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

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., to appear. `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., to appear. `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

2019	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),

Service

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

Organizer of the MIT team for 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