

ZACHARY HAMAKER

CURRICULUM VITAE

ACADEMIC POSITIONS

- Assistant professor**
Department of Mathematics
University of FloridaAugust 2019 – present
- Postdoctoral assistant professor**
Department of Mathematics
University of MichiganSeptember 2016 – May 2019
(away Fall 2017)
- Postdoctoral fellow**
Institute for Mathematics and its Applications
University of MinnesotaAugust 2014-August 2016

EDUCATION

- Dartmouth College**
Advisor: Peter Winkler, Research Area: Algebraic combinatorics and discrete probability.
Ph.D., Mathematics.
M.A., Mathematics.Fall 2009-Spring 2014

June 2014
June 2011
- CSU East Bay**
M.S., Mathematics,Summer 2008-Spring 2009
June 2009
- Bard College**
B.A., MathematicsFall 2004-Spring 2008
June 2008

PUBLICATIONS AND PREPRINTS

(ordered by arXiv upload date, * indicates undergraduate coauthor, † graduate student coauthor at time of writing)

- 25. Dual Schubert polynomials via a Cauchy identity.**
<https://arxiv.org/abs/2311.18099>submitted
- 24. Lenart’s bijection via bumpless pipe dreams.**
With A. Gregory[†].
<https://arxiv.org/abs/2207.00523>
Electronic Journal of Combinatorics Volume 30, Issue 1 P1.24 pp. 1–182022
- 23. Characters of local and regular permutation statistics.**
With B. Rhoades.
<https://arxiv.org/abs/2206.06567>Submitted
- 22. Three coloring via triangle counting.**
With V. Vatter.
<https://arxiv.org/abs/2203.08136>
Australasian Journal of Combinatorics, to appearAccepted
- 21. Involutions under Bruhat order and labeled Motzkin Paths.**
With M. Coopman[†].
<https://arxiv.org/abs/2106.06021>
European Journal of Combinatorics, Volume 103, article 103513 pp. 1–72022

- 20. Bijecting hidden symmetries for skew staircase shapes.** 2023
 With A. Morales, I. Pak, L. Serrano and N. Williams.
<https://arxiv.org/abs/2103.09551>
 Algebraic Combinatorics, Volume 6, no. 4, pp. 1095-1118.
- 19. On pattern avoidance in matchings and involutions.** 2022
 With J. Fang* and J. Troyka.
<https://arxiv.org/pdf/2009.00079>
 Electronic Journal of Combinatorics (2022) Volume 29, Issue 1 P1.39 pp. 1–22
- 18. Gröbner geometry of Schubert polynomials through ice.** 2022
 With O. Pechenik and A. Weigandt.
<https://arxiv.org/pdf/2003.13719>
 Advances in Mathematics, Volume 398, article 108228
 Séminaire Lotharingien de Combinatoire 85B, FPSAC 2021 #5 pp. 1–12 (peer-reviewed extended abstract)
- 17. Involution pipe dreams.** 2022
 With E. Marberg and B. Pawlowski.
<https://arxiv.org/pdf/1911.12009>
 Canadian Journal of Mathematics, Volume 74, Issue 5 pp. 1310–1346
 Séminaire Lotharingien de Combinatoire 82B, FPSAC 2019 12 pp. (peer-reviewed extended abstract)
- 16. Wronskian Appell polynomials and symmetric functions.** 2019
 With N. Bonneux†, J. Stembridge and M. Stevens.
<https://arxiv.org/abs/1812.01864>
 Advances in Applied Mathematics, Volume 111, Article 101932, pp. 1–18
- 15. Derivatives of Schubert polynomials and proof of a conjecture of Stanley.** 2020
 With O. Pechenik, D. Speyer and A. Weigandt.
<https://arxiv.org/abs/1812.00321>
 Algebraic Combinatorics (2020) Volume 3, Issue 2 pp. 301–307
- 14. Pattern avoidance and quasisymmetric functions.** 2020
 With B. Pawlowski and B. Sagan.
<https://arxiv.org/abs/1810.11372>
 Algebraic Combinatorics (2020) Volume 3, Issue 2 pp. 365–388
- 13. Weak order and descents for monotone triangles.** 2020
 With V. Reiner.
<https://arxiv.org/abs/1809.10571>
 European Journal of Combinatorics (2020) Volume 86, article 103083, pp. 1–21.
- 12. Atoms for signed permutations.** 2021
 With E. Marberg.
<https://arxiv.org/abs/1802.09805>
 European Journal of Combinatorics (2021) Volume 94, article 103288, pp. 1–40.
- 11. Involution Schubert-Coxeter combinatorics (peer reviewed extended abstract).** 2017
 With E. Marberg and B. Pawlowski.
 Séminaire Lotharingien de Combinatoire 78B, FPSAC 2017, pp. 1–12.
 summarizes 4, 6, 8, 9 and 10
- 10. Fixed-point-free involutions and Schur P-positivity.** 2020
 With E. Marberg and B. Pawlowski.
<https://arxiv.org/abs/1706.06665>
 Journal of Combinatorics, Volume 11, No. 1, pp. 65–110
- 9. Schur P-positivity and involution Stanley symmetric functions.** 2019

