

Calder Morton-Ferguson

Department of Mathematics
Massachusetts Institute of Technology

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Education

Massachusetts Institute of Technology

Ph.D. Student, Mathematics. Started August 2019, graduating May 2024.
Advisor: Roman Bezrukavnikov

University of Toronto

Honours Bachelor of Science, June 2019. GPA: 4.0/4.0
Mathematics Specialist, Computer Science Minor

Papers

Polishchuk's conjecture and Kazhdan-Laumon representations, preprint
arXiv:2309.13462.

Symplectic Fourier-Deligne transforms on G/U and the algebra of braids and ties, under review. preprint arXiv:2304.01998

Kazhdan-Laumon Category O , Braverman-Kazhdan Schwartz space, and the semiinfinite flag variety, under review. preprint arXiv:2210.03101

(with A. Dranowski, B. Elek, J. Kamnitzer) *Heaps, crystals, and preprojective algebra modules*, under review. preprint arXiv:2202.02490

(with A. Dranowski and J. Kamnitzer) Appendix to *The Mirkovic-Vilonen basis and Duistermaat-Heckman measures* by P. Baumann, J. Kamnitzer, and A. Knutson; Acta Math. **227** (2021), no. 1, 1-101. arXiv:1905.08460

Research Awards

NSERC PGS-D Postgraduate Scholarship, 2021-2024

Kazhdan-Laumon categories and representations

NSERC Undergraduate Student Research Award, 2018

Topology of quiver flag varieties, supervised by Joel Kamnitzer

NSERC Undergraduate Student Research Award, 2017

3-manifold topology, supervised by Dror Bar-Natan

Teaching

Course Administrator, Massachusetts Institute of Technology

18.02B (Calculus III) Winter 2022

Teaching Assistant, Massachusetts Institute of Technology

18.745 (Graduate Lie Groups & Lie Algebras) Fall 2023

18.702 (Abstract Algebra II) Spring 2023

18.02B (Calculus III) Winter 2022, 18.02A (Calculus II) Fall 2021

18.726 (Graduate Algebraic Geometry II) Spring 2021

18.725 (Graduate Algebraic Geometry I) Fall 2020

Teaching Assistant, University of Toronto

MAT257 (Analysis II) Fall 2018, Spring 2019

MAT137 (Calculus) Fall 2017, Spring 2018

MAT136 (Calculus 1B) Spring 2017

MAT135 (Calculus 1A) Fall 2016

Research Mentorship

MIT UROP Supervisor, 2021-2023

Formal degrees of representations of p -adic groups

with undergraduate student Kenta Suzuki. Fall 2022, Spring 2023.

q -quasiinvariant polynomials and Cherednik algebras at roots of unity

with undergraduate student Frank Wang. Fall 2021, Spring 2022.

MIT SPUR Mentor, Summer 2021

Convolution-exactness of perverse sheaves on the affine flag variety

with undergraduate student Alan Peng.

Toward explicit Hilbert series of quasi-invariant polynomials in characteristic p

with undergraduate student Frank Wang.

MIT PRIMES Mentor, 2020

On the generational behavior of Gaussian binomial coefficients at roots of unity

with high school students Andy Chen, Peter Jiang, and Tom Wang.

Awards

MIT Charles and Holly Housman Award, 2022

Presented for “skill and dedication in undergraduate teaching” in 2021-2022

MIT School of Science Spot Appreciation Award, 2022

Presented for work as the course administrator for 18.02B in Winter 2022

MIT Presidential Fellowship, 2019

Awarded to 110-125 new students per year “to recruit the most outstanding students worldwide” to pursue graduate studies at MIT

Janet Paterson Scholarship, 2019

Awarded annually to the top graduating student from Innis College at the University of Toronto

Governor General’s Silver Medal, Innis College Nominee, 2019

Awarded annually to the graduating student from Innis College with the highest grade-point average

Top 500, William Lowell Putnam Mathematical Competition, 2018

Samuel Beatty In-Course Scholarship, 2018

Awarded for academic performance in the 2017-2018 academic year

Margaret and Thomas Taylor Scholarships in Mathematics, 2017

University of Toronto Scholar, 2016-2018

Awarded to the top 100 undergraduates at the university each year

University of Toronto President’s Entrance Scholarship, 2015

Euclid Mathematics Contest Regional Winner, 2015

Talks and Conferences

UCLA Algebra Seminar

“Kazhdan-Laumon categories and Polishchuk's conjecture” November 3, 2023 (upcoming). Los Angeles, CA.

