

# CURRICULUM VITAE

SPENCER BACKMAN

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## 1. EDUCATION AND EMPLOYMENT

- Assistant Professor, Department of Mathematics and Statistics, University of Vermont (August 2019 - Present)
- 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: \$131,706
- Simons Foundation Collaborative Gift #854037 (2021) Amount: \$42,000
- OVPR Express Grant UVM (2020-2021) Amount: \$3,000
- Zuckerman STEM Postdoctoral Fellowship hosted by Karim Adiprasito (2017-2019)

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*Date:* June 24th, 2024.

- 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

- 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*, (20204): 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 Chapter for the Handbook of the Tutte polynomial and related topics. Ellis-Monaghan, Joanna A., and Iain Moffatt, eds. 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 1097D1110.
- 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

- Ford Spheres in the Clifford-Bianchi Setting, with Taylor Dupuy, Anton Hilado, and Veronika Potter
- Higher-Categorical Associahedra, with Nathaniel Bottman and Daria Poliakova
- 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
- Convex Geometry of Building Sets, with Rick Danner
- A Regular Unimodular Triangulation of the Matroid Base Polytope, with Gaku Liu
- Extension-lifting Bijections for Oriented Matroids, with Francisco Santos and Chi Ho Yuen.
- Cone Angles, Gram's Relation, and Flag-Angles, with Sebastian Manecke and Raman Sanyal.
- 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 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 Covid19)
- Spring 2020 Invited Lecture at Unimodality, Log-concavity, and Beyond Conference at the Mittag-Leffler Institute in Stockholm, Sweden (canceled due to Covid19)
- Spring 2020 Geometry-Algebra-Singularities-Combinatorics Seminar, Northeastern University
- Fall 2019 Number Theory Seminar, University of Vermont
- Fall2019 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, Institut 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

Boards:

- Vermont Statement Mathematics Coalition (since 2020)

UVM Mathematics and Statistics Department Committees and Service:

- Tenure-track Search Committee (2024) (Chair)
- Graduate Program Committee (2023-present)
- Mathematics Major Recruitment Committee (2022-present)
- 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

## 7. TEACHING

### Lead Instructor

- Fall 2024 Discrete Structures, CS 1640, University of Vermont
- Spring 2024 Real Analysis in Several Variables 1, Math 3468, University of Vermont
- Fall 2023, Combinatorial Graph Theory, Math 5678, University of Vermont
- Fall 2023, Basic Combinatorial Theory, Math 2678, University of Vermont
- Spring 2023, Topics in Combinatorics, Math 373: Matroids and Polytopes, University of Vermont
- Fall 2022, Discrete Structures, CS 064, University of Vermont
- Fall 2022, Real Analysis in Several Variables 1, Math 241, University of Vermont
- Spring 2022, Real Analysis in Several Variables 1, Math 241, University of Vermont
- Fall 2021, Discrete Structures, CS 064, University of Vermont
- Fall 2021, Fundamentals of Mathematics, Math 052, University of Vermont
- Spring 2021, Topology, Math 295 & 395, University of Vermont
- Fall 2020, Basic Combinatorial Theory, Math 173, University of Vermont
- Spring 2020, Topics in Combinatorics, Math 373: Matroids and Polytopes, University of Vermont
- Fall 2019, Combinatorial Graph Theory, Math 273, University of Vermont
- Spring 2013, Finite Mathematics, 1711, Georgia Tech

### PhD Students:

- Richard Danner (2022-present)

### Masters 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