Stephen McKean

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Research Interests

Arithmetic geometry, arithmetic topology, commutative algebra, applied topology.
Motivic homotopy theory, enumerative geometry, algebraic cycles, anabelian geometry, quadratic forms, residue pairings, topological waves and materials, topological neuroscience.

Employment

2022–25 **Harvard University,** Cambridge, Massachusetts
NSF Postdoctoral Fellow & Lecturer
» 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

Academic Awards

2022 **Rudin Prize,** Department of Mathematics, Duke
» Departmental award for outstanding PhD dissertation.

2022 **Mathematical Sciences Postdoctoral Research Fellowship,** National Science Foundation
» Postdoctoral support for future leaders in mathematics.

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.

2011 **President's Scholarship,** University of Utah
» Awarded to matriculating undergraduates on the basis of academic excellence.

Teaching Awards

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.

2021 **Bass Instructional Fellowship,** Duke
» Fellows propose, design, and teach an innovative undergraduate course.

2019 ***Thank a Teacher* Certificate,** 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

10. **Unstable Euler classes,**
» with Kirsten Wickelgren.
» In preparation.

9. **Circles of Apollonius two ways.**
» In preparation.

8. **Lifts, transfers, and degrees of univariate maps,**
» with Thomas Brazelton.
» To appear in *Math. Scand.*
» arXiv:2112.04592

7. **Conics meeting eight lines over perfect fields,**
» with Cameron Darwin, Aygul Galimova, and Miao (Pam) Gu.
» Submitted, 2021.
» arXiv:2107.05543

6. **Bézoutians and the $\mathbf{A}^1$-degree,**
» with Thomas Brazelton and Sabrina Pauli.
» Submitted, 2021.
» arXiv:2103.16614

5. **Rational lines on smooth cubic surfaces.**
» Submitted, 2022.
» arXiv:2101.08217

4. **Bézoutians and injectivity of polynomial maps.**
» Submitted, 2021.
» 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 $\mathbf{A}^1$-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 $\mathbf{A}^1$-enumerative geometry.**
   » shmckean.github.io/research/thesis.pdf
1. **Heights over finitely generated fields,**
   » with Soumya Sankar.
   » To appear in *Stacks Project Expository Collection*

Invited Talks

online *

2022 **Motivic Geometry Conference,** University of Oslo
» "Circles of Apollonius two ways"
Homotopy Theory Seminar*, University of Pennsylvania
» "Lifts, transfers, and degrees in motivic homotopy"
Seminar on $\mathbf{A}^1$-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
» "An arithmetic enrichment of Bézout's theorem"

Contributed Talks

online *
short talk †

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 Conferences Attended

online *

2021 **New Techniques in Resolution of Singularities***, Oberwolfach
Six Functor Formalism and Motivic Homotopy Theory, Università degli Studi di Milano
Homotopic and Geometric Galois Theory*, Oberwolfach
2020 **Monodromy and Galois Groups in Enumerative Geometry***, ICERM
Stacks Project Workshop*, University of Michigan
2019 **Computations in Motivic Homotopy Theory,** Universität Regensburg
Arithmetic Topology Workshop, University of British Columbia (PIMS)
2018 **Homotopy Theory and Arithmetic Geometry,** Imperial College
The Roots of Topology, University of Chicago

Teaching Experience

online *
self-designed †

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
Trigonometry (supplemental instruction leader), University of Utah
2016 **Intermediate Algebra (supplemental instruction leader, ×2),** University of Utah
2015 **Calculus I (supplemental instruction leader),** University of Utah

Undergraduate Mentoring

2022 **Jonathan Buchanan (Harvard),** Stably structured cobordism
2021 **Santino Panzica (Duke),** Topological insulators
Will Strong (Duke), Topological insulators
Luke Triplett (Duke), Topological insulators
Camilo Martinez (Universidad del Cauca), Polynomials over finite fields
2020 **Michael Klyachman (Whitney Young High School),** Snaith's theorem
John Igieobo (Georgia Tech), Unstable Euler classes
Steven Sanchez (Georgia Tech), Unstable Euler classes
Dae'Shawn Taylor (Georgia Tech), Unstable Euler classes

Department Service

2021 **Speaker for first-year TA training,** Duke
2021 **Presenter and panelist for first-year bootcamp,** Duke
2021–22 **Diversity, Equity, and Inclusion Team,** Duke
2021 **DOmath project manager,** Duke
2020–22 **AWM undergrad mentor,** Duke
2020, 21 **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, 19 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
2018–19 Co-organizer of the Research Horizons Seminar, Georgia Tech
2018–19 Mathematics Graduate Student Council, Georgia Tech

Professional Service

2021–now Reviewer, Mathematical Reviews
2020 Tutor, Durham Public Schools
2020–21 Tutor, SPIRE Fellows, Duke
2020–now Reviewer, zbMATH
2019 Judge for UROP poster presentations, Georgia Tech
2017–19 College of Sciences Graduate Student Diversity Council, Georgia Tech

Referee Work

IMRN

Outreach

2021 Math Employment Experience for High School Students, Duke
2021 Co-organizer and instructor, Durham Math Circle
2020–now Founder, organizer, and mentor, Twoples
2019 9th Grade Speaker Series, Gwinnett School of Math, Science, and Technology
2019 SMASH Morehouse Networking Night, Morehouse College
2017–20 High School Math Competition, Georgia Tech
2015, 16 Project Youth, University of Utah

Relevant Skills

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