Antonio Auffinger

Northwestern University
Dept. of Mathematics
2033 Sheridan Road
Evanston, IL 60208-2730

Phone: (347) 6059567
Email: auffing@math.northwestern.edu
Homepage: http://math.northwestern.edu/ auffing/

Education

Ph.D. Mathematics, New York University - USA, 2011.

M.S. Mathematics, Impa - Brazil, 2006.

B.S. in Mathematics, Universidade Federal do Espirito Santo - Brazil, 2004.

Appointments

2026-present: Wayne and Elizabeth Jones Professor in Mathematics, Northwestern University

2025-present: Director, NSF-Simons National Institute for Theory and Mathematics in Biology (NITMB)

2021-2026: Professor, Northwestern University

2023-2024: Visiting Professor, John Hopkins University

2017-2023: Associate Professor, Northwestern University

2014-2017: Assistant Professor, Northwestern University

2011-2014: L.E. Dickson Instructor, Univ. of Chicago

Fields of Interest

Probability theory: Spin glasses, growth models, random matrices and dimension reduction methods.

Honors, Awards, & Fellowships

2023 Simons Fellow in Mathematics

NSF (DMS-2235451) and Simons Foundation (MPS-NITMB-00005320) award, NSF-Simons National Institute for Theory and Mathematics in Biology, Sep 2023 - Aug 2028, PI, (co-PI: Rosemary Braun, William Kath, Stephanie Palmer, Rebecca Willett), $50,000,000

2022 Fellow, American Mathematical Society

NSF Grant DMS-2154076: Jul 2022 - Jun 2026 - "Spin Glasses and Other Models of Disordered Media", $338,133

2019 Weinberg College Distinguished Teaching Award

NSF CAREER Grant DMS-1653552, Jul 2017-Jul 2022, "Complexity of Disordered Systems": $499,999.

NSF Grant DMS-1407554 Jul 2014- Jun 2017: 'Complexity of Disordered Systems', $ 144,078.

NSA Grant H98230-19-1-003: '41st Stochastic Processes and Applications 2019', $25,000.

Simons Foundation and NSF Grant DMS-1764421, Senior Personnel, July 2018- June 2023: 'Northwestern University Quantitative Biology Center', $2,750,000.00 (PI: Richard Carthew, Co-PI: Willam Kath)

NSF Grant DMS-1744209: "Midwest Probability Colloquium", $ 49,000 (Co-PI: Elton Hsu)

Gold award by ICCM, 2017 - "for the best paper in mathematics in the last five years".

Francisco Aranda-Ordaz Prize, sponsored by the Bernoulli Society, 2012.

Wilhelm T. Magnus Memorial Prize, 2011 - "for Significant Contributions to Mathematical Sciences".

McCracken Fellowship, New York University, 2007-2011.

Research

Preprints and Journal Publications

42. Antonio Auffinger, Ahmed El Alaoui, Mark Sellke, *On the Discontinuous Breaking of Replica Symmetry and Shattering in Mean-Field Spin Glasses*, arXiv:2506.02238, preprint.

41. Antonio Auffinger, Si Tang, *On the time constant of high dimensional first passage percolation, revisited*, Electronic Journal of Probability , Vol. 30, paper no. 21, 1-13, (2025).

40. Antonio Auffinger, Daniel Fletcher, *Equilibrium Distributions for t-distributed Stochastic Neighbour Embedding*, preprint, arXiv:2304.03727, preprint.

39. Antonio Auffinger, Yuxin Zhou, *The spherical p+s spin glass at zero temperature*, Volume 406, article number 314, (2025).

38. Antonio Auffinger, Qiang Zeng. *Complexity of Gaussian random fields with isotropic increments: critical points with given indices*, submitted, arXiv:2206.13834

37. Antonio Auffinger, Andrea Montanari, Eliran Subag, *Optimization of random high-dimensional functions: Structure and algorithms*, Book chapter, "Spin Glass Theory, Far Beyond - Replica Symmetry Breaking after 40 Years", World Scientific Publishing Company, 2023.

36. Antonio Auffinger, Qiang Zeng. *Complexity of high dimensional Gaussian random fields with isotropic increments*, Communications in Mathematical Physics 402(1):1-43, July (2023)

35. Antonio Auffinger, Christian Gorski *Asymptotic shapes for stationary first passage percolation on virtually nilpotent group*, Probab. Theory and Rel. Fields, Volume 186, Issue 1-2, June (2023).

34. Antonio Auffinger, Gérard Ben Arous, Zhehua Li, *Sharp complexity asymptotics and topological trivialization for the (p, k) spiked tensor model*, J. Math. Phys. 63, 043303 (2022) - special edition in honor of Freeman Dyson.

33. Antonio Auffinger, Julian Gold. *The number of saddles of the spherical p-spin model*, preprint, arXiv:2007.08113

32. Antonio Auffinger, Yuxin Zhou. *On properties of the spherical mixed vector p-spin model*, Stochastic Processes and their Applications Volume 146, April 2022, Pages 382-413.

