Yufei Zhao

http://yufeizhao.com
yufeiz@mit.edu
MIT Department of Mathematics
77 Massachusetts Ave, Room 2-271
Cambridge, MA 02139, USA

Department of Mathematics, Massachusetts Institute of Technology — Cambridge, MA
Class of 1956 Career Development Assistant Professor — 2018—
Assistant Professor — 2017—

Previous and Visiting Academic Positions

Department of Mathematics, Stanford University — Stanford, CA
Visiting Assistant Professor — Spring 2020

Simons Institute for the Theory of Computing, UC Berkeley — Berkeley, CA
Simons-Berkeley Research Fellow — Spring 2017

New College, University of Oxford — Oxford, UK
Esmée Fairbairn Junior Research Fellow in Mathematics — 2015—2017

Education

Massachusetts Institute of Technology — Cambridge, MA
Ph.D. Mathematics. Advisor: Jacob Fox — 2011—2015

University of Cambridge — Cambridge, UK
M.A.St. Mathematics with Distinction — 2010—2011

Massachusetts Institute of Technology — Cambridge, MA
S.B. Mathematics, with minor in Economics — 2006—2010
S.B. Computer Science and Engineering

Selected Awards and Honors

MIT UROP Outstanding Mentor Award for Faculty, 2020

MIT First Year Advisor Award—Innovative Seminar, 2019

Sloan Research Fellowship, 2019

MIT Future of Science award, 2018

SIAM Dénes König Prize, 2018

Johnson Prize, MIT Mathematics Department, 2015

Microsoft Research PhD Fellowship, 2013–2015

Morgan Prize Honorable Mention, 2011

Gates Cambridge Scholarship, 2010–2011

MIT Jon A. Bucsela Prize in Mathematics, 2010

Putnam Math Competition: Three-time Putnam Fellow (top five rank) 2006, 2008, 2009; 7th Place 2007

International Mathematical Olympiad: Gold Medal 2005, Silver Medal 2006, Bronze Medal 2004

Research Interests

Extremal/probabilistic/additive combinatorics; discrete geometry; graph theory and graph limits

Grants

Sloan Research Fellowship	2019—2021
MIT Solomon Buchsbaum Research Fund	2018—
NSF award DMS-1764176	2018—2021
NSF award DMS-1362326	2017—2018

Research Internships

Microsoft Research New England — Cambridge, MA
Mentor: Henry Cohn — Summers 2010, 2011, 2013, 2014

Microsoft Research Theory Group — Redmond, WA
Mentor: Eyal Lubetzky — Summer 2012

Papers

53. Jonathan Tidor, Hung-Hsun Hans Yu, and Yufei Zhao
Joints of varieties, arXiv:2008.01610
52. Matthew Kwan, Lisa Sauermann, and Yufei Zhao,
Extension complexity of low-dimensional polytopes, arXiv:2006.08836
51. Zilin Jiang, Jonathan Tidor, Yuan Yao, Shengtong Zhang, and Yufei Zhao,
Spherical two-distance sets and eigenvalues of signed graphs, arXiv:2006.06633
50. Ashwin Sah, Mehtaab Sawhney, and Yufei Zhao,
Cayley graphs without a bounded eigenbasis, *Int. Math. Res. Not. IMRN*, to appear. arXiv:2005.04502
49. Jacob Fox, Yuval Wigderson, and Yufei Zhao,
A short proof of the canonical polynomial van der Waerden theorem,
C. R. Math. Acad. Sci. Paris, to appear. arXiv:2005.04135
48. Jacob Fox, Huy Tuan Pham, and Yufei Zhao,
Tower-type bounds for Roth's theorem with popular differences, arXiv:2004.13690
47. David Conlon, Jacob Fox, Benny Sudakov, and Yufei Zhao,
The regularity method for graphs with few 4-cycles, arXiv:2004.10180
46. Ashwin Sah, Mehtaab Sawhney, and Yufei Zhao,
Patterns without a popular difference, arXiv:2004.07722
45. Ashwin Sah, Mehtaab Sawhney, Jonathan Tidor, and Yufei Zhao,
A counterexample to the Bollobás-Riordan conjectures on sparse graph limits, arXiv:2003.05272
44. Hung-Hsun Hans Yu and Yufei Zhao,
Joints tightened, arXiv:1911.08605
43. Jonathan Tidor and Yufei Zhao,
Testing linear-invariant properties,
FOCS 2020, accepted. arXiv:1911.06793
42. Jacob Fox, Jonathan Tidor, and Yufei Zhao,
Induced arithmetic removal: complexity 1 patterns over finite fields, arXiv:1911.03427

