

Stephen McKean

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Research Interests

Algebraic geometry, arithmetic geometry, homotopy theory.
Motivic homotopy, enumerative geometry, cobordism, K-theory, anabelian geometry, rational points, homotopical physics, topological modular forms.

Employment

- 2024— **Brigham Young University**, Provo, Utah
Assistant Professor
- 2022—2024 **Harvard University**, Cambridge, Massachusetts
NSF Postdoctoral Fellow
» Sponsor: Mike Hopkins

Education

- May 2022 **Duke University**, Durham, North Carolina
Ph.D. in Mathematics
» Advisor: Kirsten Wickelgren
» Thesis: Local contributions in \mathbb{A}^1 -enumerative geometry
» Certificate in College Teaching
- Dec 2019 **Georgia Institute of Technology**, Atlanta, Georgia
M.S. in Mathematics
- May 2017 **University of Utah**, Salt Lake City, Utah
B.S. in Mathematics
» Magna cum laude
» Minors in Physics and German
» Undergraduate Research Scholar Designation

Funding

- 2024—2025 **AIM SQuaRE**, American Institute of Mathematics
» Intensive collaboration with T. Brazelton, S. Karp, J. Levinson, K. Purbhoo, and F. Sottile.
- 2022—2024 **MSPRF**, National Science Foundation
» [DMS-2202825](#): Motivic homotopy theory and algebraic geometry
» \$150,000
- 2021 **Bass Instructional Fellowship**, Duke University
» Fellows propose, design, and teach an innovative undergraduate course.
» \$12,375

Academic Awards

- 2022 **Rudin Prize**, Department of Mathematics, Duke
» Departmental award for outstanding PhD dissertation.
- 2019 **FESTA Fellowship**, School of Math, Georgia Tech
» Departmental award for students exhibiting superior academic and leadership skills.
- 2019 **Graduate committee travel support**, School of Math, Georgia Tech
» Departmental award to fund travel to a domestic conference.
- 2018 **Bob Price Travel Fellowship**, School of Math, Georgia Tech
» Departmental award to fund travel to an international conference.
- 2016 **Calvin H. Wilcox Memorial Scholarship**, Department of Math, University of Utah
» Departmental award for outstanding undergraduates.

Teaching Awards

- 2024 **Thomas Temple Hoopes Prize**, Harvard University
» For supervision of an outstanding senior thesis (by Jonathan Buchanan).
- 2022 **Teaching on Purpose Fellowship**, Kenan Institute of Ethics, Duke
» Prepares educators who help their students flourish.
- 2021 **L.P. Smith Award**, Department of Mathematics, Duke
» Departmental award for long-term commitment to excellence in teaching.
- 2019 **Thank a Teacher Certificate**, Center for Teaching and Learning, Georgia Tech
» Awarded to instructors by their students.
- 2019 **Outstanding Student Evaluations Award**, School of Math, Georgia Tech
» Departmental award for teaching assistants with highest student evaluations.

Papers & Preprints

grad coauthor *
undergrad coauthor †

14. **The unstable local A^1 -degree**,
» with John Igieobo[†], Steven Sanchez[†], Dae'Shawn Taylor[†], and Kirsten Wickelgren.
» In preparation.
13. **Lines and conics on del Pezzo surfaces**,
» with Enis Kaya, Sam Streeter, and H. Uppal.
» In preparation.
12. **Symmetric powers of null motivic Euler characteristic**,
» with Dori Bejleri.
» Preprint, 2024.
» [arXiv:2406.19506](https://arxiv.org/abs/2406.19506)
11. **KSp-characteristic classes determine Spin^h cobordism**,
» with Jonathan Buchanan[†].
» Preprint, 2023.
» [arXiv:2312.08209](https://arxiv.org/abs/2312.08209)
10. **Bounding the signed count of real bitangents to plane quartics**,
» with Mario Kummer.
» [manuscripta math. \(2023\)](https://arxiv.org/abs/2303.02008)
» [arXiv:2303.02008](https://arxiv.org/abs/2303.02008)
9. **Circles of Apollonius two ways**.
» Preprint, 2022.
» [arXiv:2210.13288](https://arxiv.org/abs/2210.13288)

8. **Lifts, transfers, and degrees of univariate maps,**
 » with Thomas Brazelton*.
 » [Math. Scand.](#) 129(1), 5–38 (2023)
 » [arXiv:2112.04592](#)
7. **Conics meeting eight lines over perfect fields,**
 » with Cameron Darwin*, Aygul Galimova*, and Miao (Pam) Gu*.
 » [J. Algebra](#) 631, 24–45 (2023)
 » [arXiv:2107.05543](#)
6. **Bézoutians and the \mathbb{A}^1 -degree,**
 » with Thomas Brazelton* and Sabrina Pauli.
 » [Algebra Number Theory](#) 17(11), 1985–2012 (2023)
 » [arXiv:2103.16614](#)
5. **Rational lines on smooth cubic surfaces.**
 » Preprint, 2022.
 » [arXiv:2101.08217](#)
4. **Bézoutians and injectivity of polynomial maps.**
 » [J. Pure Appl. Algebra](#) 227(6), 107298 (2023)
 » [arXiv:2005.09797](#)
3. **An arithmetic enrichment of Bézout’s Theorem.**
 » [Math. Ann.](#) 379(1), 633–660 (2021)
 » [arXiv:2003.07413](#)
2. **All lines on a smooth cubic surface in terms of three skew lines,**
 » with Daniel Minahan* and Tianyi Zhang*.
 » [New York J. Math.](#) 27(1), 1305–1327 (2021)
 » [arXiv:2002.10367](#)
1. **The trace of the local \mathbb{A}^1 -degree,**
 » with Thomas Brazelton*, Robert Burklund*, Michael Montoro*, and Morgan Opie*.
 » [Homology Homotopy Appl.](#) 23(1), 243–255 (2021)
 » [arXiv:1912.04788](#)

