Hanson Smith

Curriculum Vitae

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Education

Present **Assistant Professor**, California State University San Marcos.

2020-2022 **Assistant Research Professor**, University of Connecticut, Storrs.

2020 **Ph.D. Mathematics**, University of Colorado, Boulder
Thesis Title: *Monogeneity and Torsion*.
Advisor: Katherine E. Stange.

2017 **M.A. Mathematics**, University of Colorado, Boulder.

2014 **B.A. Mathematics**, Colorado College, Colorado Springs.

Research

Interests

Algebraic number theory and arithmetic geometry. Specifically, the monogeneity of algebraic number fields, i.e., the existence of a power integral basis for the ring of integers, torsion on arithmetic geometric objects, and the relationship between torsion and monogeneity.

Papers

- **Frobenius Finds Non-monogenic Division Fields of Abelian Varieties**
  International Journal of Number Theory, volume 18, number 10, pages 2299-2315.
  DOI: 10.1142/S1793042122501172
- **The Scheme of Monogenic Generators II: Local Monogenicity and Twists**
  With Sarah Arpin, Sebastian Bozlee, and Leo Herr.
  ArXiv: 2205.04620
- **The Scheme of Monogenic Generators I: Representability**
  With Sarah Arpin, Sebastian Bozlee, and Leo Herr.
  Accepted to Research in Number Theory.
  ArXiv: 2108.07185
- **Non-monogenic Division Fields of Elliptic Curves**
  Journal of Number Theory, volume 228, pages 174-187. Video abstract.
  DOI: 10.1016/j.jnt.2021.03.024

- **A divisor formula and a bound on the $\mathbb{Q}$-gonality of the modular curve $X_1(N)$**
  With Mark van Hoeij.
  Research in Number Theory, volume 7, article 22.
  DOI: 10.1007/s40993-021-00243-3
- **The monogeneity of radical extensions**
  Acta Arithmetica, volume 198, pages 313-327.
  DOI: 10.4064/aa200811-7-10
- **Monogenic fields arising from trinomials**
  With Ryan Ibarra, Henry Lembeck, Mohammad Ozaslan, and Katherine E. Stange.
  Involve, volume 15, number 2, pages 299-317.
  DOI: 10.2140/involve.2022.15.299
- **Ramification in division fields and sporadic points on modular curves**
  ArXiv: 1810.04809
- **Two families of monogenic S_4 quartic number fields**
  Acta Arithmetica, volume 186, pages 257-271.
  DOI: 10.4064/aa180423-24-8
- **A family of monogenic S_4 quartic fields arising from elliptic curves**
  With T. Alden Gassert and Katherine E. Stange.
  Journal of Number Theory, volume 197, pages 361-382.
  DOI: 10.1016/j.jnt.2018.09.026
- **Optimal packings of two to four equal circles on any flat torus**
  With Madeline Brandt, William Dickinson, AnnaVictoria Ellsworth, and Jennifer Kenkel.
  Discrete Mathematics, volume 342.
  DOI: 10.1016/j.disc.2019.111597

Invited Talks

- *Radical Geometric Monogenicity.* UC Irvine Number Theory Seminar, Nov. 3, 2022.
- *Richard Guy's Strong Law of Small Numbers and How Not to Make Friends.* San Marcos Informal Mathematics In-person Colloquium, Sept. 8, 2022.
- *A Moduli Space of Monogenerators.* Online Number Theory Seminar, Jun. 3, 2022.
- *Richard Guy's Strong Law of Small Numbers and How Not to Make Friends.* Union College Student Seminar, Apr. 21, 2022.
- *Monogenicity and Torsion.* University of Rhode Island Math Colloquium, Mar. 4, 2022.
- *Trinomials, Monogenic Polynomials, and Questions.* Online Conference on Monogeneity and Power Integral Bases, Feb. 17, 2022.
- *Richard Guy's Strong Law of Small Numbers and How Not to Make Friends.* Western Colorado University Math, Computer Science, and Engineering Seminar, Nov. 29, 2021.
- *Monogeneity and Torsion.* University of Zagreb Seminar on Number Theory and Algebra, May 3, 2021.

