

CURRICULUM VITAE

SPENCER BACKMAN

Address:

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1. EDUCATION AND EMPLOYMENT

- Associate Professor, Department of Mathematics and Statistics, University of Vermont (2025 - Present)
- Assistant Professor, Department of Mathematics and Statistics, University of Vermont (2019 - 2025)
- Zuckerman STEM Postdoctoral Scholar, Einstein Institute for Mathematics, Hebrew University of Jerusalem (January 2018 - August 2019)
- Postdoctoral Researcher, Institute for Mathematics, Goethe University of Frankfurt (SFB “Discretization and Geometry in Dynamics” A03) (April 2017 - December 2017)
- Postdoctoral Fellow, Hausdorff Center for Mathematics, University of Bonn, Germany (January 2016 - April 2017)
- Postdoctoral Researcher, Department of Computer Science, University of Rome “La Sapienza” (November 2014 - December 2015)
- Visiting Researcher, National Institute for Mathematical Sciences, Republic of Korea (May 2014 - August 2014)
- Ph.D., Algorithms, Combinatorics, and Optimization from the School of Mathematics at the Georgia Institute of Technology (Spring 2014)
- Visiting Student Researcher, Mathematics Department, University of California, Berkeley (Fall 2011 - Fall 2012)
- Math in Moscow Program (Fall 2007)
- B.A., Oberlin College, with Honors in Mathematics (2007)
- Budapest Semesters in Mathematics Program (Spring 2006)

2. FELLOWSHIPS AND AWARDS

- NSF Grant (DMS-2246967) (2023-present) Amount: \$200,000
- Simons Foundation Collaborative Gift #854037 (2021) Amount: \$42,000
- OVPR Express Grant UVM (2020-2021) Amount: \$3,000

Date: May 15, 2026.

- Zuckerman STEM Postdoctoral Fellowship hosted by Karim Adiprasito (2017-2019)
- DFG (Die Deutsche Forschungsgemeinschaft) SFB “Discretization and Geometry in Dynamics” A03 Fellowship hosted by Raman Sanyal (2017)
- Top Graduate Student Award from the School of Mathematics at the Georgia Institute of Technology (2014)
- Algorithms and Randomness Center Student Fellowship (Spring 2014)
- Georgia Institute of Technology Presidential Fellowship (2008-2012)
- Algorithms, Combinatorics, and Optimization Student Fellowship (2008-2009)

3. PUBLICATIONS

- Extension-lifting Bijections for Oriented Matroids, with Francisco Santos and Chi Ho Yuen, *Discrete and Computational Geometry*, Volume 75, pages 969–994, (2026).
- Cone Angles, Gram’s Relation, and Flag-Angles, with Sebastian Manecke and Raman Sanyal, *Algebraic Combinatorics*, Volume 9 (2026) no. 2, pp. 441-464.
- Skeletal Generalizations of Parking Functions, Dyck Paths, and Chip-firing Games, with Cole Charbonneau, Nicholas A. Loehr, Patrick Mullins, Mazie O’Connor, and Gregory S. Warrington, *Combinatorial Theory*, 5(4).
- A Regular Unimodular Triangulation of the Matroid Base Polytope, with Gaku Liu, *Duke Mathematical Journal* 174(14): 3047-3061.
- Simplicial Generation of Chow Rings of Matroids, with Christopher Eur and Connor Simpson, *Journal of the European Mathematical Society*, 26, 4491–4535 (2024).
- Fan Valuations and Spherical Intrinsic Volumes, with Sebastian Manecke and Raman Sanyal, *Annals of Combinatorics*, (2024): 1-18.
- Matroid Chern-Schwartz-MacPherson Cycles and Tutte Activities, with Ahmed Ashraf, *Proceedings of the American Mathematical Society*, 151 (2023), 2303-2309.
- Tutte Activities, in *Handbook of the Tutte Polynomial and Related Topics*, eds. Joanna A. Ellis-Monaghan and Iain Moffatt, CRC Press, 2022..
- A Convolution Formula for Tutte Polynomials of Arithmetic Matroids and Other Combinatorial Structures, with Matthias Lenz, *Séminaire Lotharingien de Combinatoire*, [B78c] (2021), 17 pp.
- Geometric Bijections for Regular Matroids, Zonotopes, and Ehrhart Theory, with Matthew Baker and Chi Ho Yuen, *Forum of Mathematics, Sigma*, Volume 7, 2019, e45.
- Transfinite Ford-Fulkerson on a Finite Network, with Tony Huynh, *Computability*, Volume 7, Issue 4, January 2018, Pages 341-347.
- Fourientation Activities and the Tutte Polynomial, with Sam Hopkins and Lorenzo Traldi, *European Journal of Combinatorics*, Volume 67, January 2018, Pages 40-60.
- Fourientations and the Tutte Polynomial, with Sam Hopkins, *Research in the Mathematical Sciences*, December 2017.
- Partial Graph Orientations and the Tutte Polynomial, *Advances in Applied Mathematics*, Special Issue on the Tutte Polynomial, June 2017.
- Riemann-Roch Theory for Graph Orientations, *Advances in Mathematics*, Volume 309, pages 655-691, March 2017.

