Aaron Mazel-Gee

Curriculum Vitae

http://etale.site
✉ aaron@etale.site

Research Interests

My primary research interests center around ***factorization homology***, particularly as it relates to
- quantum invariants in low-dimensional topology (Khovanov homology, Heegaard Floer homology, etc.), and
- algebraic K-theory, elliptic cohomology, and chromatic homotopy theory.

Education

2010–2016 **PhD student in Mathematics**, *University of California*, Berkeley, CA.
Thesis: *Goerss–Hopkins obstruction theory via model ∞-categories*, available here (545 pages).
Winner of the Kenneth Ribet & Lisa Goldberg Award.
Advisor: Peter Teichner.

Aug–Dec 2015 **Visiting PhD student**, *Montana State University*, Bozeman, MT.

Jan–Dec 2013 **Visiting PhD student**, *Massachusetts Institute of Technology*, Cambridge, MA.

Jan–Dec 2012 **Visiting PhD student**, *Max Planck Institute for Mathematics*, Bonn, Germany.

2005–2009 **ScM and ScB in Mathematics**, *Brown University*, Providence, RI.

Employment

2020-2024 **Sherman Fairchild Instructor in Mathematics**, *California Institute of Technology*, Pasadena, CA.

Spring 2020 **Research Member**, *Mathematical Sciences Research Institute*, Berkeley, CA.
Semester-long program on *Higher categories and categorification*.

2017-2020 **Research Assistant Professor**, *University of Southern California*, Los Angeles, CA.

2016-2017 **Zassenhaus Assistant Professor**, *Ohio State University*, Columbus, OH.

Grant Funding

2021 **NSF Topology Grant**, *National Science Foundation*, $281k.
Grant DMS-2105031, *Factorization homology and low-dimensional topology*.

2017 **Zumberge Individual Research Award**, *USC*, $30k.

2017 **AMS-Simons Travel Grant**, *American Mathematical Society and the Simons Foundation*, $4k.

2011 **Math department travel grant**, *UC Berkeley*, $1k for xkcd (joint student topology seminar with Stanford, see below).

2009-2014 **NSF Graduate Student Research Fellowship**, *National Science Foundation*, $30k/year (plus tuition and fees) for 3 years.

2008 **Karen T. Romer Undergraduate Teaching and Research Award**, *Brown University*, $2.5k.

Publications

May 6, 2024 **Symmetries of the cyclic nerve**, with David Ayala and Nick Rozenblyum, arXiv:2405.03897 (78 pages).

Jan 5, 2024 **A braided $(\infty, 2)$-category of Soergel bimodules**, with Yu Leon Liu, David Reutter, Catharina Stroppel, and Paul Wedrich, arXiv:2401.02956 (143 pages).

Feb 14, 2021 **Perverse schobers and 3d mirror symmetry**, with Benjamin Gammage and Justin Hilburn, arXiv:2202.06833 (43 pages).

May 6, 2021 **Derived Mackey functors and C_{p^n}-equivariant cohomology**, with David Ayala and Nick Rozenblyum, arXiv:2105.02456 (83 pages).

Apr 8, 2021 **A universal characterization of noncommutative motives and secondary algebraic K-theory**, with Reuben Stern, arXiv:2104.04021 (80 pages).
Annals of K-Theory, to appear.

Mar 29, 2021 **Dualizable objects in stratified categories and the 1-dimensional bordism hypothesis for recollements**, with Grigory Kondyrev and Jay Shah, arXiv:2103.15785 (61 pages).

Oct 31, 2019 **Stratified noncommutative geometry**, with David Ayala and Nick Rozenblyum, arXiv:1910.14602 (236 pages).
Memoirs of the American Math Society, to appear.

Jan 17, 2019 **$\mathbf{E}_\infty$ automorphisms of motivic Morava E-theories**, arXiv:1901.05713 (6 pages).

Dec 18, 2018 **Goerss–Hopkins obstruction theory for ∞-categories**, arXiv:1812.07624 (54 pages).

