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RESEARCH INTERESTS

Arithmetic Geometry, Computational Number Theory, Sphere Packing, Modular Forms, Variants of Chabauty's Method for Computing Rational Points, and much more!

EDUCATION

Massachusetts Institute of Technology, Cambridge, MA
Doctoral Candidate
Degree expected in May 2019

Cambridge University, Cambridge, CB, UK — June 2014
Master of Advanced Study in Mathematics, with Distinction

University of Michigan, Ann Arbor, MI — May 2013
Bachelor of Science, With Highest Distinction, GPA 4.0/4.0
Concentration: Highest Honors in Mathematics, High Honors in Computer Science
Honor Societies: Phi Beta Kappa, Phi Kappa Phi

FELLOWSHIPS SCHOLARSHIPS AND HONORS

- National Science Foundation Graduate Fellowship (2013)
- Churchill Scholarship Recipient (2013)
- Astronaut Scholarship Recipient (2012)
- Goldwater Scholarship Recipient as a Sophomore (2011)
- Gates-Cambridge Scholarship Finalist, Declined Interview (2013)
- University of Michigan Nominee, Marshall Scholarship (2012)
- Eight-Term James B. Angell Scholar (2013)
- Sidney Fine Teaching Award for one University of Michigan student with the potential to become an inspiring teacher and scholar in any discipline.
- Honorable Mention on Putnam Math Competition (2012, 2013)
- 14th place Nationally on United States of America Math Olympiad (2008)

PUBLICATIONS

- (with Vishal Arul, Alex Best, Edgar Costa, and Richard Magner) *Computing Zeta Functions of Cyclic Covers in Large Characteristic*, `arXiv:1806.02262`, *Proceedings of ANTS XIII* (2018).
- (with Olivia Beckwith, Victor Luo, Steven J. Miller, and Karen Shen) *Distribution of Eigenvalues of Weighted, Structured Matrix Ensembles*, `arXiv:1112.3719`, Volume 15 *Integers* (2015).
- (with Anant Godbole, Chang Mou Lim, and Vince Lyzinski) *Sharp Threshold Asymptotics for the Emergence of Additive Bases*, `arXiv:1110.1745`, Volume 13 *Integers* (2013).

PREPRINTS

- *Variants of the Method of Skolem-Chabauty-Coleman and S-integral points on* $\mathbb{P}^1 \setminus \{0, 1, \infty\}$, in preparation (2018).
- (with Henry Cohn) *Limitations from Modular Forms on LP-Bounds for Sphere Packing*, Preprint (2017).

- (with Steven J. Miller) *Determinantal Expansions in Random Matrix Theory and Number Theory*, Preprint (2014).
- (with Geoffrey Iyer and Steven J. Miller) *Moment Formulas of Classical Compact Groups*, Preprint (2014).

RESEARCH TALKS

- Title TBD (on Variants of Chabauty's Method), Junior Number Theory Days, Rutgers University - Newark, November 2018 (upcoming).
- *Computing Zeta Functions of Cyclic Covers in Large Characteristic*, AMS Fall Sectional Meeting, Special Session on from Hyperelliptic to Superelliptic Curves, University of Michigan - Ann Arbor, October 2018 (upcoming).
- *Computing Zeta Functions of Cyclic Covers in Large Characteristic*, ANTS XIII, University of Wisconsin - Madison July 2018.
- *The Szpiro Conjecture for Hyperelliptic Curves* (joint presentation with Sam Schiavone), PhD Summer school "Curves, L-functions, and Galois Representations", ICTP Trieste, September 2017.
- *Determinantal Expansions in Random Matrix Theory and Number Theory*, Joint Meetings of the American Mathematical Society, San Diego, CA, January 2013.
- *Determinantal Expansions in Random Matrix Theory and Number Theory*, Maine-Quebec Number Theory Conference, Quebec City, QC, September 2012.
- *Distributions of Eigenvalues of Variations of Hermitian Toeplitz Matrix Ensembles*, Young Mathematicians Conference, Columbus, OH, July 2012.
- *Omnimosaics*, Joint Meetings of the American Mathematical Society, New Orleans, LA, January 2011.
- *Omnisequences and Omnimosaics*, Undergraduate Math Club, University of Michigan - Ann Arbor, January 2011.

RESEARCH POSTERS

- *Limitations from Modular Forms on LP-Bounds for Sphere Packing*, ANTS XIII, University of Wisconsin - Madison, July 2018.
- *Limitations from Modular Forms on LP-Bounds for Sphere Packing*, Workshop Arithmetic Geometry and Computer Algebra, Carl von Ossietzky Universität, July 2017.

EXPOSITORY TALKS

- *Hodge filtration on the de Rham fundamental group*, Seminar on Topics in Arithmetic, Geometry, Etc. (on Nonabelian Chabauty), MIT, Cambridge, MA, April 2018.
- *Cyclotomic units and Iwasawa's theorem*, Seminar on Topics in Arithmetic, Geometry, Etc. (on Iwasawa Theory), MIT, Cambridge, MA, October 2017.
- *Representations associated to weight 1 forms: end of the proof, and applications* Seminar on Topics in Arithmetic, Geometry, Etc. (on Modular Representations of $\mathrm{Gal}(\overline{\mathbb{Q}}/\mathbb{Q})$), MIT, Cambridge, MA, February 2017.
- *Advances in sphere packing*, Pure Math Graduate Student Seminar, MIT, Cambridge, MA, November 2016.
- *Skeleton of the Jacobian: overview and uniformization*, Seminar on Topics in Arithmetic, Geometry, Etc. (on Tropical Geometry), MIT, Cambridge, MA, October 2016.
- *The Siegel modular variety*, Seminar on Topics in Arithmetic, Geometry, Etc. (on Shimura Varieties), MIT, Cambridge, MA, March 2016.
- *Dual abelian varieties*, Seminar on Topics in Arithmetic, Geometry, Etc. (on Abelian Varieties), MIT, Cambridge, MA, October 2015.

