Christopher Keyes

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Research Interests

Broad: number theory, arithmetic statistics, arithmetic geometry

Specific: higher degree points on curves, local solubility in families of varieties, local global principles, counting field extensions, modular curves, stacky curves

Appointments

King's College London

2023 – current Heilbronn Research Fellow, Department of Mathematics

Education

Emory University

2023 Ph.D., Mathematics
Thesis title: *Topics in arithmetic statistics*
Advisor: David Zureick-Brown

2021 M.S., Mathematics

Tufts University

2018 B.S., Mathematics and Chemical Engineering, *Summa Cum Laude*
Senior honors thesis: *Growth of points on hyperelliptic curves*, Highest Honors.

Publications and Preprints

Preprints

6. How often does a cubic hypersurface in $\mathbb{P}^n$ have a rational point? (joint with Lea Beneish). Submitted. (preprint)

5. Fields generated by points on superelliptic curves (joint with Lea Beneish). Submitted. (preprint)

Publications

4. On the density of locally soluble superelliptic curves (joint with Lea Beneish). *Finite Fields and Their Applications*, Volume 85, Article 102128, 2023. (journal, preprint)

3. Mertens' theorem for Chebotarev sets (joint with Santiago Arango-Piñeros and Daniel Keliher). *International Journal of Number Theory*, Volume 18, Issue 8, 2022, pp. 1823-1842. (journal, preprint)

2. Growth of points on hyperelliptic curves. *Journal de Théorie des Nombres de Bordeaux*, Volume 34, Issue 1, 2022, pp. 271-294. (journal, preprint)

[1] Updated December 29, 2024

1. Bounding the number of arithmetical structures on graphs (joint with Tomer Reiter). *Discrete Mathematics*, Volume 344, Issue 9, 2021. (journal, preprint)

Grants and Awards

2024 – 2026 AMS-Simons Travel Grant (5000 USD)

2025 ICMS Research in Groups, Existence and enumeration of integral points on spherical stacky curves, dates TBD

2025 CIRM Research in Residence, Explicit local solubility and applications, June 2025

2024 BIRS Research in Teams, Explicit local solubility and applications, December 2024

2024 ICMS Research in Groups, Explicit local solubility and applications, June 2024

2023 Graduate Student Research Award, Emory University Math Department

2023 Marshall Hall Award for Outstanding Teaching, Emory University Math Department

2018 Ralph S. Kaye Memorial Prize, Tufts University Math Department

2018 Benjamin G. Brown Scholarship for Promise in Scientific Research, Tufts University

2017 Tufts Summer Scholars, Tufts University

2017 Class of 1898 Prize for Scholarly Ability and Intellectual Interest, Tufts University

2016 Stern Term Scholarship, Tufts University

2016 Karno Dean's Award for Academic Excellence and Leadership, Tufts University

Invited Talks

17. *TBD.* London Number Theory Seminar, University College London, March 5, 2024.
16. *How often does a cubic hypersurface have a rational point?* Number Theory Seminar, University of Illinois Chicago, October 15, 2024.
15. *How often does a cubic hypersurface have a rational point?* Arithmetic Geometry Seminar, University of Bath, May 21, 2024.
14. *How often does a cubic hypersurface have a rational point?* Utrecht Geometry Centre Seminar, Utrecht University, April 9, 2024.
13. *How often does a cubic hypersurface have a rational point?* Number Theory Seminar, University of Cambridge, February 20, 2024.
12. *Explicit local solubility in families of varieties.* KCL Internal Number Theory Seminar, King's College London, November 30, 2023.
11. *Explicit local solubility in families of varieties.* Linfoot Seminar, University of Bristol, November 29, 2023.
10. *Local solubility in families of superelliptic curves.* UNT Algebra Seminar, University of North Texas, September 15, 2023.
9. *Local solubility in families of superelliptic curves.* UCI Number Theory Seminar, UC Irvine, January 19, 2023.
8. *Local solubility in families of superelliptic curves.* AMS Special Session on Arithmetic Statistics, Joint Math Meetings, January 6, 2023.
7. *Local solubility in families of superelliptic curves.* Number Theory Seminar, UC San Diego, November 21, 2022.

6. *Local solubility in families of superelliptic curves.* Number Theory Seminar, The Ohio State University, November 21, 2022.
5. *Local solubility in families of superelliptic curves.* Number Theory Seminar, University of Georgia, November 2, 2022.
4. *Local solubility in families of superelliptic curves.* Arithmetic Geometry and Number Theory Seminar, UC Berkeley, October 24, 2022.
3. *Local solubility in families of superelliptic curves.* Algebra, Geometry, and Number Theory Seminar, University of South Carolina, April 8, 2022.
2. *On the proportion of everywhere locally soluble superelliptic curves.* Secret AGeNTS, Tufts University (held virtually), November 18, 2021.
1. *Fields generated by points on superelliptic curves* (joint talk with Lea Beneish). UW Number Theory Seminar, University of Washington (held virtually), June 8, 2021.