- *Radical Monogeneity and Torsion.* UC Davis Algebra and Discrete Mathematics Seminar, Apr. 23, 2021.
- *Radical Monogeneity and Torsion.* Charles University Number Theory Seminar, Mar. 16, 2021. Video.
- *Radical Monogeneity and Torsion.* Inaugural Online Conference on Monogeneity and Power Integral Bases, Jan. 14, 2021.
- *Ramification in Division Fields and Sporadic Points on Modular Curves.* AMS Special Session on Branching Out: Ramification Invariants in Algebra and Geometry. JMM, Jan. 8, 2021.
- *The Monogeneity of Division Fields of Abelian Varieties.* Uconn Algebra Seminar. Oct. 7, 2020.
- *Non-monogenic division fields of elliptic curves.* AMS Special Session on Algorithms, Experimentation, and Applications in Number Theory. JMM Denver, Jan. 16, 2020.
- *A Survey of Monogeneity.* Number Theory Seminar, CU Boulder, Dec. 3, 2019.
- *A Family of Monogenic S_4 Quartic Fields Arising from Elliptic Curves.* Special session on algebraic number theory and Diophantine equations at the AMS Spring Central and Western Joint Sectional Meeting. University of Hawaii at Manoa, March 23, 2019.
- *Two Families of Monogenic S_4 Quartic Number Fields.* Hawaiian Number Theory (HINT). University of Hawaii at Manoa, March 20, 2019.
- *Ramification in the Division Fields of Supersingular Elliptic Curves and Sporadic Points on Modular Curves.* Number Theory Seminar, CU Boulder, September 4, 2018.
- *A Historical Motivation for Quadratic Reciprocity.* Fearless Friday, Colorado College, March 3, 2017.

Other Research Talks and Presentations

- *Frobenius and the Monogeneity of Division Fields of Abelian Varieties.* Upstate Number Theory Conference, Union College, Oct. 23, 2021.
- *Non-Monogenic Division Fields and Endomorphisms of Abelian Varieties.* Young Researchers in Algebraic Number Theory, Zoom, August 18, 2021.
- *Richard Guy's Strong Law of Small Numbers and How Not to Make Friends.* UConn Math Club talk, Zoom, September 23, 2020.
- *Non-monogenic Division Fields of Elliptic Curves.* Junior Mathematician Research Archive recorded talk, posted to YouTube September 1, 2020. Link: https://www.youtube.com/watch?v=2wkRLvfkfrs.
- *An Upper Bound on the $\mathbb{Q}$-gonality of $X_1(N)$.* Lightning talk at Front Range Number Theory Day, Zoom, April 25, 2020. I also was an organizer of this conference.
- *The Monogeneity of Kummer Extensions and Radical Extensions.* West Coast Number Theory, Pacific Grove, CA, Dec. 17, 2019. I also chaired a session at this conference.
- *Problems with Number Fields.* Graduate Student Seminar, CU Boulder, Dec. 4, 2019.

- *The Monogeneity of Kummer Extensions and Radical Extensions.* Number Theory Series in Los Angeles. Occidental College, Oct. 26, 2019.
- *Non-monogenic Division Fields of Ordinary Elliptic Curves.* Lightning talk for the Arithmetic of Low-Dimensional Abelian Varieties workshop at ICERM of Brown University, June 4, 2019.
- *Ramification in the Division Fields of Supersingular Elliptic Curves and Sporadic Points on Modular Curves.* Canadian Number Theory Association Conference, Université Laval, July 12, 2018.
- *Ramification in the Division Fields of Supersingular Elliptic Curves and Sporadic Points on Modular Curves.* Connecticut Summer School in Number Theory, The University of Connecticut, June 2, 2018.
- *Monogenic S_4 Quartic Fields Arising from Elliptic Curves.* Strength in Numbers, Queen's University, May 11, 2018.
- *Transcending the Irrationality of Pi: Hilbert's Seventh Problem.* Slow Pitch, CU Boulder, March 14, 2018.
- I presented a poster on *A family of monogenic S_4 quartic fields arising from elliptic curves*. Southern California Number Theory Day, The University of California Irvine, Oct. 21, 2017.
- *The Group Law on Elliptic Curves using Riemann-Roch.* Slow Pitch, CU Boulder, Nov. 16 and 23, 2016.
- *A Proof of Quadratic Reciprocity.* Slow Pitch, a graduate student colloquium at CU Boulder, April 20, 2016.
- *Fermat's Last Theorem, Elliptic Curves, Circle Packings, and Modular Curves.* Thesis Presentation, Colorado College, May, 2014.
- *Packings of Four Equal Circles on Flat Tori.* Mathfest Undergraduate Paper Session, with Madeline Brandt, August, 2013.