41. Jacob Fox, Huy Tuan Pham, and Yufei Zhao,
Common and Sidorenko linear equations,
Q. J. Math., to appear. arXiv:1910.06436
40. Yang Liu and Yufei Zhao,
On the upper tail problem for random hypergraphs,
Random Structures Algorithms, to appear. arXiv:1910.02916
39. Zilin Jiang, Jonathan Tidor, Yuan Yao, Shengtong Zhang, and Yufei Zhao,
Equiangular lines with a fixed angle, arXiv:1907.12466
38. Yufei Zhao and Yunkun Zhou,
Impartial digraphs,
Combinatorica, to appear. arXiv:1906.10482
37. Ashwin Sah, Mehtaab Sawhney, David Stoner, and Yufei Zhao,
Exponential improvements for superball packing upper bounds,
Adv. Math. 365 (2020), 107056. arXiv:1904.11462
36. Jacob Fox, Ashwin Sah, Mehtaab Sawhney, David Stoner, and Yufei Zhao,
Triforce and corners,
Math. Proc. Cambridge Philos. Soc. 169 (2020), 209–223. arXiv:1903.04863
35. Ashwin Sah, Mehtaab Sawhney, David Stoner, and Yufei Zhao,
A reverse Sidorenko inequality,
Invent. Math. 221 (2020), 665–711. arXiv:1809.09462
34. David Conlon, Jonathan Tidor, and Yufei Zhao,
Hypergraph expanders of all uniformities from Cayley graphs,
Proc. Lond. Math. Soc. 121 (2020), 1311–1336. arXiv:1809.06342
33. Asaf Ferber, Vishesh Jain, and Yufei Zhao,
On the number of Hadamard matrices via anti-concentration, arXiv:1808.07222
32. Ashwin Sah, Mehtaab Sawhney, David Stoner, and Yufei Zhao,
The number of independent sets in an irregular graph,
J. Combin. Theory Ser. B 138 (2019), 172–195. arXiv:1805.04021.
31. Jacob Fox, László Miklós Lovász, and Yufei Zhao,
A fast new algorithm for weak graph regularity,
Combin. Probab. Comput. 28 (2019), 777–790. arXiv:1801.05037
30. Noga Alon, Jacob Fox, and Yufei Zhao,
Efficient arithmetic regularity and removal lemmas for induced bipartite patterns,
Discrete Anal. 2019:3, 14 pp. arXiv:1801.04675
29. Yufei Zhao, Group representations that resist worst-case sampling. arXiv:1705.04675
28. Yufei Zhao, Extremal regular graphs: independent sets and graph homomorphisms,
Amer. Math. Monthly 124 (2017), 827–843. arXiv:1610.09210
27. Bhaswar B. Bhattacharya, Shirshendu Ganguly, Xuancheng Shao, and Yufei Zhao,
Upper tails for arithmetic progressions in a random set,
Int. Math. Res. Not. IMRN 2020, 167–213. arXiv:1605.02994
26. Jacob Fox, László Miklós Lovász, and Yufei Zhao,
On regularity lemmas and their algorithmic applications,
Combin. Probab. Comput. 26 (2017), 481–505. arXiv:1604.00733

