

Elena Fuchs

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Employment

- ◇ **University of California, Davis**, Associate Professor, 2018 –
- ◇ **University of California, Davis**, Assistant Professor, 2016 – 2018
- ◇ **University of Illinois, Urbana-Champaign**, Assistant Professor, 2014 – 2016
- ◇ **University of California, Berkeley**, Simons Assistant Professor, 2011 – 2014
- ◇ **Institute for Advanced Study**, Member, 2010 – 2011

Education

- ◇ **Princeton University**
Ph.D. in Mathematics, September 2010
Advisor: Peter Sarnak
Thesis: *Arithmetic properties of Apollonian circle packings*
- ◇ **University of California, Berkeley**
B.A. in Mathematics, May 2005
Advisor: Ken Ribet
Thesis: *Endomorphisms of the Jacobian of hyperelliptic curves*

Research Interests

Number theory, especially analytic aspects and arithmetic applications of homogeneous dynamics; cryptography.

Grant Support

NSF Grant DMS-2154624, June 2022 – June 2026
Sloan Research Fellowship, 2016–2018
NSF Grant DMS-1501970, September 2015 – September 2018
Co-PI for United States-Israel Binational Science Foundation Grant, “Thin matrix groups and sieve methods,” 2015–2019
NSA Young Investigator Award, 2015 [declined]

Publications and Preprints

- “Primes represented by shifted quadratic forms: on primitivity and congruence classes” (with C. Hsu, J. Rickards, D. Schindler, K. Stange), submitted
- “Apollonian packings: the rise and fall of the Local to Global Conjecture,” submitted
- “Prime and thickened prime components in Apollonian circle packings” (with H. Friedlander, P. Harris, C. Hsu, J. Rickards, K. Sanden, D. Schindler, K. Stange), to appear in the Proceedings for Women in Numbers
- “Connectivity of Markoff mod- p graphs and maximal divisors” (with J. Eddy, M. Litman, D. Martin, N. Tripeny), to appear in the Bulletin of the London Mathematical Society.
- “Orbits on K3 Surfaces of Markoff Type” (with M. Litman, J. Silverman, A. Tran), (with M. Litman, J. Silverman, A. Tran), Experimental Math. [Link](#)
- “A Cryptographic Hash Function based on Markoff Triples” (with K. Lauter, M. Litman, A. Tran), Mathematical Cryptology, **1** (2021), [Link](#)

- “Prime Components in Apollonian Packings” (with H. Friedlander, P. Harron, C. Hsu, D. Schindler, K. Sanden, K. Stange), in preparation.
- “Generic thinness in Lie Groups” (with S. Chaubey and A. Malik), in preparation.
- “Local-global principles in circle packings” (with K. Stange and X. Zhang), *Compositio Mathematica* (2019), DOI: [Link](#)
- “The dynamics of Super-Apollonian continued fractions,” (with S. Chaubey, R. Hines, and K. Stange), *Transactions of the American Mathematical Society* **372** (2019)
- “Generic properties of finitely generated subgroups of $SL_n(\mathbb{Z})$,” Oberwolfach Report.
- “Generic thinness in finitely generated subgroups of $SL_n(\mathbb{Z})$ ” (with I. Rivin), *International Mathematics Research Notices*, doi: 10.1093/imrn/rnw136 (2016) [Link](#)
- “Hyperbolic monodromy groups for the hypergeometric equation and Cartan involutions” (with C. Meiri and P. Sarnak), *Journal of the European Mathematical Society*, **16** (8), (2014), pp. 1617-1671. [Link](#)
- “Counting problems in Apollonian packings,” *Bulletin of the American Mathematical Society*, **50** (2013), 229-266. [Link](#)
- “The ubiquity of thin groups,” *Proceedings of MSRI conference on Thin Groups and Super-strong Approximation*, to appear. [Link](#)
- “On representation of integers by binary quadratic forms” (with J. Bourgain), *International Mathematics Research Notices* (2012). [Link](#)
- “A proof of the positive density conjecture for integer Apollonian circle packings” (with J. Bourgain), *Journal of the American Mathematical Society*, **24** (2011), 945-967. [Link](#)
- “Strong approximation in the Apollonian group,” *Journal of Number Theory*, **131** (2011), 2282-2302. [Link](#)
- “Some experiments with integral Apollonian circle packings” (with K. Sanden), *Journal of Experimental Mathematics*, **20** (2011), 380-399. [Link](#)
- “Positive Density in Apollonian Circle Packings,” *Oberwolfach Report*, **29** (2010), 1712-1716.
- “A note on the density of curvatures in Apollonian circle packings,” preprint, (2009). [Link](#)
- “Longest induced cycles in circulant graphs,” *The Electronic Journal of Combinatorics*, **12** (2005), 1-12. [Link](#)

