

# Andrew Hardt

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*(CV last updated January 2023)*

## EDUCATION

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- **University of Minnesota** *September 2016 - August 2022*  
Ph. D. in Mathematics, 2022  
Thesis Advisor: Prof. Ben Brubaker  
Dissertation Title: Algebraic Operations via Solvable Lattice Models  
M. S. in Mathematics, 2019
- **Carleton College** *September 2009 - June 2013*  
B.A. in Mathematics, 2013  
Magna Cum Laude, GPA: 3.89

## EMPLOYMENT

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- **Stanford University** *September 2022 - present*  
Szégo Assistant Professor of Mathematics

## RESEARCH

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**Research Interests** (for more, see [personal homepage](#))

I am interested in algebraic structures in representation theory, and using integrable systems to learn about Schubert calculus, p-adic representation theory, (non)symmetric function theory, and representations of quantum groups. In particular, I have interests in the following areas:

- Solvable lattice models
- Hamiltonian operators
- Alcove walks
- Crystals
- Representations of Hecke algebras
- Reductive groups and monoids

## Papers

- *Solving the  $n$ -Color Ice Model*, [arXiv:2212.06404](#).
- *Lattice Models, Hamiltonian Operators, and Symmetric Functions*, submitted for publication, [arXiv:2109.14597](#).
- *Frozen Pipes: Lattice Models for Grothendieck Polynomials* (with B Brubaker, C. Frechette, E. Tibor, and K. Weber), to appear in Algebraic Combinatorics. [arXiv:2007.04310](#).
- *Arborescences of Covering Graphs* (with S. Chepuri, C.J. Dowd, G. Michel, S. Zhang, and V. Zhang), *Algebr. Comb.* 5 (2022), no. 2, 319-346.
- *Characters of Renner Monoids and Their Hecke Algebras* (with J. Marx-Kuo, V. McDonald, J. O'Brien, and A. Vetter), *Internat. J. Algebra Comput.* 30 (2020), no. 7, 1505-1535.
- *Restricted Symmetric Signed Permutations* (with J. Troyka), *Pure Math. Appl.*, 23 (2012) 179-217.

## Other Documents

- Algebraic Operations via Solvable Lattice Models, University of Minnesota Dissertation, 2022, [Proquest link](#). (119 pages)
- Finite Hecke Algebras and Their Characters, University of Minnesota Oral Exam Paper, 2019, [link](#). (44 pages)
- Combinatorial Species and Graph Enumeration (with P. McNeely, J. Troyka, and T. Phan), 2013, Carleton College Comprehensive Senior Project, [arXiv:1312.0542](#) (39 pages)

## INVITED TALKS

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- (Super)symmetric Functions from Solvable Lattice Models and Discrete-Time Hamiltonian Operators, University of Minnesota Combinatorics Seminar (February 2022)
- Solvable lattice models from representations of quantum groups, Academia Sinica, Taipei (virtual), December 2021
- Hamiltonian Operators and Free Fermionic Lattice Models, Solvable Lattice Models Seminar (June 2021)
- Solvable Lattice Models, Statistical Mechanics, and Symmetric Functions, Carleton College Colloquium (June 2021)

## SELECTED CONTRIBUTED TALKS

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- Lattice Models, Hamiltonian Operators, and Symmetric Functions, Joint Mathematics Meetings (April 2022)
- Thesis Showcase, University of Minnesota (April 2022)
- Skating through Math: An Introduction to Ice Models, University of Minnesota Student Combinatorics Seminar (February 2022)
- Lattice Models and Hamiltonians Operators, Graduate Student Combinatorics Conference (April 2021)
- Solvable Lattice Models and Special Functions, New York State Regional Graduate Mathematics Conference (April 2021)
- From Automorphic Forms to Integrable Systems, UMN Student Number Theory Seminar (October 2020)
- Crystal Bases, UMN Student Representation Theory Seminar (August 2020)
- Iwahori Hecke Algebras in Multiple Contexts, UMN Student Number Theory Seminar (March 2020), UGA Graduate Student Seminar (July 2020)
- Alcove Walks (project introduction); UMN Algebra and Combinatorics REU (June 2020)
- Classification of Reductive Algebraic Monoids, UMN Student Combinatorics Seminar (October 2019)
- What is the Biggest (Finite) Number?, UMN Math Club (October 2019)
- What is Number Theory?, UMN Student Number Theory Seminar (September 2019)
- Finite Hecke Algebras and Their Characters, Oral Exam Talk (March 2019)

## OTHER CONFERENCES ATTENDED

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- New Connections in Integrable Systems, Remote (September-October 2020)
- Soergel Bimodules and Categorification of the Braid Group Workshop, ICERM, Brown University (February 2020)
- Abel Conference Honoring Robert Langlands, University of Minnesota (November 2018)
- Graduate Student Combinatorics Conference, University of Kansas (April 2017)
- Commutative Algebra Plus, University of Wisconsin-Madison (October 2016)

## AWARDS

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- Joint Mathematics Meetings Travel Grant, 2022 (\$1,300; meetings went virtual)
- Doctoral Dissertation Fellowship, awarded to “the University’s most accomplished PhD candidates” to pursue an “outstanding research project”, University of Minnesota, 2021-22 (\$25,000 award)
- Nominated for Doctoral Dissertation Fellowship, University of Minnesota Mathematics Department, 2021
- Outstanding Teaching Assistant Award (\$500 award), University of Minnesota Mathematics Department, 2018-19
- First Year Summer Fellowship, University of Minnesota Mathematics Department, Summer 2017 (\$2,000)
- Phi Beta Kappa, Carleton College, 2013
- Distinction on Comprehensive Senior Project, Carleton College, 2013