25. David Conlon and Yufei Zhao,
Quasirandom Cayley graphs,
Discrete Anal. 2017:6, 14 pp. arXiv:1603.03025
24. Bhaswar B. Bhattacharya, Shirshendu Ganguly, Eyal Lubetzky, and Yufei Zhao,
Upper tails and independence polynomials in random graphs,
Adv. Math. 319 (2017), 313–347. arXiv:1507.04074
23. László Miklós Lovász and Yufei Zhao,
On derivatives of graphon parameters,
J. Combin. Theory Ser. A 145 (2017), 364–368. arXiv:1505.07448
22. Yufei Zhao, On the lower tail variational problem for random graphs,
Combin. Probab. Comput. 26 (2017), 301–320. arXiv:1502.00867
21. Christian Borgs, Jennifer T. Chayes, Henry Cohn, and Yufei Zhao,
An L^p theory of sparse graph convergence II: LD convergence, quotients, and right convergence,
Ann. Probab. 46 (2018), 337–396. arXiv:1408.0744
20. David Conlon, Jacob Fox, and Yufei Zhao,
The Green-Tao theorem: an exposition,
EMS Surv. Math. Sci. 1 (2014), 249–282. arXiv:1403.2957
19. Eyal Lubetzky and Yufei Zhao,
On the variational problem for upper tails in sparse random graphs,
Random Structures Algorithms 50 (2017), 420–436. arXiv:1402.6011
18. Christian Borgs, Jennifer T. Chayes, Henry Cohn, and Yufei Zhao,
An L^p theory of sparse graph convergence I: limits, sparse random graph models, and power law distributions,
Trans. Amer. Math. Soc. 372 (2019), 3019–3062. arXiv:1401.2906
17. Yufei Zhao, An arithmetic transference proof of a relative Szemerédi theorem,
Math. Proc. Cambridge Philos. Soc. 156 (2014), 255–261. arXiv:1307.4959
16. Jacob Fox and Yufei Zhao,
A short proof of the multidimensional Szemerédi theorem in the primes,
Amer. J. Math. 137 (2015), 1139–1145. arXiv:1307.4679
15. David Conlon, Jacob Fox, and Yufei Zhao,
A relative Szemerédi theorem,
Geom. Funct. Anal. 25 (2015), 733–762. arXiv:1305.5440
14. Yufei Zhao, Hypergraph limits: a regularity approach,
Random Structures Algorithms 47 (2015), 205–226. arXiv:1302.1634
13. Henry Cohn and Yufei Zhao,
Sphere packing bounds via spherical codes,
Duke Math. J. 163 (2014), 1965–2002. arXiv:1212.5966
12. Henry Cohn and Yufei Zhao,
Universally optimal error-correcting codes,
IEEE Trans. Inform. Theory 60 (2014), 7442–7450. arXiv:1212.1913
11. Eyal Lubetzky and Yufei Zhao,
On replica symmetry of large deviations in random graphs,
Random Structures Algorithms 47 (2015) 109–146. arXiv:1210.7013

10. Jacob Fox, Po-Shen Loh, and Yufei Zhao,
The critical window for the classical Ramsey-Turán problem,
Combinatorica 35 (2015) 435–476. arXiv:1208.3276
9. David Conlon, Jacob Fox, and Yufei Zhao,
Extremal results in sparse pseudorandom graphs,
Adv. Math. 256 (2014), 206–290. arXiv:1204.6645
8. Yufei Zhao, The bipartite swapping trick on graph homomorphisms,
SIAM J. Discrete Math. 25 (2011), 660–680. arXiv:1104.3704
7. Yufei Zhao, Sets characterized by the number of missing sums and differences,
J. Number Theory 11 (2011), 2107–2134. arXiv:0911.2292
6. David Galvin and Yufei Zhao,
The number of independent sets in graphs with small maximum degree,
Graphs Combin. 27 (2011), 177–186. arXiv:1007.4803
5. Yufei Zhao, Counting MSTD sets in finite abelian groups,
J. Number Theory 130 (2010), 2308–2322. arXiv:0911.2288
4. Yufei Zhao, Constructing numerical semigroups of a given genus,
Semigroup Forum 80 (2010), 242–254. arXiv:0910.2075
3. Yufei Zhao, Constructing MSTD sets using bidirectonal ballot sequences,
J. Number Theory 130 (2010), 1212–1220. arXiv:0908.4442
2. Yufei Zhao, The number of independent sets in a regular graph,
Combin. Probab. Comput. 19 (2010), 315–320. arXiv:0909.3354
1. Yufei Zhao, The coefficients of a truncated Fibonacci power series,
Fibonacci Quart. 46/47 (2009), 53–55.