**Postdocs and
Graduate
Students
mentored**

- ◇ Colby Brown, Ph.D. student, University of California, Davis 2022-
- ◇ D. Martin, postdoc, University of California, Davis 2020-2023
- ◇ M. Litman, Ph.D. student, University of California, Davis 2018-2023
- ◇ X. Zhang, postdoc, University of Illinois, Urbana-Champaign 2015-2018

Thesis Supervision

- ◇ J. Tian, Senior Thesis, UC Berkeley 2013

Honors and Awards

- ◇ 2024 UC Davis Faculty Development award
- ◇ 2016 Sloan Research Fellow
- ◇ Listed in the UIUC **List of Teachers Ranked as Excellent by Their Students** every semester between Fall 2014 and Spring 2016
- ◇ **Simons Foundation** Postdoctoral Fellow, 2011 – 2014
- ◇ **National Science Foundation** Graduate Fellowship, 2005 – 2008
- ◇ **AWM** Alice T. Schafer Prize runner up, 2005

Invited Conference Talks

- Current Events Bulletin lecture, Joint Mathematics Meetings
Seattle, Washington, January 10, 2025
- Renormalization and Visualization in Geometry, Dynamics and Number Theory
CIRM, Marseille, France, December 5, 2023
- Dynamics and Asymptotics in Algebra and Number Theory
Bielefeld University, Germany, September 2023
- Computational Aspects of Discrete Subgroups of Lie Groups
ICERM (online) June 18, 2021
- UC Berkeley Undergraduate Number Theory Conference
Online, November 9, 2020
- Illustrating Number Theory and Algebra
ICERM, Providence, RI, October 19-25 2019
- Arithmetic, geometry, and modular forms: a conference in honor of Bill Duke
ETH Zürich, Switzerland, June 17-21 2019
- AMS Central Section Meeting
Ann Arbor, Michigan, October 21 2018, invited address
- Communicating Mathematics Effectively
Seattle, WA, June 2018, invited
- Women in Numbers Workshop
BIRS, Banff, Canada August 2017
- Recent developments in Analytic Number Theory
MSRI, Berkeley CA May 1-5 2017
- Special Session on Analytic Number Theory and Arithmetic at the AMS-MAA
Joint Mathematics Meetings
Atlanta, Georgia, January 4-7 2017
- The 27th Palmetto Number Theory Series, plenary speaker
University of South Carolina, Columbia, SC, December 3–4, 2016
- Thin Groups and Super Approximation in Geometry and Arithmetic
Institute for Advanced Study, Princeton NJ, March 28–April 1, 2016
- MAA Mathfest, AMS-MAA joint session “The Arithmetic of the Spheres”
Washington, DC, August 6, 2015
- New Perspectives on the Interplay between Discrete Groups in Low-Dimensional
Topology and Arithmetic Lattices
Mathematisches Forschungsinstitut Oberwolfach, June 21–27, 2015

Atkin Memorial Workshop
University of Illinois, Chicago, May 2, 2015

Zariski-dense Subgroups
IPAM, Los Angeles CA, February 11, 2015

Introductory Workshop: Geometric and Arithmetic Aspects of Homogeneous Dynamics
MSRI, Berkeley CA, February 6, 2015

Algebraic dynamics day at PUIUC
IUPUI, Indianapolis IN, October 10, 2014

Emerging Leaders and Evolving Frontiers in Analytic Number Theory,
Hausdorff Center, Bonn, Germany, July 2014

Apollonian Packings and Thin Groups: EWM Summer School, Institut Mittag-Leffler,
Djursholm, Sweden, June 2014, distinguished lecture series.

Thin Groups RTG Workshop,
University of Michigan, Ann Arbor, April 26, 2014

Southern California Number Theory Day,
California Institute of Technology, March 8, 2014

AWM Women in Number Theory session, AMS/MAA national meeting,
San Diego CA, January 12, 2013.

