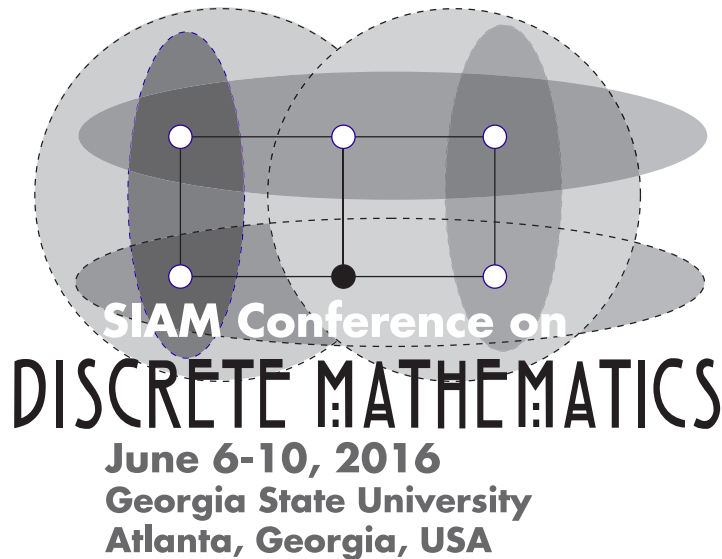


# Final Program and Abstracts

Figure courtesy Victor Chepoi, Hans-Juergen Bandelt, David Eppstein from SIDMA 24-4



Sponsored by the SIAM Activity Group on Discrete Mathematics

The SIAG on Discrete Mathematics focuses on combinatorics, graph theory, cryptography, discrete optimization, mathematical programming, coding theory, information theory, game theory, and theoretical computer science, including algorithms, complexity, circuit design, robotics, and parallel processing. This activity group provides an opportunity to unify pure discrete mathematics and areas of applied research such as computer science, operations research, combinatorics, and the social sciences. It organizes the SIAM Conference on Discrete Mathematics; co-sponsors, with ACM SIGACT, the annual Symposium on Discrete Algorithms; and sponsors minisymposia at SIAM meetings and conferences. The activity group also runs DM-Net, an electronic forum; publishes an electronic newsletter; and maintains a website and a member directory. Every two years, the activity group also awards the Dénes König Prize to a young researcher for outstanding research in the area of discrete mathematics.



Society for Industrial and Applied Mathematics

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Georgia State University, USA

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## Conference Location

All sessions and on-site registration will take place on the Georgia State University Campus located in the Student Center.

Georgia State University

Student Center

55 Gilmer Street

Atlanta, GA 30303

## SIAM Registration Desk

The SIAM registration desk is located in the Georgia State University Student Center. It is open during the following hours:

### Monday, June 6

7:00 AM – 4:00 PM

### Tuesday, June 7

7:30 AM – 3:30 PM

### Wednesday, June 8

7:30 AM – 3:30 PM

### Thursday, June 9

7:30 AM – 3:30 PM

### Friday, June 10

7:30 AM – 10:00 AM

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## Funding Agency

SIAM and the Conference Organizing Committee wish to extend their thanks and appreciation to the U.S. National Science Foundation for its support of this conference



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### Join SIAM and save!

SIAM members save up to \$130 on full registration for the 2016 SIAM Conference on Discrete Mathematics (DM16)! Join your peers in supporting the premier professional society for applied mathematicians and computational scientists. SIAM members receive subscriptions to *SIAM Review*, *SIAM News* and *SIAM Unwrapped*, and enjoy substantial discounts on SIAM books, journal subscriptions, and conference registrations.

If you are not a SIAM member and paid the Non-Member or Non-Member Mini Speaker/Organizer rate to attend

the conference, you can apply the difference between what you paid and what a member would have paid (\$130 for a Non-Member and \$65 for a Non-Member Mini Speaker/Organizer) towards a SIAM membership. Contact SIAM Customer Service for details or join at the conference registration desk.

If you are a SIAM member, it only costs \$10 to join the SIAM Activity Group on the Discrete Mathematics (SIAG/DM). As a SIAG/DM member, you are eligible for an additional \$10 discount on this conference, so if you paid the SIAM member rate to attend the conference, you might be eligible for a free SIAG/DM membership. Check at the registration desk.

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SIAM does not provide computers for any speaker. When giving an electronic presentation, speakers must provide their own computers. SIAM is not responsible for the safety and security of speakers' computers.

The Plenary Session Room will have one (1) screen, one (1) data projector and one (1) overhead projector. The data projectors support VGA connections only. Presenters requiring an HDMI or alternate connection must provide their own adaptor.

All other concurrent/breakout rooms will have one (1) screen and one (1) data projector. The data projectors support VGA connections only. Presenters requiring an HDMI or alternate connection must provide their own adaptor.

If you have questions regarding availability of equipment in the meeting room of your presentation, please see a staff member at the registration desk.

## Internet Access

The Student Center does have internet connection capability. Information regarding internet access is available at [www.siam.org/meetings/dm16/general.php](http://www.siam.org/meetings/dm16/general.php).

## Registration Fee Includes

- Admission to all technical sessions
- Business Meeting  
(open to SIAG/DM members)
- Coffee breaks daily
- Poster session
- Room set-ups and audio/visual equipment
- Welcome Reception

## Job Postings

Please check with the SIAM registration desk regarding the availability of job postings or visit <http://jobs.siam.org>.

## Important Notice to Poster Presenters

The poster session is scheduled for Thursday, June 9, at 5:30 PM. All materials must be posted by Thursday, June 9, 5:30 PM, the official start time of the session. Poster displays must be removed at the end of the session, by 6:30 PM. Posters remaining after this time will be discarded. SIAM is not responsible for discarded posters.

## SIAM Books and Journals

SIAM books are available at a discounted price during the conference. Titles on Display forms are available with instructions on how to place a book order.

## Table Top Display

Elsevier

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## Comments?

Comments about SIAM meetings are encouraged! Please send to:

Cynthia Phillips, SIAM Vice President for Programs ([vpp@siam.org](mailto:vpp@siam.org)).

## Get-togethers

- Welcome Reception  
Monday, June 6  
5:30 PM - 7:30 PM



- Business Meeting  
(open to SIAG/DM members)  
Wednesday, June 8  
6:30 PM - 7:15 PM



- Poster Session  
Thursday, June 9  
5:30 PM - 6:30 PM



## Statement on Inclusiveness

As a professional society, SIAM is committed to providing an inclusive climate that encourages the open expression and exchange of ideas, that is free from all forms of discrimination, harassment, and retaliation, and that is welcoming and comfortable to all members and to those who participate in its activities. In pursuit of that commitment, SIAM is dedicated to the philosophy of equality of opportunity and treatment for all participants regardless of gender, gender identity or expression, sexual orientation, race, color, national or ethnic origin, religion or religious belief, age, marital status, disabilities, veteran status, field of expertise, or any other reason not related to scientific merit. This philosophy extends from SIAM conferences, to its publications, and to its governing structures and bodies. We expect all members of SIAM and participants in SIAM activities to work towards this commitment.

## Please Note

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## Recording of Presentations

Audio and video recording of presentations at SIAM meetings is prohibited without the written permission of the presenter and SIAM.

## Social Media

SIAM is promoting the use of social media, such as Facebook and Twitter, in order to enhance scientific discussion at its meetings and enable attendees to connect with each other prior to, during and after conferences. If you are tweeting about a conference, please use the designated hashtag to enable other attendees to keep up with the Twitter conversation and to allow better archiving of our conference discussions. The hashtag for this meeting is #SIAMDM16.

## Invited Plenary Speakers

*\*\* All Invited Plenary Presentations will take place in SCE Speakers Auditorium - First Floor\*\**

### Monday, June 6

**8:15 AM - 9:00 AM**

**IP1** Accuracy, Privacy, and Validity: When Right is Wrong and Wrong is Right

**Cynthia Dwork**, *Microsoft Research, USA*

**1:30 PM - 2:15 PM**

**IP2** From Algorithm to Theorem (in Probabilistic Combinatorics)

**Persi Diaconis**, *Stanford University, USA*

### Tuesday, June 7

**8:15 AM - 9:00 AM**

**IP3** Stabilisation in Algebra, Geometry, and Combinatorics

**Jan Draisma**, *Technische Universiteit Eindhoven, The Netherlands*

**1:30 PM - 2:15 PM**

**IP4** Mathematical Models: Uses, Abuses, and Non-uses

**Andrew M. Odlyzko**, *University of Minnesota, USA*

## Invited Plenary Speakers

*\*\* All Invited Plenary Presentations will take place in SCE Speakers Auditorium - First Floor\*\**

**Wednesday, June 8**

**8:15 AM - 9:00 AM**

**IP5** Tangles and the Mona Lisa: Connectivity Versus Tree Structure

**Reinhard Diestel**, *Universität Hamburg, Germany*

**Thursday, June 9**

**8:15 AM - 9:00 AM**

**IP6** Induced Matchings, Arithmetic Progressions and Communication

**Benny Sudakov**, *ETH Zürich, Switzerland*

**1:30 PM - 2:15 PM**

**IP7** Quasirandomness, Sidorenko's Conjecture and Graph Norms

**David Conlon**, *University of Oxford, United Kingdom*

**Friday, June 10**

**8:15 AM - 9:00 AM**

**IP8** Excluded Grid Theorem: Improved and Simplified

**Julia Chuzhoy**, *Toyota Technological Institute at Chicago, USA*

## Prize Lecture

*\*\* The Dénes König Prize Lecture will take place in SCE Speakers Auditorium - First Floor\*\**

**Tuesday, June 7**

**5:30 PM – 6:15 PM**

**SP1 2016 Dénes König Prize Lecture:**

Phase Transitions in Random Graph Processes

**Lutz Warnke**, *University of Cambridge, United Kingdom*

# SIAM Activity Group on Discrete Mathematics (SIAG/DM)

<http://www.siam.org/activity/dm>



## A GREAT WAY TO GET INVOLVED!

Collaborate and interact with mathematicians and applied scientists whose work involves combinatorics, graph theory, cryptography, discrete optimization, mathematical programming, coding theory, information theory, game theory, and theoretical computer science, including algorithms, complexity, circuit design, robotics, parallel processing and research in mathematics that leads to new methods and techniques useful in discrete mathematics.

### ACTIVITIES INCLUDE:

- Special sessions at SIAM Annual Meetings
- Biennial Conference
- Website
- Co-sponsors, with ACM SIGACT, the annual Symposium on Discrete Algorithms
- Awards the Dénes König Prize to a young researcher for outstanding research in the area of discrete mathematics

### BENEFITS OF SIAG/DM MEMBERSHIP:

- Listing in the SIAG's online-only membership directory
- Additional \$10 discount on registration for the SIAM Conference on Discrete Mathematics (excludes student)
- Electronic communications about recent developments in your specialty
- Eligibility for candidacy for SIAG/DM office
- Participation in the selection of SIAG/DM officers

### ELIGIBILITY:

- Be a current SIAM member.

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- \$10 per year
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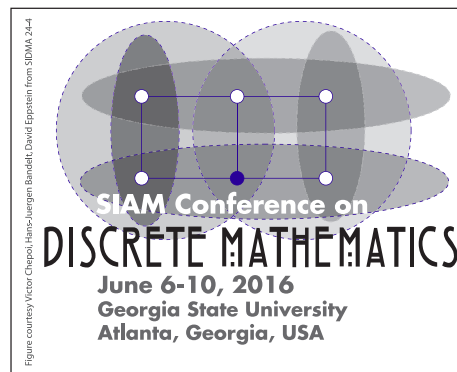
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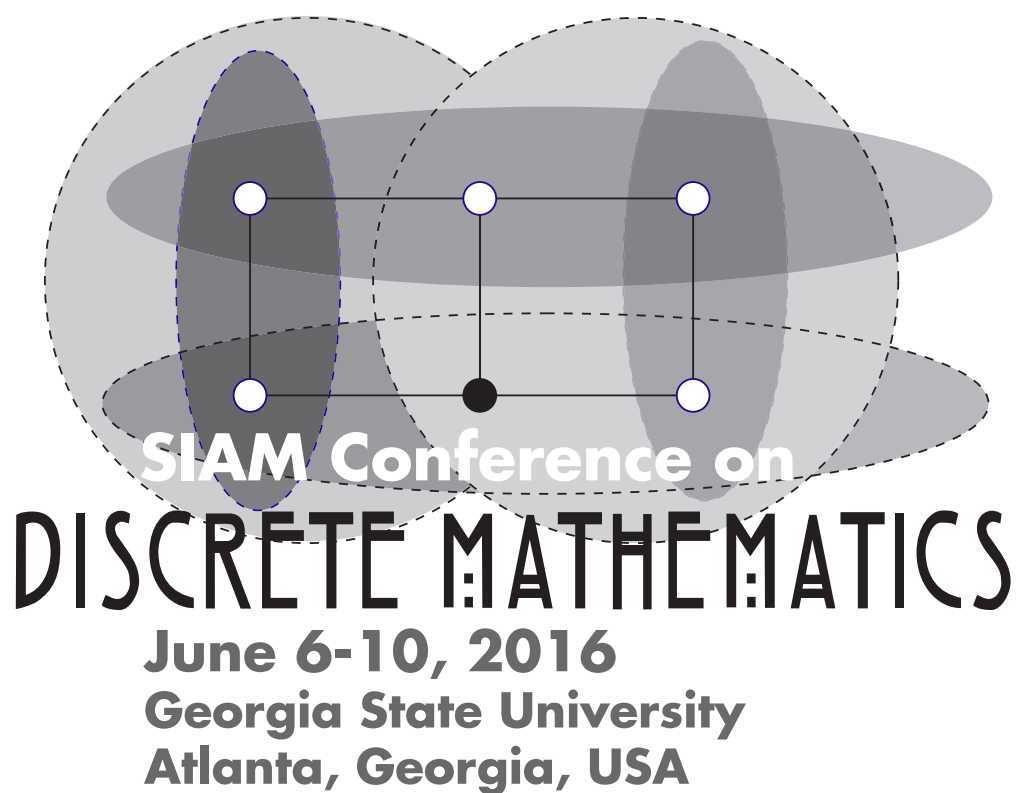
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**DM16 Program**

Figure courtesy Victor Chepoi, Hans-Juergen Bandelt, David Eppstein from SIDMA 24-4



## Monday, June 6

### Registration

7:00 AM-4:00 PM

Room: SCE Ballroom Pre-function Area - First Floor

### Welcome Remarks

8:00 AM-8:15 AM

Room: SCE Speakers Auditorium - First Floor

Monday, June 6

## IP1

### Accuracy, Privacy, and Validity: When Right is Wrong and Wrong is Right

8:15 AM-9:00 AM

Room: SCE Speakers Auditorium - First Floor

Chair: To Be Determined

In 2008 a simple pen-and-paper privacy attack on aggregate allele frequency statistics in a Genome-Wide Association Study rocked the world of genomics research and resulted in a change in access policy for aggregate statistics in studies funded by the US National Institutes of Health. After describing the original attack and summarizing recent advances in attack strategies, we shift to the defense, discussing differential privacy, a notion of privacy tailored to statistical analysis of large datasets. Signal properties of differential privacy include its resilience to arbitrary side information and the ability to understand cumulative privacy loss over multiple statistical analyses. Finally, we describe a tight connection between differential privacy and statistical validity under adaptive (exploratory) data analysis.

Cynthia Dwork

Microsoft Research, USA

### Coffee Break

9:00 AM-9:30 AM



Room: SCE Ballroom Pre-function Area - First Floor

Monday, June 6

## MS1

### Current Research in Coding Theory - Part I of III

9:30 AM-12:00 PM

Room: SCE Court Salon - First Floor

#### For Part 2 see MS7

The minisymposium is devoted to recent results and ongoing research in coding theory. The topics covered in the talks include advances in algebraic geometric codes, coding for DNA memories, network coding, combinatorial results related to the MDS conjecture, and other problems of current interest.