Oct 17, 2017 **The geometry of the cyclotomic trace**, with David Ayala and Nick Rozenblyum, arXiv:1710.06409 (48 pages).

Oct 17, 2017 **Factorization homology of enriched ∞-categories**, with David Ayala, John Francis, and Nick Rozenblyum, arXiv:1710.06414 (45 pages).

Oct 17, 2017 **A naive approach to genuine G-spectra and cyclotomic spectra**, with David Ayala and Nick Rozenblyum, arXiv:1710.06416 (84 pages).

Oct 16, 2015 **Model ∞-categories III: the fundamental theorem**, arXiv:1510.04777 (34 pages).
New York Journal of Mathematics 27 (2021), 551-599.

Oct 15, 2015 **Model ∞-categories II: Quillen adjunctions**, arXiv:1510.04392 (29 pages).
New York Journal of Mathematics 27 (2021), 508-550.

Oct 14, 2015 **Hammocks and fractions in relative ∞-categories**, arXiv:1510.03961 (43 pages).
Journal of Homotopy and Related Structures 13 (2018), no. 2, 321-383.

Oct 13, 2015 **On the Grothendieck construction for ∞-categories**, arXiv:1510.03525 (41 pages).
Journal of Pure and Applied Algebra 223 (2019), no. 11, 4602-4651.

Oct 12, 2015 **The universality of the Rezk nerve**, arXiv:1510.03150 (26 pages).
Algebraic & Geometric Topology 19 (2019) no. 7, 3217-3260.

Oct 8, 2015 **A user's guide to co/cartesian fibrations**, arXiv:1510.02402 (16 pages).
Graduate Journal of Mathematics 4 (2019), no. 1, 42-53.

Jan 13, 2015 **Quillen adjunctions induce adjunctions of quasicategories**, arXiv:1501.03146 (20 pages).
New York Journal of Mathematics 22 (2016), 57-93.

Dec 29, 2014 **Model ∞-categories I: some pleasant properties of the ∞-category of simplicial spaces**, arXiv:1412.8411 (66 pages).

Sep 29, 2014 **From fractions to complete Segal spaces**, with Zhen Lin Low, arXiv:1409.8192 (21 pages).
Homology, Homotopy and Applications 17 (2015), no. 1, 321-338.

Aug 25, 2013 **A relative Lubin–Tate theorem via meromorphic formal geometry**, with Eric Peterson and Nathaniel Stapleton, arXiv:1308.5435 (18 pages).
Algebraic & Geometric Topology 15 (2015) no. 4, 2239-2268.

Sep 2, 2009 **A cubical antipodal theorem**, with Kyle E. Kinneberg, Tia Sondjaja, and Francis Su, arXiv:0909.0471 (15 pages).

Aug 2, 2006 **Maximum volume space quadrilaterals**, with Thomas Banchoff and Nicholas Haber.
Expeditions in Mathematics 2 (2011), 175-198.

Exposition

In progress **Higher Algebra: Chapter 0**.
Textbook account of the ∞-categorical approach to homological algebra. 95% complete; incomplete draft available here (~200 pages).
Contracted to be published in the Cambridge University Press series *Studies in Advanced Mathematics*.

Awards

2016 **Kenneth Ribet & Lisa Goldberg Award in Algebra**, *UC Berkeley*, dissertation award.

2016 **Outstanding Graduate Student Instructor Award**, *UC Berkeley*.

2013 **Distinguished Graduate Student Speaker**, *USTARS conference*.

2009 **Howell Prize for Excellence in Mathematics**, *Brown University*.

2009 **Magna cum laude** (highest honor awarded), *Brown University*.

2009 **Phi Beta Kappa**, *Brown University*.

2009 **1st place, Crossword Puzzle Competition**, *Brown University*.

2009 **1st place, Intramural Ultimate Frisbee League**, *Brown University*.

2005 **Governor's Scholarship**, *California*.

Teaching Experience

Spring 2023 **Homological algebra (Math 128)**, *Caltech*, lead instructor.