Other Writing

2. **Local contributions in \mathbb{A}^1 -enumerative geometry.**
 » PhD thesis
 » [shmckean.github.io/research/thesis.pdf](#)
1. **Heights over finitely generated fields,**
 » with Soumya Sankar.
 » [Stacks Project Expository Collection](#), 222–254 (2022)

Invited Talks

online *

- 2024 **Motivic Homotopy**, Park City Mathematics Institute
 » “Unstable local \mathbb{A}^1 -degree”
Algebraic Geometry Seminar, University of Maryland
 » “Genealogy of the del Pezzo family”
Topology Seminar, MIT
 » “Motivic Euler characteristics and power structures”
Algebraic Topology Seminar*, UCLA
 » “Motivic Euler characteristics and power structures”
- 2023 **Colloquium**, Brigham Young University
 » “Counting with quadratic forms”

- Geometry Seminar**, Texas A&M
 » "Real bitangents to plane quartics"
- Real Algebraic Geometry**, SIAM Applied Algebraic Geometry (Eindhoven)
 » "Extending real enumerative geometry to arbitrary fields"
- Latin American Real and Tropical Geometry Seminar***, Universidade Estadual de Campinas
 » "Circles of Apollonius two ways"
- Applied Enumerative Geometry**, Joint Mathematics Meetings (Boston)
 » "Rational lines on cubic surfaces"
- 2022 **Algebraic Geometry Seminar**, Brown
 » "Circles of Apollonius two ways"
- Topology Seminar**, MIT
 » "Varieties from the differentiable viewpoint"
- Motivic Geometry Conference**, Universitetet i Oslo
 » "Circles of Apollonius two ways"
- Homotopy Theory Seminar***, University of Pennsylvania
 » "Lifts, transfers, and degrees in motivic homotopy"
- Seminar on \mathbb{A}^1 -Topology, Motives, and K-Theory***, EIMI (St. Petersburg)
 » "Lifts, transfers, and degrees in motivic homotopy"
- Chicagoland Topology Seminar***, UChicago & Northwestern
 » "Lifts, transfers, and degrees in motivic homotopy"
- Colloquium**, Brigham Young University
 » "Enumerative geometry beyond \mathbb{C} "
- 2021 **Seminar on Machine Computation in Homotopy***, eCHT
 » "Commutative algebraic formulas for the \mathbb{A}^1 -degree"
- Algebraic Geometry Seminar***, Ohio State
 » "Rational lines on cubic surfaces"
- Motivic Geometry Seminar***, Centre for Advanced Study (Oslo)
 » "Commutative algebraic formulas for the \mathbb{A}^1 -degree"
- 2019 **Commutative Algebra Seminar**, University of Utah
 » "An arithmetic enrichment of Bézout's theorem"
- Geometry and Topology in Arithmetic**, AMS Central Sectional (Wisconsin)
 » "An arithmetic enrichment of Bézout's theorem"

Contributed Talks

online *
 short talk †

- 2023 **Motives Seminar***, Universität Duisburg-Essen
 » "Explicit formulas for local Euler classes"
- 2021 **Midwest Topology Seminar Networking Event*†**, Wayne State
 » "Ode to the Brouwer degree"
- Hermitian K-Theory Research Seminar***, eCHT
 » "Hermitian and Poincaré categories"
- 2020 **Triangle Area Graduate Math Conference***, NC State
 » "Rational lines on cubic surfaces"
- Motives Research Seminar***, eCHT
 » "The yoga of motives"
- Real Enumerative Geometry and Beyond†**, Vanderbilt
 » "Rational lines on cubic surfaces"
- 2019 **Arithmetic Topology Workshop†**, PIMS
 » "An arithmetic enrichment of Bézout's theorem"
- Graduate Student Conference in AG&T**, Temple
 » "An arithmetic enrichment of Bézout's theorem"
- 2018 **Tech Topology Conference†**, Georgia Tech
 » "An arithmetic enrichment of Bézout's theorem"

Selected Conference Participation

online *

- 2024 Enumerative Geometry Beyond Spaces*, Banff International Research Station
Motivic Homotopy, Park City Mathematics Institute
» TA for workshop: " \mathbb{A}^1 -homotopy theory and the Weil conjectures"
- 2021 New Techniques in Resolution of Singularities*, Oberwolfach
Homotopic and Geometric Galois Theory*, Oberwolfach