Invited Talks

2021	Canadian Discrete and Algorithmic Math Conference (CanaDAM): Plenary Lecture	Online
	Joint Math Meetings MAA Invited Paper Session "Coding Theory and Geometry"	Online
2020	Warwick Centre for Discrete Mathematics and its Applications seminar	Online
	Virtual Harmonic Analysis Seminar	Online
	University of Wisconsin Number Theory / Representation Theory Seminar	Online
	Princeton Discrete Mathematics Seminar	Online
	Big Seminar by Laboratory of Combinatorial and Geometric Structures	Online
	SCMS Combinatorics Seminar	Online
	Webinar in Additive Combinatorics	Online
	Stanford Online Combinatorics Seminar	Online
	Stanford Math Department Colloquium	Stanford, CA
	Oberwolfach workshop: Combinatorics	Oberwolfach, Germany
2019	Shanghai Center for Mathematical Sciences (Fudan) Discrete Math. Seminar	Shanghai, China
	Conference on Graph Theory and its Applications: A Tribute to Professor Fan Chung	Sanya, China
	Atlanta Lectures Series in Combinatorics and Graph Theory at Emory	Atlanta, GA

	Princeton Discrete Mathematics Seminar	Princeton, NJ
	Banff workshop: Probabilistic and Extremal Combinatorics	Banff, AB
	ETH Zurich Theory of Combinatorial Algorithms Mittagsseminar	Zürich, Switzerland
	Oberwolfach workshop: Combinatorics, Probability and Computing	Oberwolfach, Germany
	Rutgers Discrete Math Seminar	Piscataway, NJ
	Yale Combinatorics Seminar	New Haven, CT
	Stanford Combinatorics Seminar	Stanford, CA
2018	Clay Math Institute workshop: Recent Advances in Extremal Combinatorics	Oxford, UK
	ICM satellite workshop — Combinatorics: Extremal, Probabilistic and Additive	São Paulo, Brazil
	Simons Institute workshop: Pseudorandomness Reunion	Berkeley, CA
	MIT Workshop on Local Algorithms (WOLA 2018)	Cambridge, MA
	MIT workshop on Sublinear Algorithms: bootcamp tutorial	Cambridge, MA
	SIAM Conference on Discrete Mathematics: minisymposium	Denver, CO
	SIAM Conference on Discrete Mathematics: Dénes König Prize Lecture	Denver, CO
	Georgia Tech workshop: Algorithms and Randomness	Atlanta, GA
	Northeastern U. Network Science Institute Talk	Boston, MA
	AMS Sectional Meeting at Northeastern University	Boston, MA
	Rutgers Discrete Math Seminar	Piscataway, NJ
	Tsinghua YMSC minicourse	Beijing, China
	CMU ACO Seminar	Pittsburgh, PA
	Harvard CMSA workshop: Probabilistic and Extremal Combinatorics	Cambridge, MA
	UCLA Combinatorics Seminar	Los Angeles, CA
2017	Harvard CMSA workshop: Additive Combinatorics	Cambridge, MA
	Birmingham workshop: Interactions with Combinatorics	Birmingham, UK
	BGSMath workshop: Random Discrete Structures and Beyond	Barcelona, Spain
	SFSU: ACG Seminar	San Francisco, CA
	Stanford Math Department Colloquium	Stanford, CA
	Simons Institute workshop: Structure and Randomness	Berkeley, CA
	MIT Combinatorics Seminar	Cambridge, MA
	UC Berkeley Combinatorics Seminar	Berkeley, CA
	Simons Institute workshop: Pseudorandomness Boot Camp	Berkeley, CA
	Stanford Combinatorics Seminar	Stanford, CA
	Oberwolfach workshop: Combinatorics	Oberwolfach, Germany
2016	Turing Institute workshop: Large-scale structures in random graphs	London, UK
	Birmingham Combinatorics Seminar	Birmingham, UK
	IHÉS Seminar	Bures-sur-Yvette, France