With E. Marberg and B. Pawlowski.
<https://arxiv.org/abs/1701.02824>
 International Mathematics Research Notices Volume 2019, Issue 17, pp. 5389–5440

- 8. Transition formulas for involution Schubert polynomials.** 2018
- With E. Marberg and B. Pawlowski.
<https://arxiv.org/abs/1609.09625>
 Selecta Mathematica, Volume 24, Issue 4, pp. 2991–3025
- 7. Doppelgänger: bijections of plane partitions.** 2020
- With R. Patrias[†], O. Pechenik and N. Williams.
<https://arxiv.org/abs/1602.05535>
 International Mathematics Research Notices, Volume 2020, Issue 2 pp. 487–540
- 6. Involution words II: braid relations and atomic structures.** 2016
- With E. Marberg and B. Pawlowski.
<https://arxiv.org/abs/1601.02269>
 Journal of Algebraic Combinatorics, Volume 44 , Number 4 pp. 1–43.
- 5. Shifted Hecke insertion and the K -theory of $OG(n, 2n + 1)$.** 2017
- With A. Keilthy*, R. Patrias[†], L. Webster*, Y. Zhang* and S. Zhou*.
<https://arxiv.org/abs/1510.08972>
 Journal of Combinatorial Theory Series A, Volume 151, pp. 207–240
 Séminaire Lotharingien de Combinatoire 78B, FPSAC 2017, pp. 1–12 (peer reviewed extended abstract)
- 4. Involution words: counting problems and connections to Schubert calculus for symmetric orbit closures.** 2018
- With E. Marberg and B. Pawlowski.
<https://arxiv.org/abs/1508.01823>
 Journal of Combinatorial Theory Series A, Volume 160, pp. 217–260
- 3. Subwords and plane partitions (peer reviewed extended abstract).** 2015
- With N. Williams.
 DMTCS Proceedings, FPSAC 2015, pp. 241–252
- 2. Coxeter-Knuth graphs and a signed Little Map for the hyperoctahedral group.** 2014
- With S. Billey, A. Roberts[†] and B. Young.
<https://arxiv.org/abs/1405.4891>
 Electronic Journal of Combinatorics, Volume 21, Issue 4, P4.6 pp. 1–39
- 1. Relating Edelman-Greene insertion to the Little Map.** 2014
- With B. Young.
<https://arxiv.org/abs/1210.7119>
 Journal of Algebraic Combinatorics, Volume 40, Issue 3, pp 693-710.
 DMTCS Proceedings, FPSAC 2013, pp. 229-240 (peer-reviewed extended abstract)
- 0. Thesis: Bijective combinatorics of reduced decompositions.** 2014
- Defended May, 2014. Comprised primarily of 1 and 2.

HONORS AND AWARDS

Grants

NSF Grant DMS-2054423 \$299,810
 Simons Collaboration Grant \$42,000 (declined)
 AMS Travel Grant \$4000

June 2021 – May 2024
 September 2021 – August 2026
 July 2018 – December 2020

Funding at Dartmouth College

GAANN Fellowship
 Dartmouth College Graduate Fellowship

Sept. 2012 – 2013
 Fall 2009 – Summer 2012, Fall 2013-Spring 2014

STUDENTS SUPERVISED

Ph.D. Students

Adam Gregory	2021–present
Joshua Arroyo	2022–present
Michael Coopman	2022–present

TEACHING EXPERIENCE

Instructor, University of Florida.

MAD4204: Introduction to Combinatorics II	Spring 2023
MH3202: Sets and Logic	Spring 2023
MH3202: Sets and Logic	Fall 2022
MAD7397: Topics in Combinatorial Theory 2	Spring 2022
MH3202: Sets and Logic	Fall 2021
MAS4105: Linear Algebra 1	Fall 2021
MAD6207: Combinatorial Theory 2	Spring 2021
MAD6206: Combinatorial Theory 1	Fall 2020
MAS4105: Linear Algebra 1	Fall 2020
MAD4204: Introduction to Combinatorics II	Spring 2020
MAC2311: Analytic Geometry and Calculus 1	Fall 2019
MAD4203: Introduction to Combinatorics	Fall 2019

Instructor, University of Michigan.

