2016 MIT PRIMES CONFERENCE

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

Saturday, May 21: Mathematics

8:20 am Welcoming remarks
Prof. Tomasz Mrowka, Head of the MIT Mathematics Department
Prof. Pavel Etingof, PRIMES Chief Research Advisor
Dr. Slava Gerovitch, PRIMES Program Director

8:50 am Session 1
Nicholas Guo, *Rational hyperplane arrangements and counting independent sets of symmetric graphs* (mentor Guangyi Yue)
Valerie Zhang, *Computer-based representations and manipulations of paths in the plane* (mentor Umut Varolgunes)
Aaron Yeiser, *A robust spectral PDE solver on skinny triangles* (mentor Dr. Alex Townsend)

10:00 am Session 2
Kai-Siang Ang, *On the geometry of icosahedral viruses* (mentor Prof. Laura Schaposnik, University of Illinois at Chicago)
Nikhil Marda, *On point separation by arrangements of lines* (mentor Borys Kadets)
Zachary Chroman, *Rational embeddings of convex polyhedra* (mentor Sheela Devadas, Stanford University)

11:10 am Session 3
Ria Das, *Investigations of mixed reinforcement-memory models for random walks* (mentor Andrew Rzeznik)
PRIMES STEP students, *Who is guilty?* (mentor Dr. Tanya Khovanova)
PRIMES STEP students, *Alternator coins* (mentor Dr. Tanya Khovanova)

1:10 pm Session 4
Felix Wang, *Ramification of solutions of functional equations* (mentor Prof. Michael Zieve, University of Michigan)
Nathan Smith, *Square-primitive gaps* (mentor Xiaoyu He, Harvard University)
Meena Jagadeesan and Karthik Karnik, *The Outer Automorphism of S_6* (mentor Akhil Mathew)

2:25 pm Session 5
Nina Anikeeva, *Applications of ergodic theory to continued fractions on the Heisenberg group* (mentor Prof. Jayadev Athreya, University of Washington)
Rafael Saavedra, *Discreet coin weighings and the Frobenius problem* (mentor Dr. Tanya Khovanova)
Harish Vemuri, *Tiling-harmonic conjugate functions* (mentor Prof. Sergiy Merenkov, CCNY – CUNY)

3:30 pm Session 6
Nelson (Shuheng) Niu, *Extensions of classic combinatorial games* (mentor Dr. Tanya Khovanova)
Kevin Chang, *Ordered Ramsey numbers of small graphs* (mentor William Kuszmaul, Stanford University)
Louis Golowich and Richard Zhou, *Maximum number of pairwise G-different permutations* (mentor Chiheon Kim)

4:40 pm Session 7
Eric Nie and Alok Puranik, *Invariants of knots* (mentor Zhenkun Li)
Albert Yue, *Knot diagram invariants and bounds for the number of Reidemeister moves needed for unknotting* (mentor Piotr Suwara)
Alec Leng, *Independence of the Miller-Rabin and Lucas probable prime tests* (mentor David Corwin)

6:15 pm Session 8
Maya Sankar, *The dimensions of partially directed nil-Temperley-Lieb algebras* (mentor Dr. Tanya Khovanova)
Laura Pierson, *Signatures of stable multiplicity spaces in symmetric group restrictions* (mentor Siddharth Venkatesh)
Dhruv Rohatgi, *A connection between vector bundles over smooth projective curves and representations of quivers* (mentor Vishal Arul)

7:20 pm Session 9
Alec Sun, *Wall crossing bijections and representations of rational Cherednik algebras* (mentor Seth Shelley-Abrahamson)
Matt Lipman, *Representations of Cherednik algebras* (mentor Gus Lonergan)
Matthew Hase-Liu, *Counting points on curves of the form $y^{m_1} = c_1 x^{n_1} + c_2 x^{n_2} y^{m_2}$* (mentor Nicholas Triantafillou)

Installation *Chord* by Antony Gormley (2015) at the entrance to MIT's Math Department. Photo by Slava Gerovitch.

Sunday, May 22: Computer Science and Computational Biology

8:45 am Welcoming remarks
Prof. Srini Devadas, MIT EECS Department
Dr. Slava Gerovitch, PRIMES Program Director

9:00 am Session 10: Computer Science
Harshal Sheth, Aashish Welling, and Nihar Sheth, *Read-copy update in a garbage collected environment* (mentor Cody Cutler)
Vivek Bhupatiraju, John Kuszmaul, and Vinjai Vale, *Exploring proof of space with hard-to-pebble graphs* (mentors Ling Ren and Albert Kwon)
Leo Alcock, *Private publishing using Bitcoin* (mentor Ling Ren)

10:30 am Session 11: Computer Science
Cristian Gutu, *SeifPass: A secure password manager* (mentor Albert Kwon)
Henry Liu, Justin Kaashoek, and Siye Zhu, *Scalable logging algorithm for in-memory database systems* (mentor Xiangyao Yu)
Yatharth Agarwal and Vishnu Murale, *Moving in next door: network flooding as a side channel in cloud environments* (mentors Dr. Jason Hennessey, Kyle Hogan, and Dr. Mayank Varia, Boston University)

11:55 am Session 12: Computational and Physical Biology
Prof. Leonid Mirny, Introductory remarks
Laura Braverman, *Protein determinants of chromosome domains* (mentor Nezar Abdennur)
Betsy Pu, *Chromatin states at boundary elements* (mentor Nezar Abdennur)
Krishna Suraj, *Emergent chromosome organization in interphase from loop extrusion* (mentor Dr. Geoffrey Fudenberg)

2:00 pm Session 13: Computational Neuroscience
Prof. Ed Boyden, Introductory remarks
Albert Gerovitch, *Metrics for comparing 3D neuron segmentations in expansion microscopy connectomics* (mentor Dr. Adam Marblestone)
Zachary Steinberg, *Automatic segmentation of punctate 3D super-resolution microscopy data* (mentor Daniel Goodwin)

3:00 pm Session 14: Medical Informatics
Prof. Gil Alterovitz, Introductory remarks
Daniel Lu, *Study of various synergistic drug mechanisms in disordered protein-related diseases* (mentor Prof. Gil Alterovitz)
Kara Luo, *Computational modeling identifies biosynthetic modifications to improve drug inhibition against Klebsiella pneumoniae* (mentor Prof. Gil Alterovitz)
Arul Prasad, *Targeting viral envelope proteins: an application to the Zika virus* (mentor Prof. Gil Alterovitz)

4:15 pm Session 15: Medical Informatics
Andrew Gritsevskiy and Adithya Vellal, *Compression and integration of human genomic variants into smart EHR systems* (mentor Prof. Gil Alterovitz)
John Flahive, *Providing clinical decision support to medical providers through interpretation of gene-drug interactions* (mentor Prof. Gil Alterovitz)
James Jusuf, *Exploring the effects of CTCF binding site mutations on transcriptional regulation* (mentor Dr. Mahmoud Ghandi, Broad Institute)

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