State University
Daniel	Hernandez	University of Minnesota Twin Cities
Olga	Holtz	University of California
Ko	Honda	University of Southern California
Jen-Chieh	Hsiao	Purdue University
Craig	Huneke	University of Virginia
Brian	Hwang	California Institute of Technology
Nathan	Ilten	University of California
Rei	Inoue	Chiba University
Srikanth	Iyengar	University of Nebraska-Lincoln
Jack	Jeffries	University of Utah

Tadeusz	Jozefiak	Mathematical Reviews
Arye	Juhasz	Technion
Arye	Juhasz	Technion---Israel Institute of Technology
Thomas	Kahle	ETH Zürich
Rinat	Kedem	University of Illinois at Urbana-Champaign
Bernhard	Keller	Université de Paris VII (Denis Diderot)
Leila	Khatami	Union College--Union University
Youngsu	Kim	Purdue University
Ryan	Kinser	Northeastern University
Robert	Korsan	retired
Olga	Kravchenko	Université Claude-Bernard (Lyon I)
Darla	Kremer	National Science Foundation
Kaie	Kubjas	Freie Universität Berlin
Manoj	Kummini	Chennai Mathematical Institute
Volha	Kushel	TU Berlin
Lisa	Lamberti	Eidgenössische TH Zürich-Zentrum
Philipp	Lampe	Universität Bielefeld
Bernard	Leclerc	Université de Caen
Chul-hee	Lee	Max-Planck-Institut für Mathematik
Matthias	Lenz	TU Berlin
Kuei-Nuan	Lin	University of California
Jichun	Liu	Zhejiang University
Linquan	Ma	University of Michigan
Antonio	Macchia	Università di Bari
Diane	Maclagan	University of Warwick
Jeff	Madsen	University of Notre Dame
Toshiaki	Maeno	Meijo University
Paolo	Mantero	Purdue University
Tom	Marley	University of Nebraska
Robert	Marsh	University of Leeds
Thomas	McConville	University of Minnesota Twin Cities
Jason	McCullough	MSRI - Mathematical Sciences Research Institute
Claudia	Miller	Syracuse University
Ezra	Miller	Duke University
Damien	Mondragon	University of California
Maria	Monks	UC Berkeley Math Faculty
Jonathan	Montano	Purdue University
Sophie	Morier-Genoud	Université de Paris VI (Pierre et Marie Curie)
Gregory	Muller	Louisiana State University
Daniel	Murfet	University of California
Gregg	Musiker	University of Minnesota Twin Cities
Muhammad	Naeem	COMSATS Institute of Information Technology Sahiwal, Pakistan.
Alfredo	Nájera Chávez	Université de Paris VII (Denis Diderot)
Tomoki	Nakanishi	Nagoya University
BHARATH	NARAYANAN	Pennsylvania State University
Patrice	Ntumba	University of Pretoria
Luis	Nunez-Betancourt	University of Michigan
Luke	Oeding	University of California
Christopher	ONeill	Duke University
Rebecca	Patrias	University of Minnesota Twin Cities
Irena	Peeva	Cornell University

