Thomas Brazelton

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Employment

Harvard University — Cambridge, MA
NSF Postdoctoral Research Fellow — 2023—2026

Education

The University of Pennsylvania — Philadelphia, PA
Ph.D, Mathematics — 2018—2023
NSF Graduate Research Fellow

The Johns Hopkins University — Baltimore, MD
B.A. + M.A., Mathematics — 2014—2018

Preprints

19. The evolution of enumerative geometry: a narrative from classical problems to enriched invariants, with C. Bethea. 23 pages, 2025.
18. C_p-Mackey functors in Macaulay2, with D. Chan, B. Mudrak, B. Spitz, C. Vogeli, C. Wang, M. Zeng, S. Zotine. 13 pages, 2025.
17. On rank 2 bundles over smooth affine fourfolds, with M. Opie, T. Syed. 37 pages, 2025.
16. The Chow–Witt rings of the classifying spaces of quadratically oriented bundles, with M. Wendt. 43 pages, 2025.
15. Monodromy in the space of symmetric cubic surfaces with a line, with S. Raman. 28 pages, 2024.
14. Bitangents to symmetric quartics, with C. Bethea. 21 pages, 2024.

Pubications

13. Concerning monoid structures on naive homotopy classes of endomorphisms of punctured affine space, with W. Hornslien. *J. Homotopy Relat. Struc.* (2025).
12. An enriched degree of the Wronski map, *New York Journal of Mathematics* **31** (2025), 195—222.
11. Equivariant enumerative geometry. *Advances in Mathematics* **461**, 2025.
10. $\mathbb{A}^1$-Brouwer degrees in Macaulay2, with N. Borisov, F. Espino, T. Hagedorn, Z. Han, J. Lopez Garcia, J. Louwsma, G. Ong, and A. Tawfeek. *J. Software Alg. Geom.* **14** (2024) pp. 175–187.
9. Residue sums of Dickson polynomials over finite fields, with J. Harrington, M. Litman, T. H. W. Wong. *J. Number Theory* **264** (2024) pp. 1—26.
8. Lifts, transfers, and degrees of univariate maps, with S. McKean. *Mathematica Scandinavica* **129** (2023) pp. 5—38.
7. Bézoutians and the $\mathbb{A}^1$-degree, with S. McKean and S. Pauli *Algebra & Number Theory* **17(11)**, 2023.
6. Homotopy Mackey functors of equivariant algebraic K-theory. *Journal of Pure and Applied Algebra*, **226(8)**, August 2022.
5. An introduction to $\mathbb{A}^1$-enumerative geometry. In Neumann F., Pál A. (eds) *Homotopy Theory and Arithmetic Geometry — Motivic and Diophantine Aspects.* Lecture notes in Mathematics, vol **2292**. Springer, Cham. 2021.
4. A note on semilinearization and twisted group rings. *Communications in Algebra*, **49:8**, 3380—3386, 2021.
3. The trace of the local $\mathbb{A}^1$-degree, with R. Burklund, M. McKean, M. Montoro, M. Opie. *Homology, Homotopy and Applications* **23(1)** (2021) pp. 1—14.
2. Zeros of newform Eisenstein series on $\Gamma_0(N)$, with V. Jakicic, *J. Number Theory* **190** (2018) pp. 109—130.
1. On consecutive primitive nth roots of unity modulo q, with J. Harrington, S. Kannan, and M. Litman, *J. Number Theory* **174** (2017) pp. 494—504.

Software

`CpMackeyFunctors`, a Macaulay2 package for doing homological algebra with C_p-Mackey functors. With D. Chan, B. Mudrak, B. Spitz, C. Vogeli, C. Wang, M. Zeng, and S. Zotine.

`A1BrouwerDegrees`, a Macaulay2 package for $\mathbb{A}^1$-Brouwer degree computation and working with symmetric bilinear forms. With N. Borisov, F. Espino, T. Hagedorn, Z. Han, J. Lopez Garcia, J. Louwsma, G. Ong, and A. Tawfeek.

