Andrew Hardt

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(CV last updated November 2021)

EDUCATION

- **University of Minnesota** *September 2016 - Present*
  Ph. D. Candidate in Mathematics; degree expected 2022
  M. S. in Mathematics, 2019
  Advisor: Prof. Ben Brubaker

- **Carleton College** *September 2009 - June 2013*
  B.A. in Mathematics, 2013
  Magna Cum Laude, GPA: 3.89

RESEARCH

Research Interests (for more, see academic homepage)

I am interested in algebraic structures in representation theory and the associated combinatorics. In particular, I have interests in the following areas:

- Solvable lattice models.

- Representations of Hecke algebras and Heisenberg algebras.

- Reductive algebraic groups and monoids, and quantum (affine) (super)algebras.

- (Non)symmetric functions arising from p-adic representation theory and Schubert calculus.

Submitted and/or Published Papers

- *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), submitted for publication, `arXiv:2007.04310`.

- *Arborescences of Covering Graphs* (with S. Chepuri, C.J. Dowd, G. Michel, S. Zhang, and V. Zhang), submitted for publication, `arXiv:1912.01060`.

- *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**, no. 7, 1505–1535 (2020).

- *Restricted Symmetric Signed Permutations* (with J. Troyka), *Pure Math. Appl.*, **23** 179–217 (2012).

Papers in Preparation

- *Whittaker Functions and Lattice Model Bijections* (as a mentor in the Polymath Jr. program), in preparation.

Other Documents

- Finite Hecke Algebras and Their Characters, University of Minnesota Oral Exam Paper, 2019, http://www-users.math.umn.edu/~hardt040/OralExamPaper.pdf (44 pages)

- Combinatorial Species and Graph Enumeration (with P. McNeely, J. Troyka, and T. Phan), 2013, Carleton College Comprehensive Senior Project, arxiv.org:1312.0542 (39 pages)

INVITED TALKS

- Academia Sinica (December 2021, *upcoming*)

- *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

- *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

- 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

- 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

- Phi Beta Kappa, Carleton College, 2013

- Distinction on Comprehensive Senior Project, Carleton College, 2013

TEACHING

- 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)*

REU MENTORING

I was assistant mentor for the following project in the Polymath Jr. program in 2021:

- Gelfand-Tsetlin Polytopes (22 students)

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)

OUTREACH

- Panelist for session on Advocacy for Mathematics and Science Policy, Joint Mathematics Meetings, January 2022 *(upcoming)*

- Counsellor for the Minnesota Program in Mathematics (MPM), a program for underrepresented undergraduates in mathematics, Winter 2021

PROFESSIONAL SERVICE

- Paper reviewer, zbMATH, 2020-21

- Referee for Minnesota Journal of Undergraduate Mathematics, Spring 2021

- Session chair, Graduate Student Combinatorics Conference, Spring 2021

UNIVERSITY SERVICE

- 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 in the Directed Reading Program for Henry Twiss, who was awarded a Goldwater Scholarship during my time mentoring him, 2017-21

- Peer Mentor, UMN Mathematics, 2017-18

- I have written a total of 8 recommendation letters for students I have taught or mentored, ranging from summer internships to fellowships to undergraduate and graduate programs.

PROFESSIONAL DEVELOPMENT

- 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

- Assistant Swim Coach, University of St. Thomas, 2013-16

- Swimming Commentator, 2018-20

- Contributing Writer, SwimSwam.com, 2018-19

- Interim Co-President, UMN Triathlon Team, 2017

- ACT/SAT Tutor, 2015-18