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Shiva Chidambaram

Employment

2021–present **Research Scientist**, *Massachusetts Institute of Technology*.

Education

2015–2021 **PhD in Mathematics**, *The University of Chicago*.

Thesis: Moduli Spaces of Abelian Varieties Associated to mod- p Galois Representations.
Advisor: Frank Calegari.

2010–2015 **BS-MS dual degree in Mathematics**, *Indian Institute of Science Education and Research, Pune*, Institute Gold medalist.

Masters thesis: Cohomology of $GL(2)$. Advisor: A Raghuram.

Publications and Preprints

- [1] Frank Calegari and Shiva Chidambaram. Rationality of twists of the Siegel modular variety of genus 2 and level 3. *Proc. Amer. Math. Soc.*, 150(5):1975–1984, 2022. arXiv:2009.00194.
- [2] Frank Calegari, Shiva Chidambaram, and David P. Roberts. Abelian surfaces with fixed 3-torsion. In *ANTS XIV—Proceedings of the Fourteenth Algorithmic Number Theory Symposium*, volume 4 of *Open Book Ser.*, pages 91–108. Math. Sci. Publ., Berkeley, CA, 2020. arXiv:2003.00604.
- [3] Frank Calegari, Shiva Chidambaram, and Alexandru Ghitza. Some modular abelian surfaces. *Math. Comp.*, 89(321):387–394, 2020. arXiv:1906.10939.
- [4] Nikola Adžaga, Shiva Chidambaram, Timo Keller, and Oana Padurariu. Rational points on hyperelliptic Atkin-Lehner quotients of modular curves and their coverings. *Res. Number Theory*, 8(4):Paper No. 87, 24, 2022. arXiv:2203.05541.
- [5] Nikola Adžaga, Vishal Arul, Lea Beneish, Mingjie Chen, Shiva Chidambaram, Timo Keller, and Boya Wen. Quadratic Chabauty for Atkin-Lehner quotients of modular curves of prime level and genus 4, 5, 6. *Acta Arith.*, 208(1):15–49, 2023. arXiv:2105.04811.
- [6] Shiva Chidambaram. Mod- p Galois representations not arising from abelian varieties. *Journal of Number Theory*, 259:219–237, 2024. arXiv:2011.00158.
- [7] Raymond van Bommel, Shiva Chidambaram, Edgar Costa, and Jean Kieffer. Computing isogeny classes of typical principally polarized abelian surfaces over the rationals. 2023. To appear in Proceedings of LuCaNT 2023. arXiv:2301.10118.

- [8] Shiva Chidambaram and Pip Goodman. Mod- ℓ Galois images of Picard curves. 2023. In preparation.
- [9] Shiva Chidambaram, Ján Mináč, Tung T. Nguyen, and Nguyen Duy Tân. Fekete polynomials of principal Dirichlet characters. 2023. To appear in J. Exp. Math. arXiv:2307.14896.

Research Interests

Galois representations, Arithmetic geometry, Algebraic number theory, Computational aspects of low dimensional abelian varieties and modular forms, Geometry of Siegel modular varieties, Modularity of abelian surfaces.

Talks

Invited talks

- February 2024 **Computing Galois images of Picard curves**, Harvard Number Theory Seminar.
- November 2023 **Computing isogeny classes of principally polarized abelian surfaces**, Oberseminar Arithmetische Geometrie, Universität Bayreuth (online).
- October 2023 **Computing \mathbb{Q} -isogeny classes of principally polarized abelian surfaces**, The Ohio State University Number Theory Seminar.
- March 2023 **Computing isogeny classes of abelian surfaces**, Algebra seminar, Illinois State University (online).
- January 2023 **Mod- ℓ Galois image of Picard curves**, AMS Special Session on Arithmetic Geometry informed by Computation, Joint Mathematics Meetings, Boston.
- September 2022 **Moduli spaces of abelian surfaces with fixed 3-torsion representation**, Number Theory seminar, Indian Institute of Science, Bangalore.
- April 2022 **Modularity of typical abelian surfaces over \mathbb{Q}** , Explicit Methods for Modularity, ICERM/MIT (online).
- September 2021 **Abelian varieties with given p -torsion representation**, MIT Number Theory Seminar.
- February 2021 **Moduli spaces of low dimensional abelian varieties with torsion**, American Graduate Student Algebraic Geometry Seminar AGSAGS (online).
- January 2021 **Mod- p Galois representations and Abelian varieties**, Number Theory seminar, University of California, Irvine (online).
- December 2020 **Mod- p Galois representations and Abelian varieties**, Junior Number Theory Days JNTD, Johns Hopkins University (online).
- October 2020 **Abelian surfaces with fixed 3-torsion**, The Ohio State University Number Theory Seminar (online).

Contributed talks

- January 2024 **Non-maximal primes for Galois representations of Picard curves**, Simons Collaboration on Arithmetic Geometry, Number Theory, and Computation Annual Meeting

- October 2023 **Computing the exceptional primes for torsion Galois representations of Picard curves**, PAlmetto Number Theory Series XXXVI, Clemson University.
- July 2023 **Mod- ℓ Galois images of Picard curves**, Software demo at LuCaNT 2023.
- June 2020 **Abelian surfaces with fixed 3-torsion**, Fourteenth Algorithmic Number Theory Symposium ANTS (online). Video of pre-talk and slides here.
- June 2020 **Abelian surfaces with fixed 3-torsion**, A lightning talk at the Chicago Number Theory Day CNTD (online). Slides here.

