Matthew Litman

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ACADEMIC EMPLOYMENT

Assistant Professor, University College Dublin — September 2024 – Present
Lecturer, University of California, Davis — June 2023 – June 2024
Teaching Assistant, Associate Instructor, University of California, Davis — September 2017 – June 2023

EDUCATION

Ph.D. in Mathematics, University of California, Davis — 2023
Advisor: Elena Fuchs. Thesis: *Explorations in Number Theory*.

M.A. in Mathematics, University of California, Davis — 2019

B.S. in Mathematics with Honors, Schreyer Honors College, Penn State University — 2017
Advisor: Sergei Tabachnikov. Thesis: *Sphere Eversion: Analysis of a Veridical Paradox*.
Minors: Statistics, Geophysics.
Magna Cum Laude, Phi Kappa Phi.

MASS Program Graduate, Department of Mathematics, Penn State University — 2015

PUBLICATIONS

1. "Connectivity of Markoff mod-p graphs and maximal divisors," joint with J. Eddy, E. Fuchs, D. Martin, and N. Tripeny. *Proceedings of the London Mathematical Society* 130 (2) (2025) e70027. DOI: 10.1112/plms.70027.
2. "Residue sums of Dickson polynomials over finite fields," joint with T. Brazelton, J. Harrington, and T. W. H. Wong. *Journal of Number Theory* 264 (2024) pp. 1–26.
3. "Error Approximation for Backwards and Simple Continued Fractions," joint with C. Bjorklund. *Research in Number Theory* 10, 2 (2024). DOI: 10.1007/s40993-023-00481-7.
4. "Orbits on K3 Surfaces of Markoff Type," joint with E. Fuchs, J. Silverman, and A. Tran. *Experimental Mathematics* (2023). DOI: 10.1080/10586458.2023.2239265.
5. "Every arithmetic progression contains infinitely many b-Niven numbers," joint with J. Harrington and T. W. H. Wong. *Bulletin of the Australian Mathematical Society* (2023). DOI: 10.1017/S0004972723000758.
6. "A Cryptographic Hash Function from Markoff Triples," joint with E. Fuchs, K. Lauter, and A. Tran. *Mathematical Cryptology* 1 (1) (2021) pp. 103–121.
7. "Beyond Expansion II: Achieving or Exceeding the Ramanujan-quality Exponent of Distribution." *Arbeitsgemeinschaft: Thin Groups and Super-Approximation, Oberwolfach Workshop Report* 2021/50 (2021) pp. 57–61.
8. "Möbius Disjointness for Skew Products on the Heisenberg Nilmanifold," joint with Z. Wang. *Proceedings of the American Mathematical Society* 147 (2019) pp. 2033–2043.

9. "Flow Instabilities Due to Interfacial Surfactant/Polar Oil Material in a Hele-Shaw Cell," joint with A. Belmonte and Z. Niroobakhsh. *Physical Review E* 96 (2017) 053102.

10. "On Consecutive Primitive nth Roots of Unity Modulo q," joint with T. Brazelton, J. Harrington, and S. Kannan. *Journal of Number Theory* 174 (2017) pp. 494–504.

MANUSCRIPTS



1. "Loxodromic Sequences of Tangent Spheres in Polytopal Packings," joint with I. Rasskin. In preparation (2026).

2. "Beyond the Polytopal Descartes Theorem," joint with I. Rasskin. In preparation (2026).

3. "Algebraic Properties of the Parameter Space of Apollonian Circle Packings," joint with S. Haag and I. Rasskin. In preparation (2026).

4. "Divisibility by p for Markoff-like Surfaces," joint with M. de Courcy-Ireland and Y. Mizuno. Under revision at *Forum of Mathematics, Sigma*. arXiv:2509.02187 (2025).

5. "Asymptotic Density of Apollonian-Type Orbits," joint with A. Sheydvasser. arXiv:2108.06358 (2021).

PRESENTATIONS



1. Algebraic Geometry & Number Theory Seminar, University of California, Davis, December 2026. *Upcoming.*

2. Dublin Mathematics Colloquium, Trinity College Dublin, October 2026. *Divisibility of Orbits for Markoff-like Surfaces*

3. Farey's Legacy in Frieze Patterns and Discrete Geometry, International Centre for Mathematical Sciences, April 2026. *Loxodromic Sequences of Tangent Circles in Polytopal Packings.*

4. Heidelberg Experimental Geometry Lab Community Seminar, Heidelberg University, December 2025. *Apollonian Circle Packings: Classical Constructions, Modern Perspectives.*

5. UCC Boole Colloquium, University College Cork, October 2025. *Markoff-like Surfaces and Divisibility of Orbits.*

6. Séminaire Ernest, Aix-Marseille University, May 2025. *Markoff mod p Graphs: Connectivity, Maximal Divisors, and Generalizations.*

7. Number Theory Seminar, University College Dublin, September 2024. *Markoff mod p Graphs: Connectivity, Maximal Divisors, and Non-Connectivity of its Generalizations.*

