

Steven N. Karp

Curriculum Vitae

Department of Mathematics
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Pronouns: he, him, his

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, Laboratoire de Combinatoire et d'Informatique Mathématique (LaCIM), Université du Québec à Montréal
- 2017–2021 Postdoctoral Assistant Professor, Department of Mathematics, University of Michigan (on leave 2019–2021)

Visiting Appointments

- Spring 2025 Member, School of Mathematics, Institute for Advanced Study
- Fall 2014 Visiting Ph.D. Student, Laboratoire d'Informatique Algorithmique: Fondements et Applications (LIAFA), Université Paris Diderot

Awards and Grants

- 2025–2028 NSF Standard Grant DMS-2452061, “Total Positivity: Combinatorics and Applications”
- 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

18. Steven N. Karp
Zero-free sector of the Wronski map on the totally nonnegative Grassmannian
[arXiv:2508.18478](#)
17. Steven N. Karp and Martha E. Precup
Richardson tableaux and components of Springer fibers equal to Richardson varieties
[arXiv:2506.20792](#)
16. Steven N. Karp, Evgeny Mukhin, and Vitaly Tarasov
Positivity and universal Plücker coordinates for spaces of quasi-exponentials
Int. Math. Res. Not. IMRN 2025, no. 15, Paper No. rnaf235, 20 pp.
[arXiv:2405.20229](#), DOI:10.1093/imrn/rnaf235
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
Selecta Math. (N.S.) 31 (2025), no. 4, Paper No. 77, 81 pp.
[arXiv:2207.12590](#), DOI:10.1007/s00029-025-01048-3
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

- 2025 05/20 Canadian Discrete and Algorithmic Mathematics conference (CanaDAM) mini-symposium on total positivity and applications, University of Ottawa
- 2025 05/01 Combinatorics, algebra, and geometry seminar, Drexel University and University of Pennsylvania
- 2025 04/24 Algebraic and geometric combinatorics seminar, Institute for Advanced Study
- 2025 04/14 Algebra seminar, Georgia Institute of Technology
- 2024 10/17 Combinatorics forum, University of California, Los Angeles
- 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

- 2025 06/29–07/04 The amplituhedron: structure, combinatorics, and positive geometry, SwissMAP Research Station
- 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

- 2025 05/20–05/23 Canadian Discrete and Algorithmic Mathematics conference (CanaDAM) invited mini-symposium on total positivity and applications, University of Ottawa
- 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 2025 Introduction to operations research (Math 30210)
- 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 2025