

# Steven N. Karp

## Curriculum Vitae

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Pronouns: he, him, his

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### Research Interests

Combinatorics and its relations to algebra, geometry, topology, and physics.

### Education

- 2017 Ph.D., Mathematics, University of California, Berkeley  
Dissertation: *Total positivity for Grassmannians and amplituhedra*  
Advisor: Lauren K. Williams
- 2012 M.A.St. (with Distinction), Mathematics, University of Cambridge
- 2011 BMath, Combinatorics & Optimization and Pure Mathematics, University of Waterloo

### Employment

- 2023– Assistant Professor, University of Notre Dame
- 2022–2023 Visiting Assistant Professor, University of Notre Dame
- 2019–2022 Postdoctoral Fellow, LaCIM, Université du Québec à Montréal
- 2017–2021 Postdoctoral Assistant Professor, University of Michigan (on leave 2019–2021)

### Awards

- 2024–2026 AIM SQuaRE, “Around the Wronski Map”
- 2019–2021 NSERC Postdoctoral Fellowship
- 2017–2019 AMS–Simons Travel Grant
- 2017 Ribet–Goldberg Award in Algebra, University of California, Berkeley
- 2014 Chateaubriand Fellowship
- 2012–2015 NSERC Postgraduate Scholarship
- 2011–2012 Studentship in Mathematics, Trinity College, Cambridge
- 2011–2012 Julie Payette–NSERC Research Scholarship
- 2011 Valedictorian, Faculty of Mathematics, University of Waterloo
- 2011 Mike Vangoch Memorial Scholarship, University of Waterloo
- 2010 NSERC–CMS Math in Moscow Scholarship
- 2009, 2010 Honorable Mention, William Lowell Putnam Mathematical Competition
- 2008, 2009 NSERC Undergraduate Student Research Assistantship
- 2007–2011 R.G. Stanton National Scholarship, University of Waterloo
- 2007 Bronze Medal, International Mathematical Olympiad

## Publications and Preprints

15. (with Kevin Purbhoo) Universal Plücker coordinates for the Wronski map and positivity in real Schubert calculus.  
*arXiv:2309.04645*
14. (with Anthony M. Bloch) Symmetric Toda, gradient flows, and tridiagonalization.  
*Phys. D* 450 (2023), Paper No. 133766, 10 pp., in honor of Hermann Flaschka. *arXiv:2304.10697*
13. (with Hugh Thomas)  $q$ -Whittaker functions, finite fields, and Jordan forms.  
*arXiv:2207.12590*
12. (with Anthony M. Bloch) On two notions of total positivity for partial flag varieties.  
*Adv. Math.* 414 (2023), Paper No. 108855, 24 pp. *arXiv:2206.05806*
11. Wronskians, total positivity, and real Schubert calculus.  
*Selecta Math. (N.S.)* 30 (2024), no. 1, Paper No. 1, 28 pp. *arXiv:2110.02301*
10. (with Anthony M. Bloch) Gradient flows, adjoint orbits, and the topology of totally nonnegative flag varieties.  
*Comm. Math. Phys.* 398 (2023), no. 3, 1213–1289. *arXiv:2109.04558*
9. (with John Machacek) Shelling the  $m = 1$  amplituhedron.  
*Comb. Theory* 3 (2023), no. 1, Paper No. 6, 22 pp. *arXiv:2104.02786*
8. (with Pavel Galashin and Thomas Lam) Regularity theorem for totally nonnegative flag varieties.  
*J. Amer. Math. Soc.* 35 (2022), no. 2, 513–579. *arXiv:1904.00527*
7. Moment curves and cyclic symmetry for positive Grassmannians.  
*Bull. Lond. Math. Soc.* 51 (2019), no. 5, 900–916. *arXiv:1805.06004*
6. (with Pavel Galashin and Thomas Lam) The totally nonnegative part of  $G/P$  is a ball.  
*Adv. Math.* 351 (2019), 614–620. *arXiv:1801.08953*
5. (with Lauren K. Williams and Yan X Zhang) Decompositions of amplituhedra. Appendix written with Hugh Thomas.  
*Ann. Inst. Henri Poincaré D* 7 (2020), no. 3, 303–363. *arXiv:1708.09525*
4. (with Pavel Galashin and Thomas Lam) The totally nonnegative Grassmannian is a ball.  
*Adv. Math.* 397 (2022), Paper No. 108123, 23 pp. *arXiv:1707.02010*
3. (with Lauren K. Williams) The  $m = 1$  amplituhedron and cyclic hyperplane arrangements.  
*Int. Math. Res. Not. IMRN* (2019), no. 5, 1401–1462. *arXiv:1608.08288*
2. Sign variation, the Grassmannian, and total positivity.  
*J. Combin. Theory Ser. A* 145 (2017), 308–339. *arXiv:1503.05622*
1. (with R.P. Anstee) Forbidden Configurations: Exact bounds determined by critical substructures.  
*Electron. J. Combin.* 17 (2010), no. 1, Research Paper 50, 27 pp.