Organizer: Alexander Barg

University of Maryland, USA

#### 9:30-9:55 Generalized Hamming Weights of Projective Reed-Muller Codes

Peter Beelen, Technical University of Denmark, Denmark

#### 10:00-10:25 On Polar and Reed-Muller Codes via Independence

Emmanuel Abbe, Princeton University, USA

#### 10:30-10:55 Decoding Reed-Muller Codes from Random Errors

Ben Lee Volk, Tel Aviv University, Israel

#### 11:00-11:25 Signature Codes for Multiple-Access Channels - Part I

Grigory Kabatiansky, Russian Academy of Sciences, Russia

#### 11:30-11:55 Signature Codes for Multiple-Access Channels - Part II

Grigory Kabatiansky, Russian Academy of Sciences, Russia

Monday, June 6

**MS2****Structures in Trees - Part I of II**

9:30 AM-12:00 PM

*Room: SCE House Salon - First Floor***For Part 2 see MS22**

There is an active interest in structures in trees, in part motivated by phylogenetics and chemical graph theory. Among others, the session will investigate problems on the number of subtrees of trees (labeled and unlabeled), and on induced quartet subtrees of binary trees (maximum agreement subtree problems and maximum quartet distance between trees). Several talks will represent the state-of-the-art in phylogeny reconstruction. The minisymposium brings together researchers from phylogenetics, extremal theory, and random trees.

Organizer: Laszlo Szekely  
*University of South Carolina, USA*

Organizer: Eva Czabarka  
*University of South Carolina, USA*

**9:30-9:55 Subtrees of Trees: Labeled and Unlabeled**

*Laszlo Szekely, University of South Carolina, USA*

**10:00-10:25 The Number of Automorphisms of Random Trees**

*Benedikt Stufler, Ludwig-Maximilians-Universität München, Germany; Stephan Wagner, Stellenbosch University, South Africa*

**10:30-10:55 Extremal Ratio Questions in Binary Trees**

*Hua Wang, Georgia Southern University, USA*

**11:00-11:25 Extremal Properties of Vertex Attributes in Trees**

*Heather C. Smith, Georgia Institute of Technology, USA; Laszlo Szekely, University of South Carolina, USA; Hua Wang, Georgia Southern University, USA; Shuai Yuan, University of South Carolina, USA*

**11:30-11:55 Species Tree Estimation in the Presence of Incomplete Lineage Sorting**

*Tandy Warnow, University of Illinois at Urbana-Champaign, USA*

Monday, June 6

**MS3****Graph Structure and Applications**

9:30 AM-12:00 PM

*Room: SCE Senate Salon - First Floor*

The speakers in the minisymposium will present their latest results in structural graph theory and related topics, including the linkage problem, connections to extremal graph theory and graph limits.

Organizer: Bojan Mohar  
*Simon Fraser University, Canada*

Organizer: Zdenek Dvorak  
*Charles University, Czech Republic*

**9:30-9:55 Normal Graph Covers**

*David Gajser, University of Ljubljana, Slovenia; Bojan Mohar, Simon Fraser University, Canada*

**10:00-10:25 Decomposing 4-Regular Random Graphs into Claws**

*Michelle Delcourt, University of Illinois at Urbana-Champaign, USA; Luke Postle, University of Waterloo, Canada*

**10:30-10:55 Notions of Convergence for Sequences of Graphs**

*Laszlo M. Lovasz, Massachusetts Institute of Technology, USA*

**11:00-11:25 New Results on Packing Odd Trails**

*Ross Churchley and Bojan Mohar, Simon Fraser University, Canada; Hehui Wu, University of Mississippi, USA*

**11:30-11:55 Finding Immersions of Digraphs with Parity Restrictions**

*Sebastian Gonzalez Hermosillo and Bojan Mohar, Simon Fraser University, Canada*

Monday, June 6

**MS4****Matroid Theory - Part I of III**

9:30 AM-12:00 PM

*Room: SCE 217 - Second Floor***For Part 2 see MS15**

Matroids are combinatorial objects that generalize well-known structures such as graphs, sets of vectors, and error-correcting codes. Research problems in matroid theory vary widely, and include problems on structure and connectivity, questions regarding the representation of matroids by more concrete objects such as matrices and graphs, problems regarding enumeration and generation of matroids, and extremal questions.

Organizer: Stefan van Zwam  
*Louisiana State University, USA*

Organizer: Carolyn Chun  
*United States Naval Academy, USA*

**9:30-9:55 When Matroids are Highly Connected**

*Stefan van Zwam, Louisiana State University, USA*

**10:00-10:25 The Packing/Covering Conjecture**

*Nathan Bowler, University of Hamburg, Germany*

**10:30-10:55 Excluded Minors for Matroids of Rank Three**

*Sonoko Moriyama, Nihon University, Japan; Hidefumi Hiraishi, University of Tokyo, Japan*

**11:00-11:25 The Cunningham-Geelen Method in Practice: Branch-Decompositions and Integer Programming**

*Susan Margulies, United States Naval Academy, USA; Illya Hicks, Rice University, USA*

**11:30-11:55 A Matroid Analogue of a Theorem of Brooks for Graphs**

*James Oxley, Louisiana State University, USA*

Monday, June 6

## MS5

### Graph Coloring I - Part I of II

9:30 AM-12:00 PM

Room: SCE 216 - Second Floor

#### For Part 2 see MS25

Speakers will present recent results on fundamental problems in graph coloring.

Organizer: Daniel Cranston  
Virginia Commonwealth University,  
USA

#### 9:30-9:55 Two-Coloring Number of Planar Graphs

Zdenek Dvorak, Charles University,  
Czech Republic; Adam Kabela and  
Tomas Kaiser, University of West  
Bohemia, Pilsen, Czech Republic

#### 10:00-10:25 Clique Immersion in Graph Products

Jessica McDonald, Auburn University,  
USA

#### 10:30-10:55 Common Vertex of Longest Cycles of Special Chordal Graphs

Hehui Wu and Shaohui Wang, University  
of Mississippi, USA; Guantao Chen,  
Georgia State University, USA

#### 11:00-11:25 Planar Graphs of Girth at Least Five are Square $(\Delta + 2)$ -Choosable

Marthe Bonamy, LaBRI, Université de  
Bordeaux, and CNRS, France; Daniel  
Cranston, Virginia Commonwealth  
University, USA; Luke Postle,  
University of Waterloo, Canada

#### 11:30-11:55 Precoloring Extension for Planar Graphs

Zdenek Dvorak, Charles University,  
Czech Republic; Bernard Lidicky,  
Iowa State University, USA

Monday, June 6

## MS6

### Extremal Combinatorics - Part I of III

9:30 AM-12:00 PM

Room: SCE Speakers Auditorium - First Floor

#### For Part 2 see MS26

Combinatorics is a fundamental discipline of modern mathematics which studies discrete objects and their properties. This minisymposium we propose will focus on the subfield of extremal combinatorics and graph theory, which has witnessed an exciting development over the past decades, and also has many striking practical applications in mathematical optimization, computer science, statistical physics and voting society. We aim to bring the top researchers to the minisymposium, where they will present the recent progress, discuss open challenges, exchange research ideas, and initiate new collaborations. We expect a minisymposium of this nature to have a lasting impact on the future of the subject.

Organizer: Hao Huang  
Emory University, USA

Organizer: Yi Zhao  
Georgia State University, USA

#### 9:30-9:55 On Graphs Decomposable into Induced Matchings of Linear Sizes

Hao Huang, Emory University, USA

#### 10:00-10:25 On the Edit Distance of Powers of Cycles

Zhanar Berikkyzy and Ryan R. Martin,  
Iowa State University, USA; Chelsea  
Peck, University of Wisconsin,  
Madison, USA

#### 10:30-10:55 Turan Numbers of Small Subdivisions

Tao Jiang, Miami University, USA

#### 11:00-11:25 How Unproportional Must a Graph Be?

Humberto Naves, University of  
Minnesota, USA; Oleg Pikhurko,  
University of Warwick, United  
Kingdom; Alex Scott, Oxford  
University, United Kingdom

#### 11:30-11:55 Locally Common Graphs and Locally Sidorenko Graphs

Fan Wei, Stanford University, USA

Monday, June 6

## CP1

### Graph Theory I

9:30 AM-11:10 AM

Room: SCE 203 - Second Floor

Chair: To Be Determined

#### 9:30-9:45 A Generalization of $\alpha$ -Orientations to Higher Genus Surfaces

Jason Suagee, George Washington  
University, USA

#### 9:50-10:05 The Family of Plane Graphs with Face Sizes 3 or 4

Sheng Bau, University of Natal,  
Pietermaritzburg, South Africa

#### 10:10-10:25 Unhinging Cycles: An Approach to Universal Cycles Under Equivalence Relations

Melinda Lanius, University of Illinois at  
Urbana-Champaign, USA

#### 10:30-10:45 Monotone Paths in Dense Edge-Ordered Graphs

Kevin Milans, West Virginia University,  
USA

#### 10:50-11:05 Bijections to Split Graphs

Karen Collins, Wesleyan University,  
USA; Ann N. Trenk, Wellesley College,  
USA; Christine T. Cheng, University of  
Wisconsin, Milwaukee, USA

Monday, June 6

**CP2****Probability Theory 1**

9:30 AM-11:30 AM

Room: SCE 218 - Second Floor

Chair: To Be Determined

**9:30-9:45 Counting Spanning Trees in Random Regular Graphs**

Matthew Kwan, ETH Zürich, Switzerland; Catherine Greenhill, University of New South Wales, Australia; Mikhail Isaev and Brendan McKay, Australian National University, Australia

**9:50-10:05 I-Cycles in Randomly Perturbed Hypergraphs**

Andrew J. Mc Dowell and Richard Mycroft, University of Birmingham, United Kingdom

**10:10-10:25 The Emergence of Patterns of Cooperative Behaviour in Grids**

Christopher Duffy and Jeannette Janssen, Dalhousie University, Canada

**10:30-10:45 Recovering the Structure of Random Linear Graphs**

Israel S. Rocha and Jeannette Janssen, Dalhousie University, Canada

**10:50-11:05 Modularity of Random Graphs**

Fiona Skerman, University of Bristol, United Kingdom; Colin McDiarmid, University of Oxford, United Kingdom

**11:10-11:25 The Region of Critical Probabilities in Bootstrap Percolation on Inhomogeneous Periodic Trees**

Milan Bradonjic, Bell Labs, Alcatel-Lucent, USA; Stephan Wagner, Stellenbosch University, South Africa

**Lunch Break**

12:00 PM-1:30 PM

Attendees on their own

Monday, June 6

**IP2****From Algorithm to Theorem (in Probabilistic Combinatorics)**

1:30 PM-2:15 PM

Room: SCE Speakers Auditorium - First Floor

Chair: To Be Determined

The general question is let  $X$  be a set of interesting “things” (permutations, graphs, partitions, ...). Pick  $x$  in  $X$  at random; what does  $x$  “look like”? There are a host of results for taking theorems (e.g., the Gale-Ryser theorem) and turning them into algorithms for efficient generation. This talk goes in the opposite direction: given an algorithm for random generation, what (limit) theorems does it imply? One key example, drawn from joint work with Chern, Kane, and Rhoades---there is a clever algorithm for generating a random set partition due to Stam. This allowed us to prove the limiting normality of the number of crossings (and many other functionals), a long-open problem.

Persi Diaconis  
Stanford University, USA

**Coffee Break**

2:15 PM-2:45 PM

Room: SCE Ballroom Pre-function Area - First Floor



Monday, June 6

**MS7****Current Research in Coding Theory - Part II of III**

2:45 PM-5:15 PM

Room: SCE Court Salon - First Floor

For Part 1 see MS1

For Part 3 see MS18

The minisymposium is devoted to recent results and ongoing research in coding theory. The topics covered in the talks include advances in algebraic geometric codes, coding for DNA memories, network coding, combinatorial results related to the MDS conjecture, and other problems of current interest.

Organizer: Alexander Barg  
University of Maryland, USA

**2:45-3:10 Locally Repairable Codes and Index Coding**

Arya Mazumdar, University of Massachusetts, Amherst, USA

**3:15-3:40 DNA Profile Codes**

Olgica Milenkovic, University of Illinois at Urbana-Champaign, USA; Han Mao Kiah, Nanyang Technical University, Singapore; Gregory J. Puleo, University of Illinois, USA

**3:45-4:10 The Role of Completely Regular Codes**

William J. Martin, Worcester Polytechnic Institute, USA

**4:15-4:40 Maximally Recoverable Codes - Part I**

Parikshit Gopalan, Microsoft Corporation, USA; Guangda Hu, Princeton University, USA; Shubhangi Saraf, Massachusetts Institute of Technology, USA; Carol Wang, Carnegie Mellon University, USA; Sergey Yekhanin, Microsoft, USA

**4:45-5:10 Maximally Recoverable Codes - Part II**

Parikshit Gopalan, Microsoft Corporation, USA; Guangda Hu, Princeton University, USA; Shubhangi Saraf, Massachusetts Institute of Technology, USA; Carol Wang, Carnegie Mellon University, USA; Sergey Yekhanin, Microsoft, USA



Monday, June 6

## MS8

### Tropical Mathematics and Applications - Part I of III

2:45 PM-4:45 PM

Room: SCE Senate Salon - First Floor

#### For Part 2 see MS14

In this minisymposium we will present recent developments in tropical mathematics, which concerns algebra and geometry over the max-plus semiring. The field has seen rapid and significant development in the past decade, and touches on many different areas of mathematics including graph theory, commutative algebra, algebraic geometry, non-Archimedean analytic geometry, matroid theory, and linear programming. It has applications to areas as diverse as enumerative geometry, auction theory, phylogenetics, and mirror symmetry. This minisymposium will bring together a diverse group of experts in tropical mathematics with a particular (but not exclusive) emphasis on combinatorial methods and applications.

Organizer: Josephine Yu  
*Georgia Institute of Technology, USA*

Organizer: Matthew Baker  
*Georgia Institute of Technology, USA*

Organizer: Ngoc Tran  
*University of California, Berkeley, USA*

#### 2:45-3:10 Metric Graphs with Prescribed Gonality

Filip Cools, KU Leuven, Belgium; *Jan Draisma*, Technische Universiteit Eindhoven, The Netherlands

#### 3:15-3:40 A Tropical Bött-Samelson Variety from Matroids Over Valuation Rings

*Alex Fink*, Queen Mary, University of London, United Kingdom

#### 3:45-4:10 A Grassmann Algebra for Matroids

Jeffrey Giansiracusa, Swansea University, United Kingdom; *Noah Giansiracusa*, University of Georgia, USA

#### 4:15-4:40 Tropical Ideals

*Felipe Rincon*, University of Oslo, Norway; *Diane Maclagan*, University of Warwick, United Kingdom

Monday, June 6

## MS9

### Monochromatic Covering and Ramsey-Type Problems - Part I of II

2:45 PM-4:45 PM

Room: SCE 217 - Second Floor

#### For Part 2 see MS28

Recently there have been some exciting developments in Ramsey theory and the related problem of covering graphs by monochromatic subgraphs. This minisymposium will focus on these recent developments and the methods used to obtain them. We will also look at future research directions in the area.

Organizer: Louis DeBiasio  
*Miami University, USA*

Organizer: Alexey Pokrovskiy  
*ETH Zürich, Switzerland*

#### 2:45-3:10 Covering by Monochromatic Subgraphs -- A Survey

*Louis DeBiasio*, Miami University, USA

#### 3:15-3:40 Monochromatic Paths in Graphs and Hypergraphs

*Maya Stein*, Universidad de Chile, Chile

#### 3:45-4:10 Monochromatic Covers and Partitions of Random Graphs

*Deepak Bal*, Ryerson University, Canada

#### 4:15-4:40 Unavoidable Patterns in Words

*David Conlon*, University of Oxford, United Kingdom; *Jacob Fox*, Stanford University, USA; *Benjamin Sudakov*, ETH Zürich, Switzerland

Monday, June 6

## MS10

### Cops and Robbers and Pursuit-Evasion in Discrete Structures - Part I of III

2:45 PM-4:45 PM

Room: SCE 216 - Second Floor

#### For Part 2 see MS29

From Cops and Robbers and its many variants, to firefighting and graph burning, pursuit-evasion is a trending topic within graph theory and discrete mathematics. Broadly speaking, pursuit-evasion focuses on agents whose goal is to capture, contain, or block intruders loose in a discrete structure. The analysis of pursuit-evasion games brings together probabilistic, structural, and algorithmic techniques. Applications range from mobile computing to modelling the spread of influence in social networks. The goal of the minisymposium is to bring together researchers in the field to present results on the state-of-the-art in the field.