Bay Area Algebraic Number Theory and Arithmetic Geometry Day,
Stanford University, March 3, 2012.

Thin Groups and Super-strong Approximation,
Hot topics workshop, MSRI, February 10, 2012.

Group Actions in Number Theory,
Centre Interfacultaire Bernoulli, Lausanne, Switzerland, June 9, 2011.

Expander Graphs session, AMS/MAA national meeting,
New Orleans LA, January 6, 2011.

Homogeneous Dynamics and Number Theory,
Mathematisches Forschungsinstitut Oberwolfach, July 5, 2010.

Graphs and Arithmetic workshop,
Centre de Recherches Mathématiques, Montreal, Canada, March 8, 2010.

Invited Talks

UC Davis Algebraic Geometry and Number Theory Seminar, January 14, 2025.

UC Davis Faculty Research Seminar, May 3, 2022.

UC Davis Annual Math Conference, April 14, 2022.

Joint Columbia-CUNY-NYU Number Theory Seminar, December 2, 2021.

UC San Diego Number Theory Seminar, May 28, 2020

UC Davis Faculty Seminar, June 6, 2019.

UC Davis Annual Math Conference, January 11, 2018.

Inaugural Pauline Sperry Anniversary Talk, UC Berkeley, April 19, 2017.

Pennsylvania State University Dynamical Systems Seminar, April 25, 2016.
 CalTech Geometry Seminar, February 13, 2015.
 UIUC GEAR Seminar, January 20, 2015.
 University of California, Santa Cruz Colloquium, January 7, 2014.
 University of Waterloo Colloquium, December 4, 2013.
 University of Illinois, Urbana-Champaign Number Theory and Ergodic Theory Seminar, December 2, 2013.
 University of California, San Diego Number Theory Seminar, November 26, 2013.
 University of California, San Diego Colloquium, November 25, 2013.
 Purdue University Colloquium, November 15, 2013.
 University of California, Davis Colloquium, January 30, 2013.
 University of California, Santa Cruz Algebra and Number Theory Seminar, January 17, 2012.
 Stanford University Number Theory Seminar, December 2, 2011.
 University of California, Berkeley Number Theory Seminar, September 21, 2011.
 Institute for Advanced Study (IAS) Mathematical Conversations Seminar, March 30, 2011.
 Temple University Geometry Seminar, February 22, 2011.
 Brown University Group Actions Seminar, October 14, 2010.
 University of California, Berkeley Number Theory Seminar, October 6, 2010.
 University of California, Berkeley, Representation theory, Geometry, and Combinatorics Seminar October 5, 2010.
 University of California, Los Angeles Number Theory Seminar, September 29, 2010.
 Yale University Dynamics of Group Actions Seminar, April 12, 2010.
 Institute for Advanced Study (IAS) Postdoc Learning Group Seminar, Special Year in Analytic Number Theory, March 4, 2010.
 Institute for Advanced Study (IAS) Analytic and Geometric Number Theory Seminar, January 21, 2010.

Teaching Experience

Math 145, Fall 2023
 Combinatorics
 Math 21B, Spring 2023, Winter 2025
 Calculus
 Math 198/298, Spring 2022
 Reading course for 7 graduate students and 4 undergraduate students on Ramanujan graphs
 Math 150B, Winter 2022
 Algebra

UCD REU mentor, Summer 2021
 Mentored a group of REU students researching a problem on Markoff triples

Math 16B, Winter 2021
 Calculus

Math 22A, Winter 2020, Winter 2022
 Linear Algebra

Math 250A, Fall 2019, Fall 2020, Fall 2021, Fall 2024
 Algebra

Math 16A, Fall 2017
 Calculus

Math 115A, Fall 2017, Fall 2019
 Number Theory

Math 115B, Winter 2017, Winter 2019, Winter 2021, Winter 2025
 Number Theory

Math 21A, Fall 2016, Fall 2023.
 Calculus

UI Urbana-Champaign, Math 595, Fall 2015.
 Graduate Topics Course: Expander graphs in number theory

UI Urbana-Champaign, Math 453, Spring 2015, Spring 2016.
 Elementary Number Theory

