Yufei Zhao

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MIT Department of Mathematics
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Current Position

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

Previous Positions

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

Research Interests

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

Selected Awards and Honors

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

Grants

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

39. Z. Jiang, J. Tidor, Y. Yao, S. Zhang, and Y. Zhao,
Equiangular lines with a fixed angle, arXiv:1907.12466
38. Y. Zhao and Y. Zhou, Impartial digraphs, arXiv:1906.10482
37. A. Sah, M. Sawhney, D. Stoner, and Y. Zhao,
Exponential improvements for superball packing upper bounds, arXiv:1904.11462
36. J. Fox, A. Sah, M. Sawhney, D. Stoner, and Y. Zhao,
Triforce and corners,
Math. Proc. Cambridge Philos. Soc., to appear. arXiv:1903.04863
35. A. Sah, M. Sawhney, D. Stoner, and Y. Zhao,
A reverse Sidorenko inequality, arXiv:1809.09462
34. D. Conlon, J. Tidor, and Y. Zhao,
Hypergraph expanders of all uniformities from Cayley graphs, arXiv:1809.06342
33. A. Ferber, V. Jain, and Y. Zhao,
On the number of Hadamard matrices via anti-concentration, arXiv:1808.07222
32. A. Sah, M. Sawhney, D. Stoner, and Y. Zhao,
The number of independent sets in an irregular graph,
J. Combin. Theory Ser. B 138 (2019), 172–195. arXiv:1805.04021.
31. J. Fox, L. M. Lovász, and Y. Zhao,
A fast new algorithm for weak graph regularity,
Combin. Probab. Comput. 28 (2019), 777–790. arXiv:1801.05037
30. N. Alon, J. Fox, and Y. Zhao,
Efficient arithmetic regularity and removal lemmas for induced bipartite patterns,
Discrete Anal. 2019:3, 14 pp. arXiv:1801.04675
29. Y. Zhao, Group representations that resist worst-case sampling. arXiv:1705.04675
28. Y. Zhao, Extremal regular graphs: independent sets and graph homomorphisms,
Amer. Math. Monthly 124 (2017), 827–843. arXiv:1610.09210
27. B. B. Bhattacharya, S. Ganguly, X. Shao, and Y. Zhao,
Upper tails for arithmetic progressions in a random set,
Int. Math. Res. Not. IMRN, to appear. arXiv:1605.02994

26. J. Fox, L. M. Lovász, and Y. Zhao,
On regularity lemmas and their algorithmic applications,
Combin. Probab. Comput. 26 (2017), 481–505. arXiv:1604.00733

25. D. Conlon and Y. Zhao,
Quasirandom Cayley graphs,
Discrete Anal. 2017:6, 14 pp. arXiv:1603.03025

24. B. B. Bhattacharya, S. Ganguly, E. Lubetzky, and Y. Zhao,
Upper tails and independence polynomials in random graphs,
Adv. Math. 319 (2017), 313–347. arXiv:1507.04074

23. L. M. Lovász and Y. Zhao,
On derivatives of graphon parameters,
J. Combin. Theory Ser. A 145 (2017), 364–368. arXiv:1505.07448

22. Y. Zhao, On the lower tail variational problem for random graphs,
Combin. Probab. Comput. 26 (2017), 301–320. arXiv:1502.00867

21. C. Borgs, J. T. Chayes, H. Cohn, and Y. 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. D. Conlon, J. Fox, and Y. Zhao,
The Green-Tao theorem: an exposition,
EMS Surv. Math. Sci. 1 (2014), 249–282. arXiv:1403.2957

19. E. Lubetzky and Y. Zhao,
On the variational problem for upper tails in sparse random graphs,
Random Structures Algorithms 50 (2017), 420–436. arXiv:1402.6011

18. C. Borgs, J. T. Chayes, H. Cohn, and Y. 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. Y. Zhao, An arithmetic transference proof of a relative Szemerédi theorem,
Math. Proc. Cambridge Philos. Soc. 156 (2014), 255–261. arXiv:1307.4959