ISM School: Langlands Correspondence for Spherical Varieties

“The derived Satake correspondence” October 4, 2023. Mont-Saint-Hilaire, QC, Canada.

Canada-USA-Mexico Representation Theory, Noncommutative Algebra and Categorification

“Kazhdan-Laumon categories and representations” (poster) August 25, 2023. Montreal, QC, Canada.

UMass Amherst Representation Theory Seminar

“Kazhdan-Laumon categories and symplectic Fourier-Deligne transforms” May 8, 2023. Amherst, MA.

Yale Geometry, Symmetry and Physics Seminar, 2023

“Kazhdan-Laumon categories, semi-infinite flags, and the algebra of braids and ties” April 3, 2023. New Haven, CT.

MIT Lie Groups Seminar, 2022

“Kazhdan-Laumon Category O , Schwartz space, and the semi-infinite flag variety” December 7, 2022. Cambridge, MA.

ICERM Program on Braids in Representation Theory and Combinatorics, 2022

“Kazhdan-Laumon categories and the symplectic Fourier transform” February 16, 2022. ICERM, Providence, RI.

MIT Pure Math Graduate Student Seminar, 2021

“Crystal bases from reverse plane partitions” September 24, 2021. Massachusetts Institute of Technology, Cambridge, MA.

IAS Quantum Groups Learning Seminar, Spring 2021

“Braid group actions and a PBW-type basis” March 4 & 11, 2021. Institute for Advanced Study, Princeton, NJ (presented virtually).

Canadian Undergraduate Math Conference, 2019

“The case for recategorification” July 24-28, 2019. Queen's University, Kingston, ON, Canada.

Canadian Undergraduate Math Conference, 2018

“Quivers, flags, and varieties: investigating a conjecture by counting” July 11-15, 2018. University of Saskatchewan, Saskatoon, SK, Canada.

Canadian Undergraduate Math Conference, 2017

“Visualizing the prime decomposition of 3-manifolds” July 19-23, 2018. University of Quebec at Montreal, Montreal, QC, Canada.

Canadian Undergraduate Math Conference, 2016

“Why some sequences are more special than others” July 13-17, 2016. University of Victoria, Victoria, BC, Canada.

Other Workshops & Seminars

MSRI Summer School in Derived Algebraic Geometry

June 26-July 7, 2023. UC Berkeley, Berkeley, CA.

Coulomb Branches and Knot Homology Summer School in Geometric Representation Theory

June 19-23, 2023. Massachusetts Institute of Technology, Cambridge, MA

Lie Groups Days in Honor of David Vogan

September 23-24, 2022. Massachusetts Institute of Technology, Cambridge, MA.

Quantized Symplectic Singularities and Applications to Lie Theory

June 13-17, 2022. Massachusetts Institute of Technology, Cambridge, MA.

Los Angeles Workshop on Representations and Geometry: Schubert Calculus and Quantum Integrability

June 6-10, 2022. University of Southern California, Los Angeles, CA.

Summer School on Geometric and Algebraic Combinatorics

June 17-28, 2019. Institut de Mathématiques de Jussieu-Paris Rive Gauche, Paris, France.

Conference on Representation Theory and Algebraic Analysis

May 11-14, 2020. Weizmann Institute of Science (attended virtually).

Thematic Program in Commutative Algebra and Algebraic Geometry

May 28-June 1, 2019. Notre Dame University, Notre Dame, IN.

Thematic Program in Geometric Representation Theory

June 11-15, 2018. Notre Dame University, Notre Dame, IN.

University of Toronto Perverse Sheaves Learning Seminar

September 2018-April 2019. University of Toronto, Toronto, ON, Canada.

Service & Other Experience

Teaching Assistant, Boston Pre-Release Center

Spring 2023, Boston, MA.

Taught high-school equivalent math to incarcerated students at the Boston Pre-Release correctional facility.

MIT Pure Math Graduate Student Seminar Co-Organizer

2020-2021, Massachusetts Institute of Technology.

University of Toronto Mathematics Union President

2017-2018, University of Toronto.

Research Assistant at TorchLight Canada

Summer 2016, Guelph, ON, Canada.