Pierre-Guy	Plamondon	Université de Caen
Christopher	PolICASTRO	University of Chicago
Claudia	Polini	University of Notre Dame
David	Pospisil	Karlovy (Charles) University (UK)
claudio	procesi	Accademia Nazionale dei Lincei
You	Qi	Columbia University
Fan	QIN	Université de Paris VII (Denis Diderot)
Claudiu	Raicu	Princeton University
Jenna	Rajchgot	MSRI - Mathematical Sciences Research Institute
idun	reiten	Norwegian University of Science and Technology (NTNU)
Vladimir	Retakh	Rutgers University
Elina	Robeva	University of California
Maria Evelina	Rossi	Università di Genova
dylan	rupel	Northeastern University
Steven	Sam	University of California
Jennifer	Schaefer	Dickinson College
Frank	Schreyer	Universität des Saarlandes
Alexandra	Secoleanu	University of Nebraska
Liana	Sega	University of Missouri
Anurag	Singh	University of Utah, Department of Mathematics
Karen	Smith	University of Michigan
Suresh	Srinivasamurthy	Kansas State University
Salvatore	Stella	Northeastern University
Jan	Stovicek	Karlovy (Charles) University (UK)
Kaisa	Taipale	MSRI - Mathematical Sciences Research Institute
Kelli	Talaska	University of California
Geetha	Thangavelu	The Institute of Mathematical Sciences, Chennai, India
Hugh	Thomas	University of New Brunswick
Howard	Thompson	University of Michigan
Dylan	Thurston	University of California
Gordana	Todorov	Northeastern University
Jan	Trlifaj	Karlovy (Charles) University (UK)
Kevin	Tucker	Princeton University
Pavel	Tumarkin	University of Durham
Bernd	Ulrich	Purdue University
Alek	Vainshtein	University of Haifa
Yadira	Valdivieso Diaz	Universidad Nacional de Mar del Plata
Michel	Van den Bergh	Limburgs Universitair Centrum
Matteo	Varbaro	Università di Genova
Emanuele	Ventura	Università di Catania
Roger	Wiegand	University of Nebraska
Sylvia	Wiegand	University of Nebraska
Lauren	Williams	UC Berkeley Math Faculty
Nathan	Williams	University of Minnesota Twin Cities
Emily	Witt	University of Minnesota Twin Cities
Nora	Youngs	University of Nebraska
Josephine	Yu	Georgia Institute of Technology
Andrei	Zelevinsky	Northeastern University
Wenliang	Zhang	University of Nebraska

Officially Registered Participant Information

Participants		150
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Gender		150
Male	66.67%	100
Female	30.67%	46
Declined to state	2.67%	4

Ethnicity*		150
White	63.33%	95
Asian	19.33%	29
Hispanic	5.33%	8
Pacific Islander	0.00%	0
Black	1.33%	2
Native American	0.67%	1
Mixed	0.67%	1
Declined to state	9.33%	14

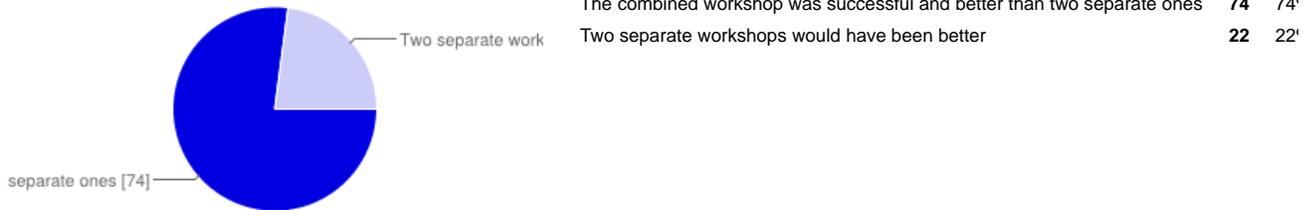
* ethnicity specifications are not exclusive

100 [responses](#)

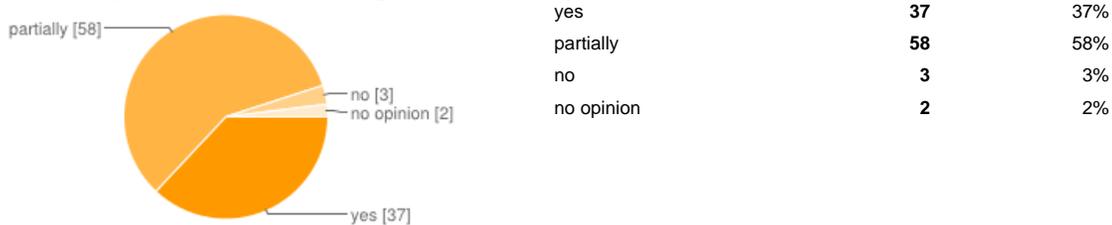
Summary [See complete responses](#)

Topic presentation and organization

Did you feel that having one combined introductory workshop was successful? Or would it have been better as two separate weeks, each focusing on one topic?