Organizer: Anthony Bonato  
*Ryerson University, Canada*

#### 2:45-3:10 The Game of Zombies and Survivors on Graphs

*Anthony Bonato*, Ryerson University, Canada

#### 3:15-3:40 Cops and Robber with Decoys

*Nancy E. Clarke*, Acadia University, Canada

#### 3:45-4:10 Watching Block Intersection Graphs

*Danny Dyer* and *Jared Howell*, Memorial University, Newfoundland, Canada

#### 4:15-4:40 Walker-Breaker Game

*Lisa Espig* and *Alan Frieze*, Carnegie Mellon University, USA; *Michael Krivelevich*, Tel Aviv University, Israel; *Wesley Pegden*, Carnegie Mellon University, USA

Monday, June 6

**MS11****Graph Theory - Part I of III**

2:45 PM-5:15 PM

*Room: SCE Speakers Auditorium - First Floor***For Part 2 see MS30**

This minisymposium consists of three sessions covering various topics surrounding extremal graph theory, structural graph theory, and cycles and paths in graphs.

Organizer: Guantao Chen

*Georgia State University, USA*

Organizer: Xingxing Yu

*Georgia Institute of Technology, USA***2:45-3:10 Improperly Coloring  $K_t+1$  Minor-Free Graphs**

*Sergey Norin, McGill University, Canada; Zdenek Dvorak, Charles University, Czech Republic*

**3:15-3:40 The Clique Number and the Smallest  $Q$ -Eigenvalue of Graphs**

*Vladimir Nikiforov, University of Memphis, USA; Leonardo De Lima, Federal Center of Technological Education, Brazil; Carla Oliveira, National School of Statistics, Brazil*

**3:45-4:10 Turan Number of Hypergraphs via Lagrangians***Yuejian Peng, Hunan University, China***4:15-4:40 The Erdős-Hajnal Conjecture and Structural Theory of  $H$ -Free Graphs**

*Krzysztof M. Choromanski, Google Research, USA*

**4:45-5:10 Title Not Available**

*Vladimir Nikiforov, University of Memphis, USA*

Monday, June 6

**CP3****Miscellaneous**

2:45 PM-4:25 PM

*Room: SCE 203 - Second Floor**Chair: To Be Determined***2:45-3:00 A Faster Algorithm for Computing Tutte Polynomials of Lattice Path Matroids**

*Jacob Turner, University of Amsterdam, Netherlands*

**3:05-3:20 Counting Hamiltonian Cycles in a Matroid Basis Graph**

*Cesar Hernandez-Velez, Universidad Autonoma de San Luis Potosi, Mexico; Cristina Fernandes and Jose de Pina, University of Sao Paulo, Brazil; Jorge Luis Ramirez Alfonsin, Universite de Montpellier II, France*

**3:25-3:40 Construction of 4-Connected Graphic Matroids with Essential Elements**

*Mahaveer P. Gadiya, University of Pune, MIT College of Engineering, India*

**3:45-4:00 Fractal Graphs and Their Combinatorial Properties**

*Pavel Skums, Georgia State University, USA; Leonid Bunimovich, Georgia Institute of Technology, USA*

**4:05-4:20 The Generalized Onsager Model for a Binary Gas Mixture with Swirling Feed**

*Sahadev Pradhan, Indian Institute of Science, Bangalore, India*

Monday, June 6

**CP4****Color 1**

2:45 PM-4:05 PM

*Room: SCE 218 - Second Floor**Chair: To Be Determined***2:45-3:00 Connectedness of the Graph of Neighborhood Distinguishing Colorings and Irregular Colorings**

*Ramar Rajasekaran, College of Applied Sciences, Sohar, Oman; Swaminathan V, Saraswathi Narayanan College, Madurai Kamaraj University, India*

**3:05-3:20 Coloring the Square of Subcubic Planar Graphs**

*Stephen Hartke, University of Colorado, USA; Jennifer Diemunsch, Saint Vincent College, USA; Sogol Jahanbekam and Brent Thomas, University of Colorado, Denver, USA*

**3:25-3:40 Coloring Intersection Graphs of Curves Crossing a Fixed Line**

*Bartosz Walczak, Jagiellonian University, Poland; Alexandre Rok, Ben Gurion University Negev, Israel*

**3:45-4:00 Universal Cycles of Graph Colorings**

*Katie V. Johnson, Danny DePrisco, and Molly Honecker, Florida Gulf Coast University, USA*

**Welcome Reception**

5:30 PM-7:30 PM



*Room: SCE Ballroom Pre-function Area - First Floor*

## Tuesday, June 7

### Registration

7:30 AM-3:30 PM

Room: SCE Ballroom Pre-function Area  
- First Floor

### Announcements

8:10 AM-8:15 AM

Room: SCE Speakers Auditorium -  
First Floor

## IP3

### Stabilisation in Algebra, Geometry, and Combinatorics

8:15 AM-9:00 AM

Room: SCE Speakers Auditorium -  
First Floor

Chair: To Be Determined

Throughout mathematics, one encounters sequences of algebraic varieties-geometric structures defined by polynomial equations. As the dimension of the variety grows, typically so does its complexity, measured, for instance, by the degrees of its defining equations. And yet, many sequences stabilise in the sense that from some member of the sequence on, all complexity is inherited from the smaller members by applying symmetries. I will present several examples of this, as yet, only partially understood phenomenon. Beautiful combinatorics of well-quasi-ordered sets plays a key role in the proofs. The hope is that, conversely, algebraic stabilisation may in the future also shed new light on well-quasi-orders.

Jan Draisma

Technische Universiteit Eindhoven, The Netherlands

Tuesday, June 7

## MS12

### The Mathematics Behind Big Data Analysis - Part I of II

9:30 AM-12:00 PM

Room: SCE Court Salon - First Floor

#### For Part 2 see MS31

How to get rigorous methods for the seemingly ill-defined notion of data analysis? What kinds of mathematical methods can be used to get provable and practical algorithmics for large data? This is a rich area of study, involving research from numerical analysis, statistics, theoretical computer science, and applied algorithmics. This minisymposium brings together researchers from the full spectrum of pure theory to pure practice, to discuss the various viewpoints on data analysis.

Organizer: C. Seshadhri

University of California, Santa Cruz, USA

Organizer: David F. Gleich

Purdue University, USA

#### 9:30-9:55 Biclustered Matrix Completion

Eric Chi, North Carolina State University,  
USA

#### 10:00-10:25 A Story of Principal Component Analysis in the Distributed Model

David Woodruff, IBM Almaden Research  
Center, USA

#### 10:30-10:55 Sampling Paths in Graphs: A Simple Technique for Not So Simple Problems

C. Seshadhri, University of California,  
Santa Cruz, USA

#### 11:00-11:25 On the Origin of Locality in Algorithms for Graph Analysis on Massive Graphs

David F. Gleich, Purdue University, USA

#### 11:30-11:55 Accurate Inferences Beyond the Empirical Distribution

Gregory Valiant, Stanford University,  
USA

Tuesday, June 7

## MS13

### Centroidal Voronoi Tessellations and its Applications

9:30 AM-12:00 PM

Room: SCE House Salon - First Floor

Centroidal Voronoi tessellations (CVTs) are Voronoi tessellations of a bounded geometric domain such that the generating points of the tessellations are also the centroids of the corresponding Voronoi regions with respect to a given density function. CVT is a fundamental notion that has a wide spectrum of applications in computational science and engineering that include art design, astronomy, clustering, geometric modeling, image and data analysis, resource optimization, quadrature design, sensor networks, and numerical solution of partial differential equations. The goal of this minisymposium is to bring together scientists including the young researchers to discuss and exchange ideas in the areas of centroidal Voronoi tessellations and its applications.

Organizer: Mrinal K.

Roychowdhury

University of Texas, Rio Grande Valley,  
USA

Organizer: Huayi Wei

Xiangtan University, China

#### 9:30-9:55 Fast Methods for Computing Centroidal Voronoi Tessellations

Huayi Wei, Xiangtan University, China;  
James C. Hatele, Unaffiliated; Long  
Chen, University of California, Irvine,  
USA

#### 10:00-10:25 An Algorithm for Computing CVTs for Any Cantor Distribution

Mrinal K. Roychowdhury, University of  
Texas, Rio Grande Valley, USA

### Coffee Break

9:00 AM-9:30 AM



Room: SCE Ballroom Pre-function Area  
- First Floor

continued on next page



**10:30-10:55 Pseudometrically  
Constrained Centroidal Voronoi  
Tessellations and its Application to  
Acquisition Design in (MRI)**

*Cheng G. Koay*, National Intrepid  
Center of Excellence and Walter Reed  
National Military Medical Center, USA

**11:00-11:25 Application of Centroidal  
Voronoi Tessellation in Continuous  
Optimization**

*Zijun Wu*, Beijing Institute for Scientific  
and Engineering Computing, China

**11:30-11:55 Quantization for Uniform  
Distributions on Equilateral Triangles**

*Carl Dettmann*, University of Bristol,  
United Kingdom; *Mrinal K.  
Roychowdhury*, University of Texas,  
Rio Grande Valley, USA

Tuesday, June 7

## MS14

### Tropical Mathematics and Applications - Part II of III

9:30 AM-11:30 PM

*Room: SCE Senate Salon - First Floor*

**For Part 1 see MS8**

**For Part 3 see MS27**

In this minisymposium we will present recent developments in tropical mathematics, which concerns algebra and geometry over the max-plus semiring. The field has seen rapid and significant development in the past decade, and touches on many different areas of mathematics including graph theory, commutative algebra, algebraic geometry, non-Archimedean analytic geometry, matroid theory, and linear programming. It has applications to areas as diverse as enumerative geometry, auction theory, phylogenetics, and mirror symmetry. This minisymposium will bring together a diverse group of experts in tropical mathematics with a particular (but not exclusive) emphasis on combinatorial methods and applications.

Organizer: *Josephine Yu*  
*Georgia Institute of Technology, USA*

Organizer: *Matthew Baker*  
*Georgia Institute of Technology, USA*

Organizer: *Ngoc Tran*  
*University of California, Berkeley, USA*

**9:30-9:55 Stochastic Mean Payoff  
Games are Tropical Semidefinite  
Programs**

*Xavier Allamigeon* and *Stephane  
Gaubert*, Inria and CMAP, Ecole  
Polytechnique, France; *Mateusz  
Skomra*, INRIA Saclay and Ecole  
Polytechnique, France

**10:00-10:25 Tropical Polynomial System  
Solving via Combinatorial Homotopy  
Continuation**

*Anders Jensen*, Technische Universität  
Kaiserslautern, Germany

**10:30-10:55 Computing Linear Systems  
on Metric Graphs**

*Bo Lin*, University of California,  
Berkeley, USA

**11:00-11:25 The Membership Problem  
for Tropical Secant Varieties**

*Yaroslav Shitov*, Moscow State  
University, Russia

Tuesday, June 7

## MS15

### Matroid Theory - Part II of III

9:30 AM-12:00 PM

*Room: SCE 217 - Second Floor*

**For Part 1 see MS4**

**For Part 3 see MS24**

Matroids are combinatorial objects that generalize well-known structures such as graphs, sets of vectors, and error-correcting codes. Research problems in matroid theory vary widely, and include problems on structure and connectivity, questions regarding the representation of matroids by more concrete objects such as matrices and graphs, problems regarding enumeration and generation of matroids, and extremal questions.

Organizer: *Stefan van Zwam*  
*Louisiana State University, USA*

Organizer: *Carolyn Chun*  
*United States Naval Academy, USA*

**9:30-9:55 Bounding the Beta Invariants  
of 3-Connected Matroids**

*Sooyeon Lee* and *Haidong Wu*,  
University of Mississippi, USA

**10:00-10:25 Enumerating Matroids of  
Fixed Rank**

*Jorn van Der Pol* and *Rudi Pendavingh*,  
Technische Universiteit Eindhoven,  
The Netherlands

**10:30-10:55 Towards an Excluded-  
Minor Characterization of the Hydra-5  
Matroids**

*Ben Clark*, Louisiana State University,  
USA

**11:00-11:25 Templates for Minor-  
Closed Classes of Binary Matroids**

*Kevin M. Grace* and *Stefan van Zwam*,  
Louisiana State University, USA

**11:30-11:55 Unavoidable Minors for  
Disjoint Bases in a Matroid**

*Peter Nelson*, University of Waterloo,  
Canada

Tuesday, June 7

## MS16

### Combinatorics and Linear Algebra Applied to Electrical Engineering

9:30 AM-12:00 PM

Room:SCE 216 - Second Floor

To accurately monitor an electric power network, it is sufficient to place monitoring device at specific network locations. This yields an optimization problem consisting of minimizing the number of monitoring devices that allows for accurate monitoring of the entire network. This problem can be interpreted as a combinatorial problem known as power domination. Recent advances have related this problem to linear algebra including non-convex rank minimization and zero forcing. This minisymposium features these new advances and offers to shed light on possible new directions.

Organizer: Franklin Kenter  
*Rice University, USA*

Organizer: Daniela Ferrero  
*Texas State University, San Marcos, USA*

#### 9:30-9:55 A Minimum Rank Interpretation for Power Domination

Daniela Ferrero, Texas State University, San Marcos, USA; Leslie Hogben, Iowa State University, USA; Franklin Kenter, Rice University, USA; Michael Young, Iowa State University, USA

#### 10:00-10:25 Connections Between Power Domination and Zero Forcing

Daniela Ferrero, Texas State University, San Marcos, USA

#### 10:30-10:55 Searching for a 3-Separation Formula: Where to Begin?

John Sinkovic, University of Waterloo, Canada

#### 11:00-11:25 Fast and Efficient High Order Sparse Matrix QR Factorization for FPGAs

Semih Aslan, Texas State University, USA

#### 11:30-11:55 On the Northeast Property of Signed Graphs with Loops

Hein van der Holst and Marina Arav, Georgia State University, USA; John Sinkovic, University of Waterloo, Canada

Tuesday, June 7

## MS17

### Graph Limits and Extremal Combinatorics

9:30 AM-12:00 PM

Room:SCE Speakers Auditorium - First Floor

Graph limits and limits of discrete structures in general form an emerging area of combinatorics with many exciting results and open problems. The most understood are dense graph limits where flag algebras provide a powerful framework for computer assisted proofs. This minisymposium will cover recent progress in graph limits and extremal combinatorics.

Organizer: Bernard Lidicky  
*Iowa State University, USA*

Organizer: Michael Young  
*Iowa State University, USA*

#### 9:30-9:55 Are Short Cycles Fractalizers?

Florian Pfender, University of Colorado, Denver, USA; Bernard Lidicky, Iowa State University, USA

#### 10:00-10:25 Some Progress on the Diamond Problem

Liana Yepremyan and Sergey Norin, McGill University, Canada

#### 10:30-10:55 Minimum Number of Edges in Odd Cycles

Ping Hu, University of Warwick, United Kingdom; Jan Volec, ETH Zürich, Switzerland; Andrzej Grzesik, Jagiellonian University, Poland

#### 11:00-11:25 Forcibility Techniques in Flag Algebras

Roman Glebov, Hebrew University of Jerusalem, Israel; Andrzej Grzesik, Jagiellonian University, Poland; Ping Hu, University of Warwick, United Kingdom; Jan Volec, ETH Zürich, Switzerland

#### 11:30-11:55 Graph Limits - Finite Forcibility and Computability

Jacob Cooper, Daniel Kral, and Taisa Martins, University of Warwick, United Kingdom

Tuesday, June 7

## CP5

### Poset

9:30 AM-11:10 AM

Room:SCE 203 - Second Floor

Chair: To Be Determined

#### 9:30-9:45 Unavoidable Trees in Tournaments

Richard Mycroft and Tássio Naia, University of Birmingham, United Kingdom

#### 9:50-10:05 On the Competition Graphs of $d$ -Partial Orders

Jihoon Choi, Seoul National University, Korea; Kyeong Seok Kim, Korea Advanced Institute of Science and Technology, Korea; Suh-Ryung Kim, Seoul National University, Korea; Jung Yeun Lee, National Institute for Mathematical Sciences, Korea; Yoshio Sano, University of Tsukuba, Japan

#### 10:10-10:25 The Nested Chain Decompositions of Some Normalized Graded Posets of Rank Three

Wei-Tian Li and Yu-Lun Chang, National Chung-Hsing University, Taiwan

#### 10:30-10:45 Shifted Young Diagrams and Binary I/D Error-Correcting Codes

Manabu Hagiwara, Chiba University, Japan

#### 10:50-11:05 Unit Tolerance Orders with Open and Closed Points

Ann N. Trenk, Wellesley College, USA

Tuesday, June 7

**CP6****Color 2**

9:30 AM-11:30 AM

Room:SCE 218 - Second Floor

Chair: To Be Determined

**9:30-9:45 Colorings of Hypergraphs with Large Number of Colors**

*Dmitry Shabanov*, Lomonosov Moscow State University, Russia; *Ilia Akolzin*, Moscow Institute of Physics and Technology, Russia

**9:50-10:05 (2,0,0)-Coloring of Planar Graphs Without 4-Cycles or Close Triangles**

*Jennifer Vandenbussche*, Kennesaw State University, USA; *Gexin Yu* and *Heather Hopkins*, College of William & Mary, USA

**10:10-10:25 A Vizing Type Adjacency Theorem on  $g_C$ -Colorings**

*Xia Zhang*, Shandong Normal University, China and College of William and Mary, USA

**10:30-10:45 Precoloring Extensions Using a Generalization of Hall's Marriage Theorem**

*Sarah Holliday*, *Jennifer Vandenbussche*, and *Erik E. Westlund*, Kennesaw State University, USA

**10:50-11:05 A Relative of the Odd Hadwiger's Conjecture**

*Dongyeap Kang* and *Sang-Il Oum*, Korea Advanced Institute of Science and Technology, Korea

**11:10-11:25 Gyárfás Conjecture Is Almost Always True**

*Yelena Yuditsky* and *Bruce Reed*, McGill University, Canada

**Lunch Break**

12:00 PM-1:30 PM

Attendees on their own

Tuesday, June 7

**IP4****Mathematical Models: Uses, abuses, and Non-uses**

1:30 PM-2:15 PM

Room:SCE Speakers Auditorium - First Floor

Chair: To Be Determined

Models are indispensable, but have to be used with caution. Some early quantitative models, drawn from the early history of British railways and related to the ubiquitous gravity models of transportation, urban planning, spacial economics, and related areas, will be presented. They demonstrate how even clearly false models can be useful, and how sometimes they are misused or tragically not used.