31. Antonio Auffinger, Cathy Xi Chen. *Thouless-Anderson-Palmer equations for the Ghatak-Sherrington mean field spin glass model.*, tJournal of Statistical Physics volume 184, Article number: 22 (2021).

30. Antonio Auffinger, Antonio Lerario, Erik Lundberg. *Topologies of random geometric complexes on Riemannian manifolds in the thermodynamic limit*, IMRN, 10.1093/imrn/rnaa050 (2020).

29. Antonio Auffinger, Wei-Kuo Chen, Qiang Zeng. *The SK model is Full-Step Replica Symmetry Breaking at zero temperature*, Comm. Pure Appl. Math., 73: 921-943, (2020).

28. Antonio Auffinger, Aukosh Jagannath. *On spin distributions for generic p-spin models*, J. Stat. Phys, Volume 174, 316–332, (2019).

27. Antonio Auffinger, Qiang Zeng. *Existence of two-step replica symmetry breaking for the spherical mixed spin glass at zero temperature*, Comm. Math. Phys., Volume 370, Issue 1, pp 377–402, (2019).

26. Antonio Auffinger, Aukosh Jagannath. *Thouless-Anderson-Palmer equations for conditional Gibbs measures in the generic p-spin glass model*, Annals of Probability, Volume 47, Number 4, 2230–2256, (2019).

25. Antonio Auffinger, Dylan Cable. *Pemantle's min-plus binary tree*, to appear at Combinatorics, Probability and Computing (2022).

24. Antonio Auffinger, Wei-Kuo Chen. *On concentration properties of disordered Hamiltonians.* Proc. Amer. Math. Soc. 146, no. 4, 1807–1815, (2018).

23. Antonio Auffinger, Wei-Kuo Chen. *On the energy landscape of spherical spin glasses*, Advances in Mathematics 330, 553–588, (2018).

22. Antonio Auffinger, Wei-Kuo Chen. *Parisi formula for the ground state energy in the mixed p-spin model*, Annals of Probability. 45 , no. 6B, 4617–4631, (2017).

21. Antonio Auffinger, Michael Damron, Jack Hanson. *50 years of first passage percolation*. University Lecture Series, Volume: 68; 161 pp. (2017).

20. Antonio Auffinger, Wei-Kuo Chen. *A duality principle in spin glasses*, Electron. J. Probab., Vol 22, no. 61, 17 pp.m, (2017).

19. Antonio Auffinger. *Upper and lower bounds for stochastic processes.* Bull. Amer. Math. Soc. (N.S.) 53, no. 1, 173–177, (2016).

18. Antonio Auffinger, Si Tang. *On the time constant of high dimensional first passage percolation.* Elect. Journal of Probab. Vol. 21, no. 24. (2016).

17. Antonio Auffinger, Wei-Kuo Chen. *The Legendre structure of the Parisi formula.* Comm. in Math. Physics, Volume 348, Issue 3, pp 751–770, (2016).

16. Antonio Auffinger, Si Tang. *Extreme eigenvalues of sparse, heavy tailed random matrices.* Stoc. Proc. and Applications, Volume 126, Issue 11, Pages 3310–3330, (2016).

15. Antonio Auffinger, Wei-Kuo Chen. *Universality of chaos and ultrametricity in mixed p-spin glasses.*, Comm. on Pure and Applied Mathematics, Vol. LXIX, 2107–2130 (2016).

14. Antonio Auffinger, Michael Damron and Jack Hanson. *Rate of convergence of the mean for sub-additive ergodic sequences.* Adv. in Math. Volume 285, Pages 138–181, (2015).

13. Antonio Auffinger, Wei-Kuo Chen. *The Parisi formula has a unique minimizer.* Comm. in Math. Phys., Volume 335, Issue 3, pp 1429–1444, (2015).

12. Antonio Auffinger, Wei-Kuo Chen. *On properties of Parisi measures.* Probab. Theory and Rel. Fields, Vol. 161, Issue 3, pp 817-850, (2015).

11. Antonio Auffinger, Michael Damron and Jack Hanson. *Limiting geodesics for first-passage percolation on subsets of* $\mathbb{Z}^2$, Annals of Applied Probability Volume 25, 373–405, (2015).

10. Antonio Auffinger, Wei-Kuo Chen. *Complexity and free energy of bipartite mean field spin glasses,* Journal of Stat. Phys. 2014, Volume 157, Issue 1, pp 40-59, (2014).

9. Antonio Auffinger, Michael Damron. *A simplified proof of the relation between scaling exponents in first-passage percolation,* Annals of Probability, Vol. 42, No. 3, 1197-1211, (2014).

8. Antonio Auffinger, Michael Damron. *The universal scaling relation for polymers in a random environment and related models,* ALEA, Lat. Am. J. Probab. Math. Stat. 10 (2), 857-880 (2013).

