

Mike Miller Eismeier

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Employment	Academia Sinica Assistant Research Fellow	2026-
	University of Vermont Assistant Professor	2023-
	Columbia University Ritt Assistant Professor of Mathematics	2019-2023
Education	UCLA Ph.D. in Mathematics Advanced to Candidacy: February 2017 Ph.D. granted: June 2019	2014-2019
	Santa Clara University B.Sc. in Mathematics	2010-2014
Publications	1. <i>On integral rigidity in Seiberg–Witten theory</i>, with Francesco Lin, available at arXiv:2409.17884. Forum of Mathematics, Sigma 13 (2025): e184. 2. <i>Equivariant instanton homology</i>, PhD thesis. Available at arXiv:1907.01091. To appear in Memoirs of the AMS. 3. <i>Monopoles, twisted integral homology, and Hirsch algebras</i>, with Francesco Lin, Geom. Topol. 28 (2024), no. 8, 3697-3778. 4. <i>3-manifolds without any embedding in symplectic 4-manifolds</i>, with Aliakbar Daemi and Tye Lidman, Geom. Topol. 28 (2024), no. 7, 3357-3372. 5. <i>Fourier transforms and integer homology cobordism</i>, Algebr. Geom. Topol. 24 (2024), no. 7, 4085-4101. 6. <i>Hyperplanes in abelian groups and twisted signatures</i>, with Aiden Sagerman, Topology Appl. 339 (2023), Paper No. 108692. 7. <i>The distance from a point to its opposite along the surface of a box</i>, with Edward F. Schaefer, Pi Mu Epsilon Journal, 14, 2015, 143-154	

Preprints

8. *A Lefschetz decomposition over $\mathbb{Z}$, and applications*
with Analisa Faulkner Valiente, available at arXiv:2507.00844.
Submitted.
9. *Filtered instanton homology and cosmetic surgery*
with Aliakbar Daemi and Tye Lidman, available at arXiv:2410.21248.
Submitted.
10. *Instantons and rational homology spheres*,
with Aliakbar Daemi, available at arXiv:2210.14071.
Submitted.
11. *Framed instanton homology and Frøyshov's invariant*
with Sudipta Ghosh, available at arXiv:2511.18885.
12. *The topological and smooth Hausmann-Weinberger invariants disagree*
available at arXiv:2601.07040.

In preparation

13. *Equivariant instanton Floer homology: small dg-modules and connected sums*
Book project with Aliakbar Daemi and Christopher Scaduto.
14. *Instantons, indefinite 4-manifolds, and Dehn surgery*
with Aliakbar Daemi and Xingpei Liu.

Lecture series

Frøyshov's invariant and its generalizations August 2025
A minicourse explaining Frøyshov's invariant, modern formulations, and applications to topology.
"Topological and geometric structures in low dimensions" thematic semester,
Floer theory workshop, UQAM/CRM

Equivariant instanton homology, and instantons mod 2 August 2024
A minicourse on the foundations of equivariant instanton homology and the *suspension technique* developed by Ali Daemi and myself; I explained how this proves that the equivariant instanton complex is 'well-defined', and how the same technique leads to results constraining the topology of indefinite cobordisms.
"Gauge theory in Tokyo" conference, University of Tokyo

Transversality and gluing for framed instantons July 2023
A minicourse on the foundations of the framed instanton theory, the appearance of obstructed gluing theory, and its relation to Floer's theory. The series concludes in a research talk on applications to surgery theory of 3-manifolds.
"Gauge theory and applications" workshop, Universität Regensburg.

Invited talks

A cellular approach to Morse-Bott homology March 2026
AMS Special Session on Topology, Gauge Theory, and Special Geometric Structures
Chestnut Hill, MA

Frøyshov's invariant and framed instanton homology December 2025
MIT Geometry & Topology Seminar

Frøyshov's invariant and Dehn surgery November 2025
Peking University Topology Seminar

