Grant T. Barkley — Curriculum Vitae

Contact Information

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Education

Harvard University

Ph.D. student in Mathematics, advised by Lauren Williams (expected May 2025)
M.A. in Mathematics (March 2022)

North Carolina State University

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

- Honors program in Mathematics, University Scholars program
- GPA: 4.0
- College of Sciences 2019 Student Excellence Award Co-winner
- College of Sciences 2020 Outstanding Scholar

Publications

"On combinatorial invariance of parabolic Kazhdan-Lusztig polynomials" (with C. Gaetz). Available at `arXiv:2404.04246`.

"Bender–Knuth Billiards in Coxeter Groups" (with C. Defant, E. Hodges, N. Kravitz, and M. Lee). 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). Available at `arXiv:2303.15577`.

"Combinatorial descriptions of biclosed sets in affine type" (with D. Speyer), to appear in *Combinatorial Theory*. 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

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

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 Experience

2024	Head TF, Math 157: Mathematics in the World
2023	Teaching Fellow, Math M
2022-2023	Tutorial Leader, Harvard Qualifying Exams
2022	Guest Lecturer, Math 155: Intro to Combinatorics
2022	Teaching Fellow, Math M
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

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

Outreach

2023-	Twoples mentor
2021-	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

Mentorship

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

Leadership

2023-2024	Chair of Technology for the Harvard Graduate Student Council
2023	Organizer for Harvard Kashiwara Crystals learning seminar
2022-	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