Grant T. Barkley — Curriculum Vitae

CONTACT INFORMATION

1829 East Hall
Department of Mathematics
University of Michigan
Ann Arbor, MI 48109

gbarkley@umich.edu
gtbarkley.org

EMPLOYMENT

University of Michigan, Ann Arbor

NSF Research Fellow and Parekh IBL Research Assistant Professor — 2025-Present

EDUCATION

Harvard University

Ph.D. in Mathematics, advised by Lauren Williams — May 2025
M.A. in Mathematics — March 2022

- Merit Fellow, Harvard Graduate School of Arts and Sciences
- Chateaubriand Fellow, French Embassy to the United States

North Carolina State University

B.S. in Mathematics and Physics, minor in Computer Science — May 2020

- College of Sciences 2020 Outstanding Scholar
- College of Sciences 2019 Student Excellence Award

PUBLICATIONS AND PREPRINTS

"Extended Weak Order for the Rank 3 Universal Coxeter Group" (with C. Defant, P. Hersh, J. McCammond, T. McConville, and D. Speyer). Available at arXiv:2509.00871.

"Extended weak order for the affine symmetric group". Available at arXiv:2502.05875.

"The Affine Tamari Lattice" (with C. Defant). Available at arXiv:2502.07198.

"The BBDVW Conjecture for Kazhdan–Lusztig polynomials of lower intervals" (with C. Gaetz). Available at arXiv:2412.10256.

Appendix to "A note on Combinatorial Invariance of Kazhdan–Lusztig polynomials" by F. Esposito and M. Marietti (with C. Gaetz). *Bulletin of the London Mathematical Society*, 2025. Available at arXiv:2404.12834.

"On two notions of total positivity for generalized partial flag varieties of classical Lie types" (with J. Boretsky, C. Eur, and J. Gao). Available at arXiv:2410.11804.

"Oriented matroid structures on rank 3 root systems" (with K. Tung). Available at arXiv:2410.11717.

"On combinatorial invariance of parabolic Kazhdan-Lusztig polynomials" (with C. Gaetz). *Selecta Mathematica New Series*, Volume 31, Article 51, 2025. Available at arXiv:2404.04246.

"Bender–Knuth Billiards in Coxeter Groups" (with C. Defant, E. Hodges, N. Kravitz, and M. Lee), *Forum of Mathematics, Sigma*, Volume 13, e7, 2025. Available at arXiv:2401.17360.

"Affine extended weak order is a lattice" (with D. Speyer). Available at

arXiv:2311.05737.

"Combinatorial invariance for Kazhdan–Lusztig R-polynomials of elementary intervals" (with C. Gaetz). *Mathematische Annalen*, Volume 392, pages 3299-3317, 2025. Available at arXiv:2303.15577.

"Combinatorial descriptions of biclosed sets in affine type" (with D. Speyer), *Combinatorial Theory*, Volume 4, Issue 2, 2024. Available at arXiv:2207.05998.

"Channels, Billiards, and Perfect Matching 2-Divisibility" (with R. Liu), *Electronic Journal of Combinatorics*, Volume 28, Issue 2, 2021. Available at arXiv:1911.08102.

Conference and Invited Talks

Extended weak order at the University of California, Berkeley combinatorics seminar, November 2025.

Affine Cambrian lattices at the Michigan State University cluster algebras seminar, October 2025.

The combinatorial invariance conjecture at the University of Washington combinatorics seminar, October 2025.

Extended weak order for $\widetilde{S}_n$ and the lattice of torsion classes at the international conference on Formal Power Series and Algebraic Combinatorics in Sapporo, Japan, July 2025.

Torsion classes for affine-type preprojective algebras at the CMS Summer Meeting in Québec City, June 2025.

Torsion classes for the preprojective algebra of the cycle quiver at the Auslander Lectures in Woods Hole, Massachusetts, April 2025.

The affine Tamari lattice at the Brandeis combinatorics seminar, April 2025.

The BBDVW conjecture for Kazhdan–Lusztig polynomials of lower intervals at the AMS Special Session on Geometric and Algebraic Combinatorics in Hartford, Connecticut, April 2025.

The affine Tamari lattice at the AMS Special Session on Dynamical Algebraic Combinatorics in Hartford, Connecticut, April 2025.

The combinatorial invariance conjecture at the UCLA Combinatorics Forum, February 2025.

Extended weak order at the workshop on Lattice Theory at Banff International Research Station, January 2025.

The combinatorial invariance conjecture at the University of Notre Dame Algebraic Geometry/Commutative Algebra seminar, December 2024.