## Conference and Seminar Talks

- 2024 01/18 Colloquium, University of Minnesota
- 2023 11/29 Hamiltonian systems seminar, online
- 2023 09/18 Algebraic geometry seminar, Texas A&M University
- 2023 04/17 Combinatorics seminar, Washington University in St. Louis
- 2023 03/27 Discrete combinatorics, algebra, topology and statistics (CATS) seminar, University of Kentucky
- 2022 12/06 Colloquium, University of Notre Dame
- 2022 09/30 Combinatorics seminar, University of Michigan
- 2022 09/06 Algebraic geometry/commutative algebra seminar, University of Notre Dame
- 2022 04/27 Combinatorics seminar, University of Washington
- 2021 12/09 Scattering amplitudes, cluster algebras, and positive geometries mini-workshop, Mathematisches Forschungsinstitut Oberwolfach
- 2021 12/03 CMS Winter Meeting scientific session on combinatorics and geometry of moduli of curves, online
- 2021 11/09 Combinatorics, physics and probability seminar, Center of Mathematical Sciences and Applications
- 2021 10/25 Algebra and combinatorics seminar, North Carolina State University
- 2021 10/08 Séminaire de combinatoire, LaCIM, Université du Québec à Montréal
- 2021 09/22 Algebraic geometry seminar, Washington University in St. Louis
- 2021 05/20 Algebraic and enumerative combinatorics seminar, University of Waterloo
- 2021 04/08 The amplituhedron: algebra, combinatorics, and physics, online
- 2021 01/24 Combinatorial Algebra meets Algebraic Combinatorics (CAAC), online
- 2020 10/03 AMS Sectional special session on cluster algebras and plabic graphs, online
- 2020 07/22 Formal Power Series and Algebraic Combinatorics conference (FPSAC), online
- 2020 03/09 Applied algebra seminar, York University
- 2020 03/07 Algebra, Geometry and Combinatorics Day (ALGECOM), University of Illinois at Urbana–Champaign
- 2020 01/10 Séminaire de combinatoire, LaCIM, Université du Québec à Montréal
- 2019 03/28 Geometry, combinatorics, and integrable systems seminar, Ohio State University
- 2018 11/30 Combinatorics seminar, Massachusetts Institute of Technology and Microsoft Research
- 2018 11/29 Discrete math seminar, University of Massachusetts Amherst
- 2018 10/21 AMS Sectional special session on cluster algebra, Poisson geometry, and related topics, University of Michigan
- 2018 07/19 Formal Power Series and Algebraic Combinatorics conference (FPSAC), Dartmouth College
- 2018 05/10 Cluster Algebras and Mathematical Physics conference, Michigan State University
- 2017 10/27 Combinatorics seminar, University of Michigan

2017 09/29 Combinatorics seminar, University of Minnesota, Twin Cities  
 2017 09/28 Student combinatorics seminar, University of Minnesota, Twin Cities  
 2017 07/09 Formal Power Series and Algebraic Combinatorics conference (FPSAC), Queen Mary University of London  
 2017 03/30 Algebra-geometry-combinatorics seminar, University of Illinois at Urbana-Champaign  
 2016 12/01 Combinatorics seminar, University of California, Los Angeles  
 2016 10/17 Discrete geometry and combinatorics seminar, Cornell University  
 2016 08/29 Combinatorics seminar, University of California, Berkeley  
 2016 04/22 Discrete math seminar, Texas State University  
 2016 02/19 Combinatorics seminar, University of Michigan  
 2015 07/07 Formal Power Series and Algebraic Combinatorics conference (FPSAC), Korea Advanced Institute of Science and Technology  
 2015 03/11 Algebra-geometry-combinatorics seminar, San Francisco State University  
 2015 02/09 Combinatorics seminar, University of California, Berkeley  
 2014 11/20 Séminaire de combinatoire, LIAFA, Université Paris Diderot

### Conference Organization

2020 12/05–12/08 CMS Winter Meeting scientific session on enumerative combinatorics, online  
 2018 10/20–10/21 AMS Sectional special session on combinatorics in algebra and algebraic geometry, University of Michigan

### Seminar Organization

Fall 2016–Spring 2017 Combinatorics seminar, University of California, Berkeley  
 Spring 2014 Combinatorics student seminar, University of California, Berkeley  
 Spring 2013–Fall 2013 Many Cheerful Facts seminar, University of California, Berkeley

### Teaching

University of Notre Dame

Spring 2024 Basic discrete mathematics (Math 60610)  
 Fall 2023 Calculus III (Math 20550), 2 sections  
 Spring 2023 Basic combinatorics (Math 40210)  
 Spring 2023 Introduction to linear algebra and differential equations (Math 20580)  
 Fall 2022 Introduction to probability (Math 30530)

University of Michigan

Winter 2019 Linear algebra (Math 217)  
 Fall 2018 Linear algebra (Math 217), 2 sections  
 Winter 2018 Algebraic combinatorics (Math 566)

Fall 2017	Calculus I (Math 115), 2 sections
University of California, Berkeley (Graduate student instructor)	
Spring 2017	Calculus (Math 1B)
Spring 2016	Multivariable calculus (Math 53)
Fall 2015	Linear algebra (Math 110)
Fall 2013	Multivariable calculus (Math 53)
Spring 2013	Calculus (Math 1B)
Fall 2012	Calculus (Math 1A)

*Updated January 2024*