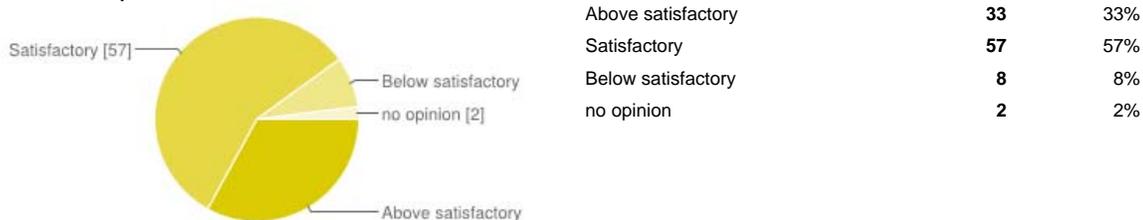
Did the various topics within the workshop integrate into a coherent picture?



Were the speakers generally clear and well organized in their presentation?



Was there adequate time between lectures for discussion?

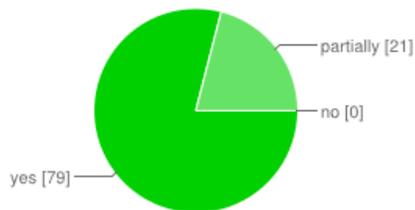


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Additional comments on the topic presentation and organization

Very good speakers! Could have been more lectures on commutative algebra I liked having a joint introductory workshop, but it was too long. A one week joint introductory workshop following the three ...

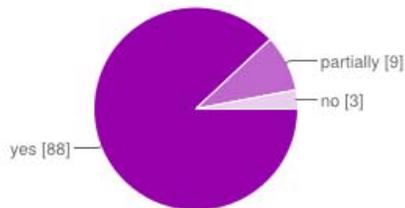
Personal assessment

Was your background adequate to access a reasonable portion of the material?



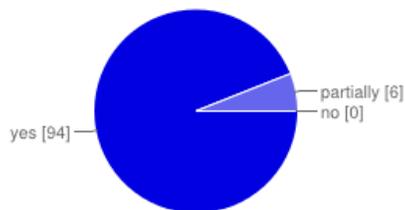
yes	79	79%
partially	21	21%
no	0	0%

Did the workshop increase your interest in the subject?



yes	88	88%
partially	9	9%
no	3	3%

Was the workshop worth your time and effort?



yes	94	94%
partially	6	6%
no	0	0%

Additional comments on your personal assessment

I really liked having the opportunity to learn more about cluster algebras. I learned a lot and started a potential collaboration with someone outside my field, so I consider it a big success. The wor ...

Venue

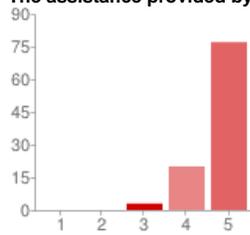
Your overall experience at MSRI

Joint Introductory Workshop: Cluster Algebras and Commutative Algebra, August 27 to September 7, 2012 at MSRI, Berkeley, CA USA



1 - Not satisfactory	0	0%
2	0	0%
3	1	1%
4	28	28%
5 - Above satisfactory	71	71%

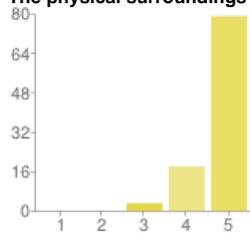
The assistance provided by MSRI staff



1 - Not satisfactory	0	0%
2	0	0%
3	3	3%
4	20	20%
5 - Above satisfactory	77	77%

Not satisfactory Above satisfactory

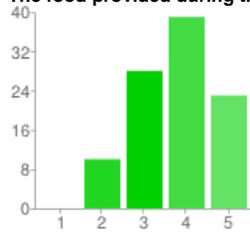
The physical surroundings



1 - Not satisfactory	0	0%
2	0	0%
3	3	3%
4	18	18%
5 - Above satisfactory	79	79%

Not satisfactory Above satisfactory

The food provided during the workshop



1 - Not satisfactory	0	0%
2	10	10%
3	28	28%
4	39	39%
5 - Above satisfactory	23	23%