*Andrew M. Odlyzko*  
University of Minnesota, USA

**Coffee Break**

2:15 PM-2:45 PM



Room:SCE Ballroom Pre-function Area - First Floor

Tuesday, June 7

**MS18****Current Research in Coding Theory - Part III of III**

2:45 PM-5:15 PM

Room:SCE Court Salon - First Floor

**For Part 2 see MS7**

The minisymposium is devoted to recent results and ongoing research in coding theory. The topics covered in the talks include advances in algebraic geometric codes, coding for DNA memories, network coding, combinatorial results related to the MDS conjecture, and other problems of current interest.

Organizer: *Alexander Barg*  
University of Maryland, USA

**2:45-3:10 Inclusion Matrices and the MDS Conjecture**

*Ameera Chowdhury*, Rutgers University, USA

**3:15-3:40 Rate-Distance Tradeoff for Codes Above Graph Capacity**

*Daniel Cullina*, University of Illinois at Urbana-Champaign, USA

**3:45-4:10 Uncertainty Principle and Stronger Hypercontractivity on the Hypercube**

*Yuri Polyanskiy*, Massachusetts Institute of Technology, USA; *Alex Samorodnitsky*, Hebrew University of Jerusalem, Israel

**4:15-4:40 Estimating the Capacity of the 2-D Hard Square Constraint Using Generalized Belief Propagation - Part I**

*Navin Kashyap*, Indian Institute of Science, Bangalore, India

**4:45-5:10 Estimating the Capacity of the 2-D Hard Square Constraint Using Generalized Belief Propagation - Part II**

*Navin Kashyap*, Indian Institute of Science, Bangalore, India

Tuesday, June 7

## MS19

### Discrete Mathematical Biology - Part I of II

2:45 PM-5:15 PM

Room: SCE 217 - Second Floor

#### For Part 2 see MS39

This minisymposium will focus on the importance of discrete models and methods across a spectrum of mathematical biology. Our goal is to highlight common mathematical challenges motivated by different biological applications.

Organizer: Christine Heitsch  
*Georgia Institute of Technology, USA*

Organizer: Heather C. Smith  
*Georgia Institute of Technology, USA*

#### 2:45-3:10 Strings, Trees, and {RNA} Folding

*Christine Heitsch, Georgia Institute of Technology, USA*

#### 3:15-3:40 Using Inequality-Based Gene Tree Invariants in Phylogenomic Inference

*Ruth Davidson, University of Illinois at Urbana-Champaign, USA*

#### 3:45-4:10 Branching Polytopes for Parametric Analysis of RNA Secondary Structure Prediction

*Svetlana Poznanovikj, Clemson University, USA*

#### 4:15-4:40 Convexity in Tree Spaces

Bo Lin and Bernd Sturmfels, University of California, Berkeley, USA; Xiaoxian Tang, University of Bremen, Germany; Ruriko Yoshida, University of Kentucky, USA

#### 4:45-5:10 Analysis of Breast Cancer Genome Data Using Discrete Computational Topology

*Javier Arsuaga, University of California, Davis, USA*

Tuesday, June 7

## MS20

### Combinatorial Reconfiguration

2:45 PM-5:15 PM

Room: SCE 216 - Second Floor

Reconfiguration problems consist in finding step-by-step transformations between two solutions such that all intermediate results are also feasible. Such problems model dynamic situations where a given solution is in place and has to be modified, but no property disruption can be afforded. Two types of questions are interesting concerning reconfiguration problems: in which case can we ensure that there exists such a transformation? And what is the complexity of finding such a reconfiguration?

Organizer: Marthe Bonamy  
*LaBRI, Université de Bordeaux, and CNRS, France*

#### 2:45-3:10 Invitation to Combinatorial Reconfiguration

*Takehiro Ito, Tohoku University, Japan*

#### 3:15-3:40 Kempe Equivalence of Colourings of Graphs

*Carl Feghali, Durham University, United Kingdom*

#### 3:45-4:10 Kempe Reconfiguration and Potts Antiferromagnets

*Jesus Salas, Universidad Carlos III de Madrid, Spain*

#### 4:15-4:40 Shortest Reconfiguration Paths in the Solution Space of Boolean Formulas

*Amer Mouawad, University of Bergen, Norway; Naomi Nishimura and Vinayak Pathak, University of Waterloo, Canada; Venkatesh Raman, Institute of Mathematical Sciences, Chennai, India*

#### 4:45-5:10 Reconfiguring Graph Homomorphisms and Colourings

Richard Brewster and Sean McGuinness, Thompson Rivers University, Canada; Benjamin Moore, Simon Fraser University, Canada; Jonathan A. Noel, University of Oxford, United Kingdom

Tuesday, June 7

## MS21

### Extremal Problems for Hypergraphs - Part I of II

2:45 PM-5:15 PM

Room: SCE Speakers Auditorium - First Floor

#### For Part 2 see MS35

In recent years, the study of hypergraphs has grown tremendously, with particular focus on extremal questions such as Turán- and Dirac-type problems. Hypergraphs have also proven to be useful tools in tackling a range of questions from other areas of mathematics (for example, through the hypergraph container method). This minisymposium will give a detailed discussion of recent developments regarding various extremal problems and techniques for hypergraphs. Topics covered include perfect matchings, tilings and coverings, random hypergraphs, the absorbing method and universality. We propose an international line-up with speakers based in Europe, North America and South America.

Organizer: Andrew Treglown  
*University of Birmingham, United Kingdom*

Organizer: Richard Mycroft  
*University of Birmingham, United Kingdom*

#### 2:45-3:10 Exact Minimum Codegree Threshold for $K_4$ -Factors

*Andrew Treglown, University of Birmingham, United Kingdom; Jie Han, University of Sao Paulo, Brazil; Allan Lo, University of Birmingham, United Kingdom; Yi Zhao, Georgia State University, USA*

#### 3:15-3:40 Codegree Thresholds for Hypergraph Covering

Victor Falgas-Ravry, Vanderbilt University, USA; Yi Zhao, Georgia State University, USA

*continued on next page*



**3:45-4:10 Turan Problems for Sparse Hypergraphs***Tao Jiang*, Miami University, USA**4:15-4:40 Fractional Clique Decompositions of Dense Graphs and Hypergraphs***Richard Montgomery*, University of Cambridge, United Kingdom; Ben Barber, University of Bristol, United Kingdom; Daniela Kuhn, Deryk Osthus, and Allan Lo, University of Birmingham, United Kingdom**4:45-5:10 Perfect Matchings in Hypergraphs***Jie Han*, University of Sao Paulo, Brazil

Tuesday, June 7

**CP7****Graph Theory II**

2:45 PM-4:25 PM

*Room: SCE 203 - Second Floor**Chair: To Be Determined***2:45-3:00 Antimagic Labelings of Weighted Graphs***Victor Larsen*, Kennesaw State University, USA; Zhanar Berikkyzy, Iowa State University, USA; Axel Brandt and Sogol Jahanbekam, University of Colorado, Denver, USA; Danny Rorabaugh, Queen's University, Canada**3:05-3:20 Realization Graphs of Degree Sequences***Michael D. Barrus*, University of Rhode Island, USA**3:25-3:40 Hamiltonian Cycles in Directed Toeplitz Graphs***Shabnam Malik*, Forman Christian College, Pakistan**3:45-4:00 Ore's Condition for Spanning Halin Subgraphs***Songling Shan*, Vanderbilt University, USA; Guantao Chen, Georgia State University, USA; Colton Magnant, Georgia Southern University, USA**4:05-4:20 Generating Near-Bipartite Bricks***Nishad Kothari*, University of Waterloo, Canada

Tuesday, June 7

**CP8****Probability Theory II**

2:45 PM-4:45 PM

*Room: SCE 218 - Second Floor**Chair: To Be Determined***2:45-3:00 Spatial Networks with Random Connections***Carl Dettmann*, University of Bristol, United Kingdom; Orestis Georgiou, Toshiba Corporation, Japan; Justin Coon, University of Oxford, United Kingdom**3:05-3:20 Evolutionary Dynamics in Finite Populations Mix Rapidly***Ioannis Panageas*, Georgia Institute of Technology, USA; Piyush Srivastava, California Institute of Technology, USA; Nisheeth K. Vishnoi, École Polytechnique Fédérale de Lausanne, Switzerland**3:25-3:40 Uniform Distribution, Stein-Like Characterizations and Identities***Vladimir I. Khokhlov* and *Oleg Viskov*, Steklov Institute of Mathematics, Russia; *Valerii Maksimov*, Russian State University for the Humanities, Russia**3:45-4:00 Corners in Tree-Like Tableaux***Amanda Lohss* and *Pawel Hitczenko*, Drexel University, USA**4:05-4:20 Algebraic Bounds for Heterogeneous and Correlated Percolation***Kathleen Hamilton*, Oak Ridge National Laboratory, USA; *Leonid Pryadko*, University of California, Riverside, USA**4:25-4:40 Using Optimization to Define Unbiased Treatment Effect Estimators for Causal Inference Using Observational Data***Sheldon H. Jacobson*, University of Illinois, USA; *Jason Sauppe*, University of Wisconsin, La Crosse, USA

Tuesday, June 7

## SP1

### 2016 Dénes König Prize Lecture - Phase Transitions in Random Graph Processes

5:30 PM-6:15 PM

Room: SCE Speakers Auditorium - First Floor

Chair: To Be Determined

One of the most interesting features of Erdős-Rényi random graphs is the 'percolation phase transition', where the global structure intuitively changes from only small components to a single giant component plus small ones. In this talk, we discuss the percolation phase transition of Achlioptas processes, which are a class of time-evolving variants of Erdős-Rényi random graphs that (i) can exhibit somewhat surprising phenomena, and (ii) are difficult to analyze due to dependencies between the edges.

Lutz Warnke

University of Cambridge, United Kingdom

## Wednesday, June 8

### Registration

7:30 AM-3:30 PM

Room: SCE Ballroom Pre-function Area - First Floor

### Announcements

8:10 AM-8:15 AM

Room: SCE Speakers Auditorium - First Floor

Wednesday, June 8

## IP5

### Tangles and the Mona Lisa: Connectivity Versus Tree Structure

8:15 AM-9:00 AM

Room: SCE Speakers Auditorium - First Floor

Chair: To Be Determined

Tangles, first introduced by Robertson and Seymour in their work on graph minors, are a radically new way to define regions of high connectivity in a graph. The idea is that, whatever that highly connected region might 'be', low-order separations of the graph cannot cut through it, and so it will orient them: towards the side of the separation on which it lies. A tangle, thus, is simply a consistent way of orienting all the low-order separations in a graph. The new paradigm this brings to connectivity theory is that such consistent orientations of all the low-order separations may, in themselves, be thought of as highly connected regions: rather than asking exactly which vertices or edges belong to such a region, we only ask where it is, collecting pointers to it from all sides. Pixellated images share this property: we cannot tell exactly which pixels belong to the Mona Lisa's nose, rather than her cheek, but we can identify 'low-order' separations of the picture that do not cut right through such features, and which can therefore be used collectively to delineate them. This talk will outline a general theory of tangles that applies not only to graphs and matroids but to a broad range of discrete structures. Including, perhaps, the pixellated Mona Lisa.

Reinhard Diestel

Universität Hamburg, Germany

### Coffee Break

9:00 AM-9:30 AM



Room: SCE Ballroom Pre-function Area - First Floor

Wednesday, June 8

**MS22****Structures in Trees -  
Part II of II**

9:30 AM-12:00 PM

*Room: SCE House Salon - First Floor***For Part 1 see MS2**

There is an active interest in structures in trees, in part motivated by phylogenetics and chemical graph theory. Among others, the session will investigate problems on the number of subtrees of trees (labeled and unlabeled), and on induced quartet subtrees of binary trees (maximum agreement subtree problems and maximum quartet distance between trees). Several talks will represent the state-of-the-art in phylogeny reconstruction. The minisymposium brings together researchers from phylogenetics, extremal theory, and random trees.

Organizer: Laszlo Szekely  
*University of South Carolina, USA*

Organizer: Eva Czabarka  
*University of South Carolina, USA*

**9:30-9:55 On Local Profiles of Trees**

Sebastien Bubeck, Microsoft Research, USA; Katherine Edwards, Princeton University, USA; Horia Mania, University of California, Berkeley, USA; Cathryn Supko, McGill University, Canada

**10:00-10:25 The Maximum Quartet  
Distance Between Phylogenetic Trees**

*Humberto Naves*, University of Minnesota, USA; Noga Alon, Tel Aviv University, Israel; Benny Sudakov, ETH Zürich, Switzerland

**10:30-10:55 The Shape of Treespace**  
*Katherine St. John*, City University of New York, USA

**11:00-11:25 Efficient Quartet Systems in  
Phylogenetic Applications**

*Ruth Davidson*, University of Illinois at Urbana-Champaign, USA; MaLyn Lawhorn, Joseph P. Rusinko, and Noah Weber, Winthrop University, USA

**11:30-11:55 Inducibility in Binary Trees  
and Tanglegram Crossing Numbers**

*Eva Czabarka* and *Laszlo Szekely*, University of South Carolina, USA; Stephan Wagner, Stellenbosch University, South Africa

Wednesday, June 8

**MS23****Algebraic and Variational  
Approaches to Problems on  
Graphs**

9:30 AM-12:00 PM

*Room: SCE Senate Salon - First Floor*

Due to their flexible modeling capabilities, graphs provide a useful abstraction for describing many combinatorial problems arising in various applications. Examples of problems that have received much attention in recent years include community detection and finding structured subgraphs inside larger graphs. This minisymposium presents recent developments on efficient algorithms for such problems on large graphs, with a particular emphasis on algebraic and variational approaches.

Organizer: Utkan Onur Candogan  
*California Institute of Technology, USA*

Organizer: Venkat Chandrasekaran  
*California Institute of Technology, USA*

**9:30-9:55 Finding Planted Graphs with  
Few Eigenvalues Using the Schur Horn  
Relaxation**

*Utkan Onur Candogan* and *Venkat Chandrasekaran*, California Institute of Technology, USA

**10:00-10:25 Graph Profiles: Algorithms  
and Approximation Guarantees**

*Ethan R. Elenberg*, Karthikeyan Shanmugam, Michael Borokhovich, and Alex Dimakis, University of Texas at Austin, USA

**10:30-10:55 Convex Optimization for  
Clustering: Theoretical Guarantees  
and Practical Applications**

*Ramya Korlakai Vinayak*, Samet Oymak, and Babak Hassibi, California Institute of Technology, USA

**11:00-11:25 Chordal Structure in  
Computational Algebra**

*Diego Cifuentes* and *Pablo A. Parrilo*, Massachusetts Institute of Technology, USA

Wednesday, June 8

**MS24****Matroid Theory - Part III of III**

9:30 AM-12:00 PM

*Room: SCE 217 - Second Floor***For Part 2 see MS15**

Matroids are combinatorial objects that generalize well-known structures such as graphs, sets of vectors, and error-correcting codes. Research problems in matroid theory vary widely, and include problems on structure and connectivity, questions regarding the representation of matroids by more concrete objects such as matrices and graphs, problems regarding enumeration and generation of matroids, and extremal questions.

