

# Stephen McKean

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## Research Interests

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

## Employment

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2022–25 **Harvard University**, Cambridge, Massachusetts  
NSF Postdoctoral Fellow  
» Sponsor: Mike Hopkins

## Education

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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

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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

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- 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

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grad coauthor \*  
undergrad coauthor †

13. **The unstable local  $A^1$ -degree**,  
» with John Igieobo<sup>†</sup>, Steven Sanchez<sup>†</sup>, Dae'Shawn Taylor<sup>†</sup>, and Kirsten Wickelgren.  
» In preparation.
12. **Quadratic counts of highly tangent lines to hypersurfaces**,  
» with Wern Juin Gabriel Ong<sup>†</sup>.  
» In preparation.
11. **Splitting quaternionic spin cobordism at 2**,  
» with Jonathan Buchanan<sup>†</sup>.  
» In preparation.
10. **Bounding the signed count of real bitangents to plane quartics**,  
» with Mario Kummer.  
» [manuscripta math.](#) (2023)  
» [arXiv:2303.02008](#)
9. **Circles of Apollonius two ways**.  
» Preprint, 2022.  
» [arXiv: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  $A^1$ -degree**,  
» with Thomas Brazelton\* and Sabrina Pauli.  
» To appear in *Algebra Number Theory*  
» [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

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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

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online \*

- 2023 **Topology Seminar**, MIT
  - » “Quaternionic spin cobordism at 2”**Geometry Seminar**, Texas A&M
  - » “Enriched counts of torsion points on abelian varieties”**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”

## Invited Conference Participation

online \*

- 2024 Enumerative Geometry Beyond Spaces, Banff International Research Station
- 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<sup>†</sup> (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 & High School Mentoring

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- 2023–24 Helen Dai (Harvard), Senior thesis advisor
- Garbriel Ong (Bowdoin College), Research mentor
- 2023 Dania Rustom (Cambridge Rindge & Latin School), Internship mentor
- 2022–24 Jonathan Buchanan (Harvard), Research mentor & senior thesis advisor
- 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

## Department Service

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- 2023–24 Qualifying Exam Committee, Harvard
- 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

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- 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

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- Full report Abh. Math. Semin. Univ. Hambg., IMRN
- Quick opinion JAMS

## Outreach

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- 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–now Founder, organizer, and mentor, [Twoples](#)
- 2019 9<sup>th</sup> 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

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