Math 425: Introduction to Probability	Winter 2019
Math 416: Theory of Algorithms	Winter 2019
Math 217: Linear Algebra with proofs (two sections)	Fall 2018
Math 115: Calculus I (two sections)	Winter 2018
Math 217: Linear Algebra with proofs (two sections)	Winter 2017
Math 115: Calculus I (two sections)	Fall 2016

Instructor, University of Minnesota.

Math 4707: Introduction to Combinatorics and Graph Theory	Fall 2015
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Instructor, Dartmouth College.

Math 20: Discrete Probability	Spring 2014
Math 8: Calculus of Functions of One and Several Variables	Spring 2013
Math 20: Discrete Probability	Fall 2011

Teaching Assistant, Dartmouth College.

Math 10: Introduction to Statistics	Spring 2011
Math 8: Calculus of Functions of One and Several Variables	Fall 2010
Math 13: Calculus of Vector-Valued Functions	Winter 2010
Math 3: Introduction to Calculus	Fall 2009

Teaching Associate, CSU East Bay.

Math 802: Elementary Algebra B	Spring 2009
Math 950: Intermediate Algebra	Fall 2008

SELECTED RESEARCH PRESENTATIONS

CONFERENCE AND SEMINAR PRESENTATIONS

Shifted tableaux and Schubert Calculus

Schubert Conference Summer 2023 (50 min) 6/18/2023 University of Illinois, Champaign, IL

Fourier Analysis and the Symmetric Group

- Simple Words (50 min) 3/23/23 University of Florida, Gainesville, FL
- A derivative identity for Schubert polynomials**
 AMS Special Session on MacDonal Theory (25 min) 3/19/23 Georgia Tech, Atlanta, GA
- Functions of permutations via partial permutations**
 UF Combinatorics Seminar (50 min) 11/8/22 University of Florida, Gainesville, FL
- Virtual characters of permutation statistics**
 Algebraic and Enumerative Combinatorics Seminar (50 min) 6/9/22 University of Waterloo, Waterloo, ON
 Kennesaw State Combinatorics Seminar (50 min) 9/29/22 Kennesaw State University, Kennesaw, GA
 UF Combinatorics Seminar (50 min) 2/14/23 University of Florida, Gainesville, FL
- Symplectic bumpless pipe dreams**
 Combinatorics Seminar (50 min) 3/11/22 University of Michigan, Ann Arbor, MI
 Combinatorics Seminar (50 min) 11/22/21 Washington University, St. Louis, MO
- What is a... Schubert polynomial**
 Combinatorics Seminar (50 min) 11/3/20 University of Florida, Gainesville, FL
- (Almost) symmetries of sorting networks**
 AMS Special Session (25 min) 5/3/20 Cancelled
- Some techniques for shellability**
 Bubenik Research Meeting (50 min) 2/23/20 University of Florida, Gainesville, FL
 Topology and Dynamics Seminar (50 min) 2/17/20 University of Florida, Gainesville, FL
- Döppelgangers – an example of algebraic combinatorics in action**
 Graduate Mathematics Association Colloquium (50 min) 11/20/19 University of Florida, Gainesville, FL
- Pattern avoidance for matchings and for involutions under one roof**
 Special Session on Patterns in Permutations (25min) 11/2/19 AMS Sectional Meeting, Gainesville, FL
- Gröbner geometry of Schubert polynomials through ice**
 AMS Special Session (25 min) 5/3/20 Cancelled
 Algebra Seminar (50 min) 10/25/19 University of Florida, Gainesville, FL
- Involution pipe dreams**
 FPSAC Poster session 7/2/19 University of Ljubljana, Ljubljana, Slovenia
- Schubert polynomials and the strong Sperner property**
 Combinatorics Seminar (50 min) 10/29/19 University of Florida, Gainesville, FL
 6th Lake Michigan Workshop on Combinatorics and Graph Theory
 (25 min) 4/6/19 Western Michigan University, Kalamazoo, MI
- Schubert calculus, involutions and symmetric matrices**
 Combinatorics Seminar (50 min) 2/27/20 Michigan State University, East Lansing MI
 Math Colloquium (50 min) 1/15/19 Drexel University, Philadelphia, PA
 Department Colloquium (50 min) 1/7/19 University of Florida, Gainesville, FL
- Wronskian Appell polynomials and symmetric functions**
 Integrable Systems and Random Matrix Theory. 11/12/18 (50 min) University of Michigan, Ann Arbor, MI
- Coxeter combinatorics of involutions with applications to geometry**
 Minnesota Combinatorics Seminar. 3/30/18 (50 min) University of Minnesota, Minneapolis, MN
- K-triangulations, subwords and plane partitions**
 Michigan Combinatorics Seminar. 3/9/18 (50 min) University of Michigan, Ann Arbor, MI