8. Special Session on Recent Developments on Markoff Triples, Joint Mathematics Meetings, January 2024. *Connectivity of Markoff mod p Graphs and Maximal Divisors.*

9. Number Theory Seminar, University of Illinois at Urbana-Champaign, March 2023. *Markoff-type K3 Surfaces: Local and Global Finite Orbits.*

10. Number Theory Seminar, Duke University, November 2022. *Markoff-type K3 Surfaces: Local and Global Finite Orbits.*

11. Dynamics, Geometry, and Groups Seminar, Queen's University, October 2022. *Markoff-type K3 Surfaces: Local and Global Finite Orbits.*

12. Number Theory Seminar, Queen's University, October 2022. *Error Approximation for Backwards and Simple Continued Fractions.*
13. Number Theory Seminar, University of Colorado Boulder, October 2022. *Markoff-type K3 Surfaces: Local and Global Finite Orbits.*
14. Front Range Number Theory Day, University of Colorado Boulder, October 2022. *Residue Sums for Dickson Polynomials.*
15. Algebra & Discrete Math Seminar, University of California, Davis, January 2022. *Markoff-type K3 Surfaces: Local and Global Finite Orbits.*
16. Algebra Seminar, University of California, San Diego, January 2022. *Markoff-type K3 Surfaces: Local and Global Finite Orbits.*
17. Number Theory Seminar, University of Washington, November 2021. *Markoff-type K3 Surfaces: Local and Global Finite Orbits.*
18. Arbeitsgemeinschaft on Thin Groups and Super-Approximation, Mathematisches Forschungsinstitut Oberwolfach, October 2021. *Beyond Expansion II: Achieving or Exceeding the Ramanujan-quality Exponent of Distribution.*
19. Mid-Atlantic Seminar on Numbers V (MASON V), Towson University (virtual), March 2021. *Distinct Residues of Lucas Polynomials over* $\mathbb{F}_q$.
20. Number Theory Series in Los Angeles II, Occidental College, February 2020. *Error Approximation for Backwards and Simple Continued Fractions.*
21. UC Davis Student-Run Research Seminar, University of California, Davis, January 2020. *Error Approximation for Backwards and Simple Continued Fractions.*
22. Illustrating Algebra and Number Theory, ICERM, October 2019. *Approximation Properties for Backwards and Standard Continued Fractions.*
23. Mathematical Outing for Undergraduates, Penn State University, April 2017. *Continued Fractions and Symbolic Coding via the Moduli Space* $\mathrm{SL}(2,\mathbb{R})/\mathrm{SL}(2,\mathbb{Z})$.
24. Mid-Atlantic Seminar on Numbers I (MASON I), Towson University, October 2016. *On Consecutive Primitive nth Roots of Unity Modulo q.*
25. Young Mathematicians Conference, Ohio State University, August 2016. *On Consecutive Primitive nth Roots of Unity Modulo q.*

AWARDS

Research in Residence, Arithmetic and Geometry of Apollonian Packings, Centre International de Rencontres Mathématiques — May 2025

Clay Mathematics Institute Travel Grant, Renormalization and Visualization in Geometry, Dynamics and Number Theory, Centre International de Rencontres Mathématiques — December 2023

American Institute of Mathematics Travel Grant, 50 Years of Number Theory and Random Matrix Theory, Institute for Advanced Study — June 2022

William Karl Schwarze Scholarship, Department of Mathematics, University of California, Davis — Spring 2022

Henry L. Alder Prize for Excellence in Teaching, Department of Mathematics, University of California, Davis — Spring 2021

Yueh-Jing Lin Fund, Department of Mathematics, University of California, Davis — Spring 2021

SERVICE

Co-Organizer, 2024 JMM Special Session on "Covering Systems of the Integers and Their Applications" — 2023 – 2024

Graduate Program Committee Chair, University of California, Davis — 2020 – 2021

TEACHING

University College Dublin

MST30080 – Research in Mathematics — Spring 2025

MST30070 – Differential Geometry — Spring 2026

MST30040 – Differential Equations — Spring 2025

MATH10290 – Linear Algebra for Science — Spring 2025, 2026

MST10010 – Calculus — Autumn 2024, 2025, 2026

University of California, Davis

MAT145 – Combinatorics — Summer 2020

MAT115A – Number Theory — Summer 2021, 2023

MAT22A – Linear Algebra — Autumn 2023, Winter 2024

MAT21C – Calculus III — Spring 2023

MAT21B – Calculus II — Summer 2019

MAT21A – Calculus I — Autumn 2023, Winter 2024, Spring 2024

ADVISING

Final-year theses, University College Dublin

Type Classification for Hyperbolic Apollonian Circle Packings (Mark Henry) — 2026 – 2027

Apollonian Circle Packings (Mhyls Salapuddin) — 2025 – 2026

Undergraduate research project, University of California, Davis

Residue Sums for Fibonacci Polynomials (Mani Ebrahimi Mojaveri & Mia Striebeck) — 2023 – 2024