- *Isogeny volcanoes*, Pure Math Graduate Student Seminar, MIT, Cambridge, MA, March 2015.
- *Finite flat group schemes*, Seminar on Topics in Arithmetic, Geometry, Etc. (on Abelian Varieties), MIT, Cambridge, MA, February 2015.
- *Initial results on multiple zeta values*, Seminar on Topics in Arithmetic, Geometry, Etc. (on the Projective Line Minus Three Points), MIT, Cambridge, MA, November 2014.
- *Modular polynomials and complex multiplication*, Part III Seminar Series, Cambridge University, Cambridge, CB, March 2014.

RESEARCH POSITIONS

Research Intern Summer 2016
Microsoft Research New England, Cambridge, MA

- Studied linear programming bounds for sphere packing. Project is on-going.

Researcher at SMALL REU Summer 2012
Williams College, Williamstown, MA

- Developed effective formulas for the n-level density of holomorphic cusp forms for test functions with large support using techniques from analytic number theory.
- Proved Katz-Sarnak correspondence between random matrix theory and number theory for test functions with largest known support.
- Disproved several conjectures about structured ensembles of random matrices.

Research Intern at Department of Defense Summer 2011

- Developed and optimized algorithms in computational algebraic geometry.
- Developed an efficient implementation of a new cryptologic.

Researcher at ETSU REU Summer 2010
East Tennessee State University, Johnson City, TN

- Utilized probabilistic and constructive approaches to discover new results in combinatorics and additive number theory.

TEACHING EXPERIENCE

Teaching Assistant - 18.05 (Probability and Statistics) Spring 2018
Massachusetts Institute of Technology, Cambridge, MA

- Supported students in partially flipped-classroom style class.
- Gave presentations to the class.

Instructor - 18.01 IAP (Calculus I and II Review Class) January 2017
Massachusetts Institute of Technology, Cambridge, MA

- Four weeks of lecture to review all of 18.01 (Calculus I and II) for students who almost passed during the year.
- Worked with individual students to fill weaknesses in background knowledge, test taking strategies, etc.

Teaching Assistant - Project Lab in Mathematics Spring 2016
Massachusetts Institute of Technology, Cambridge, MA

- Mentored teams of students on short-term research projects.
- Provided concrete suggestions for improving overall paper structure and general math-

ematical writing.

Instructor - Art of Problem Solving (various classes) 2015 to present

- Taught mathematical problem-solving based online classes to bright middle and high-school students.

Instructor - Games and Puzzles Fall 2012

University of Michigan, Ann Arbor, MI

- Designed and taught course on games and puzzles for Honors freshmen.
- Taught mathematical problem solving skills as related to economics, computer science, psychology, and education.
- Held weekly office hours.

Course Assistant - Honors Analysis I, II Fall 2012 - Spring 2013

University of Michigan, Ann Arbor, MI

- Prepared and gave weekly lectures as discussion section leader.
- Evaluated and suggested improvements to students' proof writing and solution methods.

Course Assistant - Honors Mathematics I, II Fall 2011 - Spring 2012

University of Michigan, Ann Arbor, MI

- Prepared and gave weekly lectures as discussion section leader.
- Held weekly office hours to explain important concepts of introductory analysis and various other topics.
- Graded all homework assignments.

Course Assistant - Explorations in Randomness Spring 2011

University of Michigan, Ann Arbor, MI

- Explained important concepts of combinatorics and probability to students in twice-weekly office hours.
- Graded all homework assignments and assisted with exam grading.

Grader Summer 2010

Mathematical Olympiad Summer Program, Lincoln, NE

- Worked with small groups of the nation's best mathematics students to teach creative problem solving in combinatorics.
- Evaluated and suggested improvements to students' mathematical rigor and proof-writing style.

SERVICE

2017-2018

- MIT Institute Committee on Graduate Stipends, Co-Chair
- MIT Institute Working Group on Graduate Housing, Member
- MIT Graduate Student Council, Housing and Community Affairs Co-Chair - supported subcommittees focused on mental health and on support for underpriviledged and/or minority students.
- Co-organized Seminar Topics in Arithmetic, Geometry, Etc. (on Nonabelian Chabauty) at MIT in Spring semester

2016-2017

- Mentored high school student on research project counting points on superelliptic curves through PRIMES program
- President of Sidney-Pacific Graduate Community (responsible for all social and academic programming for a 670+ person graduate apartment building)
- Founder and co-organizer of Sidney-Pacific Graduate Student Seminar
- Graduate Student Representative to MIT Math Visiting Committee (an evaluation body for the department)

2015-2016

- Organizer of MIT Pure Math Graduate Student Seminar

2014

- Volunteer in Middle School Classrooms through STIMULUS Program

2013

- Chair of Contributed Talk Session on Number Theory at Joint Math Meetings

2010 - 2013

- Undergraduate Assistant, Michigan Math Circle (MMC) - MMC provides area middle and high school students who enjoy mathematics with the opportunity to learn exciting topics that fall outside of the standard curriculum.
- Grader, United States of America Math Olympiad

2012

- Assistant Coach, Michigan team for American Regional Mathematics League
- Reviewer for MathSciNet

2011

- Chair of Contributed Talk Session on Combinatorics at Joint Math Meetings

2005 - 2009

- Coach, Saginaw Arts and Sciences Academy MATHCOUNTS Team