Some thoughts on K -theory of the Lagrangian Grassmannian

Special Session on Cohomologies and Combinatorics 5/6/17 (25 min) AMS Sectional Meeting, New York, NY

Transition Equations for K -orbit closures

MIT Combinatorics Seminar 5/5/17 (60 min) Massachusetts Institute of Technology, Cambridge, MA

Involution words – a survey

CAGE Comb. and Alg. Geometry Seminar. 2/4/16 (60 min) University of Pennsylvania, Philadelphia, PA
 UW Combinatorics Seminar. 1/6/16 (60 min) University of Washington, Seattle, WA
 Michigan Combinatorics Seminar. 12/4/15 (50 min) University of Michigan, Ann Arbor, MI
 Michigan State Combinatorics Seminar. 12/1/15 (60 min) Michigan State University, East Lansing, MI
 UC Davis Combinatorics Seminar. 11/6/15 (60 min) UC Davis, Davis, CA
 Ohio State Combinatorics Seminar. 10/21/15 (60 min) The Ohio State University, Columbus, OH
 UIUC Combinatorics Seminar. 10/26/15 (60 min) University of Illinois Urbana-Champaign, Urbana, IL
 MIT Combinatorics Seminar. 10/2/15 (60 min) Massachusetts Institute of Technology, Cambridge, MA
 Dartmouth College Combinatorics Seminar. 10/1/15 (60 min) Dartmouth College, Hanover, NH.

Involution Sorting networks

University of Minnesota Combinatorics Seminar. 4/3/15 (60 min) University of Minnesota, Minneapolis, MN.

Subword complexes and plane partitions

University of Oregon Probability Seminar 1/15/15 (60 min) University of Oregon, Eugene, OR.

Little maps and insertion algorithms.

IMA Postdoc Seminar. 11/18/2014 (60 min) IMA, Minneapolis, MN.
 Special Session in Algebraic combinatorics. 9/21/14 (25 min) AMS Sectional Meeting, Eau Claire, WI.
 University of Washington Combinatorics Seminar. 1/29/14 (60 min) University of Washington, Seattle, WA.
 CAGE Comb. and Alg. Geometry Seminar. 11/26/13 (60 min) Drexel University, Philadelphia, PA.
 LaCIM Combinatorics Seminar. 10/18/2013 (60 min) LaCIM at UQAM, Montréal QC.

Relating Edelman-Greene insertion to the Little map.

FPSAC. 6/25/13 (30 min) Université Sorbonne Nouvelle, Paris, France.
 Graduate Student Combinatorics Conference. 4/21/13 (30 min) University of Minnesota, Minneapolis, MN.
 University of Michigan Combinatorics Seminar. 10/26/12 (50 min) University of Michigan, Ann Arbor, MI.
 Dartmouth Combinatorics Seminar. 10/18/12 (60 min) Dartmouth College, Hanover, NH.
 UVM Combinatorics Seminar. 10/10/12 (50 min) University of Vermont, Burlington, VT.

GENERAL AUDIENCE AND UNDERGRADUATE-LEVEL TALKS

Boolean functions and decision

Undergraduate Mathematics Society Seminar 2/6/23 (50 min) University of Florida, Gainesville, FL

Involution words – a survey

Encuentro Colombiano de Combinatoria. 6/9/18 (25 min) Universidad del Norte, Barranquilla, Colombia

Random Sorting Networks.

Bi-college Colloquium. November 25, 2013 Haverford College Haverford, PA.
 Bard College Mathematics Seminar. November 21, 2013 Bard College Annandale-on-Hudson, NY.

SERVICE AND OUTREACH

Editorial Work

2022-2023

FPSAC 2023, member Program Committee

Referee

Ongoing

Journal of Combinatorial Theory Series A, Algebraic Combinatorics, Journal of Algebraic Combinatorics, SIAM Journal of Discrete Mathematics, European Journal of Combinatorics, FPSAC, Electronic Journal of Combinatorics, Discrete Mathematics, Annals of Combinatorics, Journal of Combinatorics, Proceedings of the American Math Society, Journal of the American Mathematics Society, Ars Mathematica Contemporanea, Australasian Journal of Combinatorics, Selecta Mathematica, Journal of Algebra, International Mathematics Research Notices, Involve, Combinatorial Theory

