

# Steven N. Karp

## Curriculum Vitae

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Pronouns: he, him, his

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### Research Interests

Algebraic combinatorics, in particular total positivity, and connections with algebraic geometry, representation theory, topology, dynamical systems, and theoretical 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., Mathematics, University of Cambridge (with Distinction)
- 2011 BMath, Combinatorics and Optimization & Pure Mathematics, University of Waterloo  
(with Distinction, Dean's Honours List)

### Employment

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

### Awards and Grants

- 2024–2029 Simons Foundation Travel Support for Mathematicians
- 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, University of Waterloo Faculty of Mathematics
- 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

- 16. Steven N. Karp, Evgeny Mukhin, and Vitaly Tarasov  
Positivity and universal Plücker coordinates for spaces of quasi-exponentials  
[arXiv:2405.20229](#)
- 15. Steven N. Karp and Kevin Purbhoo  
Universal Plücker coordinates for the Wronski map and positivity in real Schubert calculus  
[arXiv:2309.04645](#)
- 14. Anthony M. Bloch and Steven N. Karp  
Symmetric Toda, gradient flows, and tridiagonalization  
*Phys. D* 450 (2023), Paper No. 133766, 10 pp., in honor of Hermann Flaschka  
[arXiv:2304.10697](#), DOI:10.1016/j.physd.2023.133766
- 13. Steven N. Karp and Hugh Thomas  
 $q$ -Whittaker functions, finite fields, and Jordan forms  
[arXiv:2207.12590](#)
- 12. Anthony M. Bloch and Steven N. Karp  
On two notions of total positivity for partial flag varieties  
*Adv. Math.* 414 (2023), Paper No. 108855, 24 pp.  
[arXiv:2206.05806](#), DOI:10.1016/j.aim.2022.108855
- 11. Steven N. Karp  
Wronskians, total positivity, and real Schubert calculus  
*Selecta Math. (N.S.)* 30 (2024), no. 1, Paper No. 1, 28 pp.  
[arXiv:2110.02301](#), DOI:10.1007/s00029-023-00888-1
- 10. Anthony M. Bloch and Steven N. Karp  
Gradient flows, adjoint orbits, and the topology of totally nonnegative flag varieties  
*Comm. Math. Phys.* 398 (2023), no. 3, 1213–1289  
[arXiv:2109.04558](#), DOI:10.1007/s00220-022-04540-5
- 9. Steven N. Karp and John Machacek  
Shelling the  $m = 1$  amplituhedron  
*Comb. Theory* 3 (2023), no. 1, Paper No. 6, 22 pp.  
[arXiv:2104.02786](#), DOI:10.5070/C63160419
- 8. Pavel Galashin, Steven N. Karp, and Thomas Lam  
Regularity theorem for totally nonnegative flag varieties  
*J. Amer. Math. Soc.* 35 (2022), no. 2, 513–579  
[arXiv:1904.00527](#), DOI:10.1090/jams/983
- 7. Steven N. Karp  
Moment curves and cyclic symmetry for positive Grassmannians  
*Bull. Lond. Math. Soc.* 51 (2019), no. 5, 900–916

- arXiv:1805.06004, DOI:10.1112/blms.12280
6. Pavel Galashin, Steven N. Karp, and Thomas Lam  
The totally nonnegative part of  $G/P$  is a ball  
*Adv. Math.* 351 (2019), 614–620  
arXiv:1801.08953, DOI:10.1016/j.aim.2019.05.009
  5. Steven N. Karp, Lauren K. Williams, and Yan X Zhang, with an appendix by the authors and Hugh Thomas  
Decompositions of amplituhedra  
*Ann. Inst. Henri Poincaré D* 7 (2020), no. 3, 303–363  
arXiv:1708.09525, DOI:10.4171/AIHPD/87
  4. Pavel Galashin, Steven N. Karp, and Thomas Lam  
The totally nonnegative Grassmannian is a ball  
*Adv. Math.* 397 (2022), Paper No. 108123, 23 pp.  
arXiv:1707.02010, DOI:10.1016/j.aim.2021.108123
  3. Steven N. Karp and Lauren K. Williams  
The  $m = 1$  amplituhedron and cyclic hyperplane arrangements  
*Int. Math. Res. Not. IMRN* (2019), no. 5, 1401–1462  
arXiv:1608.08288, DOI:10.1093/imrn/rnx140
  2. Steven N. Karp  
Sign variation, the Grassmannian, and total positivity  
*J. Combin. Theory Ser. A* 145 (2017), 308–339  
arXiv:1503.05622, DOI:10.1016/j.jcta.2016.08.003
  1. R. P. Anstee and S. N. Karp  
Forbidden configurations: exact bounds determined by critical substructures  
*Electron. J. Combin.* 17 (2010), no. 1, Research Paper 50, 27 pp.  
DOI:10.37236/322

### Conference and Seminar Talks

- 2024 07/22 Formal Power Series and Algebraic Combinatorics conference (FPSAC),  
Ruhr-Universität Bochum
- 2024 04/04 Combinatorics colloquium, University of Illinois Urbana–Champaign
- 2024 03/27 Richard P. Stanley seminar in combinatorics, Harvard University and  
Massachusetts Institute of Technology
- 2024 02/29 Geometry seminar, University of Texas at Austin
- 2024 02/06 Mathematical physics seminar, Purdue University
- 2024 01/26 Colloquium, Indiana University–Purdue University Indianapolis
- 2024 01/26 Representation theory seminar, Indiana University–Purdue University  
Indianapolis
- 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 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
- 2017 09/28 Student combinatorics seminar, University of Minnesota
- 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 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

### Workshop Participation

2023 07/24–07/28 Theory and applications of total positivity, American Institute of  
Mathematics  
2021 12/06–12/10 Scattering amplitudes, cluster algebras, and positive geometries,  
Mathematisches Forschungsinstitut Oberwolfach  
2019 10/14–11/05 Spacetime and quantum mechanics, total positivity and motives, Center  
of Mathematical Sciences and Applications

### 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

Fall 2024 Introduction to probability (Math 30530)  
Fall 2024 Introduction to operations research (Math 30210)  
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 August 2024*