<i>Cosmetic surgery on knots in S^3</i> Chinese Academy of Sciences AMSS Topology Seminar	November 2025
<i>Frøyshov's menagerie</i> Floer theory workshop, UQAM/CRM	August 2025
<i>Naturality in HF^∞</i> Geometry & Topology Seminar, Columbia University	April 2025
<i>Naturality in HF^∞</i> Topology seminar, Princeton University	April 2025
<i>ASD Connections & Cosmetic Surgery</i> Symplectic Geometry, Gauge Theory, and Low-Dimensional Topology Seminar, Stony Brook University	March 2025
<i>ASD Connections & Cosmetic Surgery</i> Simons Collaboration on “New Structures in Low-Dimensional Topology”, Annual Meeting	March 2025
<i>Instantons, indefinite cobordisms, and Dehn surgery</i> Topology seminar, Stanford University	September 2024
<i>Chern–Simons invariants and Cosmetic surgery</i> “Gauge theory in Tokyo” conference, University of Tokyo	August 2024
<i>Filtered instanton Floer homology and cosmetic surgery</i> “Gauge Theory, Low-Dimensional Topology, and Geometric Analysis Conference”, Rutgers – New Brunswick	May 2024
<i>Instantons, indefinite cobordisms, and Dehn surgery</i> Gauge Theory Virtual Seminar	April 2024
<i>Gauge theory and indefinite 4-manifolds</i> “Geometry and topology” seminar, Dartmouth	February 2024
<i>Chern–Simons and diffeomorphism invariants</i> “Geometry and topology” seminar, MIT	December 2023
<i>Filtered instanton homology and cosmetic surgery</i> Gauge Theory Virtual Seminar	October 2023
<i>Filtered instanton homology and cosmetic surgery</i> 9th KTGU Workshop, Kyoto University	October 2023
<i>CS implies CS</i> “Topology of 3- and 4-dimensional manifolds” conference, Princeton University	July 2023
<i>A first look at an equivariant surgery sequence</i> “Instantons and foams” conference, MIT	May 2023
<i>Instantons, suspension, and surgery</i> The second of a pair of joint talks on joint work with Ali Daemi. “Gauge Theory and Low Dimensional Topology” conference, IMSA, U Miami	April 2023
<i>Cobordism maps without equivariant transversality</i> 2023 Midwest Geometry Conference, Kansas State University	March 2023
<i>Instantons and Dehn surgery</i> Colloquium, Kansas State University	March 2023
<i>Instantons, indefinite manifolds, and Dehn surgery</i> Symplectic Geometry, Gauge Theory, and Low-Dimensional Topology Seminar, Stony Brook University	December 2022

	<i>Instantons mod 2 and indefinite 4-manifolds</i> Topology seminar, Harvard University	September 2022
	<i>Monopole Floer homology, Hirsch algebras, and twisted homology</i> Topology seminar, Princeton University	November 2021
	<i>Monopole Floer homology and twisted homology</i> Geometry/Topology seminar, Rutgers University in New Brunswick	September 2021
	<i>Invariance and functoriality in equivariant instanton homology</i> Gauge Theory Virtual seminar	May 2021
	<i>Mod 2 instanton homology and homology cobordism</i> AMS Special Session on Floer Homology in Dimensions 3 and 4 Madison, WA	September 2019
	<i>Equivariant instanton homology and group cohomology</i> Conference on Floer Homotopy Theory and Low-Dimensional Topology, University of Oregon	August 2019
	<i>Equivariant instanton homology and group cohomology</i> Topology Seminar, University of Arkansas	April 2019
	<i>Equivariant instanton homology and group cohomology</i> Symplectic Geometry, Gauge Theory, and Categorification Seminar, Columbia University	December 2018
	<i>Equivariant instanton homology and group cohomology</i> Geometric Analysis Seminar, Rutgers University	October 2018
	<i>Equivariant instanton homology and group cohomology</i> Topology Seminar, Princeton University	October 2018
	<i>Equivariant instanton homology and group cohomology</i> Geometry and Topology Seminar, MIT	September 2018
	<i>Equivariant instanton homology and group cohomology</i> Conference on Gauge Theory and Applications, Universität Regensburg	July 2018
	<i>Equivariant instanton homology and group cohomology</i> Seminar in Topology and Symplectic Geometry, Stony Brook University	May 2018
Student-oriented talks	<i>Middle-dimensional topology: exotic notions of smoothness in 4D</i> Undergraduate Math Society Lecture, Columbia University	April 2025
	<i>The winding number, from complex calculus to algebra to topology</i> Math Club Seminar, University of Vermont	October 2024
	<i>Instantons: from physics to exotic topology</i> Michael Zhao Memorial Student Colloquium, Columbia University	February 2023
	<i>dg-Algebras, twisted homology, and homotopy commutativity</i> Michael Zhao Memorial Student Colloquium, Columbia University	September 2021
	<i>ℓ^p is not ℓ^q</i> Undergraduate Math Society Lecture, Columbia University	February 2021
	<i>The winding number throughout mathematics</i> Undergraduate Math Society Lecture, Columbia University	October 2020
	<i>Triangulations and homology cobordism</i> Graduate Student Mathematics Colloquium, University of Arkansas	April 2019