Workshops and Professional Development

- Park City Mathematics Institute Research Program. Summer 2022.
- Inclusive STEM Teaching Learning Community. Online, spring 2022.
- Virtual Inquiry Based Learning Workshop run by the Academy of Inquiry Based Learning. June 23-26, 2020.
- TRansforming Instruction in Undergraduate Mathematics via Primary Historical Sources (TRIUMPHS) Workshop. New Mexico State University, July 19-20, 2019.
- Arizona Winter School on Topology and Arithmetic. The University of Arizona, March 2-6, 2019.
- Arizona Winter School on Iwasawa Theory. The University of Arizona, March 3-7, 2018.
- Pacific Institute for the Mathematical Sciences (PIMS) Workshop on Computational Arithmetic Geometry. Simon Fraser University, June 5-9, 2017.

Outreach Talks and Panels

- *Richard Guy's Strong Law Of Small Numbers And How Not To Make Friends,* UConn Math Club. Sept. 23, 2020

- *Colorado College SIAM Virtual Graduate School Information Panel*, panelist. Colorado College, Nov. 5, 2020.
- *The Difficulty of Putting Sprinkles on Donuts*. 3 Minute Thesis Competition Finals, CU Boulder, Jan. 31, 2020.
- *The Difficulty of Putting Sprinkles on Donuts.* 3 Minute Thesis Competition Preliminary Round, CU Boulder, Nov. 8, 2019.
- *The Difficulty of Putting Sprinkles on Donuts.* Lightning talk at the Research and Innovation Week. CU Boulder, Oct. 16, 2019. This talk won the Research and Innovation Week lightning talks session.
- *Number Theory, Geometry, Elliptic Curves, and a Piece of the Pie.* STEMinar: A seminar for coached general audience talks, CU Boulder, February 21, 2019.
- *Putting Sprinkles on Donuts.* 3 Minute Thesis Competition, CU Boulder, fall 2018.
- *Number Theory, Geometry, Elliptic Curves, and a Piece of the Pie.* Colorado Academy Math Club Invited Talk. Denver, CO, October 30, 2018.
- *Number Theory, Geometry, Elliptic Curves, and a Piece of the Pie.* Great Talks for a General Audience: Coached Presentations for Graduate Students. MathFest Denver, CO, August 4, 2018.
- *Beyond an Undergraduate Mathematics Degree.* I was a panelist in the aforementioned panel at the Pikes Peak Regional Undergraduate Mathematics Conference, University of Colorado Colorado Springs, Feb. 24, 2018.
- *Number Theory: A Problematic Introduction.* Initial Conditions, a seminar for first-year graduate students at CU Boulder, Nov. 3, 2017.
- *Richard Guy's Strong Law of Small Numbers, Numerology, and How Not to Make Friends.* Inaugural Tangents Colloquium, CU Boulder, April 14, 2017.