Committee work	Ongoing
Advanced Undergraduate Curriculum Committee	2019–2023
Colloquium Committee	2019–2020
Graduate Admissions Committee	2020,2023
Hiring Committee	2021,2022
Co-organizer – Professional development seminar	September–Ongoing
Co-organized biweekly seminar on professional development for graduate students at University of Florida	
Organizer – University of Florida Combinatorics Seminar	September 2019–Ongoing
Organized weekly seminar	
Organizer – Special Session on Algebraic Combinatorics in the Southeast	November 2021
Organized special session at AMS Fall Southeastern Sectional Meeting	
Supervisor – undergraduate research project	May–July 2021
Collaborated with University of Florida undergraduate, supported by an NSF grant	
Supervisor – undergraduate research project	May–July 2020
Collaborated with University of Florida undergraduate, resulting in one publication (19.)	
Mentor – University of Michigan REU	May–July 2019
Mentored one student in research project on the Happy Ending conjecture	
Mentor, Geometry Lab	January–April 2019
Co-supervised three undergrads in research project on moduli space of origami folds at University of Michigan	
CR coordinator – Linear algebra	September–December 2018
Met weekly with several high school students enrolled in Math 217 at University of Michigan	
Organizer – Special Session on Combinatorics in Algebra and Geometry	October 2018
Organized special session at AMS Fall Central Sectional Meeting	
Mentor – University of Washington REU	June – July 2016
Mentored three undergraduate students, resulting in the preprint arxiv.org/abs/1710.10407	
Mentor – University of Minnesota REU	June – July 2015
Mentored four undergraduate students, resulting in one publication (6.) and another paper currently in preparation.	
Organizer – IMA Postdoc Seminar	September 2014–May 2015
Organized weekly seminar	
Exploring Mathematics	July–August 2011
Instructor for a math camp for local middle and high school students	
Other outreach	Ongoing

Faculty Advisor, Puppy Club at University of Florida
 Panelist advising graduate students on ‘The academic job process’ at University of Florida
 Volunteer at GROW conference for undergraduate women in mathematics
 Panelist advising graduate students on the ‘The academic job process’ at University of Michigan
 Instructor and volunteer at multiple math circles affiliated with University of Michigan
 Organizer and presenter for IMA outreach at the Minnesota State Fair
 Graduate Student Council department representative 2012-2013
 Volunteer assistant coach, Dartmouth Women’s Volleyball team 2011

PROFESSIONAL DEVELOPMENT

Workshop on Inquiry-Based Learning August 2018
 Participated in 12 hour workshop on inquiry-based learning run by the University of Michigan Mathematics Department.

IMA: Discrete Structures – Applications and Analysis September 2014-May 2015
 Member for annual program, including workshops on probabilistic and extremal combinatorics, additive and analytic combinatorics, geometric and enumerative combinatorics, convexity and optimization, the power of randomness in computation, information theory and concentration phenomena, analytic tools in probability

Visitor at University of Oregon January 2015
 Sponsored visit to the University of Oregon for a month to collaborate with faculty.

Communicating Science. Fall 2013
 One of fifteen students selected to participate in quarter-long course in affiliation with the Allen Alda Center for Communicating Science.

MSRI: Random Spatial Processes January-May, 2012
 Member for semester long program, including workshops on integrable systems, percolation and random walks in random environment

Dartmouth Mathematics Department Teaching Course. Summer 2011
 An intensive six week course designed to prepare mathematics graduate students to teach their own courses. Participants read and write about pedagogical theory and practice, design and teach two one-week mathematics camps for high school students, and teach two class meetings of a Dartmouth course.

Selected conferences and workshops attended.

31st FPSAC at University of Ljubljana, Ljubljana, Slovenia	July 2019
30th FPSAC at Dartmouth College, Hanover, NH	July 2018
Encuentro Colombiano de Combinatorica 2018 Barranquilla, Colombia	June 2018
Geometric and topological combinatorics: Modern techniques and methods at MSRI	October 2017
Introductory Workshop: Geometric and topological combinatorics at MSRI	September 2017
28th FPSAC at UBC, Vancouver, Canada	July 2016
27th FPSAC at KAIST, Daejeon, Korea	July 2015
Workshop on Dynamical Algebraic Combinatorics at AIM, San Jose, CA	March 2015
26th FPSAC at DePaul University, Chicago, IL	July 2014
9th Cornell Probability Summer School, Ithaca, NY	July 2013
Erdős Centennial at Hungarian Academy of Sciences, Budapest, Hungary	July 2013
25th FPSAC at Université Sorbonne Nouvelle, Paris, France	July 2013
8th Cornell Probability Summer School, Ithaca, NY	July 2012

REFERENCES

Available upon request.