Professional Service	*Co-Organizer*, Macaulay2 Workshop 2025, UW-Madison (DMS-2508868) *Co-Organizer*, Mid-Atlantic Topology Conference 2024, Northeastern University (DMS-2349755) *Co-Organizer*, AMS Special Session on Homotopy Theory, JMM 2024 *Project leader*, Macaulay2 Workshop 2023, University of Minnesota
Committee work	Graduate Admissions Committee, Harvard Mathematics, 2024–present Community Committee, Harvard Mathematics, 2024–Present
Referee work	*Referee*: Advances in Mathematics, Annali della Scuola Normale Superiore di Pisa, Geometry & Topology, IMRN *Reviewer*, MathSciNet

Research Talks	SIAM AG Minisymposium: Numerical and certified methods in algebraic geometry	Jul 2025
	Arithmetic, algebraic K-theory and algebraic cycles, OSU	May 2025
	UPenn Geometry & Topology Seminar	Mar 2025
	AMTRaK Seminar, UVA	Feb 2025
	UVA Topology Seminar	Feb 2025
	Brown Algebra Seminar	Jan 2025
	Notre Dame Topology Seminar	Jan 2025
	UW-Madison Algebra and Algebraic Geometry Seminar	Dec 2024
	CU-Boulder Topology Seminar	Nov 2024
	Harvard/MIT Algebraic Geometry Seminar	Oct 2024
	Enumerative Geometry Beyond Spaces, Banff	Aug 2024
	Workshop on Applied and Computational Enumerative Geometry, Fields Institute	Jun 2024
	Université du Québec à Montréal, LACIM Seminar	Apr 2024
	Algebra Seminar, University of Pennsylvania	Apr 2024
	Geometry/Topology Seminar, University of Pennsylvania	Apr 2024
	CIMAT Topology Seminar	Feb 2024
	University of Minnesota Topology Seminar	Feb 2024
	University of Chicago Algebraic Topology Seminar	Feb 2024
	University of Chicago No Boundaries Seminar	Feb 2024
	Northeastern Topology Seminar	Jan 2024
	UC-Irvine Topology Seminar	Jan 2024
	UCLA Topology Seminar	Jan 2024
	AMS Special Session on Equivariant Algebra, JMM	Jan 2024
	eCHT Research Seminar	Nov 2023
	Texas A&M Geometry Seminar	Nov 2023
	MIT Topology Seminar	Oct 2023
	Notre Dame Algebraic Geometry & Commutative Algebra Seminar	May 2023
	University of Maryland Algebra & Number Theory Seminar	Mar 2023
	Tulane University Algebraic Geometry & Geometric Topology Seminar	Feb 2023
	Emory University Algebra Number Theory Seminar	Feb 2023
	University of Waterloo Geometry/Topology Seminar	Feb 2023
	University of Virginia Topology Seminar	Feb 2023
	Brown University Algebraic Geometry Seminar	Feb 2023
	JMM Special Session on Applied Enumerative Geometry	Jan 2023
	UCLA Topology Seminar	Nov 2022
	Rochester University Topology Seminar	Nov 2022
	Binghamton University Graduate Conference (BUGCAT)	Nov 2022
	Binghamton University Topology Seminar	Nov 2022
	AMS Special Session on K-theory and Chromatic Homotopy Theory, U-Utah	Oct 2022
	Johns Hopkins University Topology Seminar	Oct 2022
	Loyola University Chicago Topology, Algebra, Combinatorics & Operators Seminar	Oct 2022
	UChicago Topology Seminar	Oct 2022
	Young Topologists Meeting 2022, Copenhagen	Jul 2022
	Homotopy Theory with Applications to Arithmetic and Geometry, Fields Institute	Jun 2022
	GROOT (Graduates Reminisce Online On Topology)	Jun 2022
	Algebraic Structures in Topology, San Juan	Jun 2022
	Algebra Seminar, Texas A&M University	Mar 2022
	FRG Grant on Trace Methods	Jan 2022

SECANT 2021, Cedar Crest College — Jan 2022
Topology/Geometry Seminar, University of Oregon — Nov 2021
Geometry/Topology Seminar, University of Pennsylvania — Nov 2021
Algebra Seminar, University of Pennsylvania — Nov 2021
Young Topologists Meeting 2020/2021 — Jul 2021
Algebra Seminar, University of Pennsylvania — Apr 2020
Binghamton University Graduate Conference (BUGCAT) — Nov 2020
Geometry/Topology Seminar, University of Pennsylvania — Oct 2020
AMS Fall Sectional, UW-Madison — Sep 2019
PIMS Workshop on Arithmetic Topology — Jun 2019
Rényi Institute Number Theory Seminar, Budapest — Sep 2016

Awards and Fellowships

AIM SQuaRE Grant — 2023—2026,
Around the Wronski map, with S. Karp, J. Levinson, S. McKean, K. Purbhoo, F. Sottile

AIM SQuaRE Grant — 2023—2026,
An algebraic approach to Thom spectra, with M. Calle, D. Chan, L. Keenan, M. Péroux

NSF Postdoctoral Research Fellowship — 2023—2026

AMS Travel Grant — 2022

Graduate Fellow for Teaching Excellence,
Penn Center for Teaching and Learning — 2022—2023

Moez Alimohamed Graduate Student Award for Distinguished Teaching in Mathematics, University of Pennsylvania — 2021

