Calder Morton-Ferguson

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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

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

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

Teaching

Course Administrator, Massachusetts Institute of Technology
18.02B (Calculus III) Winter 2022

Teaching Assistant, Massachusetts Institute of Technology
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

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

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

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.

Canada Math Camp, 2017
"Conway's sequences and nested recursions" August 2, 2017. University of Toronto, Toronto, ON, 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
Taught high-school equivalent math to incarcerated folks 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.