UI Urbana-Champaign, Math 347, Fall 2014.
 Fundamental Mathematics

UC Berkeley, Math 104. Spring 2014.
 Introduction to Real Analysis

UC Berkeley, Math 250A. Fall 2012.
 Groups, Rings, and Fields (Graduate Algebra I)

UC Berkeley, Math 113. Spring 2012.
 Abstract Algebra

Princeton University, 2009 – 2010.
 Graduate Fellow at McGraw Center for Teaching and Learning

Princeton University, 2009.
 “Apollonian Circle Packings Minicourse” Summer Workshop

Synergistic Activities

Organization:

Co-organizer of 2025 BIRS Workshop “Perspectives on Markov numbers,” Banff, Canada, January 2025.

Co-Organizer of 2025 AMS Special session on Local-to-Global in Apollonian Circle Packings and Beyond at the Joint Mathematics Meetings, January 2025.

Co-organizer of 2024 AMS Special Session on Markoff triples at the Joint Mathematics Meetings, January 2024.

Co-organizer of 2016 Midwestern Women in Mathematics Symposium, and Co-PI on NSF grant DMS-1565670 supporting the symposium. Hosted at UIUC, April 2 2016

Organized (with Kevin Ford) the 2015 Illinois Number Theory Conference, August 13 –14 2015
(<http://math.uiuc.edu/nt2015>)

Helped to create a public High Performance Computing Server at UC Berkeley Mathematics Department, 2012

Summer Workshop for Women in Mathematics (SWIM) at Princeton University, program assistant, 2009 and 2010, (<http://www.math.princeton.edu/swim>)

“Mentoring Moebius” at Princeton University, co-organizer and mentor, 2009 – 2010, (<http://www.math.princeton.edu/noetherian/mentoring.html>)

“Princeton University Noetherian Ring,” president, 2009 – 2011
(<http://www.math.princeton.edu/noetherian>)

Princeton University Math Graduate Student Seminar, organizer, 2006 – 2007, (<http://www.math.princeton.edu/gradseminar>)

Referee work

Referee, American Mathematical Monthly, Annales de l’Institut Fourier, Bulletin of the London Math Society, Crelle’s Journal, Experimental Mathematics, Expositiones Mathematicae, GAFA, Geometriae Dedicata, Illinois Journal of Mathematics, Mathematical Proceedings of the Cambridge Philosophical Society, MSRI Proceedings, IMRN, Transactions of the AMS, Duke Mathematical Journal

Reviewer, AMS Mathematical Reviews **Reviewer**, NSF DMS grant proposal reviewer

Service

2024-2025: Graduate Program Committee, Department Relations Committee (chair)

2024-: UC Davis Disability Issues Administrative Advisory Committee

2023-2024: Faculty Search Committee, Graduate Program Committee

2022-2023: AI Mentor

2022: UC President’s Postdoctoral Program reviewer

2022: UCD Hellman Fellowship reviewer

2021-2022: Krener Assistant Professor Search Committee

2020-2022: Elected member of the UCD Faculty Representative Committee (chair for 2021-2022)

2020-2024: Elected member of the AWM Executive Committee

2020-2021: Graduate Program Committee, Department Relations Committee

2019-2020: Math Club Advisor, Graduate Program Committee

2018-2019: Undergraduate Program Committee

2017-2018: AI Mentor, Krener Assistant Professor Search Committee

2016-2017: Math Displays, Career and Other Events Committee at UC Davis

2017-present: Association for Women in Mathematics (AWM) Awards Committee

2015-2016: Prizes Committee and TA Teaching Awards Committee at University of Illinois, Urbana-Champaign

2014-2015: Postdoc Search Committee at University of Illinois, Urbana-Champaign

2014-2015: Member of several Number Theory Preliminary Examination Committees

Outreach:

Cal-Bridge mentor, 2024 –

Founded and lead M-PACT, an outreach program in mathematics to Smythe Academy in Sacramento, 2017 – 2020

Participated in Critical Issues in Mathematics Education Workshop at MSRI, March 15-17 2017

Marin Math Circle, invited speaker, May 2012, March 2013

Berkeley Math Circle, invited speaker, November 2011, March 2013, December 2016

Stanford University Mathematical Organization Seminar (for undergraduates), invited speaker, October 2011

Princeton Math Circle, co-founder, organizer, 2009 – 2010