- Explicit Deformation of Lattice Ideals via Chip Firing Games on Directed Graphs, with Madhusudan Manjunath, *Journal of Algebraic Combinatorics*, Volume 42, Issue 4, December 2015, pages 1097–1110.
- Infinite Reduction of Divisors on Metric Graphs, *European Journal of Combinatorics*, Volume 35, January 2014, Pages 67-74.
- Sum-Product Inequalities with Perturbation, with Ernie Croot, Mariah Hamel, and Derrick Hart, *INTEGERS* Volume 11A (2011) Proceedings of the Integers Conference 2009 in Honor of the Birthdays of Melvyn Nathanson and Carl Pomerance.

4. PREPRINTS

- Quantized Rational Chip-firing, with Nicholas A. Loehr and Gregory S. Warrington.
- Line Shellings of Geometric Lattices, with Galen Dorpalen-Barry, Anastasia Nathanson, Ethan Partida, and Noah Prime.
- Ford Spheres in the Clifford-Bianchi Setting, with Taylor Dupuy, Anton Hilado, and Veronika Potter.
- Higher-Categorical Associahedra, with Nathaniel Bottman and Daria Poliakova.
- Convex Geometry of Building Sets, with Rick Danner.
- A Bijection Between the Recurrent Configurations of a Hereditary Chip-Firing Model and Spanning Trees.
- Chip-Firing and Riemann-Roch Theory for Directed Graphs, with Arash Asadi.

5. RESEARCH TALKS

- Spring 2025, Algebra Seminar, Georgia Institute of Technology.
- Fall 2025, Beyond Permutahedra and Associahedra, Centre International de Rencontres Mathématiques (CIRM), Luminy, France.
- Fall 2025, Closing Conference, Combinatorial Geometry and Geometric Combinatorics Program, Centre de Recerca Matemàtica (CRM), Barcelona, Spain.
- Summer 2025, Canadian Mathematical Society Meeting, Quebec City, Special Session on Enumerative and Algebraic Combinatorics.
- Spring 2025, Combinatorics Seminar, University of Michigan.
- Spring 2025, Combinatorics Seminar, Michigan State.
- Winter 2025, Joint Mathematical Meetings, Seattle, Washington, Special Session on Geometric and Topological Combinatorics.
- Fall 2024, BUGCAT Conference, SUNY Binghamton.
- Spring 2024, Workshop on Flow Polytopes, Gentle Algebras and Associated Posets, UQAM, Montreal, Quebec.
- Spring 2024, Dartmouth-UVM Math Day, plenary talk.
- Fall 2023, Canadian Mathematical Society, Session Algebraic and Enumerative Combinatorics, Montreal, Quebec.
- Fall 2023, Combinatorics Seminar, KTH Stockholm, Sweden.
- Spring 2023, Matroids - Combinatorics, Algebra and Geometry Seminar, Fields Institute.
- Fall 2022, Combinatorics Seminar, University of Massachusetts Amherst.

