Christopher Keyes

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Research Interests

Number theory, arithmetic statistics, arithmetic geometry.

Appointments

King's College London

2023 – Heilbronn Research Fellow (starting October 2023)

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

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

Invited Talks

12. *Local solubility in families of superelliptic curves.* UNT Algebra Seminar, University of North Texas, September 15, 2023.

[1] Updated September 7, 2023

11. *Local solubility in families of superelliptic curves.* UCI Number Theory Seminar, UC Irvine, January 19, 2023.

10. *Local solubility in families of superelliptic curves.* AMS Special Session on Arithmetic Statistics, Joint Math Meetings, January 6, 2023.

9. *Local solubility in families of superelliptic curves.* Number Theory Seminar, UC San Diego, November 21, 2022.

8. *Local solubility in families of superelliptic curves.* Number Theory Seminar, The Ohio State University, November 21, 2022.

7. *Local solubility in families of superelliptic curves.* Number Theory Seminar, University of Georgia, November 2, 2022.

6. *Local solubility in families of superelliptic curves.* Arithmetic Geometry and Number Theory Seminar, UC Berkeley, October 24, 2022.

5. *Local solubility in families of superelliptic curves.* Algebra, Geometry, and Number Theory Seminar, University of South Carolina, April 8, 2022.

4. *On the proportion of everywhere locally soluble superelliptic curves.* Secret AGeNTS, Tufts University (held virtually), November 18, 2021.

3. *Chip-firing games and arithmetical structures on graphs.* WashU Undergraduate Mathematics Seminar, Washington University in St. Louis (held virtually), November 9, 2021.

2. *Fields generated by points on superelliptic curves* (joint talk with Lea Beneish). UW Number Theory Seminar, University of Washington (held virtually), June 8, 2021.

1. *Counting number fields: problems and progress.* WashU Undergraduate Mathematics Seminar, Washington University in St. Louis (held virtually), January 29, 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 (held virtually), 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

Emory University

2020 – 2021	Instructor of record, 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

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: A Graduate Student Blog* at MAA's Math Values Blog
Fall 2021	Staff writer, AMS grad blog
2015 – 2017	Fellow, Tufts STOMP

Awards

2023	Graduate Student Research Award, Emory University Math Department
2023	Marshall Hall Award for Outstanding Teaching, Emory University Math Department
2018	Honorable Mention, NSF Graduate Research Fellowship
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
2016	Honorable Mention, Mathematical Contest in Modeling
2014	National Merit Scholarship

Computing

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