Christopher Keyes

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Research Interests

Number theory, arithmetic statistics, arithmetic geometry.

Education

Emory University

- Ph.D., Mathematics (expected graduation: 2023).
- M.S., Mathematics (2021).
- Advisor: David Zureick-Brown.

Tufts University

- B.S., Mathematics and Chemical Engineering, *Summa Cum Laude* (2018).
- 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). Accepted for publication in *Finite Fields and Their Applications*. (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

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

[1] Updated November 4, 2022

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

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

Tufts University

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

Organization

Seminars

- Co-organizer of *RANT*, Emory's weekly graduate student seminar in algebra and number theory, with Alexis Newton (Fall 2020 – present). Seminar website.
- Co-organizer of *Geometric Arithmetic Statistics at Emory Seminar (GASES)*, with Santiago Arango Piñeros and David Zureick-Brown (Spring 2021). Seminar website.
- Co-organizer of *Emory ARithmetic Statistics Student Seminar (EARSSS)*, with Santiago Arango Piñeros and David Zureick-Brown (Fall 2020). Seminar website.

Emory Math Directed Reading Program

Created and organized a directed reading program matching undergraduate students with graduate students to read and discuss a mathematical text (Spring 2021 – present). See this webpage.

Topics mentored:

- *Sports analytics*, Ezra Arovas (Spring 2022).
- *Elliptic curves*, 3 students (Fall 2021).
- *p-adic numbers*, 4 students (Spring 2021).

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.

Levels taught:

- Instructor, Emory Math Circle, High School Level B, 29 students total (Fall 2022).
- Instructor, Emory Math Circle, High School Level A, 30 students total (Fall 2021 – Spring 2022).
- Instructor, Emory Math Circle, Middle School Level C, 91 students total (Spring 2019 – Spring 2020).
- Assistant, Emory Math Circle Week of Mathematical Exploration (Summer 2019, Summer 2020).
- Instructor, Emory Math Circle, Middle School Level A, 25 students (Fall 2018).

Other Outreach Activities

- Staff writer for *Learning Through the Ranks: A Graduate Student Blog* at MAA's Math Values Blog (Spring 2022 – present).
- Staff writer, AMS grad blog (Fall 2021).
- Fellow, Tufts STOMP (Spring 2015 – Spring 2017).

Awards

- Honorable Mention, NSF Graduate Research Fellowship (2018).
- Ralph S. Kaye Memorial Prize, Tufts University Math Department (2018).
- Benjamin G. Brown Scholarship, Tufts University (2018).
- Tufts Summer Scholars, Tufts University (2017).
- Class of 1898 Prize, Tufts University (2017).
- Stern Term Scholarship, Tufts University (2016).
- Karno Dean's Award for Academic Excellence and Leadership, Tufts University (2016).
- Honorable Mention, Mathematical Contest in Modeling (2016).
- National Merit Scholarship (2014).

Computing

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