Graduate Fellow for Equitable and Inclusive Teaching, Penn Center for Teaching and Learning — 2021—2022

Master TA, University of Pennsylvania Mathematics Department — 2021—2023

Dean's Scholar, University of Pennsylvania
Honored as one of nine doctoral students across the School of Arts & Sciences. — 2020—2021

Good Teaching Award, University of Pennsylvania Mathematics Department — Fall 2020

NSF Graduate Research Fellow — 2019 — 2024

Calabi Fellow, University of Pennsylvania Mathematics Department — 2017 — 2020

J.J. Sylvester Award for Excellence in Mathematics (Johns Hopkins) — May 2018

NSF GRFP, Honorable Mention — 2018

William Lowell Putnam Award (Johns Hopkins) — May 2016

Teaching

Harvard University
MATH1B, Calculus — Fall 2025
MATH101, Sets, groups, and geometry — Spring 2025
MATH266, Unstable motivic homotopy theory — Fall 2024

MIT Educational Justice Initiative
TA, Code your dreams (Python, HTML, Flask) — Spring 2025
TA, Intro to Python — Fall 2024

University of Pennsylvania
Instructor, MATH8100 Enumerative Geometry — Spring 2023
Designed and taught an inquiry-based learning course on enumerative geometry for graduate students and advanced undergrads.

Penn Directed Reading Program — Fall 2019 — Spring 2023

Co-founded and co-organized the DRP at Penn with Mona Merling (Fall 2019), co-organized with George Wang (Spring 2020 — Spring 2021), and with Marielle Ong (Fall 2021 — Spring 2023). Mentor for the following projects:

$\mathbb{A}^1$-*Milnor numbers*, Zhong Zhang	Spring 2023
Algebraic geometry from an $\mathbb{A}^1$-*viewpoint*, Zhong Zhang	Fall 2022
Enumerative geometry and string theory II, Zhong Zhang	Spring 2022
Enumerative geometry and string theory, Zhong Zhang	Fall 2021
Category theory and homotopy theory, Abigail Timmel	Spring 2020
Group theory and applications, Stephanie Wu	Fall 2019
Persistent homology, Mira Wattal (JHU)	Spring 2018

Princeton Prison Teaching Initiative Spring 2021 — Spring 2022

Volunteer math instructor for South Woods State Prison in New Jersey.

Instructor/Team Leader for MATH015	Spring 2022
Instructor for MATH020	Fall 2021
Grader for MATH015	Spring 2021

Penn Summer Prep Philadelphia, PA

Instructor, Introduction to Voting Theory Summer 2021

Designed and taught a two-week course on voting theory for advanced high school students.

University of Pennsylvania Philadelphia, PA

Teaching Assistant, MATH 370 Algebra I	Spring 2021
Teaching Assistant, MATH 114 Calculus II	Fall 2020

The Johns Hopkins University Baltimore, MD

Teaching Assistant, AS.110.421 Dynamical Systems	Spring 2018
Teaching Assistant, AS.110.202 Calculus III	Fall 2017

Seminars organized

Harvard/MIT Juvitop, The norm residue isomorphism theorem, (w/ Logan Hyslop)	Fall 2025
eCHT[1], Quadratically enriched curve counting (w/ Sabrina Pauli)	Fall 2024
eCHT, Algebraic, motivic, and topological vector bundles (w/ Morgan Opie)	Fall 2023
UPenn Homotopy Theory Seminar (w/ Andres Mejia)	Spring 2021—Spring 2023
Penn Graduate Student Seminar (w/ Marielle Ong)	Fall 2019—Spring 2020

Facilitation

Center for Teaching and Learning, University of Pennsylvania

Designing Problems for STEM Classes Fall 2022

Designed a university-wide workshop on scaffolding and backwards design in problem sets in STEM.

Inclusive and Equitable Teaching in STEM Spring 2022

Designed and facilitated a five-session mini-course on inclusive and equitable teaching in STEM disciplines for graduate students.

Inclusive and Equitable Teaching Fall 2021

Co-facilitated a five-session mini-course on inclusive and equitable teaching for graduate students.