Beyond weak order on the affine symmetric group at the University of Minnesota Combinatorics seminar, November 2024.

Beyond weak order on the affine symmetric group at the LACIM seminar at Université du Québec à Montréal, October 2024.

Beyond weak order on affine Weyl groups at the Philadelphia-area Combinatorics, Algebra, and Geometry (CAGE) seminar, September 2024.

The combinatorial invariance conjecture at Lehigh University Mathematics Department Colloquium, September 2024.

Hypercube decompositions and the Combinatorial Invariance Conjecture at the Harvard–MIT Richard P. Stanley Seminar in Combinatorics, September 2024.

Shards for the affine symmetric group at the international conference on Formal Power Series and Algebraic Combinatorics in Bochum, Germany, July 2024.

Formal geometry of affine Coxeter arrangements at Kennesaw State University Discrete Math Seminar, April 2024.

Some perspectives on biclosed sets at the workshop on Bruhat order: recent developments and open problems in Bologna, Italy, April 2024.

Combinatorial invariance of R-polynomials for elementary intervals at the Tor Vergata University of Rome Algebra and Representation Theory seminar, April 2024.

Formal geometry of affine Coxeter groups at University of Michigan Combinatorics seminar, January 2024.

Combinatorial invariance for elementary intervals at the international conference on Formal Power Series and Algebraic Combinatorics in Davis, California, July 2023.

Extending the weak Bruhat order at the Cornell University Discrete Geometry and Combinatorics seminar, December 2022.

Extending the weak Bruhat order at the Université Paris Diderot Enumerative and Analytic Combinatorics seminar, November 2022.

Extending the weak Bruhat order at the Graduate Online Combinatorics Colloquium, October 2022.

Extended weak order in affine type at the international conference on Formal Power Series and Algebraic Combinatorics in Bangalore, India, July 2022.

The lattice of biclosed sets in affine type at the University of Michigan Combinatorics seminar, January 2022.

Extended weak order in affine type at the Harvard–MIT–Microsoft Combinatorics seminar, November 2021.

Billiards, Channels, and Perfect Matching 2-Divisibility at the international conference on Formal Power Series and Algebraic Combinatorics online, July 2020.

Undergraduate Mathematics at NC State at the NC State College of Sciences Donor Recognition Dinner, January 2020.

Coxeter groups and the lattice of total orders at the Triangle Area Graduate Mathematics Conference in Chapel Hill, NC, November 2019.

Undergraduate Mathematics at NC State at the NC State Math Department 130th Anniversary, October 2019.

Perfect matchings, Channels, and 2-Divisibility at the Southeastern International Conference on Combinatorics, Graph Theory & Computing in Boca Raton, FL, March 2019.

Domino Tilings and Divisibility at the ACC Meeting of the Minds in Louisville, KY, March 2019.

Other Talks

Structure theorem and balancing at the University of Michigan tropical geometry learning seminar, October 2025.

The Hecke category at the Harvard Soergel Bimodules learning seminar, January 2025.

The affine Tamari lattice at the Harvard Trivial Notions seminar, October 2024.

Algebraic and polyhedral geometry at the Harvard Tropical Geometry learning seminar, February 2024.

Shards and non-crossing arc diagrams at the Harvard informal combinatorics seminar, October 2023.

$R = T$ theorems for GL_1 at the MIT Modularity and Fermat's Last Theorem seminar, October 2023.

Non-standard analysis at the Harvard Trivial Notions seminar, October 2023.

Spherical varieties at the Harvard Relative Langlands learning seminar, September 2023.

Introduction to Kashiwara crystals at the Harvard Crystals learning seminar, September 2023.

Combinatorial invariance for lower intervals at the Harvard informal combinatorics seminar, April 2023.

Kazhdan–Lusztig theory at the Harvard Geometric Representation Theory learning seminar, April 2023.

Hypertoric varieties at the Harvard Positive Geometry learning seminar, March 2023.

L-functions and functoriality at the Harvard Trivial Notions seminar, February 2023.

Surreal numbers at the Harvard Combinatorics learning group, January 2023.

Quiver representations and cluster categories at the Harvard Cluster Categories learning seminar, July 2022.

Tilting and Auslander-Reiten translation at the Harvard Cluster Categories learning seminar, June 2022.

Disintegration and assembly of ∞-operads at the Harvard Infinity Categories seminar, April 2022.

Kac–Moody groups and Bott periodicity at the Harvard Trivial Notions seminar, March 2022.

Straightening and unstraightening at the Harvard Infinity Categories seminar, February 2022.

Equivariant homology of the affine Grassmannian at the Harvard Universal Centralizers seminar, October 2021.