Spring 2023 **Algebraic and differential topology III (Math 151c)**, *Caltech*, lead instructor.

Spring 2022 **Algebraic and differential topology III (Math 151c)**, *Caltech*, lead instructor.

Fall 2021 **Algebraic and differential topology I (Math 151a)**, *Caltech*, lead instructor.

Winter 2021 **Homological algebra (Math 128)**, *Caltech*, lead instructor.

Fall 2020 **Algebraic and differential topology I (Math 151a)**, *Caltech*, lead instructor.

Fall 2019 **Fundamental concepts of modern algebra (Math 410)**, *USC*, lead instructor.

Fall 2019 **Multivariable calculus (Math 226)**, *USC*, lead instructor.

Spring 2019 **Factorization homology (Math 641 – graduate seminar)**, *USC*, lead instructor.

Fall 2018 **Fundamental concepts of analysis (Math 425A)**, *USC*, lead instructor.

Fall 2018 **Multivariable calculus (Math 226)**, *USC*, lead instructor.

Spring 2018 **Single-variable calculus (Math 125)**, *USC*, lead instructor (two sections) and course coordinator (six sections total).

Fall 2017 **Single-variable calculus (Math 125)**, *USC*, lead instructor.

Fall 2016 **Seminar ∞ (graduate seminar)**, *Ohio State*, lead instructor.

Fall 2016 **Linear algebra (Math 2568)**, *Ohio State*, lead instructor (three sections).

Summer 2016 **Multivariable calculus (Math W53 – online course)**, *UC Berkeley*, T.A. under Michael Hutchings.

Spring 2016 **An invitation to factorization algebras (Math 276 – graduate seminar)**, *UC Berkeley*, jointly taught with Peter Teichner.

Spring 2016 **Linear algebra [proof-based] (Math 110)**, *UC Berkeley*, T.A. under Edward Frenkel (two sections).

Spring 2015 **Single-variable calculus (Math 1B)**, *UC Berkeley*, T.A. under Nikolai Reshetikhin (two sections).

Fall 2011 **Single-variable calculus (Math 1A)**, *UC Berkeley*, T.A. under Ian Agol (two sections).

Summer 2009 **7th grade math teacher**, *Breakthrough Summerbridge (Austin, TX)*.
Designed and implemented lesson plans for high-potential students from underserved communities.

Spring 2009 **Combinatorial topology (Math 141)**, *Brown University*, T.A. under Thomas Banchoff.

Fall 2008 **Multivariable calculus [for engineers] (Math 20)**, *Brown University*, T.A. under Benoît Pausader.

Spring 2008 **Non-Euclidean geometry (Math 104)**, *Brown University*, T.A. under Thomas Banchoff.

2007-2009 **MathCounts**, *The Wheeler School*, assistant coach under Thomas Wharton.

2001-2010 **Math tutor**, self-employed.

Advisorship

Spring 2023 **Undergraduate reading project supervision**, *Caltech*, mentor for Miguel Aparicio, Max Gilligan, and Emeka Nkurumeh on category theory.
Basic category theory (Leinster).

Spring 2022 **Undergraduate reading project supervision**, *Caltech*, mentor for Elia Gorokhovsky, Erik Imathiu-Jones, Ely Jrade, and Lewis McGoldrick on TQFTs.
Frobenius algebras and 2d topological quantum field theories (Kock).

Spring 2021 **Undergraduate reading project supervision**, *Caltech*, mentor for Erik Imathiu-Jones, Ely Jrade, and Noah Moran on category theory.
Basic category theory (Leinster).

Summer 2020 **Undergraduate research project supervision**, *Caltech*, mentor for Leon Liu on knot homology.
Culminating in joint paper (see above).

Fall 2019 **Undergraduate reading project supervision**, *USC*, mentor for Jiaxuan Lu on abstract algebra.
Algebra (Artin).

Fall 2019 **Undergraduate reading project supervision**, *USC*, mentor for Kelley Yang on category theory.
Category theory [lecture notes] (Safronov).