7. Antonio Auffinger, Gerard Ben Arous. *Complexity of random smooth functions of many variables,* Annals of Probability, Vol. 41, No. 6, 4214-4247, (2013).

6. Antonio Auffinger, Michael Damron. *Differentiability at the edge of the limit shape and related results in first passage percolation,* Probab. Theory and Rel. Fields, Vol. 156, Issue 1-2, pp 193-227, (2013).

5. Antonio Auffinger, Gerard Ben Arous and Jiri Cerny. *Random matrices and complexity of spherical spin glasses,* Comm. on Pure and Applied Mathematics, Volume 66, Issue 2, pages 165-201, (2013).

4. Antonio Auffinger, Oren Louidor. *Directed polymers in random environment with heavy tails.* Comm. on Pure and Applied Mathematics, Volume 64, Issue 2, pages 183-204, (2011).

3. Antonio Auffinger, Gerard Ben Arous and Sandrine Peche. *Poisson convergence for the largest eigenvalues of Heavy Tailed Random Matrices*. Annales de l'Institut Henri Poincare Volume 45 no. 3 pg. 589-610 (2009).

2. Antonio Auffinger, Jinho Baik and Ivan Corwin Universality for directed polymer in thin rectangles, *arXiv1204.4445*

1. Antonio Auffinger, Random Matrices, Complexity of Spin Glasses and Heavy Tailed Processes *Ph.D. thesis, May 2011.*

Invited Talks and Minicourses

150+ invited talks from July 2010-present - complete list upon request.

Invited lecturer at the following Schools in 2022-2025:

XVIII Brazilian School of Probability - August 2025

Cornell Probability Summer School - August 2024

SLMath Summer School on Spin glasses - July 2024

Workshop on Spin Glasses in Les Diablerets, September 2022 - Les Diablerets, Switzerland

Mathematics meets physics on disordered systems, April 2022 - Cortona, Italy

Youth in High-dimensions: Machine Learning, High-dimensional Statistics and Inference for the New Generation, ICTP - Trieste, Italy

Mentorship

Post-doctoral fellows supervised

1. Zhehua Li (2019-2021), Julian Gold (2017-2021), Han Gan (2017-2019), Qiang Zeng (2015-2018), Tianmin Yu (2024-), Sofiia Dubova (2024-).

Ph.D. Students advised (years, initial placement)

Curtis Grant (2021–2026, U. Waterloo) – *joint with Reza Gheissari*

Yi Gu (2017–2025, Google DeepMind)

Yuxin Zhou (2018–2023, U. Chicago)

Daniel Fletcher (2018–2023, SIG)

Christian Gorski (2017–2023, U. Washington)

Pax Kivimae (2016–2022, Courant Institute, NYU) – *Recipient of NSF Postdoctoral Fellowship*

Cathy Chen (2016–2022, Northwestern University)

Si Tang (2013–2017, Duke University) – *joint with Steven Lalley*

Undergraduate Senior Theses

Ethan Dlugie (2018)

Editorial Service

Grant proposal reviewer for NSF, NSA, the Simons Foundation, Swiss National Science Foundation, Israel Science Foundation, among others.

Associate editor for Annals of Probability, 2024-

Associate editor for Journal of Statistical Physics, 2023-

Associate editor for Bulletin of the American Mathematical Society, 2024-

Associate editor for ALEA, Revista Latino-Americana de Probabilidade e Estatistica, 2021-2024

Peer refereed:

ACTA, Annals of Applied Probability, Annals of Mathematics, Annals of Probability, Communication in Mathematical Physics, Comm. in Pure and Applied Mathematics, Duke Mathematical Journal, Electronic Communications in Probability, Electronic Journal of Probability, Journal of Statistical Physics, Probability Theory and Related Fields, SPA, Statistics and Probability Letters, among others.

Reviewed articles for Mathscinet

Academic Service

Northwestern University, Evanston, USA

Colloquium committee (2014/2015), Boas hiring committee (2015/16, 2016/17 - chair), Lectureship hiring committee (2016/17 - chair), Budget committee (2016/17, 2017/18), Emphasis year committee (2015/16), Undergraduate prize award committee (2016/17), Bellow/Pinsky lecture committee (2016/17 - chair), Graduate admission committee (2017/18, 2018/19, 2019/20), Leadership council, NSF-Simons center for Quantitive Biology (2019-2023) Director of graduate studies (2018-2021), Chair of Personnel Committee (2021/22), Colloquium Committee (2022/23)

Department Chair (Fall 2024-)

Promotion Committee (2023 - 2026), Weinberg College of Arts and Sciences.

Executive Committee (2022 -), IDEAL Institute.

Associate Director of Convening Activities (2023 - 2025), NSF-Simons National Institute for Theory and Mathematics in Biology.

Director, (2025 -), NSF-Simons National Institute for Theory and Mathematics in Biology.