16. J. Fox and Y. Zhao,
A short proof of the multidimensional Szemerédi theorem in the primes,
Amer. J. Math. 137 (2015), 1139–1145. arXiv:1307.4679

15. D. Conlon, J. Fox, and Y. Zhao,
A relative Szemerédi theorem,
Geom. Funct. Anal. 25 (2015), 733–762. arXiv:1305.5440

14. Y. Zhao, Hypergraph limits: a regularity approach,
Random Structures Algorithms 47 (2015), 205–226. arXiv:1302.1634

13. H. Cohn and Y. Zhao,
Sphere packing bounds via spherical codes,
Duke Math. J. 163 (2014), 1965–2002. arXiv:1212.5966

12. H. Cohn and Y. Zhao,
Universally optimal error-correcting codes,
IEEE Trans. Inform. Theory 60 (2014), 7442–7450. arXiv:1212.1913

11. E. Lubetzky and Y. Zhao,
On replica symmetry of large deviations in random graphs,
Random Structures Algorithms 47 (2015) 109–146. arXiv:1210.7013
10. J. Fox, P. Loh, and Y. Zhao,
The critical window for the classical Ramsey-Turán problem,
Combinatorica 35 (2015) 435–476. arXiv:1208.3276
9. D. Conlon, J. Fox, and Y. Zhao,
Extremal results in sparse pseudorandom graphs,
Adv. Math. 256 (2014), 206–290. arXiv:1204.6645
8. Y. Zhao, The bipartite swapping trick on graph homomorphisms,
SIAM J. Discrete Math. 25 (2011), 660–680. arXiv:1104.3704
7. Y. Zhao, Sets characterized by the number of missing sums and differences,
J. Number Theory 11 (2011), 2107–2134. arXiv:0911.2292
6. D. Galvin and Y. Zhao,
The number of independent sets in graphs with small maximum degree,
Graphs Combin. 27 (2011), 177–186. arXiv:1007.4803
5. Y. Zhao, Counting MSTD sets in finite abelian groups,
J. Number Theory 130 (2010), 2308–2322. arXiv:0911.2288
4. Y. Zhao, Constructing numerical semigroups of a given genus,
Semigroup Forum 80 (2010), 242–254. arXiv:0910.2075
3. Y. Zhao, Constructing MSTD sets using bidirectonal ballot sequences,
J. Number Theory 130 (2010), 1212–1220. arXiv:0908.4442
2. Y. Zhao, The number of independent sets in a regular graph,
Combin. Probab. Comput. 19 (2010), 315–320. arXiv:0909.3354
1. Y. Zhao, The coefficients of a truncated Fibonacci power series,
Fibonacci Quart. 46/47 (2009), 53–55.

Invited Talks

2020	Cumberland Conference on Combinatorics, Graph Theory, and Computing	Williamsburg, VA
	Workshop on Critical and Collective Effects in Graphs and Networks (CCEGN-V)	Cape Cod, MA
2019	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

[U = Undergraduate, G = Graduate]

MIT	Spr 2020	U	18.212 Algebraic Combinatorics
	Fall 2019	G	18.217 Graph Theory and Additive Combinatorics
	Fall 2019	U	18.A34 Mathematical Problem Solving (Putnam Seminar)
	Spr 2019	G	18.218 The Probabilistic Method
	Fall 2018	U	18.A34 Mathematical Problem Solving (Putnam Seminar)
		U	18.211 Combinatorial Analysis
	Fall 2017	U	18.A34 Mathematical Problem Solving (Putnam Seminar)

		G	18.S997 Graph Theory and Additive Combinatorics
Oxford	MT 2016	U	Geometry (tutorial)
	TT 2016	G	Polynomial Method in Combinatorics

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–)

Service

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

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

Other Experiences and Activities

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