Teaching and Advising

- Algebraic Number Theory, Connecticut Summer School in Number Theory, UConn, summer 2022. I taught a four lecture mini-course giving a rapid introduction to algebraic number theory.
- Introduction to Number Theory, UConn, spring 2022. I was responsible for a class of 25 students.
- Honors Linear Algebra, UConn, spring 2022. I was responsible for a class of 35 students.
- Independent Study in Algebraic Number Theory, UConn, spring 2022. I advised two students with the goal gaining some perspective on algebraic number theory.
- Introduction to Number Theory, UConn, fall 2021. I was responsible for a class of 25 students.
- Linear Algebra, UConn, fall 2021. I was responsible for a class of 40 students.
- Linear Algebra, UConn, spring 2021. I was responsible for two classes of 35 students.
- Linear Algebra, UConn, fall 2020. I was responsible for two classes of 35 students.
- Calculus 3, CU Boulder, spring 2020. I was responsible for a class of 32 students.
- Calculus 3, CU Boulder, fall 2019. I was responsible for a class of 32 students.

- Abstract Algebra 1, Colorado College, spring 2018. I was invited back to my alma mater to co-teach this course with Beth Malmskog.
- Calculus 2, CU Boulder, fall 2017. I was responsible for a class of 32 students.
- Calculus 2, CU Boulder, spring 2017. I was responsible for a class of 32 students.
- Precalculus, CU Boulder, summer 2016. I was responsible for all aspects of the first half of this 32 student course.
- Calculus 1, CU Boulder, spring 2016. I was responsible for a class of 32 students.
- Calculus 1, CU Boulder, fall 2015. I was responsible for a class of 32 students.
- 2017-spring 2020: Mentorship of a local, mathematically-advanced high school student. This involved teaching my mentee algebraic and analytic number theory once a week as well as advising them on academic decisions.

Research Directed

- In the summer of 2018, my advisor and I ran an REU with three University of Colorado students studying the monogeneity of trinomials. The research program was based on my previous work and led to new results. See above for the resulting paper.

Service and Leadership

- Co-founder and organizer of the Front Range Number Theory Day, a day long gathering of number theorists of all levels from around the Colorado Front Range. I organized and co-wrote the Research and Innovation Office (REO) grant that funded the spring 2019 number theory day at CU. I also co-wrote our successful NSF grant; see below.
- Reviewer for *Research in Number Theory*, *Communications in Algebra*, *The Asian-European Journal of Mathematics*, *Publicationes Mathematicae Debrecen*, and *Commentationes Mathematicae Universitatis Carolinae*.
- MAA Undergraduate Student Poster Session judge. JMM Denver, Jan. 17, 2020 and JMM, Jan 7, 2021.
- Organizer of a graduate student and faculty seminar on Bjorn Poonen's book "Rational Points on Varieties." CU Boulder and Colorado State University, spring 2020.
- Organizer of a graduate student and faculty seminar on the proof of Fermat's Last Theorem. CU Boulder, fall 2018.
- Cofounder and organizer of the Tangents Colloquium at CU. This is a more informal colloquium intended to highlight interesting, but not necessarily research level, topics. A large aim of this colloquium is to encourage conversations between faculty and graduate students.
- MathSciNet Reviewer.
- Representative for CU Boulder, JMM Graduate Fair, JMM 2017.

Grants

- Site Tester for a new primary source project, part of the TRIUMPHS project on undergraduate math instruction via primary sources. Fall 2020.

- Co-Principal Investigator on an NSF grant for Conferences and Workshops in the Mathematical Sciences: This grant is currently providing three years of funding for the Front Range Number Theory Day.

Awards and Honors

- Graduate School Summer Doctoral Research Fellowship. CU Boulder, 2019
- Magna Cum Laude with Distinction in Mathematics. Colorado College, 2014
- Sophie Germain Prize in Mathematics. Colorado College, 2014

Research as an Undergraduate

- In the summer of 2013, I worked with another undergraduate at the Grand Valley State University mathematics REU under the guidance of Professor William Dickinson. Our work contributed to *Optimal Packings of Two to Four Equal Circles on Any Flat Torus*; see above.
- I was awarded a Collaborative Faculty-Student Research Venture Grant with Colorado College professor Stefan Erickson for work during the summer of 2012.