Funding	NSF Topology Grant Recommended for funding (declined due to relocation)	08/01/26, \$200,000
Awards	At Columbia University: Received Presidential Award for Outstanding Teaching One of 5 recipients (of 600 nominees). Finalist, Presidential Award for Outstanding Teaching 10 finalists, 600 nominees. Nominee, Mark Van Doren Award for Teaching 12 nominees. Department of Mathematics Junior Faculty Recognition Award for Excellence in Teaching At UCLA: Pacific Journal Prize UCLA Dissertation Year Fellowship O'Neill Memorial Travel Grant Horn-Moez Prize for excellence in first-year graduate studies	Spring 2023 Spring 2022 Spring 2022 Spring 2021 June 2019 June 2018 May 2017 June 2015
Teaching	Instructor (UVM) Math 3551 (Abstract Algebra I) Math 3555 (Abstract Algebra II) Math 6551 (Abstract Algebra III) Math 6344 (Algebraic Topology) Math 6444 (Measure Theory) Math 6441 (Complex Analysis) Instructor (Columbia) Math 1201 (Multivariable Calculus I) Math 1202 (Multivariable Calculus II) Math 1207 (Honors Math A) Math 1208 (Honors Math B) Math 2010 (Linear Algebra) Math 3952 (Undergraduate seminar) Math 4501 (Topology) Teaching assistant (UCLA) Math 31B (Integral Calculus) Math 32A (Multivariable Calculus) Math 33A (Linear Algebra) Math 123 (Foundations of Geometry) Math 132 (Complex Analysis) Math 170B (Probability Theory II) Math 225A (Differential Topology) Math 225B (Differential Geometry) Math 225C (Algebraic Topology)	Fall 2023 Spring 2024 Fall 2024 Fall 2025 Fall 2025 Spring 2026 Fall 2019, Spring 2020, Summer 2020 Fall 2021, Spring 2022 Spring 2021 Fall 2022 Spring 2023 Spring 2021 Spring 2023 Fall 2020, Fall 2021 Fall 2014 Fall 2015, Fall 2017 Winter 2015 Winter 2018 Spring 2015, Summer 2016 Summer 2015 Fall 2015, Fall 2016, Fall 2017 Winter 2015, Winter 2016, Winter 2017 Spring 2016

Mentorship

Supervised undergraduate research Summer 2024
Supervised undergraduate Analisa Faulkner Valiente on research which became the paper “A Lefschetz decomposition over $\mathbb{Z}$, and applications”.

Jointly supervised graduate research Spring 2024-Fall 2024
With Spencer Backman, helped PhD student Sienna Unter develop a research project on the d -invariants of graphs.

Supervised senior thesis Summer 2022-Spring 2023
Columbia University, with Arjun Kunidoor.
Topic: Atiyah–Singer’s index theorem and the early history of instantons.

Joint research with undergraduate Spring 2022, Summer 2022
Columbia University, with Aiden Sagerman. Led to the publication ‘Hyperplanes in abelian groups and twisted signatures’.

Directed independent study courses 2019-2024
University of Vermont. Four courses, six students. Topics in abstract algebra; complex analysis and the prime number theorem; differential topology.

Columbia University. Eight courses, thirteen students.
Topics: History of Lagrange multipliers; differential topology; point-set topology; algebraic topology; integral geometry; advanced linear algebra (twice); differential geometry for electromagnetism

Service

Served as referee 2020-2025
Acta Mathematica; Journal of Differential Geometry; Communications in Analysis and Geometry; Geometry & Topology; Mathematische Annalen; Algebraic & Geometric Topology; Michigan Mathematics Journal

Organized UVM Colloquium 2025-2026 *Organized SGGTC seminar* 2019-2020; 2022-2023
Columbia University

TA for minicourse on Instanton Floer homology July 2019
PCMI Graduate Student Summer School

Took official notes for Floer Homotopy conference/summer school Summer 2017
UCLA

Organized Graduate Student Seminar Fall 2015-Winter 2017
UCLA