- Fall 2022, AMS Sectional, Special Session on Geometric Aspects of Algebraic Combinatorics, University of Massachusetts Amherst.
- Summer 2022, Joint Meetings of the EMS, AMS, and FSM, Special Session on Graph and Matroid Polynomials, University of Grenoble, France.
- Summer 2022, Combinatorics and Geometry Seminar, University of Washington.
- Spring 2022, Combinatorics Seminar, University of Amsterdam, The Netherlands.
- Spring 2022, Combinatorics Seminar, Brandeis University.
- Spring 2022, Combinatorics Seminar, Dartmouth College.
- Spring 2022, Combinatorics Seminar, KTH Stockholm, Sweden.
- Summer 2020, FPSAC Lecture (originally scheduled for Bar-Ilan University, Israel and moved online due to COVID-19).
- Spring 2020, Invited Lecture at Unimodality, Log-concavity, and Beyond Conference at the Mittag-Leffler Institute in Stockholm, Sweden (canceled due to COVID-19).
- Spring 2020, Geometry-Algebra-Singularities-Combinatorics Seminar, Northeastern University.
- Fall 2019, Number Theory Seminar, University of Vermont.
- Fall 2019, Combinatorics Seminar, University of Vermont.
- Summer 2019, Vermont Summer Combo, University of Vermont.
- Summer 2019, Discrete Geometry Seminar, University of Frankfurt, Germany.
- Summer 2019, Arrangements at Western Workshop, University of Western Ontario, Canada.
- Spring 2019, Discrete Geometry Seminar, Institute Henri Poincaré, Paris, France.
- Fall 2018, Combinatorics Seminar, Hebrew University of Jerusalem, Israel.
- Fall 2018, Combinatorial Geometries: Matroids, Oriented Matroids and Applications Conference, CIRM, Luminy, France.
- Fall 2018, University of Vermont Mathematics Colloquium.
- Fall 2018, MIT Combinatorics Seminar.
- Summer 2018, FPSAC Lecture, Hanover, New Hampshire.
- Fall 2017, MSRI Geometric and Topological Combinatorics Semester, MSRI Berkeley.
- Summer 2017, Kombinatorik Seminar, Leipzig University.
- Spring 2017, András Frank's Seminar, Eötvös Loránd University, Budapest, Hungary.
- Spring 2017, Algebra Seminar, Renyi Institute, Budapest, Hungary.
- Winter 2016, Discrete Mathematics, Geometry, and Optimization Seminar, University of Frankfurt.
- Winter 2016, Representation Theory Seminar, Hausdorff Center for Mathematics, University of Bonn.
- Fall 2016, Chip-firing and Divisors on Graphs and Complexes Special Session, AMS Sectional, Minneapolis, Minnesota.
- Summer 2016, Summer Combo in Vermont, St. Michael's College.
- Spring 2016, Discrete Geometry Seminar, Freie Universität Berlin.
- Spring 2016, Graph Polynomials: Towards a Comparative Theory, Dagstuhl Seminar, Schloss Dagstuhl – Leibniz Center for Informatics.

- Fall 2015, Sandpile Groups Workshop, Casa Matemática Oaxaca - Banff International Research Station (CMO-BIRS), Oaxaca, Mexico.
- Fall 2015, Le Laboratoire d'Informatique, de Robotique et de Microélectronique de Montpellier (LIRMM), Montpellier, France.
- Fall 2015, Arrangements: Combinatorics and Topology Seminar, University of Fribourg, Switzerland.
- Fall 2015, Algebraic Geometry Seminar, Roma Tre University.
- Fall 2015, Joint Session of the 75th Sèminaire Lotharingien de Combinatoire and of the XX Incontro Italiano di Combinatoria Algebrica, Bertinoro, Italy.
- Summer 2015, Summer Combo in Vermont, St. Michael's College.
- Summer 2015, Workshop on New Directions for the Tutte Polynomial, Royal Holloway University of London, England.
- Spring 2015, Algebraic Geometry Seminar, Fluminense Federal University, Brazil.
- Spring 2015, Combinatorics Seminar, Georgia Tech.
- Spring 2015, Combinatorics Seminar, UC Berkeley.
- Fall 2014, Special Session on Combinatorics in Algebraic Geometry, AMS Western Sectional, SFSU.
- Fall 2014, Combinatorics Seminar, MIT.
- Summer 2014, Algebraic Geometry Seminar, Korean Institute of Advanced Study (KIAS).
- Summer 2014, Discrete Mathematics Seminar, Korean Advanced Institute of Science and Technology (KAIST).
- Spring 2014, Student Tropical Algebraic Geometry Seminar, Yale University.
- Spring 2014, Graph Theory Seminar, Georgia Tech.
- Spring 2014, Combinatorics Seminar, Georgia Tech.
- Fall 2013, Mathematics Colloquium, Reed College.
- Fall 2013, Algebra Seminar, Georgia Tech.
- Summer 2013, SIAM Conference on Applied Algebraic Geometry; Tropical Geometry and Combinatorics in Dynamical Systems Minisymposium.
- Fall 2012, Combinatorial Commutative Algebra Seminar, MSRI.
- Fall 2012, Combinatorics Seminar, Georgia Tech.
- Spring 2012, Joint University of Kaiserslautern & University of Saarlands Seminar.
- Spring 2012, Tropical Geometry Day, University of Warwick.
- Fall 2011, Chip-Firing Day, UC Berkeley.
- Fall 2011, European Conference on Combinatorics, Budapest, Hungary.
- Fall 2011, Combinatorics Seminar, University of Minnesota.

