Calder Morton-Ferguson

Department of Mathematics
Stanford University

https://caldermf.github.io/
caldermf@stanford.edu

Education

Massachusetts Institute of Technology
Ph.D. Student, Mathematics. August 2019-May 2024.
Advisor: Roman Bezrukavnikov

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

Employment

Stanford University
Szegő Assistant Professor, since July 2024

Papers

6. (with R. Bezrukavnikov) *Perverse sheaves and t-structures on the thin and thick affine flag varieties*, under review. preprint arXiv:2409.16259
5. *Polishchuk's conjecture and Kazhdan-Laumon representations*, under review. preprint arXiv:2309.13462
4. *Symplectic Fourier–Deligne Transforms on G/U and the Algebra of Braids and Ties,* Int. Math. Res. Not. IMRN **2024** (2024), no. 13, 10219–10235. arXiv:2304.01998
3. *Kazhdan-Laumon Category O, Braverman-Kazhdan Schwartz space, and the semiinfinite flag variety*, to appear in Representation Theory. arXiv:2210.03101
2. (with A. Dranowski, B. Elek, J. Kamnitzer) *Heaps, crystals, and preprojective algebra modules*, Selecta Math. (N.S.) **30** (2024), no. 5, 94. arXiv:2202.02490
1. (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

MIT Charles W. and Jennifer C. Johnson Prize, 2024
Best graduate student paper, awarded for *Symplectic Fourier–Deligne Transforms on G/U and the Algebra of Braids and Ties*

NSERC PGS-D Postgraduate Scholarship, 2021-2024
Kazhdan-Laumon categories and representations

NSERC Undergraduate Student Research Awards, 2017 & 2018
Topology of quiver flag varieties, supervised by Joel Kamnitzer, 2018
3-manifold topology, supervised by Dror Bar-Natan, 2017

Teaching

Instructor, Stanford University
Math 51 (Linear Algebra & Multivariable Calculus) Fall 2024
Math 245C (Topics in Algebraic Geometry) Spring 2025 (upcoming)

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

Teaching Assistant, Massachusetts Institute of Technology
18.726 (Graduate Algebraic Geometry II) Spring 2024
18.745 & 18.755 (Graduate Lie Groups & Lie Algebras) Fall 2023, Spring 2024
18.702 (Abstract Algebra II) Spring 2023
18.02A & 18.02B (Calculus II & III) Fall 2021, Winter 2022
18.725 & 18.726 (Graduate Algebraic Geometry I & II) Fall 2020, Spring 2021

Teaching Assistant, University of Toronto
MAT257 (Analysis II) 2018-2019, MAT137 (Calculus) 2017-2018
MAT135 & MAT136 (Calculus 1A/1B) Fall 2016, Spring 2017

Other 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 of 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

Research Mentorship

MIT UROP Supervisor, 2021-2024
Formal degrees of representations of p-adic groups
with undergraduate student Kenta Suzuki. Fall 2022-Spring 2024.
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 generational behavior of Gaussian binomial coefficients at roots of unity
with high school students Andy Chen, Peter Jiang, and Tom Wang.

Seminar & Conference Talks

University of Michigan GLNT Seminar October 21, 2024 (upcoming)

Stanford Representation Theory Seminar September 26, 2024
"Kazhdan-Laumon categories and representations of $G(\mathbb{F}_q)$"

MIT Seminar on Affine Kac-Moody Algebras May 6 & 9, 2024
"Screening operators of the first and second kind"

UCLA Algebra Seminar November 3, 2023
"Kazhdan-Laumon categories and Polishchuk's conjecture"

Canada-USA-Mexico Representation Theory, Noncommutative Algebra and Categorification, University of Montreal August 25, 2023
"Kazhdan-Laumon categories and representations" (poster)

UMass Amherst Representation Theory Seminar May 8, 2023
"Kazhdan-Laumon categories and symplectic Fourier-Deligne transforms"

Yale Geometry, Symmetry and Physics Seminar April 3, 2023
"Kazhdan-Laumon categories, semi-infinite flags, and the algebra of braids and ties"

MIT Lie Groups Seminar December 7, 2022
"Kazhdan-Laumon Category O, Schwartz space, and the semi-infinite flag variety"

ICERM Program on Braids in Representation Theory and Combinatorics February 26, 2022
"Kazhdan-Laumon categories and the symplectic Fourier transform" February 16, 2022.

MIT Pure Math Graduate Student Seminar September 24, 2021
"Crystal bases from reverse plane partitions"

IAS Quantum Groups Learning Seminar March 4 & 11, 2021
"Braid group actions and a PBW-type basis"

Canadian Undergraduate Math Conferences, 2016-2019
Queen's University, Kingston, ON, 2019
University of Saskatchewan, Saskatoon, SK, 2018
University of Quebec at Montreal, Montreal, QC, 2017
University of Victoria, Victoria, BC, 2016

Workshops & Conferences Attended

WARTHOG 2024: Coherent-Constructible Equivalences in Local Geometric Langlands and Representation Theory
July 22-26, 2024. University of Oregon.

Relative Langlands Duality Summer School & Workshop
June 3-6, 2024. University of Minnesota.

MSRI Summer School in Derived Algebraic Geometry
June 26-July 7, 2023. UC Berkeley.

Coulomb Branches and Knot Homology Summer School in Geometric Representation Theory
June 19-23, 2023. Massachusetts Institute of Technology.

Lie Groups Days in Honor of David Vogan
September 23-24, 2022. Massachusetts Institute of Technology.

Quantized Symplectic Singularities and Applications to Lie Theory
June 13-17, 2022. Massachusetts Institute of Technology.

Los Angeles Workshop on Representations and Geometry: Schubert Calculus and Quantum Integrability
June 6-10, 2022. University of Southern California.

Conference on Representation Theory & Algebraic Analysis
May 11-14, 2020. Weizmann Institute of Science (attended virtually).

Summer School on Geometric & Algebraic Combinatorics
June 17-28, 2019. Institut de Mathématiques de Jussieu-Paris Rive Gauche.

Thematic Program in Commutative Algebra & Algebraic Geometry
May 28-June 1, 2019. Notre Dame University.

Thematic Program in Geometric Representation Theory
June 11-15, 2018. Notre Dame University.

University of Toronto Perverse Sheaves Learning Seminar
September 2018-April 2019. University of Toronto.

Service & Other Experience

Seminars Co-organized
Stanford Representation Theory Seminar, 2024-2025
MIT Pure Math Graduate Student Seminar, 2020-2021

Refereeing
IMRN, Transformation Groups.

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.

University of Toronto Mathematics Union President
2017-2018, University of Toronto.