## STANFORD TEACHING

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- Winter 2023 – Math 121, Galois Theory
- Fall 2022 – Math 51, Linear Algebra, Multivariable Calculus, and Modern Applications

## MINNESOTA TEACHING

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- Spring 2021 – Math 1001, Excursions in Mathematics (*sole lecturer*)  
*Controlled course structure, topics covered, lectures, and assessments; managed 1 TA*  
*Lecture videos posted [here](#).*
- Fall 2020 – Math 3283W, Sequences, Series, and Foundations (*TA*)
- Spring 2020 – Math 3283W, Sequences, Series, and Foundations (*TA*)
- Fall 2019 – Math 1031, College Algebra (*lecturer and course coordinator*)  
*Controlled course structure, topics covered, lectures, and assessments*  
*Coordinated 3 total lecturers and 7 total TAs; directly managed 2 TAs*
- Spring 2019 – Math 1031, College Algebra (*lecturer and course coordinator*)  
*Controlled course structure, topics covered, lectures, and assessments*  
*Coordinated 2 total lecturers and 3 total TAs; directly managed 2 TAs*

- Fall 2018 – Math 1031, College Algebra (*lecturer*)  
*Managed 1 TA*
- Spring 2018 – Math 2574H, Honors Calculus IV (*TA*)
- Fall 2017 – Math 2573H, Honors Calculus III (*TA*)
- Fall 2017 – Designed and taught course at Osher Lifetime Learning Institute (OLLI) for older adults entitled *Math and Proofs*
- Spring 2017 – Math 1272, Calculus II (*TA*)
- Fall 2016 – Math 1271, Calculus I (*TA*)
- Spring 2013 – Carleton College Math 352, Abstract Algebra II (*grader*)

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### REU MENTORING

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I was the assistant mentor for the following projects in the Polymath Jr. program (2021-22):

- Solvable lattice models (2022)
- Gelfand-Tsetlin Polytopes (2021)

I was the mentor (project leader) for the following project in the University of Minnesota Combinatorics and Algebra REU in 2020:

- Alcove Walks and Whittaker Functions (N. Borade, M. Huynh, H. Twiss)

I was a TA (assistant mentor) for the following projects in the University of Minnesota Combinatorics and Algebra REU (2018-19):

- Arborescences of Covering Graphs (2019; C.J Dowd, V. Zhang, S. Zhang)
- Dihedral Sieving on Cluster Complexes (2019; Z. Stier, J. Wellman, Z. Xu)
- Homomesy and Rowmotion on the Trapezoid Poset (2019; Q. Dao, J. Wellman, C. Yost-Wolff, S. Zhang)
- Metaplectic Analogues of Gelfand-Graev Models (2019; Q. Dao, N. Kenshur, F. Lin, C. Meng, Z. Stier, C. Yost-Wolff)
- Characters of Renner Monoids and Their Hecke Algebras (2018; J. Marx-Kuo, V. McDonald, J. O'Brien, A. Vetter)
- Generating Functions for f-Vectors and the cd-Index of Weight Polytopes (2018; J. Gao, V. McDonald)

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### OUTREACH

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- Gave a talk on lattice models at Palo Alto High School math club, November 2022
- Instructor at MathCEP Saturday Morning Math, fun math sessions for 6th-8th graders, Spring 2022
- Panelist for session on Advocacy for Mathematics and Science Policy, Joint Mathematics Meetings, April 2022
- Counsellor for the Minnesota Program in Mathematics (MPM), a program for underrepresented undergraduates in mathematics, Winter 2021

## PROFESSIONAL SERVICE

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- Have been a referee for:
  - Communications of the AMS, Spring 2022
  - Minnesota Journal of Undergraduate Mathematics, Spring 2021
- Paper reviewer, zbMATH, 2020-22
- Session chair at
  - Joint Math Meetings, Contributed Paper Session on Lattices and Geometries II, Spring 2022
  - Graduate Student Combinatorics Conference, Spring 2021

## UNIVERSITY SERVICE

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- Paper reader for Jackson Hampton's Senior Honor's Thesis, Spring 2021
- Co-organizer for a series of department Town Halls where graduate students had a chance to meet candidates for Department Head, Fall 2020
- Facilitator for the teacher training portion of the new graduate student orientation, Fall 2020
- Co-organizer for UMN student number theory seminar, 2019-20
- Mentor, Directed Reading Program, 2017-21
- Peer Mentor, UMN Mathematics, 2017-18
- I have written a total of 9 recommendation letters for students I have taught or mentored, ranging from summer internships to fellowships to undergraduate and graduate programs, including Ph. D. programs in mathematics.

## PROFESSIONAL DEVELOPMENT

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- Teaching Assistant and Postdoc Professional Development Program Certificate; attended a series of 6 lectures, and wrote a capstone 3 page teaching reflection paper.
- Attendee at *Speaking Sciences* Conference, University of Minnesota (January 2019)

## OTHER EXPERIENCE

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- Swimming Commentator, 2018-present
- Contributing Writer, SwimSwam.com, 2018-19
- Interim Co-President, UMN Triathlon Team, 2017
- ACT/SAT Tutor, 2015-18
- Assistant Swim Coach, University of St. Thomas, 2013-16