

# 2014 MIT PRIMES CONFERENCE

## Program for Research In Mathematics, Engineering, and Science for High School Students



MIT Simmons Hall. Photo (cc) 2009 nd-nA

### Saturday, May 17: Mathematics

#### 8:30 am Welcoming remarks

Prof. Michael Sipser, Acting Dean of the MIT School of Science, Head of the MIT Mathematics Department  
Prof. Pavel Etingof, PRIMES Chief Research Advisor  
Dr. Slava Gerovitch, PRIMES Program Director

#### 9:00 am Session 1

Kavish Gandhi, *Geodesics in the hypercube* (mentor Yufei Zhao)  
Noah Golowich, *Removing cycles from dense digraphs* (mentor László Miklós Lovász)  
Eric Nie and Alok Puranik, *Cellular automata on a hexagonal grid* (mentor Dr. Tanya Khovanova)

#### 10:20 am Session 2

Arjun Khandelwal, *Compact dot representations in permutation avoidance* (mentor Rik Sengupta)  
Joseph Zurier, *Generalizations of the joints problem* (mentor Ben Yang)

#### 11:05 am Session 3: PRIMES-IGL

Jessica Li, *On the geometry and mathematical modelling of snowflakes and viruses* (mentor Prof. Laura Schaposnik, University of Illinois at Urbana-Champaign)  
Yilun Du, *Tiling harmonic functions* (mentor Prof. Sergiy Merenkov, University of Illinois at Urbana-Champaign)

#### 12:00 pm Session 4: PRIMES-USA

Eric Neyman, *Cylindric Young tableaux and their properties* (mentor Darij Grinberg)  
Sara Kim, *Connected matchings in graphs of independence number 2* (mentor Dr. Peter Csikvari)  
Andrew He, Suzy Lou, and Max Murin, *On the existence of  $srg(99, 14, 1, 2)$*  (mentor Dr. Peter Csikvari)

#### 2:15 pm Session 5: PRIMES-USA

Shyam Narayanan, *Improving the accuracy of primality tests by enhancing the Miller-Rabin theorem* (mentor David Corwin)  
Kyle Gettig, *Linear extensions of directed acyclic graphs* (mentor Benjamin Iriarte)  
Brice Huang, *G-parking functions and monotone monomial ideals* (mentor Wuttisak Trongsiriwat)

#### 3:30 pm Session 6: PRIMES-USA

Alexandria Yu, *Classification of unital 7-dimensional commutative algebras* (mentor Sherry Gong)  
Peter Tian, *On the extremal functions of multi-dimensional forbidden matrices* (mentor Jesse Geneson)  
Shashwat Kishore, *Decomposition of tensor products of Verma modules* (mentor Gus Lonergan)

#### 4:45 pm Session 7: Reading groups

Cameron Derwin and Margalit Glasgow, *The probabilistic method* (mentor Chiheon Kim)  
Rohil Prasad, William Kuszmaul, and Isaac Xia, *Proving the trefoil is knotted* (mentor Umut Varolgunes)  
Ravi Jagadeesan and Luke Sciarappa, *Simplicial homology* (mentor Akhil Mathew)

### Sunday, May 18: Computer Science Physical and Computational Biology

#### 8:45 am Welcoming remarks

Prof. Srinivasa Devadas, MIT Department of Electrical Engineering and Computer Science  
Dr. Slava Gerovitch, PRIMES Program Director

#### 9:00 am Session 8

William Wu and Nicolaas Kaashoek, *How to teach a class to grade itself* (mentors Christos Tzamos and Matt Weinberg)  
Amy Chou and Justin Kaashoek, *Automatically generating puzzle problems of different complexity levels* (mentor Rishabh Singh)  
Istvan Chung and Oron Propp, *Inferring the structure of probabilistic graphical models for efficient natural language understanding* (mentor Dr. Thomas Howard)

#### 10:40 am Session 9

Nathan Wolfe and Ethan Zou, *Protecting private data in the cloud: A path oblivious RAM protocol* (mentors Ling Ren and Xiangyao Yu)  
Lalita Devadas, *Modelling changes in gene expression in neurodegeneration in mice* (mentor Angela Yen)  
Michael Colavita, *Network motifs of pathogenic genes in human regulatory network* (mentor Soheil Feizi)

#### 12:00 pm Invited Lecture

**Stephen Wolfram, *Making discoveries using computation***

#### 2:15 pm Session 10: Medical Informatics

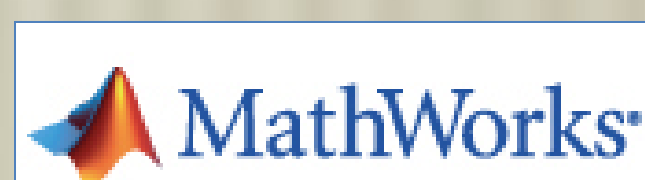
Dr. Gil Alterovitz, Computer Science & Artificial Intelligence Lab, Introductory remarks  
Yishen (Tom) Chen, *SMART Genomics API* (mentor Dr. Gil Alterovitz)  
Xi (Steve) Chen, *Genomics development library for Android* (mentor Dr. Gil Alterovitz)  
John Zhang, *Integrating genomic, clinical, and patient questionnaire information for breast cancer diagnosis and treatment* (mentor Dr. Gil Alterovitz)  
Andrew Li and Arul Prasad, *Exploration of disordered proteins related to drug resistance in Hepatitis B virus and lung cancer* (mentor Dr. Gil Alterovitz)

#### 4:00 pm Session 11: Physical and Computational Biology

Prof. Leonid Mirny, Physics Department, Introductory remarks  
Andrew Luo, *The impact of protein aggregates on the sub-diffusion of a DNA locus* (mentors Geoffrey Fudenberg and Maxim Imakaev)  
Carolyn Lu, *Loop extruding enzymes in interphase: Dynamic folding of chromatin domains* (mentors Geoffrey Fudenberg and Maxim Imakaev)

#### 5:00 pm Session 12: Mathematics

Yonah Borns-Weil and Junho Won, *Discrete and continuous dynamical systems: Applications and examples* (mentor Dr. Aaron Welters)  
Joshua Xiong, *On the winning positions in generalizations of Nim* (mentor Dr. Tanya Khovanova)  
Niket Gowravaram and Uma Roy, *A diagrammatic approach to the  $K(\pi, 1)$  conjecture* (mentor Alisa Knizel)



Room 4-163, MIT  
web.mit.edu/primes