Organizer: Stefan van Zwam  
*Louisiana State University, USA*

Organizer: Carolyn Chun  
*United States Naval Academy, USA*

**9:30-9:55 The Binary Matroids Whose  
Only Odd Circuits are Small**

*Kristen Wetzler*, Louisiana State University, USA

**10:00-10:25 A Lattice Point Counting  
Generalisation of the Tutte Polynomial**

*Amanda Cameron* and *Alex Fink*, Queen Mary, University of London, United Kingdom

**10:30-10:55 Matroids with Many Small  
Circuits and Many Small Cocircuits**

*Simon Pfeil*, Louisiana State University, USA

**11:00-11:25 On Representations of  
Frame Matroids Over Fields**

*Daryl Funk*, Victoria University of Wellington, New Zealand

**11:30-11:55 Bicircular Matroids  
Representable Over  $GF(4)$  or  $GF(5)$** 

*Tyler Moss* and *Deborah Chun*, West Virginia University Institute of Technology, USA; *Daniel Slilaty* and *Xiangqian Zhou*, Wright State University, USA

Wednesday, June 8

## MS25

### Graph Coloring II - Part II of II

9:30 AM-12:00 PM

Room: SCE 216 - Second Floor

#### For Part 1 see MS5

Speakers will present recent results on fundamental problems in graph coloring.

Organizer: Daniel Cranston  
Virginia Commonwealth University, USA

#### 9:30-9:55 Colorings of Plane Graphs

Daniel Kral, University of Warwick,  
United Kingdom

#### 10:00-10:25 Maximal $k$ -Edge-Colorable Subgraphs, Vizing's Theorem, and Tuza's Conjecture

Gregory J. Puleo, University of Illinois,  
USA

#### 10:30-10:55 Reed's Conjecture and Strong Edge Coloring

Marthe Bonamy, LaBRI, Université de Bordeaux, and CNRS, France;  
Thomas Perrett, Technical University of Denmark, Denmark; Luke Postle, University of Waterloo, Canada

#### 11:00-11:25 A Topological Approach Related to Hedetniemi's Conjecture

Marcin Wrochna, University of Warsaw, Poland

#### 11:30-11:55 Generalizations of Reed's Conjecture

Luke Postle, University of Waterloo, Canada

Wednesday, June 8

## MS26

### Extremal Combinatorics - Part II of III

9:30 AM-12:00 PM

Room: SCE Speakers Auditorium - First Floor

#### For Part 1 see MS6

#### For Part 3 see MS46

Combinatorics is a fundamental discipline of modern mathematics which studies discrete objects and their properties. This minisymposium we propose will focus on the subfield of extremal combinatorics and graph theory, which has witnessed an exciting development over the past decades, and also has many striking practical applications in mathematical optimization, computer science, statistical physics and voting society.

We aim to bring the top researchers to the minisymposium, where they will present the recent progress, discuss open challenges, exchange research ideas, and initiate new collaborations. We expect a minisymposium of this nature to have a lasting impact on the future of the subject.

Organizer: Hao Huang  
Emory University, USA

Organizer: Yi Zhao  
Georgia State University, USA

#### 9:30-9:55 On a Conjecture of Erdős on Triangle-Free Graphs

Jacques Verstraëte, University of California, San Diego, USA; Alexandr Kostochka, University of Illinois at Urbana-Champaign, USA; Benny Sudakov, ETH Zürich, Switzerland

#### 10:00-10:25 A Sparse Regular Approximation Lemma

Asaf Shapira and Guy Moshkovitz, Tel Aviv University, Israel

10:30-10:55 Degenerate Hypergraphs  
Linyuan Lu and Shuliang Bai, University of South Carolina, USA

#### 11:00-11:25 Exploring with Flag Algebras

Sergey Norin and Yue Ru Sun, McGill University, Canada

#### 11:30-11:55 Off-Diagonal Hypergraph Ramsey Numbers

Andrew Suk, University of Illinois at Chicago, USA

Wednesday, June 8

## CP9

### Graph Theory 3

9:30 AM-11:30 AM

Room: SCE 203 - Second Floor

Chair: To Be Determined

#### 9:30-9:45 The Decomposition Threshold of a Given Graph

Stefan Glock, Daniela Kuehn, and Allan Lo, University of Birmingham, United Kingdom; Richard Montgomery, University of Cambridge, United Kingdom; Deryk Osthus, University of Birmingham, United Kingdom

#### 9:50-10:05 Cycle Decompositions with No Subsystems

John Asplund, Dalton State College, USA; Michael Schroeder, Marshall University, USA; Venkata Dinavahi, University of Findlay, USA

#### 10:10-10:25 Clique Decompositions of Multipartite Graphs and Completion of Latin Squares

Allan Lo, University of Birmingham, United Kingdom; Ben Barber, University of Bristol, United Kingdom; Daniela Kühn, Deryk Osthus, and Amelia Taylor, University of Birmingham, United Kingdom

#### 10:30-10:45 On (Strongly) Chordal- $(k, \ell)$ Graph Sandwich Problem

R Sritharan, University of Dayton, USA

#### 10:50-11:05 Proof of the Barát-Thomassen Conjecture

Ararat Harutyunyan, University of Toulouse III, France; Julien Bensmail and Martin Merker, Technical University of Denmark, Denmark; Tien-Nam Le and Stéphane Thomassé, École Normale Supérieure de Lyon, France

#### 11:10-11:25 Strong Oriented Graphs with Largest Directed Metric Dimension

Rinovia Simanjuntak and Yozef Tjandra, Bandung Institute of Technology, Indonesia



Wednesday, June 8

## CP10

### Theoretical Computer Science

9:30 AM-11:10 AM

Room: SCE 218 - Second Floor

Chair: To Be Determined

#### 9:30-9:45 A Minimum-Change Version of the Chung-Feller Theorem

Torsten Mütze, Veit Wiechert, and  
Christoph Standke, Technische  
Universität Berlin, Germany

#### 9:50-10:05 Spectral Graph Properties in Combined Routing-Facility Location Problems

Dimitri Papadimitriou, Bell Laboratories,  
Alcatel-Lucent, Belgium

#### 10:10-10:25 Approximate Recognition of Nonregular Languages by Finite Automata

Bala Ravikumar, Sonoma State University,  
USA; Jacob Combs, University of  
Arizona, USA

#### 10:30-10:45 Stability Number Linear Programs

Craig E. Larson, Virginia Commonwealth  
University, USA

#### 10:50-11:05 Modified Linear Programming and Class 0 Bounds for Graph Pebbling

Carl Yenger, Davidson College,  
USA; Daniel Cranston, Virginia  
Commonwealth University, USA; Luke  
Postle, University of Waterloo, Canada;  
Chenxiao Xue, Davidson College, USA

### Lunch Break

12:00 PM-1:30 PM

Attendees on their own

Wednesday, June 8

## MS27

### Tropical Mathematics and Applications - Part III of III

1:30 PM-4:00 PM

Room: SCE Senate Salon - First Floor

#### For Part 2 see MS14

In this minisymposium we will present recent developments in tropical mathematics, which concerns algebra and geometry over the max-plus semiring. The field has seen rapid and significant development in the past decade, and touches on many different areas of mathematics including graph theory, commutative algebra, algebraic geometry, matroid theory, and linear programming. It has applications to areas as diverse as enumerative geometry, auction theory, phylogenetics, and mirror symmetry. This minisymposium will bring together a diverse group of experts in tropical mathematics with a particular (but not exclusive) emphasis on combinatorial methods and applications.

Organizer: Josephine Yu  
Georgia Institute of Technology, USA

Organizer: Matthew Baker  
Georgia Institute of Technology, USA

Organizer: Ngoc Tran  
University of California, Berkeley, USA

#### 1:30-1:55 Anticanonical Tropical del Pezzo Cubic Surfaces Contain Exactly 27 Lines

Maria Angelica Cueto, Ohio State  
University, USA; Anand Deopurkar,  
Columbia University, USA

#### 2:00-2:25 Bitangents of Tropical Plane Quartic Curves

Matthew Baker, Georgia Institute  
of Technology, USA; Yoav Len,  
Universität des Saarlandes, Germany;  
Ralph Morrison, KTH Royal Institute  
of Technology, Sweden; Nathen  
Pflueger, Brown University, USA;  
Qingchun Ren, Google, Inc., USA

#### 2:30-2:55 A Versatile Technique for the Construction of Spectra

Andrew Dudzik, University of California,  
Berkeley, USA

#### 3:00-3:25 Scheme Theoretic Tropicalization

Oliver Lorscheid, Instituto de  
Matemática Pura e Aplicada, Brazil

#### 3:30-3:55 Tropical Skeletons and the Section of Tropicalization

Walter Gubler, Universität Regensburg,  
Germany; Joseph Rabinoff, Georgia  
Institute of Technology, USA; Annette  
Werner, Goethe Universität Frankfurt,  
Germany

Wednesday, June 8

## MS28

### Monochromatic Covering and Ramsey-Type Problems - Part II of II

1:30 PM-4:00 PM

Room: SCE 217 - Second Floor

#### For Part 1 see MS9

Recently there have been some exciting developments in Ramsey theory and the related problem of covering graphs by monochromatic subgraphs. This minisymposium will focus on these recent developments and the methods used to obtain them. We will also look at future research directions in the area.

Organizer: Louis DeBiasio  
*Miami University, USA*

Organizer: Alexey Pokrovskiy  
*ETH Zürich, Switzerland*

#### 1:30-1:55 Partitioning a Graph into a Cycle and a Sparse Graph

Alexey Pokrovskiy, ETH Zürich,  
Switzerland

#### 2:00-2:25 Monochromatic Cycle Partitions

Shoham Letzter, University of Cambridge,  
United Kingdom

#### 2:30-2:55 Monochromatic Cycle Partitioning of 2-Edge-Colored Graphs with Minimum Degree $2n/3$

Peter Allen and Julia Böttcher, London School of Economics, United Kingdom;  
Richard Lang, Universidad de Chile, Chile; Jozef Skokan, London School of Economics, United Kingdom; Maya Stein, Universidad de Chile, Chile

#### 3:00-3:25 Ramsey Numbers of Sparse Graphs and Monochromatic Partitions

Jozef Skokan, London School of Economics, United Kingdom

#### 3:30-3:55 Decompositions of Edge-Colored Infinite Graphs into Monochromatic Connected Pieces

Daniel Soukup, University of Calgary and Pacific Institute for the Mathematical Sciences, Canada

Wednesday, June 8

## MS29

### Cops and Robbers and Pursuit-Evasion in Discrete Structures - Part II of III

1:30 PM-4:00 PM

Room: SCE 216 - Second Floor

#### For Part 1 see MS10

#### For Part 3 see MS40

From Cops and Robbers and its many variants, to firefighting and graph burning, pursuit-evasion is a trending topic within graph theory and discrete mathematics. Broadly speaking, pursuit-evasion focuses on agents whose goal is to capture, contain, or block intruders loose in a discrete structure. The analysis of pursuit-evasion games brings together probabilistic, structural, and algorithmic techniques. Applications range from mobile computing to modelling the spread of influence in social networks. The goal of the minisymposium is to bring together researchers in the field to present results on the state-of-the-art in the field.

Organizer: Anthony Bonato  
*Ryerson University, Canada*

#### 1:30-1:55 Fundamental Conjectures on Eternal Domination

Chip Klostermeyer, University of North Florida, USA

#### 2:00-2:25 The Firefighter Problem for All Orientations of the Cubic Grid

Gary MacGillivray, University of Victoria, Canada

#### 2:30-2:55 On the Zero-Visibility Cops and Robber Game

Dariusz Dereniowski, Gdansk University of Technology, Poland; Danny Dyer and Ryan Tifenbach, Memorial University, Newfoundland, Canada; Boting Yang, University of Regina, Canada

#### 3:00-3:25 The Robot Crawler Graph Process

Anthony Bonato, Ryerson University, Canada; Calum MacRury, Dalhousie University, Canada; Jake Nicolaidis, Xavier Perez Gimenez, and Pawel Pralat, Ryerson University, Canada; Rita María del Río-Chanona, Universidad Nacional Autonoma de Mexico, Mexico; Kirill Ternovsky, Ryerson University, Canada

#### 3:30-3:55 Fully-Active Cops and Robbers

Ilya Gromovikov, Dawson College, Canada; Bill Kinnersley, University of Rhode Island, USA; Ben Seamone, Dawson College, Canada

*continued in next column*

Wednesday, June 8

## MS30

### Graph Theory - Part II of III

1:30 PM-4:00 PM

Room: SCE Speakers Auditorium - First Floor

For Part 1 see MS11

For Part 3 see MS41

This minisymposium consists of three sessions covering various topics surrounding extremal graph theory, structural graph theory, and cycles and paths in graphs.

Organizer: Guantao Chen  
Georgia State University, USA

Organizer: Xingxing Yu  
Georgia Institute of Technology, USA

#### 1:30-1:55 Packing Cycles in Doubly Group Labeled Graphs

Paul Wollan, University of Rome La Sapienza, Italy

#### 2:00-2:25 Quadrangular Embeddings of Complete Graphs

Mark Ellingham, Vanderbilt University, USA; Wenzhong Liu, Nanjing University of Aeronautics and Astronautics, China; Dong Ye and Xiaoya Zha, Middle Tennessee State University, USA

#### 2:30-2:55 3-Flows with Large Support

Jessica McDonald, Auburn University, USA

#### 3:00-3:25 Minimum Degree and Dominating Paths

Ralph Faudree, University of Memphis, USA; Ronald Gould, Emory University, USA; Michael Jacobson, University of Colorado at Denver, USA; Douglas B. West, Zhejiang Normal University, China and University of Illinois, USA

#### 3:30-3:55 A Polyhedral Description of Kernels

Wenan Zang, University of Hong Kong, China

Wednesday, June 8

## CP11

### Algebraic or Number-Theoretic Combinatorics

1:30 PM-3:10 PM

Room: SCE 203 - Second Floor

Chair: To Be Determined

#### 1:30-1:45 Combinatorial Approaches Stanley Depth: Where Do We Stand?

Mitchel T. Keller, Washington and Lee University, USA; Stephen Young, Pacific Northwest National Laboratory, USA

#### 1:50-2:05 On Solution-Free Sets of Integers

Robert A. Hancock and Andrew Treglown, University of Birmingham, United Kingdom

#### 2:10-2:25 Orphans in Forests of Linear Fractional Transformations

Johann Thiel, Satyanand Singh, Sandie Han, and Ariane Masuda, New York City College of Technology, CUNY, USA

#### 2:30-2:45 On Zeros of a Polynomial in a Finite Grid: The Alon-Füredi Bound

John Schmitt, Middlebury College, USA; Anurag Bishnoi, Ghent University, Belgium; Pete L. Clark, University of Georgia, USA; Aditya Potukuchi, Rutgers University, USA

#### 2:50-3:05 The $(u,v)$ Calkin Wilf Tree

Satyanand Singh, Sandie Han, Ariane Masuda, and Johann Thiel, New York City College of Technology, CUNY, USA

Wednesday, June 8

## CP12

### Extremal Combinatorics

1:30 PM-3:10 PM

Room: SCE 218 - Second Floor

Chair: To Be Determined

#### 1:30-1:45 Generalizations of Erdős-Ko-Rado Theorem to $\{0, \pm 1\}$ -Vectors

Andrey Kupavskii, Moscow Institute of Physics and Technology, Russia; Peter Frankl, Renyi Institute, Hungary

#### 1:50-2:05 Saturation Multiplicity of Graphs

Paul Wenger, Rochester Institute of Technology, USA

#### 2:10-2:25 Involution Factorizations of Random Permutations Chosen from the Ewens Distribution

Charles D. Burnette, Drexel University, USA

#### 2:30-2:45 Grids, Diamonds, and the Comb Algorithm

Wesley K. Hough, University of Kentucky, USA

#### 2:50-3:05 Plane Permutations and their Applications

Ricky X. Chen, Virginia Tech, USA; Christian Reidys, Los Alamos National Laboratory, USA; Andrei Bura, Virginia Tech, USA

## Coffee Break

4:00 PM-4:30 PM

Room: SCE Ballroom Pre-function Area - First Floor



Wednesday, June 8

**Hot Topics Session:  
Graph Isomorphism in  
Quasipolynomial Time -  
Part I of II**

4:30 PM-5:15 PM

Room: SCE Speakers Auditorium - First Floor

Chair: To Be Determined

One of the fundamental computational problems in the complexity class NP on Karp's 1973 list, the Graph Isomorphism problem asks to decide whether or not two given graphs are isomorphic. While program packages exist that solve this problem remarkably efficiently in practice (McKay, Piperno, and others), for complexity theorists the problem has been notorious for its unresolved asymptotic worst-case complexity; strong theoretical evidence suggests that the problem should not be NP-complete, yet its worst-case complexity has stood at  $\exp(O(\sqrt{v \log v}))$  (Luks, 1983) for decades, where  $v$  is the number of vertices.

