Yufei Zhao

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MIT Department of Mathematics
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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	Conference on Random Structures & Algorithms (RS&A): Plenary Speaker	Gniezno, Poland
	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
	Cumberland Conference Plenary speaker (Canceled due to COVID-19)	Williamsburg, VA
	Simons Collaboration: Algorithms & Geometry Annual Conference Plenary Lecture (Canceled due to COVID-19)	New York, NY
	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 Eindhoven, Netherlands
     (6-hour minicourse co-taught with Christian Borgs)

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