Abelian varieties with complex multiplication at Juvitop, March 2021.

The geometric Satake correspondence at the Harvard Geometric Langlands seminar, February 2021.

Cotangent stacks and twisted D-modules at the Harvard Geometric Langlands seminar, January 2021.

The Calculus of Constructions at the Harvard Trivial Notions seminar, October 2020.

Coxeter groups and the lattice of total orders at the NC State SUM Series, December 2019.

Coxeter groups and the lattice of total orders at the UMich REU seminar, July 2019.

Spectral Sequences and the Universal Coefficient Theorem at the NC State Geometry and Topology learning seminar, February 2019.

Domino Tilings and Divisibility at the NC State SUM Series, December 2018.

Modular Functions at the NC State Math Insight Talks, October 2018.

Teaching

2024	Head TF, Math 157: Mathematics in the World
2023	TF, Math Mb: Introduction to Functions and Calculus II
2022-2023	Tutorial Leader, Harvard Qualifying Exams
2022	Guest Lecturer, Math 155: Intro to Combinatorics
2022	TF, Math Mb: Introduction to Functions and Calculus II
2021	Head TF, Math 99r: Quantum Mechanics for the Math-Minded
2021	Course Assistant, Lie Groups and Lie Algebras
2019-2020	Recitation Leader, Problem Solving for Competitions (Volunteer)
2017-2018	Teaching Assistant, Foundations of Advanced Mathematics
2017-2018	Mathematics and Physics Tutor, University Tutorial Center

Honors and Awards

2025	Best Student Paper Award, International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC)
2025-	NSF Mathematical Sciences Postdoctoral Research Fellow
2024	GSAS Merit Fellow, Harvard University GSAS

	2022	Chateaubriand Fellow, French Embassy in the United States
	2020	Outstanding Scholar Award, NC State College of Sciences
	2020	Outstanding Community Outreach Award, NC State Department of Mathematics
	2020	Wesley O. Doggett Award for Scholarship, NC State Department of Physics
	2019	Student Excellence Award, NC State College of Sciences
	2019	Best Student Paper Award, Southeastern International Conference on Combinatorics, Graph Theory, and Computing
	2017	Meritorious Winner, Mathematical Contest in Modeling
	2016	National Merit Scholar
	2016	Eagle Scout
MENTORSHIP	2025	Chi Dinh, Yifan Jing, Emma Lou, Shaotian Sun, Owen Wu: Translation invariant total orders
	2025	Gary Hu: Soergel bimodules
	2024	Preston Bushnell: Topos theory and internal logic
	2024-	Maria Delgado: First order logic and model theory, group theory
	2024	Al Liu: Ring theory
	2024	Christian Chiu and Bruce Fang: Tropical geometry
	2024	Dora Woodruff: Soergel bimodules
	2023	Avery Watts: Linear algebra
	2023	Katherine Tung: Lie groups and Lie algebras
	2023	Autumn Shin: Combinatorics and graph theory
	2022-2023	Elaine Li: Intro to proofs, real analysis, topology
	2022	Ryland Gross: Group theory, ring theory
	2022	Eric Du, Marvin Li, and Peter Luo: Enumerative combinatorics
	2022	Guarav Goel and Eric Shen: Young tableaux
	2020-2021	Ray Shang: Lie algebras, commutative algebra, representation theory
	2021	Lara Zeng and Nadine Meister: Quantum mechanics and functional analysis
	2021	Shane Kissinger: Harmonic analysis and C*-algebras
OUTREACH	2023-	Twoples mentor
	2021-2025	Harvard Math Includes small group leader
	2019	Initiated and ran NC State's first Julia Robinson Mathematics Festival
	2018-2020	Coach for the Centennial Middle School Math Team
	2017-2020	Game-runner at Washington STEM Elementary Math & Science Night
LEADERSHIP	2024-2025	Lead organizer for the Harvard Directed Reading Program
	2024-2025	President of the Harvard Graduate Residence Hall Council
	2023-2024	Chair of Technology for the Harvard Graduate Student Council
	2023	Organizer for Harvard Kashiwara Crystals learning seminar
	2022-2025	Co-organizer of the Harvard Directed Reading Program
	2021-2023	Department representative for Harvard Graduate Student Council
	2021-2022	Organizer of the Harvard Trivial Notions seminar
	2019-2020	President of the NC State Society for Undergraduate Mathematics
	2018-2019	Secretary of the NC State Society for Undergraduate Mathematics
	2018-2020	Ambassador for the NC State College of Sciences
	2018-2020	Organizer for various math competitions at NC State
	2018-2019	Director of Finance for the Honors Quad Area Council