Steven N. Karp

Curriculum Vitae

Department of Mathematics
University of Notre Dame
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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

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
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
Selecta Math. (N.S.) (to appear)
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

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 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 June 2025