# Calder Morton-Ferguson

Department of Mathematics
Yale University

https://caldermf.github.io/
calder.morton-ferguson@yale.edu

## Education

**Massachusetts Institute of Technology**
Ph.D., Mathematics. August 2019–May 2024. GPA: 5.0/5.0
Advisor: Roman Bezrukavnikov

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

## Employment

**Yale University**
Gibbs Assistant Professor, since July 2025

**Stanford University**
Szegő Assistant Professor, 2024–2025

## Papers

9. (with P. Diaconis) *Markov chains on Weyl groups from the geometry of the flag variety*, under review. arXiv:2510.02285

8. (with P. Boixeda Alvarez) *Weight modules and gluing of sheaves on the flag variety*, under review. arXiv:2509.25156

7. (with R. Bezrukavnikov, M. Finkelberg, and D. Kazhdan) *Modular reduction of complex representations of finite reductive groups.* arXiv:2502.09605

6. (with R. Bezrukavnikov) *Perverse sheaves and t-structures on the thin and thick affine flag varieties*, under review; positive reviews received at J. Eur. Math. Soc. arXiv:2409.16259

5. *Polishchuk's conjecture and Kazhdan-Laumon representations*, Compositio Mathematica **161** (2025) no. 5, 993-1020. 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*, Represent. Theory **29** (2025), 1-34. 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 Mirković-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**<br>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**<br>Kazhdan-Laumon categories and representations |
| | **NSERC Undergraduate Student Research Awards**<br>Topology of quiver flag varieties, supervised by Joel Kamnitzer, 2018<br>3-manifold topology, supervised by Dror Bar-Natan, 2017 |
| Teaching | **Instructor,** Yale University<br>Math 3500 (Abstract Algebra) Spring 2026<br>Math 2250 (Linear Algebra with Proofs) Fall 2025 |
| | **Instructor**, Stanford University<br>Math 245C (Topics in Algebraic Geometry) Spring 2025<br>Math 51 (Linear Algebra & Multivariable Calculus) Fall 2024 |
| | **Course Administrator**, Massachusetts Institute of Technology<br>18.02B (Calculus III) Winter 2022 |
| | **Teaching Assistant**, Massachusetts Institute of Technology<br>18.726 (Graduate Algebraic Geometry II) Spring 2024<br>18.745 & 18.755 (Graduate Lie Groups & Lie Algebras) 2023–2024<br>18.702 (Abstract Algebra II) Spring 2023<br>18.02A & 18.02B (Calculus II & III) Fall 2021, Winter 2022<br>18.725 & 18.726 (Graduate Algebraic Geometry I & II) 2020–2021 |
| | **Teaching Assistant**, University of Toronto<br>MAT257 (Analysis II) 2018-2019, MAT137 (Calculus) 2017–2018<br>MAT135 & MAT 136 (Calculus 1A/1B) Fall 2016, Spring 2017 |
| Other Awards | **MIT Charles and Holly Housman Award, 2022**<br>Presented for "skill and dedication in undergraduate teaching" |
| | **MIT School of Science Spot Appreciation Award, 2022**<br>Presented for work as the course administrator for 18.02B in 2022 |
| | **MIT Presidential Fellowship, 2019**<br>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**<br>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**
Awarded to undergraduate or graduate students who demonstrate exceptional achievement in mathematics

**University of Toronto Scholar, 2016-2018**
Awarded to the top 100 undergraduates at the university each year

**University of Toronto President's 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-quasiinvariants and Cherednik algebras at roots of unity*
with undergraduate student Frank Wang. Fall 2021-Spring 2022.

**MIT SPUR Mentor, Summer 2021**
*Convolution-exact perverse sheaves on the affine flag variety*
with undergraduate student Alan Peng

*Toward explicit Hilbert series of quasiinvariants in char. p*
with undergraduate student Frank Wang.

**MIT PRIMES Mentor, 2020**
*Gaussian binomial coefficients at roots of unity*
with high school students Andy Chen, Peter Jiang, and Tom Wang.

---

## Technical Research Skills

**Programming and Scientific Computing**
Proficiency in Python, PyTorch, SageMath, Wolfram Language

**High-Performance Computing & Infrastructure**
SLURM, Bash, Git, Linux/Unix Environments, Parallel Programming & GPU Acceleration

---

| | |
|---|---|
| Seminar & Conference Talks | **Duke University Number Theory Seminar** April 8, 2026 |
| | **Univ. of Toronto Geom. & Physics Seminar** February 2, 2026 |
| | **Northeastern University GPRT Seminar** November 13, 2025 |
| | **MIT Lie Groups Seminar** November 12, 2025 |
| | **UC Berkeley Number Theory Seminar** May 5, 2025 |
| | **UCLA Algebra Seminar** March 14, 2025 |
| | **University of Michigan GLNT Seminar** October 21, 2024 |
| | **Stanford Representation Theory Seminar** September 26, 2024 |
| | **MIT Seminar on Affine Kac-Moody Algebras** May 6 & 9, 2024 |
| | **UCLA Algebra Seminar** November 3, 2023 |
| | **Canada-USA-Mexico Represent. Theory, Noncomm. Alg. and Categorification, University of Montreal** August 25, 2023 |
| | **UMass Amherst Representation Theory Seminar** May 8, 2023 |
| | **Yale Geometry, Symmetry and Physics Seminar** April 3, 2023 |
| | **MIT Lie Groups Seminar** December 7, 2022 |
| | **ICERM Program on Braids in Representation Theory and Algebraic Combinatorics** February 26, 2022 |
| | **MIT Pure Math Graduate Student Seminar** September 24, 2021 |
| | **IAS Quantum Groups Learning Seminar** March 4 & 11, 2021 |
| | **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 |
| Conferences, Workshops, & Research Visits | **Research Visits to SMRI** March 18-25, 2025 and March 4-14, 2026. University of Sydney. |
| | **Arizona Winter School, Session Leader** March 8-12. University of Arizona. |
| | **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** 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 & Applic. 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 RG.

**Thematic Program in Comm. 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<br>& Other<br>Experience | **Seminars Co-organized**<br>Stanford Representation Theory Seminar, 2024-2025<br>MIT Pure Math Graduate Student Seminar, 2020-2021 |
| | **Refereeing**<br>Compositio Mathematica, IMRN, Transformation Groups,<br>Representation Theory, Annals of Representation Theory,<br>Mathematical Research Letters. |
| | **Teaching Assistant, Boston Pre-Release Center**<br>Spring 2023, Boston, MA. Taught high-school equivalent math to<br>incarcerated students at the Boston Pre-Release correctional facility. |
| | **University of Toronto Mathematics Union President**<br>2017-2018, University of Toronto. |