Not satisfactory Above satisfactory

Additional comments on the venue

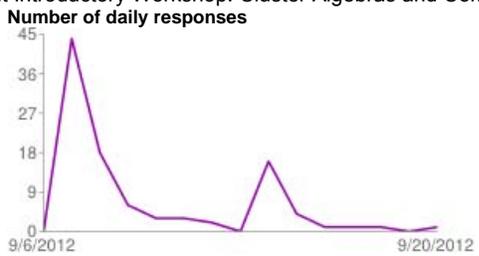
Heating/Cooling problems in the auditorium Is there a tactful way to indicate which caterer will be providing lunch each day? I'm not alone in vastly preferring stuffed inn. the quality and quantity ...

Thank you for completing this survey

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

I didn't realize that the "connections for women" workshop would provide even more background for the talks. Many thanks. A drinks/chocolate vending machine. A telephone room with computer to allow di ...

Joint Introductory Workshop: Cluster Algebras and Commutative Algebra, August 27 to September 7, 2012 at MSRI, Berkeley, CA USA



Joint Introductory Workshop: Cluster Algebras and Commutative Algebra

August 27 to September 7, 2012

Additional Survey Responses

Additional comments on the topic presentation and organization

- Very good speakers!
- Could have been more lectures on commutative algebra
- I liked having a joint introductory workshop, but it was too long. A one week joint introductory workshop following the three days of connections workshop would have been better. Some evidence that it was too long was that the organizers of the workshop, and more notably the programs, didn't come to all talks... As a commutative algebraist, I found the cluster talks almost all accessible, and generally of a higher quality than the commutative algebra talks. Also on logistics, it was unfortunate for the third speaker each day that the audience was starting to lose the ability to pay attention by 12:30. Having the problem sessions in that slot and two talks after lunch might have been easier to deal with. The problem of two one-hour talks back-to-back was something that the MSRI administration could have predicted would cause a problem. On the flip side, I'm only complaining about the length because the overall quality of the talks was so high that I wanted to come to everything (so am complaining about the lack of time to work!).
- it would be very useful to have the videos of the lecture the next day because some speakers were very fast.
- Talks going over time took away from discussion potential. There was no clear session chair to keep them on time, it would have been better if there were.
- Having three morning talks felt very rushed and made it impossible to stick to the schedule. It would have been much better to put a tutorial in place of the third morning talk and rearranged the afternoon. Also, it was difficult to do other work/collaboration due to the number of talks. It would have been better to give most lecturers only 2 talks. Not only did the third talks take up a lot of time, they also often became technical and hard to follow.
- It would have been better if the lectures were 50 minutes with time for questions built in. Too often the speakers spoke for 65-70 minutes before asking for questions.
- The areas covered were very broad - more focus might have worked better. But I got a lot out of the talks.
- I disliked the problem session format. I prefer the setting where the participants do the work, with the advice of the experts. Just watching an expert work examples seems less helpful than doing them yourself.
- The speakers were of very high level mathematically and also didactically. They were clear also for non-experts.
- (As usual) some of the tutorials were just additional lectures.
- I wish the tutorials were more interactive. Most of them ended up being yet another lecture. I think Huneke's list of problems was great. There should be more "homework" and discussion among participants.
- The Cluster Algebras portion was particularly coherent and unfailingly well presented, all the way through to each speaker's third lecture. Some of the Commutative Algebra lectures were

pitched too high (not accessible) or could have included more to motivate someone coming from outside the field.