Teaching Experience

online *
self-designed †

- 2024 Sets, Groups, and Real Analysis (instructor), Harvard
- 2023 Topological Modular Forms[†] (instructor), Harvard
Cryptography[†] (instructor), Harvard Pre-College
- 2022 Cryptography[†] (instructor), Duke Pre-College
- 2021 The Art of Proof[†] (instructor), Duke
- 2020 Laboratory Calculus I* (instructor), Duke
Linear Algebra and Differential Equations* (TA), Duke
- 2019 Differential Calculus (head TA), Georgia Tech
Algebra Comp Prep Course (instructor), Georgia Tech
Calculus for Life Sciences (instructor), Georgia Tech
- 2018 Differential Calculus (head TA), Georgia Tech
Differential Calculus (lecture assistant), Georgia Tech
Integral Calculus (TA), Georgia Tech
- 2017 Multivariable Calculus (TA), Georgia Tech
Pre-calculus[†] (instructor), Utah TRIO
Statistics[†] (instructor), Utah TRIO
Algebra[†] (instructor), Utah TRIO

Undergraduate Thesis Advising

- 2024—2025 Lev Kruglyak (Harvard), Exotic spheres and the Kervaire invariant
- 2023—2024 Jonathan Buchanan (Harvard), The Atiyah–Bott–Shapiro orientation in bordism and field theory
» Hoopes Prize recipient
- 2023—2024 Helen Dai (Harvard), A construction of an exotic \mathbb{R}^4 using Freedman's and Donaldson's theorems

Undergraduate & High School Mentoring

- 2024 Stephanie Atherton (Otis College of Art and Design), Twoples mentor
- 2023—2024 Garbriel Ong (Bowdoin College), Research mentor
- 2023 Dania Rustom (Cambridge Rindge & Latin School), Internship mentor
- 2022—2024 Jonathan Buchanan (Harvard), Research mentor
- 2021 Santino Panzica (Duke), DOMath project assistant
Will Strong (Duke), DOMath project assistant
Luke Triplett (Duke), DOMath project assistant
Camilo Martinez (Universidad del Cauca), Twoples mentor
- 2020 Michael Klyachman (Whitney Young High School), Twoples mentor
John Igieobo (Georgia Tech), DOMath project assistant
Steven Sanchez (Georgia Tech), DOMath project assistant
Dae'Shawn Taylor (Georgia Tech), DOMath project assistant

Departmental Service

2024—	Faculty Coordinator for Student Research Conference, BYU
2024—	Outreach Committee, BYU
2024	Co-host for professional development lunch: “Work-life balance”, Harvard
2023—2024	Qualifying Exam Committee, Harvard
2021	Speaker for first-year TA training, Duke
2021	Presenter and panelist for first-year bootcamp, Duke
2021—2022	Diversity, Equity, and Inclusion Team, Duke
2021	DOmath project manager, Duke
2020—2022	AWM undergrad mentor, Duke
2020, 2021	Designed DOmath t-shirts, Duke
2020	REU project assistant, Duke
2020	Co-organizer, presenter, and panelist for first-year bootcamp, Duke
2019	Instructor for first-year TA training, Georgia Tech
2019	Panelist for grad student orientation, Georgia Tech
2018, 2019	Panelist for admitted grad student day, Georgia Tech
2018	Panelist for first-year course: “Getting Involved”, Georgia Tech
2018	Designed and organized School of Math t-shirts, Georgia Tech
2018	Co-organizer of the Intersection Theory Learning Seminar, Georgia Tech
2018—2019	Co-organizer of the Research Horizons Seminar, Georgia Tech
2018—2019	Mathematics Graduate Student Council, Georgia Tech

Professional Service

2020	Tutor, Durham Public Schools
2020—2021	Tutor, SPIRE Fellows, Duke
2019	Judge for UROP poster presentations, Georgia Tech
2017—2019	College of Sciences Graduate Student Diversity Council, Georgia Tech

Outreach

2023	Three presentations on research in math, Harvard Pre-College
2021	Math Employment Experience for High School Students, Duke
2021	Co-organizer and instructor, Durham Math Circle
2020—	Founder, organizer, and mentor, Twopiles
2019	9 th Grade Speaker Series, Gwinnett School of Math, Science, and Technology
2019	SMASH Morehouse Networking Night, Morehouse College
2017—2020	High School Math Competition, Georgia Tech
2015, 2016	Project Youth, University of Utah

Referee Work

Full report	Abh. Math. Semin. Univ. Hambg., AKT, Algebr. Geom. Topol., IMRN, JSAG, Proc. AMS
Quick opinion	Doc. Math., JAMS, JSAG
Reviews	Mathematical Reviews (×8), zbMATH (×13)

Relevant Skills

Language:	English (native), German (fluent), French (basic)
Design:	Photoshop/GIMP (proficient), Inkscape (proficient)
Coding:	Python/Sage (moderate), HTML/CSS (moderate), JavaScript (moderate), Macaulay2 (basic)