By addressing the bottleneck for Luks's method, we reduce this "moderately exponential" upper bound to quasipolynomial, i.e.,  $\exp((\log v)^c)$ .

The problem we actually solve is the more general String Isomorphism (SI) problem ("anagrams under a given permutation group"), introduced by Luks in his seminal 1980/82 paper, E.M. Luks: Isomorphism of graphs of bounded valence can be tested in polynomial time. J. Comp. Sys. Sci. 25:42--65, 1982.

This Talk and Abstract is split into two parts. Please read the Abstract of the second part; the two Abstracts are meant to form a single document.

László Babai  
The University of Chicago, USA

**Intermission**

5:15 PM-5:30 PM

Wednesday, June 8

**Hot Topics Session:  
Graph Isomorphism in  
Quasipolynomial Time -  
Part II of II**

5:30 PM-6:15 PM

Room: SCE Speakers Auditorium - First Floor

Chair: To Be Determined

Our divide-and-conquer algorithm attempts to significantly reduce the size  $n$  of the permutation domain, at a modest multiplicative cost. This is achieved by finding a canonical  $k$ -ary relation with  $k=O(\log n)$ , from which we infer either a good partitioning of the domain or find a canonically embedded Johnson graph. While the latter does not permit good canonical partitioning, it leads to a dramatic reduction of the problem size; so each outcome yields efficient Luks reduction.

The canonical  $k$ -ary relation is found via group theoretic "local certificates." A new group-theoretic lemma is at the heart of the design and analysis of the algorithm.

In the first talk we shall sketch the main ingredients of the algorithm and indicate how they lead to quasipolynomial recurrence.

In the second talk we shall discuss the core "Local Certificates" algorithm in detail and sketch the aggregation of the local certificates.

Familiarity with basic concepts of group theory (such as kernel of a homomorphism) will be assumed.

The paper is available at  
arXiv:1512.03547.

This Talk and Abstract is split into two parts. Please read the Abstract of the first part; the two Abstracts are meant to form a single document.

László Babai  
The University of Chicago, USA

**SIAG/DM Business Meeting**

6:30 PM-7:15 PM

Room: SCE Speakers Auditorium - First Floor



## Thursday, June 9

**Registration**

7:30 AM-3:30 PM

Room: SCE Ballroom Pre-function Area - First Floor

**Announcements**

8:10 AM-8:15 AM

Room: SCE Speakers Auditorium - First Floor

## IP6

**Induced Matchings,  
Arithmetic Progressions and  
Communication**

8:15 AM-9:00 AM

Room: SCE Speakers Auditorium - First Floor

Chair: To Be Determined

Extremal combinatorics is one of the central branches of discrete mathematics that deals with the problem of estimating the maximum possible size of a combinatorial structure which satisfies certain restrictions. Often, such problems also have applications to other areas including theoretical computer science, additive number theory and information theory. In his talk, we will illustrate this fact using several closely related examples, focusing on the recent works with Alon, Fox, Huang and Moitra.

Benny Sudakov  
ETH Zürich, Switzerland

**Coffee Break**

9:00 AM-9:30 AM

Room: SCE Ballroom Pre-function Area - First Floor





Thursday, June 9

## MS31

### The Mathematics Behind Big Data Analysis - Part II of II

9:30 AM-11:00 AM

Room: SCE Court Salon - First Floor

#### For Part 1 see MS12

How to get rigorous methods for the seemingly ill-defined notion of data analysis? What kinds of mathematical methods can be used to get provable and practical algorithmics for large data? This is a rich area of study, involving research from numerical analysis, statistics, theoretical computer science, and applied algorithmics. This minisymposium brings together researchers from the full spectrum of pure theory to pure practice, to discuss the various viewpoints on data analysis.

Organizer: C. Seshadhri

University of California, Santa Cruz, USA

Organizer: David F. Gleich

Purdue University, USA

#### 9:30-9:55 Network Meso-Structure -- Behind the Complexity Curtain

Blair Sullivan, North Carolina State University, USA

#### 10:00-10:25 Reparametrization Covariant Invariants of Time Series and Cyclicities

Yuliy Baryshnikov, University of Illinois at Urbana-Champaign, USA

#### 10:30-10:55 Network-Based Personalization at Twitter

Aneesh Sharma, Twitter Inc., USA

Thursday, June 9

## MS32

### Random Discrete Structures - Part I of III

9:30 AM-12:00 PM

Room: SCE Senate Salon - First Floor

#### For Part 2 see MS38

The aim of the minisymposium is to provide insight into recent advances in the area of random discrete structures, which deals mainly with typical properties and parameters of combinatorial objects (graphs, hypergraphs, algebraic and data structures, etc), their limit distributions as well as randomized algorithms for generating and analyzing the structures. Presented topics will cover objects of purely theoretical origin and also models of random discrete structures motivated by other fields of science like statistical physics, computer science and network engineering.

Organizer: Andrzej Rucinski

Adam Mickiewicz University, Poland, and Emory University, USA

Organizer: Matas Sileikis

Charles University in Prague, Czech Republic

#### 9:30-9:55 Looking for Vertex Number One

Alan Frieze and Wesley Pegden, Carnegie Mellon University, USA

#### 10:00-10:25 Universality and Resilience in Pseudorandom Graphs

Julia Boettcher and Peter Allen, London School of Economics, United Kingdom; Julia Ehrenmueller, Hamburg University of Technology, Germany; Anusch Taraz, Technische Universität Hamburg, Germany

#### 10:30-10:55 An Occupancy Method for Bounding Partition Functions and Counting Matchings

Ewan Davies and Matthew Jenssen, London School of Economics, United Kingdom; Will Perkins, University of Birmingham, United Kingdom; Barnaby Roberts, London School of Economics, United Kingdom

#### 11:00-11:25 Towards Disproving the Erdős-Hajnal Conjecture...

Krzysztof M. Choromanski, Google Research, USA

#### 11:30-11:55 The Ramsey-Turán Problem with Small Independence Number

Patrick Bennett and Andrzej Dudek, Western Michigan University, USA

continued in next column

Thursday, June 9

## MS33

### Matroids Antimatroids - Part I of II

9:30 AM-11:30 AM

Room: SCE 217 - Second Floor

#### For Part 2 see MS44

Matroids and antimatroids are set systems that satisfy certain combinatorial properties. Matroid theory provides a framework in which problems on graphs, matrices, designs, etc. become easy to understand and solve. Antimatroids have many applications to the theory of geometric spaces and knowledge spaces. These two areas have grown significantly in recent decades. This minisymposium brings together researchers in both areas to seek commonalities and extensions of major work.

Organizer: Kira Adaricheva  
*Nazarbayev University, Kazakhstan*

Organizer: Sandra Kingan  
*Brooklyn College of the City University of New York, USA*

#### 9:30-9:55 Matroids, Antimatroids and Groups

*Jean-Paul Doignon, Université Libre de Bruxelles, Belgium*

#### 10:00-10:25 Deletions, Contractions, and Connectivity

*Joao Paulo Costalonga, Federal University of Espirito Santo, Brazil*

#### 10:30-10:55 A Class of Infinite Convex Geometries

*James B. Nation, University of Hawaii, USA; Kira Adaricheva, Nazarbayev University, Kazakhstan*

#### 11:00-11:25 Strong Splitter Theorem and its Applications

*Sandra Kingan, Brooklyn College of the City University of New York, USA*

Thursday, June 9

## MS34

### Parameterized Algorithms and Graph Decompositions - Part I of II

9:30 AM-12:00 PM

Room: SCE 216 - Second Floor

#### For Part 2 see MS45

The minisymposium will focus on the latest developments in the area of parameterized algorithms and fixed-parameter tractability. Particular emphasis is put on various graph decompositions and structural graph theory with their application in graph algorithms.

Organizer: Marek Cygan  
*University of Warsaw, Poland*

Organizer: Marcin Pilipczuk  
*University of Warsaw, Poland*

Organizer: Michal Pilipczuk  
*University of Warsaw, Poland*

#### 9:30-9:55 The Directed Grid Theorem

*Ken-ichi Kawarabayashi, National Institute of Informatics, Japan; Stephan Kreutzer, Technische Universität Berlin, Germany*

#### 10:00-10:25 Canonical Decompositions and Isomorphism Testing

*Pascal Schweitzer, RWTH Aachen University, Germany*

#### 10:30-10:55 Fixed-Parameter Tractable Canonization and Isomorphism Test for Graphs of Bounded Treewidth

*Daniel Lokshtanov, University of Bergen, Norway; Marcin Pilipczuk and Michal Pilipczuk, University of Warsaw, Poland; Saket Saurabh, Institute of Mathematical Sciences, India*

#### 11:00-11:25 The Splitter Game on Nowhere Dense Classes of Graphs

*Sebastian Siebertz, Technische Universität Berlin, Germany*

#### 11:30-11:55 Constructive Algorithm for Path-Width of Matroids

*Jisu Jeong, Korea Advanced Institute of Science and Technology, Korea; Eun Jung Kim, CNRS, France; Sang-II Oum, Korea Advanced Institute of Science and Technology, Korea*

Thursday, June 9

## MS35

### Extremal Problems for Hypergraphs - Part II of II

9:30 AM-12:00 PM

Room: SCE Speakers Auditorium - First Floor

#### For Part 1 see MS21

In recent years, the study of hypergraphs has grown tremendously, with particular focus on extremal questions such as Turán- and Dirac-type problems. Hypergraphs have also proven to be useful tools in tackling a range of questions from other areas of mathematics (for example, through the hypergraph container method). This minisymposium will give a detailed discussion of recent developments regarding various extremal problems and techniques for hypergraphs. Topics covered include perfect matchings, tilings and coverings, random hypergraphs, the absorbing method and universality. We propose an international line-up with speakers based in Europe, North America and South America.

Organizer: Andrew Treglown  
*University of Birmingham, United Kingdom*

Organizer: Richard Mycroft  
*University of Birmingham, United Kingdom*

#### 9:30-9:55 Hamilton Cycles in Hypergraphs

*Frederik Garbe and Richard Mycroft, University of Birmingham, United Kingdom*

#### 10:00-10:25 Hypergraph Embeddings

*Peter Allen, Julia Boettcher, Ewan Davies, and Jozef Skokan, London School of Economics, United Kingdom*

*continued on next page*

**10:30-10:55 The Codegree Threshold of  $\{abc, abd, abe, cde\}$** *Victor Falgas-Ravry*, Vanderbilt

University, USA; Edward Marchant, Trinity College, Cambridge, United Kingdom; Oleg Pikhurko, University of Warwick, United Kingdom; Emil Vaughan, Queen Mary, University of London, United Kingdom

**11:00-11:25 Universal Hypergraphs**

Samuel Hetterich, Olaf Parczyk, and Yury Person, University of Frankfurt, Germany

**11:30-11:55 Spectra of Random Symmetric Hypermatrices and Random Hypergraphs***Joshua Cooper*, University of South Carolina, USA

Thursday, June 9

**CP13****Graph Theory IV****9:30 AM-11:50 AM***Room: SCE 203 - Second Floor**Chair: To Be Determined***9:30-9:45 When Every Minimal Separator is Complete Multipartite***Terry McKee*, Wright State University, USA**9:50-10:05 Characterization of Unit Interval Bigraphs of Open and Closed Intervals***Ashok K. Das*, University Of Calcutta, India**10:10-10:25 On Forbidden Induced Subgraphs for Unit Disk Graphs***Victor Zamaraev*, University of Warwick, United Kingdom; Aistis Atminas, The Open University, United Kingdom**10:30-10:45 A New Proof of Seymour's 6-Flow Theorem***Robert Samal*, Charles University, Czech Republic; Matt DeVos, Simon Fraser University, Canada; Edita Rollova, University of West Bohemia, Pilsen, Czech Republic**10:50-11:05 Large Induced Forests in Planar and Subcubic Graphs of Girth 4 and 5***Thomas Kelly*, University of Waterloo, Canada; Chun-Hung Liu, Princeton University, USA**11:10-11:25 On the Largest Number of Colorings of a Graph***Aysel Erey*, University of Denver, USA; Jason Brown, Dalhousie University, Canada**11:30-11:45 Short Containers in Modified Line Digraphs***Prashant D. Joshi*, Cadence Design Systems, USA; Frank Hsu, Fordham University, USA; Arunabha Sen, Arizona State University, USA; Said Hamdioui and Koen Bertels, Delft University of Technology, Netherlands**Lunch Break****12:00 PM-1:30 PM***Attendees on their own*

Thursday, June 9

**IP7****Quasirandomness, Sidorenko's Conjecture and Graph Norms****1:30 PM-2:15 PM***Room: SCE Speakers Auditorium - First Floor**Chair: To Be Determined*

Using the theory of quasirandomness as an underlying theme, we will discuss recent progress on a number of problems in extremal graph theory, including Sidorenko's conjecture and a question of Lovász asking for a classification of graphs that define norms.

David Conlon

*University of Oxford, United Kingdom***Coffee Break****2:15 PM-2:45 PM***Room: SCE Ballroom Pre-function Area - First Floor*

Thursday, June 9

## MS36

### Combinatorial Algorithms: How Do We Cope with Hard Problems?

2:45 PM-5:15 PM

Room:SCE Court Salon - First Floor

This minisymposium will highlight a variety of computing options available for combinatorial problems. Many problems from graph theory and combinatorics face the issue of combinatorial explosion, making it difficult to obtain exact solutions. Even pure mathematicians working strictly within the realm of theorems and proofs must derive base cases from which to make conjectures. In the world of discrete mathematics, computing simple base cases can be a significant obstacle. To deal with this, we showcase several different case studies and traditional algorithms, as well as a variety of new computing methods that some mathematicians may be unfamiliar with.

Organizer: Victoria Horan

Air Force Research Laboratory, USA

#### 2:45-3:10 A Comparison of Approaches for Solving Hard Graph-Theoretic Problems

Victoria Horan, Air Force Research Laboratory, USA

#### 3:15-3:40 Techniques for Solving the Sudoku Puzzle

Eric Chi, North Carolina State University, USA; Kenneth Lange, University of California, Los Angeles, USA

#### 3:45-4:10 Using the D-Wave Machine for Combinatorial Problems

Andrew D. King, D-Wave Systems, Inc., Canada

#### 4:15-4:40 Algorithms for Combinatorial Generation

Joe Sawada, University of Guelph, Canada

#### 4:45-5:10 The Graph Isomorphism Problem and Adiabatic Algorithms

Omar Shehab, University of Maryland, Baltimore County, USA

Thursday, June 9

## MS37

### Discrete Geometry

2:45 PM-4:15 PM

Room:SCE House Salon - First Floor

Organizer: Boris Bukh

Carnegie Mellon University, USA

#### 2:45-3:10 Quantitative Helly-Type Results

Pablo Soberon, Northeastern University, USA

#### 3:15-3:40 Bounds on Equiangular Lines and on Related Spherical Codes

Boris Bukh, Carnegie Mellon University, USA

#### 3:45-4:10 Geometric Discrepancy and its Applications

Esther Ezra, Georgia Institute of Technology, USA

Thursday, June 9

## MS38

### Random Discrete Structures - Part II of III

2:45 PM-5:15 PM

Room:SCE Senate Salon - First Floor

For Part 1 see MS32

For Part 3 see MS43

The aim of the minisymposium is to provide insight into recent advances in the area of random discrete structures, which deals mainly with typical properties and parameters of combinatorial objects (graphs, hypergraphs, algebraic and data structures, etc), their limit distributions as well as randomized algorithms for generating and analyzing the structures. Presented topics will cover objects of purely theoretical origin and also models of random discrete structures motivated by other fields of science like statistical physics, computer science and network engineering.