Expository Talks

Texas A&M Undergrad Math Society Nov 2022

Gimbal lock and covering spaces

Penn Undergrad Math Society Nov 2022

A hands-on introduction to homotopy

Penn Geometry/Topology Grad Seminar

Local homotopy theory and Galois descent	Sep 2022
The algebraic vector bundle problem	Feb 2022
Euler characteristics of real algebraic manifolds	Oct 2021

[1] electronic Computational Homotopy Theory seminar

MIT Talbot Workshop, 2021 — Oct 2021
Ambidexterity

Penn General Robotics, Automation, Sensing & Perception Laboratory — Oct 2019
A brief introduction to topology

Moravian College REU Seminar — Jun 2019
A hands-on introduction to homotopy

University of Pennsylvania Graduate Pizza Seminar
How to prevent nuclear war and then decide what to watch on Netflix — Feb 2023
Elliptic curves and the NSA — Jan 2020
Gimbal lock — Dec 2020
Social choice and topology — Mar 2019
The generalized Poincaré conjecture — Oct 2018

Johns Hopkins Undergraduate Mathematics Seminar — Apr 2018
A Crash Course in Homotopy Theory

Selected Conferences and Workshops (* indicates online)

Enumerative Geometry Beyond Spaces, Banff	Aug 2023
PCMI Research Program in Motivic Homotopy Theory	Jul 2023
International Workshop on Algebraic Topology, Shanghai	Jun 2024
Algebraic Structures in Topology II, San Juan	Jun 2024
Workshop on Computational and Applied Enumerative Geometry, Fields Institute	Jun 2024
Motives in Mainz	Mar 2024
Joint Mathematics Meetings 2024, San Francisco	Jan 2024
European Autumn School in Topology 2023	Sep 2023
Stacks Project Workshop 2023, Ann Arbor	Aug 2023
Recent Advances in Algebraic K-Theory, IHES	Jul 2023
Motivic and non-commutative aspects of enumerative geometry, Nijmegen	Jul 2023
Scissors K-theory and Trace Methods, Indiana University	Jun 2023
Macaulay2 Workshop, University of Minnesota	May 2023
Mid-Atlantic Topology Conference, Philadelphia	Apr 2023
Joint Mathematics Meeting, Boston	Jan 2023
Banff Workshop on Toric Degenerations	Dec 2022
Binghamton University Graduate Conference in Algebra & Topology	Nov 2022
AMS Sectional, Salt Lake City	Oct 2022
Young Topologists Meeting, Copenhagen	Jul 2022
Homotopical Methods in Fixed Point Theory, CU-Boulder	Jul 2022
Homotopy Theory with Applications to Arithmetic and Geometry, Fields Institute	Jun 2022
Algebraic K-theory, motivic cohomology and motivic homotopy theory, INI	Jun 2022
Algebraic Structures in Topology, San Juan	Jun 2022
Graduate Student Conference in Algebra, Geometry, & Topology, Temple University	May 2022
MIT Talbot Workshop: Ambidexterity in Chromatic Homotopy Theory, Plymouth MA	Oct 2021
Mathematics Teacher-Scholar Symposium, Reed College*	May 2021
Institute for Mathematics and Democracy 2021*	May 2021
Graduate Student Conference in Geometry and Topology*	Apr 2021
Midwest Topology Conference*	Apr 2021
Binghamton University Graduate Conference in Algebra and Topology*	Nov 2020
ICERM: Monodromy and Galois groups in enumerative geometry*	Aug–Sep 2020
Regensburg Transatlantic Transchromatic Homotopy Theory Conference II*	Aug 2020
IHES Motivic, Equivariant and Non-commutative Homotopy Theory*	July 2020
Motives and What Not, Universität Regensburg*	May 2020
Midwest Topology Seminar*	May 2020
MAGUS*	May 2020
Motives & Stacks, Universität Duisburg-Essen	Sep 2019
European Autumn School in Topology 2019, Utrecht	Sep 2019
AMS Fall Sectional, UW-Madison	Sep 2019
PIMS Workshop on Arithmetic Topology, UBC	Jun 2019
Graduate Student Conference in Algebra, Geometry, & Topology, Temple University	Jun 2019
Arizona Winter School 2019: Topology and Arithmetic	Mar 2019

Homotopy Theory Summer Berlin 2018 — Jun 2018
Joint Mathematics Meeting, Atlanta — Jan 2017

Service

Master TA, UPenn

In charge of running TA trainings and conducting observations.

The Franklin Institute Science Museum — 2018 — 2022

Volunteer science presenter with Team Boson, responsible for running tables at exhibits and discussing science with the public.

Johns Hopkins Math Club — 2015 — 2018

President (2017-2018), Vice President (2016-2017), organizer of speakers and events, test writer / grader / organizer for the Johns Hopkins Math Tournament, held yearly for high school students in the greater DC area. Founder of the Johns Hopkins Undergraduate Math Seminar.

Experience

Noblis, Inc — Reston, VA
PhD intern in post-quantum cryptography. — Summer 2018

Texas A&M REU — College Station, TX
Analytic number theory, supervised by Dr. Matthew Young. — Summer 2017

Muhlenberg College REU — Allentown, PA
Number theory, supervised by Dr. Joshua Harrington. — Summer 2016