	Warwick DIMAP Seminar	Coventry, UK
	LSE/Queen Mary Colloquia in Combinatorics	London, UK
	Oberwolfach workshop: Combinatorics, Probability and Computing	Oberwolfach, Germany
	Simons Symposium: Analysis of Boolean Functions	Krün, Germany
	British Mathematical Colloquium: Combinatorics Workshop	Bristol, UK
	Oxford Mathematical Institute North meets South Colloquium	Oxford, UK
	AMS-MAA Joint Mtgs: AMS Spec. Session on Pseudorandomness and Its Applications	Seattle, WA
2015	London School of Economics Discrete Mathematics and Game Theory Seminar	London, UK
	Queen Mary Combinatorics Seminar	London, UK
	Warwick Combinatorics Seminar	Coventry, UK
	Oxford Combinatorial Theory Seminar	Oxford, UK
	Northeastern U. workshop: Random Graphs, Simplicial Complexes, and their Appl'ns	Boston, MA
	U. of Chicago Combinatorics and Theoretical Computer Science Seminar	Chicago, IL
	Rutgers Discrete Math Seminar	Piscataway, NJ
	ICERM workshop: Crystals, Quasicrystals and Random Networks	Providence, RI
2014	Atlanta Lectures Series in Combinatorics and Graph Theory at Emory	Atlanta, GA
	GSU Colloquium	Atlanta, GA
	CRM workshop: New Topics in Additive Combinatorics	Montreal, QC
	IMA workshop: Additive and Analytic Combinatorics	Minneapolis, MN
	Clay Math Institute workshop: Extremal and Probabilistic Combinatorics	Oxford, UK
	Georgia Tech Combinatorics Seminar	Atlanta, GA
	IAS Computer Science/Discrete Mathematics Seminar	Princeton, NJ
	Oxford Combinatorial Theory Seminar	Oxford, UK
	London School of Economics Discrete Mathematics and Game Theory Seminar	London, UK
	Eurandom: Minicourse on Graph Limits (6-hour minicourse co-taught with Christian Borgs)	Eindhoven, Netherlands
	Oberwolfach workshop: Combinatorics	Oberwolfach, Germany
2013	Simons Institute workshop: Neo-Classical Methods in Discrete Analysis	Berkeley, CA
	Rutgers Discrete Math Seminar	Piscataway, NJ
	MIT Combinatorics Seminar	Cambridge, MA
	Yale Combinatorics and Probability Seminar	New Haven, CT
	Microsoft Research Theory Reading Group	Cambridge, MA
	Oberwolfach workshop: Combinatorics and Probability	Oberwolfach, Germany
2012	MIT Combinatorics Seminar	Cambridge, MA
	SIAM Conference on Discrete Mathematics	Halifax, NS
2009	MIT Combinatorics Seminar	Cambridge, MA

Teaching

Graph Theory and Additive Combinatorics (graduate, MIT)

Term	Enrollment (credit + listener)	Instructor evaluation (max 7)
Fall 2019	30 + 14	6.9
Fall 2017	31 + 17	7.0

Probabilistic Method in Combinatorics (graduate, MIT)

Spring 2019	47 + 25	6.9

Combinatorial Analysis (undergraduate, MIT)

Fall 2018	22 + 7	6.8

Additional teaching:

Mathematical Problem Solving (Putnam Seminar), MIT undergraduate seminar, every Fall starting 2017

Polynomial Method in Combinatorics, graduate-level, Oxford, 2016

Undergraduate tutorials in geometry, Oxford, 2016

Advising

Current PhD students:

Aaron Berger
Benjamin Gunby
Jonathan Tidor

Undergraduate research supervised:

Yang Liu (2018)
Ryan Alweiss (2018)
Yunkun Zhou (2018–2019)
Mehtaab Sawhney (2018–)
Ashwin Sah (2018–)
David Stoner (2018–2019)
Yuan Yao (2019–)
Shengtong Zhang (2019–)
Hung-Hsun Yu (2019–)
Mihir Singhal (2019–)
Zachary Chroman (2019–)

Service

Co-organizer of MIT Combinatorics Seminar, Fall 2017—current

Organizer of the MIT team for the Putnam Competition, Fall 2017—current

AMS–Simons Travel Grants Committee Member, 2021—2024

Other Experiences and Activities

Organizer and Chief Coordinator of Cyberspace Mathematical Competition (CMC) 2020
Quantitative Research Intern, D. E. Shaw & Co., New York
MIT Lusztig PRIMES Mentor
Research Experience for Undergraduates at Duluth participant (mentor: Joe Gallian)
Deputy Leader for Canadian IMO Team
Instructor at Canadian IMO Training Camps
Mentor at AwesomeMath Summer Program, Dallas
Trainer at US Math Olympiad Summer Program, Lincoln, Nebraska
Teacher at Spirit of Math Schools, Toronto