Organizer: Andrzej Rucinski

Adam Mickiewicz University, Poland, and Emory University, USA

Organizer: Matas Sileikis

Charles University in Prague, Czech Republic

#### 2:45-3:10 Unsatisfiability Proofs of Random (2,3)-SAT Require Much Space

Patrick Bennett, Western Michigan University, USA; Michael Molloy, University of Toronto, Canada

#### 3:15-3:40 Online Sprinkling

Asaf Ferber, Yale University and Massachusetts Institute of Technology, USA

#### 3:45-4:10 Independence of Random Sets in Hypergraphs

Karen Gunderson, University of Manitoba, Canada

continued on next page



**4:15-4:40 How to Determine if a Random Graph with a Fixed Degree Sequence has a Giant Component**

Felix Joos and *Guillem Perarnau*,  
University of Birmingham, United Kingdom; Dieter Rautenbach,  
Universität Ulm, Germany; Bruce Reed,  
McGill University, Canada

**4:45-5:10 Using Pólya Urns to Show Normal Limit Laws for Fringe Subtrees in  $m$ -ary Search Trees and Preferential Attachment Trees**

*Cecilia Holmgren* and Svante Janson,  
Uppsala University, Sweden; Matas Sileikis, Charles University in Prague,  
Czech Republic

Thursday, June 9

## MS39

### Discrete Mathematical Biology - Part II of II

2:45 PM-5:15 PM

Room: SCE 217 - Second Floor

#### For Part 1 see MS19

This minisymposium will focus on the importance of discrete models and methods across a spectrum of mathematical biology. Our goal is to highlight common mathematical challenges motivated by different biological applications.

Organizer: Christine Heitsch  
*Georgia Institute of Technology, USA*

Organizer: Heather C. Smith  
*Georgia Institute of Technology, USA*

#### 2:45-3:10 Complexity of the Single Cut-Or-Join Model for Genome Rearrangement

Istvan Miklos, *Renyi Institute, Hungary*;  
*Heather C. Smith, Georgia Institute of Technology, USA*

#### 3:15-3:40 A Topological Language of Rna Structures

*Wenda Huang and Christian Reidys, Virginia Tech, USA*

#### 3:45-4:10 Convex Hulls in Phylogenetic Tree Space

*Megan Owen, Lehman College, CUNY, USA*

#### 4:15-4:40 Predict, Prevent and Manage Antimicrobial Drug Resistance: Discrete and Algebraic Approaches

*Kristina Crona, American University, USA*

#### 4:45-5:10 Emergent Dynamics from Network Connectivity: A Minimal Model

*Carina Curto, Pennsylvania State University, USA*

Thursday, June 9

## MS40

### Cops and Robbers and Pursuit-Evasion in Discrete Structures - Part III of III

2:45 PM-5:15 PM

Room: SCE 216 - Second Floor

#### For Part 2 see MS29

From Cops and Robbers and its many variants, to firefighting and graph burning, pursuit-evasion is a trending topic within graph theory and discrete mathematics. Broadly speaking, pursuit-evasion focuses on agents whose goal is to capture, contain, or block intruders loose in a discrete structure. The analysis of pursuit-evasion games brings together probabilistic, structural, and algorithmic techniques. Applications range from mobile computing to modelling the spread of influence in social networks. The goal of the minisymposium is to bring together researchers in the field to present results on the state-of-the-art in the field.

Organizer: Anthony Bonato  
*Ryerson University, Canada*

#### 2:45-3:10 To Catch a Falling Robber

*Pawel Pralat, Ryerson University, Canada*; Douglas B. West, *Zhejiang Normal University, China* and *University of Illinois, USA*; Bill Kinnersley, *University of Rhode Island, USA*

#### 3:15-3:40 The Prisoner's Dilemma Game on Graphs

*Jeannette Janssen, Dalhousie University, Canada*

#### 3:45-4:10 Searching Graph Products

*Margaret-Ellen Messinger, Mount Allison University, Canada*

#### 4:15-4:40 Cops, Robbers, and Infinite Graphs

*Gena Hahn, Université de Montréal, Canada*

#### 4:45-5:10 Cops and Robbers and Barricades

*Erin Meger and Anthony Bonato, Ryerson University, Canada*

Thursday, June 9

## MS41

### Graph Theory - Part III of III

2:45 PM-5:15 PM

Room: SCE Speakers Auditorium - First Floor

#### For Part 2 see MS30

This minisymposium consists of three sessions covering various topics surrounding extremal graph theory, structural graph theory, and cycles and paths in graphs.

Organizer: Guantao Chen

Georgia State University, USA

Organizer: Xingxing Yu

Georgia Institute of Technology, USA

#### 2:45-3:10 Degree Sum and Dominating Paths

Ronald Gould, Emory University, USA;

Jill Faudree, University of Alaska,

Fairbanks, USA; Ralph Faudree,

University of Memphis, USA; Paul

Horn, University of Denver, USA;

Michael Jacobson, University of

Colorado at Denver, USA

#### 3:15-3:40 Clique Degrees in Random Graphs

Anton Bernshteyn, University of

Illinois at Urbana-Champaign, USA;

Christopher Cox, Carnegie Mellon

University, USA; Paul Horn, University

of Denver, USA; Franklin Kenter, Rice

University, USA; Bernard Lidicky and

Bernard Lidicky, Iowa State University,

USA; Humberto Naves, University

of Minnesota, USA; Florian Pfender,

University of Colorado, Denver, USA;

Michael Tait, University of California,

San Diego, USA

#### 3:45-4:10 Packing and Covering Immersions in 4-Edge-Connected Graphs

Chun-Hung Liu, Princeton University, USA

#### 4:15-4:40 Tiling Directed Graphs with Tournaments

Cyzgrinow Andrzej, Arizona State

University, USA; DeBiasio Louis,

Miami University, USA; Theodore

Molla, University of Illinois at Urbana-

Champaign, USA; Andrew Treglown,

University of Birmingham, United

Kingdom

#### 4:45-5:10 On Box-Perfect Graphs

Guoli Ding, Louisiana State University, USA

Thursday, June 9

## CP14

### Ramsey

2:45 PM-4:25 PM

Room: SCE 203 - Second Floor

Chair: To Be Determined

#### 2:45-3:00 Bounded Colorings of Multipartite Graphs

Nina Kamcev, Benny Sudakov, and Jan Volec, ETH Zürich, Switzerland

#### 3:05-3:20 Online Ramsey Theory for $C_3$

Hojin Choi, Ilkyoo Choi, Jisu Jeong, and Sang-Il Oum, Korea Advanced Institute of Science and Technology, Korea

#### 3:25-3:40 Diagonal Forms of Incidence Matrices Arising from Bipartite Graphs and Applications to Zero-Sum Ramsey Problems

Wing Hong Tony Wong, Kutztown University of Pennsylvania, USA

#### 3:45-4:00 Ramsey Goodness of Bounded Degree Trees

Igor Balla, Alexey Pokrovskiy, and Benjamin Sudakov, ETH Zürich, Switzerland

#### 4:05-4:20 On Ordered Ramsey Numbers of Bounded-Degree Graphs

Martin Balko, Vít Jelínek, and Pavel Valtr, Charles University in Prague, Czech Republic

Thursday, June 9

**PP1****Poster Session**

5:30 PM-6:30 PM

*Room: SCE Ballroom Pre-function Area - First Floor***Fast and Efficient High Order Sparse Matrix Qr Factorization for Fpgas***Semih Aslan, Texas State University, USA***Linear Sequential Dynamical Systems and the Moebius Functions of Partially Ordered Sets***Ricky X. Chen, Virginia Tech, USA;  
Christian Reidys, Los Alamos National Laboratory, USA***Method for Finding the Maximum Region Disjoint Paths in a Network***Rucha M. Joshi, Westwood High School, USA***Linear Feedback State Registers Fool Finite Automata***Bjørn Kjos-Hanssen, Achilles Beros, and  
Mushfeq Khan, University of Hawaii, Manoa, USA***Enumeration of Chord Diagrams***Evgeniy Krasko and Alexander  
Omelchenko, St. Petersburg Academic University, Russia***Analyzing RNA Secondary Structures with Fixed Percentage of Bases***Thomas J. Li and Christian Reidys, Virginia Tech, USA***Moments and Cycle Structures for Random Permutations with Restricted Positions***Enes Ozel, University of Southern California, USA***A Combinatorial Approach to Deep Learning and Compression***Hristo S. Paskov, John C. Mitchell, and Trevor Hastie, Stanford University, USA***Friday, June 10****Registration**

7:30 AM-10:30 AM

*Room: SCE Ballroom Pre-function Area - First Floor***Closing Remarks**

8:10 AM-8:15 AM

*Room: SCE Speakers Auditorium - First Floor*

Friday, June 10

**IP8****Excluded Grid Theorem: Improved and Simplified**

8:15 AM-9:00 AM

*Room: SCE Speakers Auditorium - First Floor**Chair: To Be Determined*

One of the key results in Robertson and Seymour's seminal work on graph minors is the Excluded Grid Theorem. The theorem states that there is a function  $f$ , such that for every positive integer  $g$ , every graph whose treewidth is at least  $f(g)$  contains the  $(g \times g)$ -grid as a minor. This theorem has found many applications in graph theory and algorithms. An important open question is establishing tight bounds on  $f(g)$  for which the theorem holds. Robertson and Seymour showed that  $f(g) \geq \Omega(g^2 \log g)$ , and this remains the best current lower bound on  $f(g)$ . Until recently, the best upper bound was super-exponential in  $g$ . In this talk, we will give an overview of a recent sequence of results, that has lead to the best current upper bound of  $f(g) = O(g^{19} \text{polylog}(g))$ .

Julia Chuzhoy  
Toyota Technological Institute at Chicago, USA

**Coffee Break**

9:00 AM-9:30 AM

*Room: SCE Ballroom Pre-function Area - First Floor*

Friday, June 10

## MS42

### Markov Chains in the Sciences

9:30 AM-12:00 PM

*Room: SCE Court Salon - First Floor*

Markov chains are widely used throughout the sciences. Markov chain Monte Carlo methods provide a simple way to sample from complex distributions or to count combinatorial objects. Markov chains also arise naturally as stochastic processes that are interesting in their own right. The analysis of Markov chains draws techniques and insights from probability, combinatorics, graph theory, theoretical computer science and the various scientific disciplines using them. In this minisymposium, we explore Markov chains from areas such as statistical physics and cryptography as well as the mathematical techniques used to understand and analyze them.

Organizer: Sarah Miracle  
*University of St. Thomas, USA*

Organizer: Amanda Streib  
*Center for Computing Sciences, USA*

#### 9:30-9:55 Cycle Basis Markov Chain for the Ising Model

*Amanda Streib and Noah Streib, Center for Computing Sciences, USA; Isabel Beichl, National Institute of Standards and Technology, USA; Francis Sullivan, Center for Computing Sciences, USA*

#### 10:00-10:25 Reverse Cycle Walking and its Applications

*Sarah Miracle and Scott Yilek, University of St. Thomas, USA*

#### 10:30-10:55 Sampling Integer Partitions Using Biased Markov Chains

*Prateek Bhakta, Dana Randall, Ben Cousins, and Matthew Fahrbach, Georgia Institute of Technology, USA*

#### 11:00-11:25 Sampling on Lattices with Free Boundary Conditions Using Randomized Extensions

*Sarah Cannon and Dana Randall, Georgia Institute of Technology, USA*

#### 11:30-11:55 On Sampling Crossing-Free Geometric Structures

*Ivona Bezakova, Rochester Institute of Technology, USA*

Friday, June 10

## MS43

### Random Discrete Structures - Part III of III

9:30 AM-12:00 PM

*Room: SCE Senate Salon - First Floor*

#### For Part 2 see MS38

The aim of the minisymposium is to provide insight into recent advances in the area of random discrete structures, which deals mainly with typical properties and parameters of combinatorial objects (graphs, hypergraphs, algebraic and data structures, etc), their limit distributions as well as randomized algorithms for generating and analyzing the structures. Presented topics will cover objects of purely theoretical origin and also models of random discrete structures motivated by other fields of science like statistical physics, computer science and network engineering.

Organizer: Andrzej Rucinski  
*Adam Mickiewicz University, Poland, and Emory University, USA*

Organizer: Matas Sileikis  
*Charles University in Prague, Czech Republic*

#### 9:30-9:55 Multicolour Ramsey Properties of Random Graphs

*Pawel Pralat, Ryerson University, Canada; Andrzej Dudek, Western Michigan University, USA*

#### 10:00-10:25 Folkman Numbers and Hypergraph Containers

*Troy Retter, Emory University, USA*

#### 10:30-10:55 Finding Structures in Random Graphs Economically

*Asaf Ferber, Yale University and Massachusetts Institute of Technology, USA; Michael Krivelevich, Tel Aviv University, Israel; Benny Sudakov and Pedro Vieira, ETH Zürich, Switzerland*

#### 11:00-11:25 On a Phase Transition of the Random Intersection Graph: Supercritical Region

*Jeong Han Kim, Korea Institute for Advanced Study, Korea; Sang June Lee, Duksung Women's University, Korea; Joohan Na, Korea Institute for Advanced Study, Korea*

#### 11:30-11:55 Concentration of Extension Counts in $G(n,p)$

*Matas Sileikis, Charles University in Prague, Czech Republic; Lutz Warnke, University of Cambridge, United Kingdom*

*continued in next column*

Friday, June 10

**MS44****Matroids Antimatroids -  
Part II of II**

9:30 AM-11:30 AM

*Room: SCE 217 - Second Floor***For Part 1 see MS33**

Matroids and antimatroids are set systems that satisfy certain combinatorial properties. Matroid theory provides a framework in which problems on graphs, matrices, designs, etc. become easy to understand and solve. Antimatroids have many applications to the theory of geometric spaces and knowledge spaces. These two areas have grown significantly in recent decades. This minisymposium brings together researchers in both areas to seek commonalities and extensions of major work.

Organizer: Kira Adaricheva  
*Nazarbayev University, Kazakhstan*

Organizer: Sandra Kingan  
*Brooklyn College of the City University of New York, USA*

**9:30-9:55 Clones in Matroids**

*Talmage J. Reid, University of Mississippi, USA*

**10:00-10:25 Effective Implicational Bases of Convex Geometries**

*Kira Adaricheva, Nazarbayev University, Kazakhstan*

**10:30-10:55 Coefficients of the Tutte Polynomial**

*Vaidyanathan Sivaraman, Binghamton University, USA*

**11:00-11:25 Clones in Matroids Representable Over a Prime Field**

*Xiangqian Zhou, Wright State University, USA*

Friday, June 10

**MS45****Parameterized Algorithms  
and Graph Decompositions  
- Part II of II**

9:30 AM-12:00 PM

*Room: SCE 216 - Second Floor***For Part 1 see MS34**

The minisymposium will focus on the latest developments in the area of parameterized algorithms and fixed-parameter tractability. Particular emphasis is put on various graph decompositions and structural graph theory with their application in graph algorithms.

Organizer: Marek Cygan  
*University of Warsaw, Poland*

Organizer: Marcin Pilipczuk  
*University of Warsaw, Poland*

Organizer: Michal Pilipczuk  
*University of Warsaw, Poland*

**9:30-9:55 Modular Decomposition and its Algorithmic Applications**

*Yixin Cao, The Hong Kong Polytechnic University, Hong Kong*

**10:00-10:25 Optimization Problems via Minimal Triangulations and Potential Maximal Cliques**

*Ioan Todinca, Universite d'Orleans, France*

**10:30-10:55 Structural Sparseness and Complex Networks**

*Felix J. Reidl, North Carolina State University, USA*

**11:00-11:25 Color Coding-Related Techniques**

*Meirav Zehavi, Tel Aviv University, Israel*

**11:30-11:55 Parameterized Algorithms Using Matroids**

*Saket Saurabh, Institute of Mathematical Sciences, India*

Friday, June 10

**MS46****Extremal Combinatorics -  
Part III of III**

9:30 AM-12:00 PM

*Room: SCE Speakers Auditorium - First Floor***For Part 2 see MS26**

Combinatorics is a fundamental discipline of modern mathematics which studies discrete objects and their properties. This minisymposium we propose will focus on the subfield of extremal combinatorics and graph theory, which has witnessed an exciting development over the past decades, and also has many striking practical applications in mathematical optimization, computer science, statistical physics and voting society. We aim to bring the top researchers to the minisymposium, where they will present the recent progress, discuss open challenges, exchange research ideas, and initiate new collaborations. We expect a minisymposium of this nature to have a lasting impact on the future of the subject.