Other talks

- 2015-2020 Regular speaker in the University of Chicago graduate student number theory seminar every quarter.

Teaching

Instructor, Massachusetts Institute of Technology

Responsibilities included preparing and giving lectures, assigning and grading weekly homework, holding office hours, and advising students with final projects.

- Spring 2023 Math 18.782: Introduction to Arithmetic Geometry.

Teaching assistant, PCMI Graduate Summer School

- July 2021 TA for the course on Inverse Galois Problem by Tim Dokchitser.
Week 3 - Number Theory Informed by Computation, Graduate Summer School, Park City Mathematics Institute, IAS (online).

Lecturer, University of Chicago

Responsibilities included lecturing, assigning homework, quizzes, holding problem sessions, office hours, preparing and grading exams and overseeing course assistants.

- Winter 2021 MATH 19620: Linear Algebra.
- Winter 2020 MATH 15300: Calculus III.
- Autumn 2019 MATH 15200: Calculus II.
- Spring 2019 MATH 15300: Calculus III.
- Winter 2019 MATH 15200: Calculus II.
- Autumn 2018 MATH 15100: Calculus I.
- Spring 2018 MATH 19620: Linear Algebra.
- Winter 2018 MATH 15300: Calculus III.
- Autumn 2017 MATH 15200: Calculus II.

College Fellow, University of Chicago

Assisted undergraduate classes, by grading homework and exams, running problem sessions and office hours, writing exam questions, and giving a few lectures.

- 2016-2017 Teaching assistant for MATH 16100,16200,16300: Honors Calculus IBL

Teaching Assistant, IISER Pune

Held problem sessions, office hours, and graded homework and exams.

- Spring 2015 MATH 102: Multi-variable calculus

Mentoring

Responsibilities included advising students in choosing topics, guiding them through projects, and assisting them with final presentations and expository papers.

Undergraduate Research Opportunities Program, Massachusetts Institute of Technology

- Spring 2024 **Maxim Li**
Directed Reading Program, Massachusetts Institute of Technology
- January 2024 **Arnav Goel, Mohamed Wacyl Meddour**: Prime number theorem
Directed Reading Program, University of Chicago
- Spring 2020 **Sean Ryan**: p -adic numbers
- Autumn 2019 **Vijay Srinivasan**: Mordell-Weil Theorem and CM theory of elliptic curves
- Winter 2019 **Vijay Srinivasan**: Arithmetic of elliptic curves
Research Experience for Undergraduates, University of Chicago
- Summer 2019 **Jacob Laxer**: An introductory overview to characteristic classes
- Summer 2019 **Matthew Chen**: Paley graphs, quadratic residues, and linear constructions
- Summer 2018 **Carlos Azpurua**: Root systems and a generalization of Catalan numbers
- Summer 2018 **Carson Collins**: Covering spaces, graphs, and groups
- Summer 2018 **Che Li**: Introduction to Class Field Theory and Primes of the Form $x^2 + ny^2$
- Summer 2017 **James Zhou**: An introduction to NP-complete problems
- Summer 2017 **Leonardo Ferreira Guilhoto**: Applying Markov chains to Monte Carlo integration

Professional service

Organizing

- January 2024 **AMS Special Session on Arithmetic Geometry with a View toward Computation**, *Joint Mathematics Meetings*, San Francisco.
with David Lowry-Duda, Barinder Banwait, Juanita Duque-Rosero, Brendan Hassett, Ciaran Schembri
- Summer 2018 **Graduate seminar on Modularity Lifting**, *University of Chicago*, Chicago.
with Noah Taylor

Refereeing

Refereed articles for Simons symposium conference proceedings, *Journal de Théorie des Nombres de Bordeaux*, LuCaNT 2023.

Reviewing

Reviewed articles for AMS MathSciNet and IAS/Park City Mathematics Series.

Professional development

- Spring 2019 **Course design and college teaching**, *Chicago Center for Teaching*.

Programming Skills

Expertise in Magma, SageMath and Mathematica.

Good experience with PARI/GP, Python.

Familiarity with HTML and CSS.

Awards and Honours

- 2018-2020 **Non-resident Graduate Fellowship**, *International House*, Chicago.
- 2015 **Eligible for Dr. Shyama Prasad Mukherjee Fellowship**, *CSIR-UGC*, India.
awarded to toppers of National Eligibility Test for pursuing a PhD program in India.
- 2015 **Institute Gold Medal**, *IISER*, Pune.
awarded for highest CGPA in the graduating class for BS-MS dual degree.
- 2010-2015 **KVPY National Scholarship in Basic Sciences**, *IISc*, Bangalore.
awarded to around 50 Indian students every year.
- 2012-2014 **Academic Excellence Prize**, *IISER*, Pune.
awarded in Fall 2012, Spring 2013 and 2014 semesters.
- 2014 **Visiting Students Research Programme Fellowship**, *TIFR*, Mumbai.
- 2012 **Summer Research Fellowship**, *IASc-INSa-NASl*.
- 2011, 2012 **First prize in Madhava Mathematics Competition**, *S. P. College, Pune & HBCSE, TIFR*, Mumbai.
- 2009 **Indian National Mathematical Olympiad Award**, *NBHM*, India.
selected (but unable) to attend IMO training and selection camp.