Summer 2019 **Undergraduate reading project supervision**, *USC*, mentor for Jiaxuan Lu on differential topology.
Differential topology (Guillemin & Pollack).

Spring 2019 **Undergraduate reading project supervision**, *USC*, mentor for Kelley Yang on differential topology.
Differential topology (Guillemin & Pollack).

Summer 2018 **Undergraduate research project supervision**, *USC*, mentor for Reuben Stern on secondary algebraic K-theory.
Culminating in joint paper (see above).

Spring 2015 **Directed Reading Program**, *UC Berkeley*, mentor for Robert Housden on category theory and sheaf theory.
Categories for the working mathematician (Mac Lane), *Foundations of algebraic geometry* (Vakil).

Service

Organizational

2022-2023 **Geometry and topology seminar**, *Caltech*.
Organizer.

2022 **Double conference on "Homotopy theory with applications to arithmetic and geometry"**, *Fields Institute for Research in Mathematical Sciences (Toronto, Canada) and Max Planck Institute for Mathematics (Bonn, Germany)*.
Co-organizer of a new eco-friendly conference format; see websites Fields/MPIM.

2020-2021 **Geometry and topology seminar**, *Caltech*.
Organizer.

2020 **Double conference on "Geometric representation theory"**, *Perimeter Institute for Theoretical Physics (Waterloo, Canada) and Max Planck Institute for Mathematics (Bonn, Germany)*.
Co-organizer of a new eco-friendly conference format; see websites PI/MPIM.

Fall 2019-Spring 2020 **Geometry, topology, and categorification seminar**, *USC*.
Co-organizer.

Spring 2019 **Joint Los Angeles topology seminar**, *USC*.
Co-organizer.

2018 **Double conference on "Higher algebra and mathematical physics"**, *Perimeter Institute for Theoretical Physics (Waterloo, Canada) and Max Planck Institute for Mathematics (Bonn, Germany)*.
Co-organizer of a new eco-friendly conference format; see websites PI/MPIM and LMS article (page 32).

2010-2015 **Berkeley–Stanford student topology seminar ("xkcd group")**.
Co-founder and organizer; travel grant co-administrator. See website here.

2006-2009 **Math Department Undergraduate Group**, *Brown University*.
President, Fall 2007 - Spring 2009; coordinated volunteer tutoring program, Fall 2007 - Spring 2008; organized annual undergraduate math conference ("SUMS"), 2008 and 2009.

Journal-related

2016-present **Associate journal editor**, *Journal of Geometry, Topology, and Mathematical Physics*.

2015-present **Journal referee**, *Topology and its Applications; Advances in Mathematics; Algebraic & Geometric Topology; Israel Journal of Mathematics; Journal of Pure and Applied Algebra; Transactions of the American Math Society*.

Departmental

Spring 2023 **Undergraduate thesis committee**, *Caltech*.
Reviewed bachelor's theses submitted by graduating seniors.

Fall 2021 **Qualifying exam committee (algebra)**, *Caltech*.
Administered exam for graduate students seeking to fulfill their PhD requirements.

Fall 2020-Fall 2023 **Graduate admissions application review**, *Caltech*.
Reviewed applications each year for PhD program in mathematics (three times total).

Fall 2018 - Spring 2020 **Screening exam committee (geometry & topology)**, *USC*.
Administered exams each semester for graduate students seeking to fulfill their PhD requirements (four times total); committee chair in Fall 2019 and Spring 2020.

References

Ben Antieau
Northwestern University
antieau@northwestern.edu

David Ayala
Montana State University
david.ayala@montana.edu

David Ben-Zvi
UT Austin
benzvi@math.utexas.edu

Andrew Blumberg
Columbia University
andrew.blumberg@columbia.edu

Chris Douglas
Oxford
cdouglas@maths.ox.ac.uk

David Gepner
Johns Hopkins University
dgepner1@jhu.edu

Elena Mantovan (teaching)
Caltech
mantovan@caltech.edu