6. SERVICE

UVM Mathematics and Statistics Department Committees and Service:

- Reappointment and Promotion to Tenure Committees (Chair \times 2)
- Tenure-track Search Committee (2024) (Chair)
- Graduate Program Committee (2023-present)
- Mathematics Major Recruitment Committee (2022-2025)
- Organizer for UVM Combinatorics Seminar (2021-present)

- Mathematics Colloquium Committee (2021 & 2022)
- Putnam Exam Committee (2020 & 2021)
- Undergraduate Curriculum Committee (2020 & 2021)

Refereeing Service:

- Advances in Mathematics
- Annals of Combinatorics
- Combinatorial Theory
- Discrete Mathematics
- Discrete and Computational Geometry
- Electronic Journal of Combinatorics
- European Journal of Combinatorics
- Journal of Combinatorial Theory Series A
- Journal of Combinatorial Theory Series B
- New York Journal of Mathematics
- Proceedings of the AMS
- Selecta Mathematica

Boards:

- Vermont Statement Mathematics Coalition (since 2020)

Conference Organizing:

- Banff International Research Station Workshop: Algebra and Combinatorics of Polyhedral Geometry (2027) (Co Organizer with Federico Castillo, Isabella Novik, Jesús De Loera, and Katharina Jochemko).
- Montreal ISM Discovery School on Combinatorics of Moduli of Curves in Genus 0 and Chow Rings of Matroids, May 11-15, 2026. (Co Organizer with Maria Gillespie-Monks, Alejandro Morales, and Jake Levinson).
- UVM-Dartmouth Math Day, April 27th, 2025 at the University of Vermont (Organizer)
- Mostly Matroids, August 19th-23rd 2024 at the Institute for Basic Science, Daejeon, South Korea (Organizer)
- Formal Power Series and Algebraic Combinatorics, July 22nd–26th, 2024, Bochum, Germany (Program Committee Member)

7. TEACHING

Lead Instructor:

University of Vermont:

- Spring 2026 Discrete Structures, CS 1640
- Spring 2026 Elementary Number Theory, Math 3517
- Spring 2025 Real Analysis in Several Variables 2, Math 3472
- Fall 2024 Discrete Structures, CS 1640

- Spring 2024 Real Analysis in Several Variables 1, Math 3468
- Fall 2023, Combinatorial Graph Theory, Math 5678
- Fall 2023, Basic Combinatorial Theory, Math 2678
- Spring 2023, Topics in Combinatorics, Math 373: Matroids and Polytopes
- Fall 2022, Discrete Structures, CS 064
- Fall 2022, Real Analysis in Several Variables 1, Math 241
- Spring 2022, Real Analysis in Several Variables 1, Math 241
- Fall 2021, Discrete Structures, CS 064
- Fall 2021, Fundamentals of Mathematics, Math 052
- Spring 2021, Topology, Math 295 & 395
- Fall 2020, Basic Combinatorial Theory, Math 173
- Spring 2020, Topics in Combinatorics, Math 373: Matroids and Polytopes
- Fall 2019, Combinatorial Graph Theory, Math 273

Georgia Institute of Technology:

- Spring 2013, Finite Mathematics, 1711

PhD Students:

- Richard Danner (2022-present)
- Sienna Unter (2024-present)
- Noah Prime (2025-present)

Master's Students

- Spring 2020, Patrick Mullins

Emory-Tibet Science Initiative

- Summer 2013, Emory-Tibet Science Initiative Mathematics Lecturer, Sarah College, Dharamsala, India
- Summer 2012, Emory-Tibet Science Initiative Mathematics Lecturer, Sarah College, Dharamsala, India

Substitute Instructor

- Fall 2011, UC Berkeley, Undergraduate Algebraic Geometry

Teaching Assistant

- Fall 2010, Calculus 3, 2401
- Fall 2009, Linear and Discrete Mathematics, 2602
- Summer 2009, Linear and Discrete Mathematics, 2602
- Fall 2008, Calculus 1, 1501