Organizer: Hao Huang  
*Emory University, USA*

Organizer: Yi Zhao  
*Georgia State University, USA*

**9:30-9:55 On Some Turán and Dirac-Type Questions for Triple Systems**

*Andrzej Rucinski, Adam Mickiewicz University, Poland, and Emory University, USA*

**10:00-10:25 Extremal Problems for Uniformly Dense Hypergraphs**

*Mathias Schacht, Universitat Hamburg, Germany*



Friday, June 10

## MS46

### Extremal Combinatorics - Part III of III

9:30 AM-12:00 PM

Room:SCE Speakers Auditorium - First Floor

continued

#### 10:30-10:55 The Matching-Number Process

Michael Krivelevich, Tel Aviv University, Israel; *Po-Shen Loh*, Carnegie Mellon University, USA; Benjamin Sudakov, ETH Zürich, Switzerland

#### 11:00-11:25 Problems and Results on Bisections

*Jie Ma*, University of Science and Technology of China, China; *Hehui Wu*, University of Mississippi, USA

#### 11:30-11:55 Saturation in Random Graphs

*Daniel Korandi* and Benjamin Sudakov, ETH Zürich, Switzerland

Friday, June 10

## CP15

### Geometry

9:30 AM-11:10 AM

Room:SCE 203 - Second Floor

Chair: To Be Determined

#### 9:30-9:45 On the Widom-Rowlinson Occupancy Fraction in Regular Graphs

*Emma Cohen*, Georgia Institute of Technology, USA; *Will Perkins*, University of Birmingham, United Kingdom; *Prasad Tetali*, Georgia Institute of Technology, USA

#### 9:50-10:05 Discrete Curvature and Abelian Groups

*Peter Ralli*, Georgia Institute of Technology, USA

#### 10:10-10:25 Local Polyhedrality of Integer Hulls of Strict Convex Sets

*Umakanta Pattanayak* and *Vishnu Narayanan*, Indian Institute of Technology-Bombay, India

#### 10:30-10:45 The Graded Lexicographic Polytope and Two New Families of Dantzig Figures

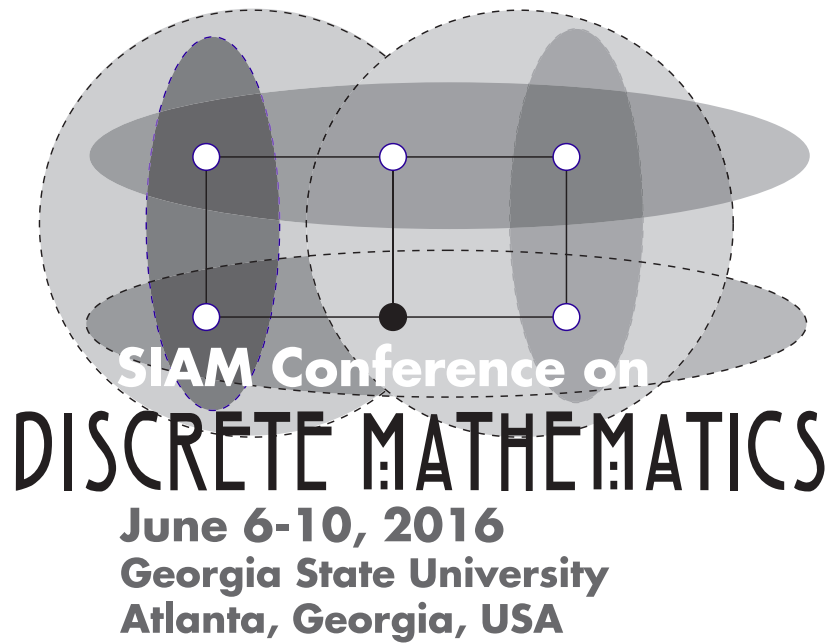
*Akshay Gupte* and *Svetlana Poznanovic*, Clemson University, USA

#### 10:50-11:05 Reconstructing a Finite Topological Space from Quotient-Spaces

*J. M. S. Simoes-Pereira*, University of Coimbra, Portugal

## Abstracts

Figure courtesy Victor Chepoi, Hans-Juergen Bandelt, David Eppstein from SIDMA 24-4



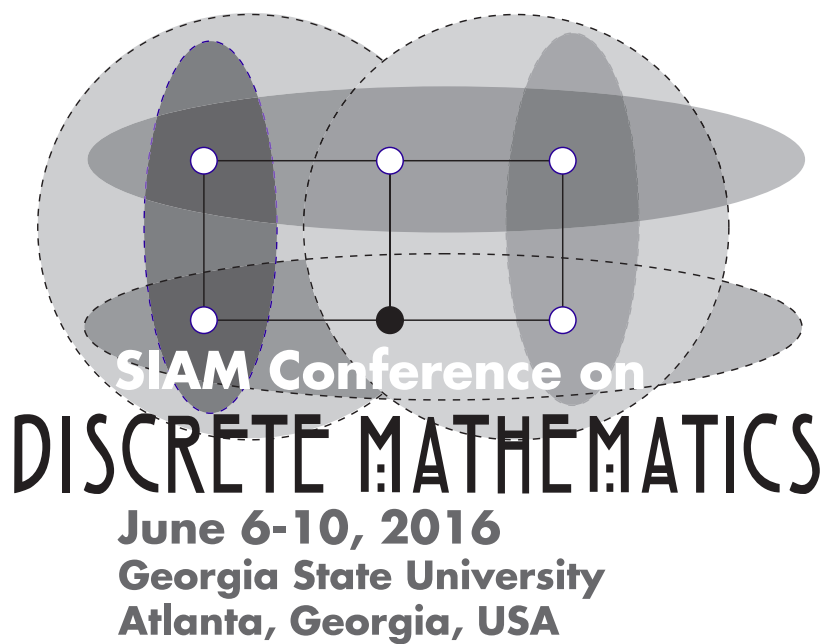
Abstracts are printed as submitted by the authors.

## Notes



## Speaker and Organizer Index

Figure courtesy Victor Chepoi, Hans-Juergen Bandelt, David Eppstein from SIDMA 24-4



**A**

Abbe, Emmanuel, MS1, 10:00 Mon  
*Adaricheva, Kira, MS33, 9:30 Thu*  
*Adaricheva, Kira, MS44, 9:30 Fri*  
 Adaricheva, Kira, MS44, 10:00 Fri  
 Allen, Peter, MS35, 10:00 Thu  
 Arsuaga, Javier, MS19, 4:45 Tue  
 Aslan, Semih, MS16, 11:00 Tue  
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 Asplund, John, CP9, 9:50 Wed

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Babai, László, 4:30 Wed  
 Babai, László, 5:30 Wed  
*Baker, Matthew, MS8, 2:45 Mon*  
*Baker, Matthew, MS14, 9:30 Tue*  
*Baker, Matthew, MS27, 1:30 Wed*  
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*Barg, Alexander, MS1, 9:30 Mon*  
*Barg, Alexander, MS7, 2:45 Mon*  
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 Barrus, Michael D., CP7, 3:05 Tue  
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 Beelen, Peter, MS1, 9:30 Mon  
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 Bhakta, Prateek, MS42, 10:30 Fri  
 Boettcher, Julia, MS32, 10:00 Thu  
*Bonamy, Marthe, MS20, 2:45 Tue*  
 Bonamy, Marthe, MS25, 10:30 Wed  
*Bonato, Anthony, MS10, 2:45 Mon*  
 Bonato, Anthony, MS10, 2:45 Mon  
*Bonato, Anthony, MS29, 1:30 Wed*  
*Bonato, Anthony, MS40, 2:45 Thu*  
 Bowler, Nathan, MS4, 10:00 Mon  
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 Bukh, Boris, MS37, 3:15 Thu

Burnette, Charles D., CP12, 2:10 Wed

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*Candogan, Utkan Onur, MS23, 9:30 Wed*  
 Candogan, Utkan Onur, MS23, 9:30 Wed  
 Cannon, Sarah, MS42, 11:00 Fri  
 Cao, Yixin, MS45, 9:30 Fri  
*Chandrasekaran, Venkat, MS23, 9:30 Wed*  
*Chen, Guantao, MS11, 2:45 Mon*  
*Chen, Guantao, MS30, 1:30 Wed*  
*Chen, Guantao, MS41, 2:45 Thu*  
 Chen, Ricky X., CP12, 2:50 Wed  
 Chen, Ricky X., PP1, 5:30 Thu  
 Chi, Eric, MS12, 9:30 Tue  
 Chi, Eric, MS36, 3:15 Thu  
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 Choromanski, Krzysztof M., MS32, 11:00 Thu  
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*Chun, Carolyn, MS15, 9:30 Tue*  
*Chun, Carolyn, MS24, 9:30 Wed*  
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 Chuzhoy, Julia, IP8, 8:15 Fri  
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*Cranston, Daniel, MS25, 9:30 Wed*

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 Cullina, Daniel, MS18, 3:15 Tue  
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*Cygan, Marek, MS45, 9:30 Fri*  
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*Czabarka, Eva, MS22, 9:30 Wed*  
 Czabarka, Eva, MS22, 11:30 Wed

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 Davidson, Ruth, MS22, 11:00 Wed  
*Debiasio, Louis, MS9, 2:45 Mon*  
 Debiasio, Louis, MS9, 2:45 Mon  
*Debiasio, Louis, MS28, 1:30 Wed*  
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 Doignon, Jean-Paul, MS33, 9:30 Thu  
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 Draisma, Jan, MS8, 2:45 Mon  
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 Ellingham, Mark, MS30, 2:00 Wed  
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 Ferber, Asaf, MS38, 3:15 Thu  
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 Harutyunyan, Ararat, CP9, 10:50 Wed  
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 Miracle, Sarah, MS42, 10:00 Fri  
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*Mycroft, Richard, MS35, 9:30 Thu*  
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 Naves, Humberto, MS22, 10:00 Wed  
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 Person, Yury, MS35, 11:00 Thu  
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*Pilipczuk, Marcin, MS34, 9:30 Thu*  
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*Pilipczuk, Marcin, MS45, 9:30 Fri*  
*Pilipczuk, Michal, MS34, 9:30 Thu*  
*Pilipczuk, Michal, MS45, 9:30 Fri*  
*Pokrovskiy, Alexey, MS9, 2:45 Mon*  
*Pokrovskiy, Alexey, MS28, 1:30 Wed*  
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*Rucinski, Andrzej, MS32, 9:30 Thu*  
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*Rucinski, Andrzej, MS43, 9:30 Fri*  
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*Szekely, Laszlo, MS22, 9:30 Wed*

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*Yu, Josephine, MS14, 9:30 Tue*  
*Yu, Josephine, MS27, 1:30 Wed*  
*Yu, Xingxing, MS11, 2:45 Mon*  
*Yu, Xingxing, MS30, 1:30 Wed*  
*Yu, Xingxing, MS41, 2:45 Thu*  
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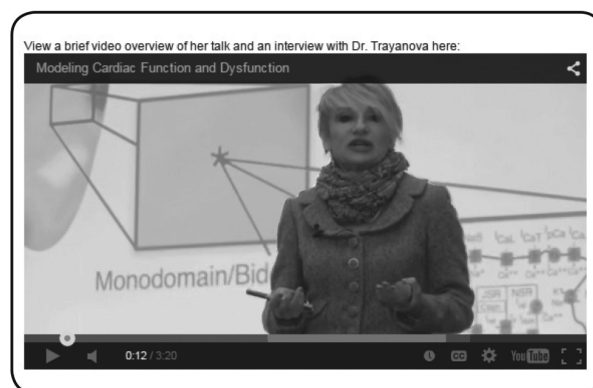
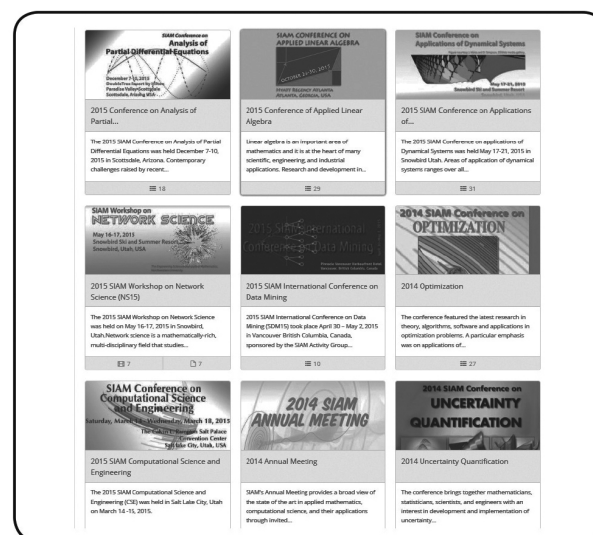
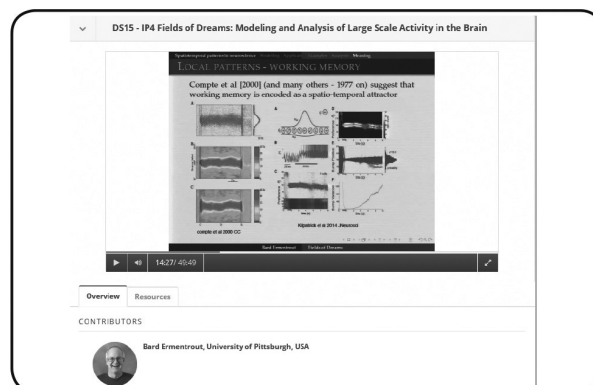
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## DM16 Budget

**Conference Budget**  
**SIAM Conference on Discrete Mathematics**  
**June 6-10, 2016**  
**Atlanta, Georgia**

**Expected Paid Attendance** 320

**Revenue**

Registration Income	\$88,870.00
GSU Support	\$10,000.00
Total	<u>\$98,870.00</u>

**Expenses**

Printing	\$2,200.00
Organizing Committee	\$3,800.00
Invited Speakers	\$10,500.00
Food and Beverage	\$15,000.00
Room Rental	\$9,000.00
Advertising	\$3,000.00
Conference Labor (including benefits)	\$38,512.00
Other (supplies, staff travel, freight, misc.)	\$3,550.00
Administrative	\$8,293.00
Accounting/Distribution & Shipping	\$4,450.00
Information Systems	\$8,247.00
Customer Service	\$3,002.00
Marketing	\$4,690.00
Office Space (Building)	\$3,050.00
Other SIAM Services	\$3,101.00
Total	<u>\$120,395.00</u>

Net Conference Expense -\$21,525.00

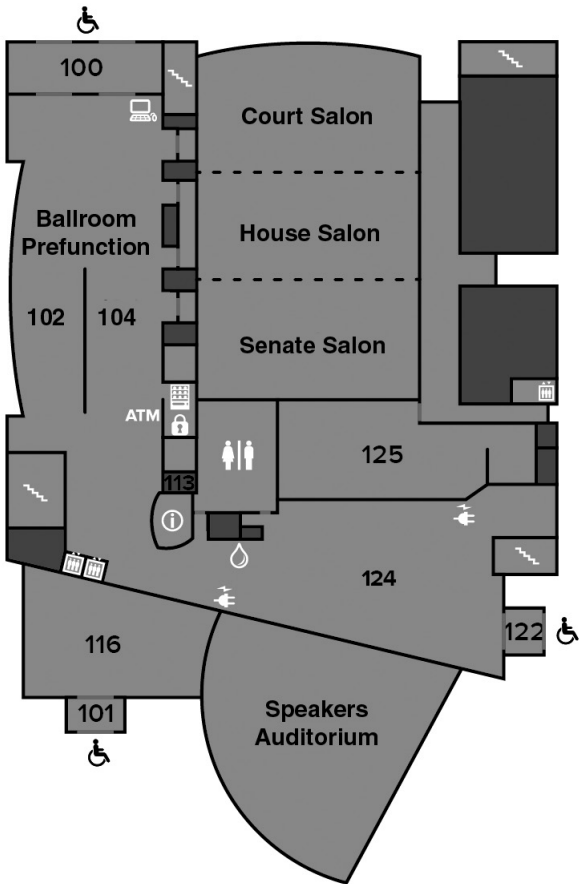
Support Provided by SIAM	<u>\$21,525.00</u>
	<u>\$0.00</u>

**Estimated Support for Travel Awards not included above:**

Early Career and Students	22	\$17,100.00
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# Georgia State University Student Center Floor Plan

Student Center East (SCE): 1st Floor



Student Center East (SCE): 2nd Floor