- All three series of talks (first week) on cluster algebras were excellent
- I am not sure about the relative advantages and disadvantages. I think having the tutorials for both themes simultaneously is a bad idea. As it was, people mainly attended the tutorials from their own theme. Perhaps in part because of this, the presentation in the commutative algebra tutorials which I attended was not at the level where I felt like I could understand it in a hands-on way. (Jason did a very good job on free resolutions, and I didn't attend all of the commutative algebra tutorials, so there may have been others which were equally good.)
- It was very difficult to understand the advanced talks of the other field.
- All speakers were excellent

Additional comments on your personal assessment

- I really liked having the opportunity to learn more about cluster algebras.
- I learned a lot and started a potential collaboration with someone outside my field, so I consider it a big success.
- The workshop was long, and became a bit tiring to continue to go to talks for that long. On the other hand many of the talks were very good, so it was a mixed blessing.
- It was a fantastic opportunity for me to listen to specialists, I learned a lot and got many ideas about what to do next
- It was wonderful. The speakers were mostly very clear and stimulating and I became very interested in looking for connections between the topics.
- It was a really amazing experience. Thank you
- See my topic presentation comments.
- I guess I am kind of an expert on cluster algebras. I wouldn't normally describe myself as such, and there are lots of people here who know more about particular topics, but I feel like I already understood most of what was said in the cluster algebra talks. This is more or less fine with me, but I hope there were people attending who found the ideas more new than I did. As regards the commutative algebra, I mostly felt that the talks were well done on their own terms, but hard to take much away from for someone without a background in current topics of interest in commutative algebra. Brenner's series was, I would say, particularly accessible; and Van den Bergh's was close to my interests, so I found those comparatively valuable.

Additional comments on the venue

- Heating/Cooling problems in the auditorium
- the quality and quantity of the food didn't match the price
- lecture hall was cold down, most people were freezing, but nothing changed during the two weeks
- Occasionally food ran out at lunch which was hard for previous speakers arriving later.
- The stuffed inn catering was much more efficient than the caterer for the second week.
- Prefer the first week's food to the second week's food. Please invite Stuffed Inn again!
- it is very convenient to have lunch venue in the institute
- The doors in women's restroom need to be fixed.
- The lecture hall was too cold because of the air conditioning
- The lunch vendor the first week was preferable to the lunch vendor the second week
- The lunch selections were limited and unvarying. The lecture hall had temperature issues; many participants covered the nearby vents. Getting down the hill on the bus was sometimes difficult or impossible, particularly when the special MSRI event shuttle didn't run.
- capacity of downhill bus is too small that somebody could not get on. This is expected and should be remedied.

- A comment on food orders not during the workshops: It would be nice if it were possible to order lunch using a credit card rather than PayPal. I do not want to use PayPal, so I have not ordered any lunches.
- Physical surroundings is great except for temperature control in the auditorium. Stuffed Inn Caterer greatly preferred.

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

- I didn't realize that the "connections for women" workshop would provide even more background for the talks.
- Many thanks.
- A drinks/chocolate vending machine. A telephone room with computer to allow discussion without disturbing other officemates.
- It was very frustrating not to be able to rewatch the lectures online right away, particularly as they were lecture series with future coming parts. Quite frankly, having a four week gap before the lectures become available online makes the video taping process helpful only to those people who were not at the conference in person at all.
- It's a great environment for doing math. Thank you. I guess the only minor inconvenience especially for foreigners is that the reimbursement happens at the very end of the conference. One has to change money coming to the States and then change back what was reimbursed in dollars in the very last day. I understand that it is probably impossible to do in advance but it seems that there is not time constraints to do it in the middle of a two-week workshop, and not at the very end.
- vending machines might be helpful at times
- If possible a little more free time to communicate informally with other participants and keep up with one's own projects. Also possibly the time limits should be enforced for talks.
- Provide a summary of some good restaurants and places of interest in Berkeley. I personally used to live in Berkeley, so most evenings I ended up gathering visitors and taking them to a restaurant, pub or other venue for dinner and discussions; there shouldn't have to be a (former) local in the group to make this happen.