Contributed Talks

8. *Local solubility in families of superelliptic curves.* Connecticut Number Theory Conference (CTNT), University of Connecticut, June 10, 2022.
7. *On the proportion of everywhere locally soluble superelliptic curves.* Upstate Number Theory Conference, Union College, October 23, 2021.
6. *Fields generated by points on superelliptic curves.* Young Researchers in Algebraic Number Theory (Y-RANT), University of Bristol (held virtually), August 19, 2021.
5. *Mertens' product theorem for primes in Chebotarev sets.* Front Range Number Theory Day, held virtually, April 24, 2021.
4. *An upper bound for the number of arithmetical structures on a graph.* Mid-Atlantic Seminar on Numbers (MASON) V, held virtually, March 27, 2021.
3. *An upper bound for the number of arithmetical structures on a graph.* PAlmetto Joint Arithmetic, Modularity, and Analysis Series (PAJAMAS), University of South Carolina, December 6, 2020.
2. *Growth of points on hyperelliptic curves.* Tufts Undergraduate Research Symposium, Tufts University, May 3, 2018.
1. *Growth of points on hyperelliptic curves.* PAlmetto Number Theory Series (PANTS) XXVIII, University of Tennessee Knoxville, September 17, 2017.

Teaching Experience

London Taught Course Consortium

Spring 2025	Instructor, Arithmetic Statistics (advanced graduate course)

Emory University

2020 – 2021	Instructor, Math 111 (Calculus I), 2 sections, 68 students total
2019 – 2020	Teaching Assistant, Math 221 (Linear Algebra), 4 sections, 104 students total
2018 – 2019	Grader, Math 250 (Foundations of Mathematics), 3 sections
Spring 2019	Grader, Math 212 (Differential Equations)
Fall 2018	Grader, Math 328 (Number Theory)
2018 – 2019	Tutor, weekly calculus workshops

Tufts University

2017 – 2018 Tutor, various courses including mathematical modeling, linear algebra, discrete mathematics, differential equations, calculus I - III

Organization

Seminars

Summer 2025 Co-organizer of *London Number Theory Seminar*, with Igor Wigman (seminar website)

2024 – Co-organizer of *KCL Postdoc Colloquium*, a series of talks given by and for the postdoctoral researchers at King's College London, with Jeremy Mann (seminar website)

Spring 2024 Co-organizer of *Show and Tell*, a series of talks by HIMR-London fellows, with Alex Best

2020 – 2023 Co-organizer of *RANT*, Emory's weekly graduate student seminar in algebra and number theory, with Alexis Newton (seminar website)

Spring 2023 Co-organizer of *Geometric Arithmetic Statistics at Emory Seminar (GASES)*, with Santiago Arango Piñeros and David Zureick-Brown (seminar website)

Fall 2023 Co-organizer of *Emory ARithmetic Statistics Student Seminar (EARSSS)*, with Santiago Arango Piñeros and David Zureick-Brown (seminar website)

Emory Math Directed Reading Program

Created and organized a directed reading program matching undergraduates with graduate students to read and discuss a mathematical text, serving 46 students total (Spring 2021 – Spring 2023). See this webpage.

Total of 9 students mentored in multiple topics:

Spring 2023 *Clutch hitting*, Aileen He

Spring 2022 *Sports analytics*, Ezra Arovas

Fall 2021 *Elliptic curves*, 3 students

Spring 2021 *p-adic numbers*, 4 students

Outreach

Julia Robinson Math Festival

Co-organized (with Riti Bahl) math exploration event at Emory University on August 27, 2022, attended by about 150 middle and high school students and their families. Responsibilities included selecting and preparing activities, recruiting 15 volunteers, and leading volunteer training on the day of the festival.

Math Circle

Worked as an instructor with Emory Math Circle to plan and lead math exploration activities for middle and high school students in the Atlanta community.

2022 – 2023 Instructor, Emory Math Circle, High School Level B, 2 semesters, 52 students total

2021 – 2022 Instructor, Emory Math Circle, High School Level A, 2 semesters, 30 students total

2019 – 2020 Instructor, Emory Math Circle, Middle School Level C, 3 semesters, 91 students total

Summer 2019 Assistant, Emory Math Circle Week of Mathematical Exploration

Fall 2018 Instructor, Emory Math Circle, Middle School Level A, 25 students

Other Outreach Activities

2022 –	Staff writer for *Learning Through the Ranks* at MAA's Math Values Blog
Fall 2021	Staff writer, AMS grad blog
2015 – 2017	Fellow, Tufts STOMP

Expository Writing

Notes and study guides

- Algebraic geometry study guide (link)
- Notes on derived functors and cohomology (link)

MAA Math Values Blog

- Reflections on applying for jobs as a PhD student, Part II, October 2024 (link)
- Reflections on applying for jobs as a PhD student, Part I, October 2024 (link)
- On directed reading, curiosity, and baseball, April 2022 (link)

AMS Graduate Student Blog

- You should have a website (and it doesn't have to be hard), December 2021 (link)
- Reflections on a return to in-person conferences, November 2021 (link)
- Formatting your CV in LaTeX, October 2021 (link)

Professional Service

Refereeing

- Advances in Mathematics
- Journal of the American Mathematical Society (quick opinion)
- Mathematics of Computation
- Nagoya Mathematical Journal
- Philosophical Transactions of the Royal Society A
- Research in the Mathematical Sciences
- Research in Number Theory

Reviews

- MathReviews

Computing

Familiar with Sage, Magma, C++, CUDA, Python, MATLAB