

# Yufei Zhao

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

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## Current Position

**Massachusetts Institute of Technology**  
Assistant Professor, Department of Mathematics

Cambridge, MA  
2017—

## Previous Positions

**UC Berkeley**  
Simons Institute Research Fellow

Berkeley, CA  
Spring 2017

**University of Oxford**  
Esmée Fairbairn Junior Research Fellow in Mathematics, New College

Oxford, UK  
2015—2017

## Education

**Massachusetts Institute of Technology**  
Ph.D. Mathematics. Advisor: Jacob Fox

Cambridge, MA  
2011—2015

**University of Cambridge**  
M.A.St. Mathematics with Distinction

Cambridge, UK  
2010—2011

**Massachusetts Institute of Technology**  
S.B. Mathematics, with minor in Economics  
S.B. Computer Science and Engineering

Cambridge, MA  
2006—2010

## Research Interests

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

## Selected Awards and Honors

SIAM Dénes König Prize, 2018

Johnson Prize, MIT Mathematics Department, 2015

Microsoft Research PhD Fellowship, 2013–2015

MIT Akamai Presidential Fellowship, 2011–2012

Leslie Walshaw Prize, Examination Prize, and Senior Scholarship, Trinity College, Cambridge, 2011

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 Internships

**Microsoft Research** New England

Mentor: Henry Cohn

Cambridge, MA  
Summers 2010, 2011, 2013, 2014

**Microsoft Research** Theory Group

Mentor: Eyal Lubetzky

Redmond, WA  
Summer 2012

## Papers

32. A. Sah, M. Sawhney, D. Stoner, and Y. Zhao,  
The number of independent sets in an irregular graph, arXiv:1805.04021.
31. J. Fox, L. M. Lovász, and Y. Zhao,  
A fast new algorithm for weak graph regularity, arXiv:1801.05037.
30. N. Alon, J. Fox, and Y. Zhao,  
Efficient arithmetic regularity and removal lemmas for induced bipartite patterns, 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.
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.
26. J. Fox, L. M. Lovász, Y. Zhao,  
On regularity lemmas and their algorithmic applications,  
*Combin. Probab. Comput.* 26 (2017), 481–505.
25. D. Conlon and Y. Zhao,  
Quasirandom Cayley graphs,  
*Discrete Analysis* 2017:6, 14 pp.
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.
23. L. M. Lovász and Y. Zhao,  
On derivatives of graphon parameters,  
*J. Combin. Theory Ser. A* 145 (2017), 364–368.
22. Y. Zhao, On the lower tail variational problem for random graphs,  
*Combin. Probab. Comput.* 26 (2017), 301–320.
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.
20. D. Conlon, J. Fox, and Y. Zhao,  
The Green-Tao theorem: an exposition,  
*EMS Surv. Math. Sci.* 1 (2014), 249–282.
19. E. Lubetzky and Y. Zhao,  
On the variational problem for upper tails in sparse random graphs,  
*Random Structures Algorithms* 50 (2017), 420–436.
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.
17. Y. Zhao, An arithmetic transference proof of a relative Szemerédi theorem,  
*Math. Proc. Cambridge Philos. Soc.* 156 (2014), 255–261.
  16. J. Fox and Y. Zhao,  
A short proof of the multidimensional Szemerédi theorem in the primes,  
*Amer. J. Math.* 137 (2015), 1139–1145.
  15. D. Conlon, J. Fox, and Y. Zhao,  
A relative Szemerédi theorem,  
*Geom. Funct. Anal.* 25 (2015), 733–762.
  14. Y. Zhao, Hypergraph limits: a regularity approach,  
*Random Structures Algorithms* 47 (2015), 205–226.
  13. H. Cohn and Y. Zhao,  
Sphere packing bounds via spherical codes,  
*Duke Math. J.* 163 (2014), 1965–2002.
  12. H. Cohn and Y. Zhao,  
Universally optimal error-correcting codes,  
*IEEE Trans. Inform. Theory* 60 (2014), 7442–7450.
  11. E. Lubetzky and Y. Zhao,  
On replica symmetry of large deviations in random graphs,  
*Random Structures Algorithms* 47 (2015) 109–146.
  10. J. Fox, P. Loh, and Y. Zhao,  
The critical window for the classical Ramsey-Turán problem,  
*Combinatorica* 35 (2015) 435–476.
  9. D. Conlon, J. Fox, and Y. Zhao,  
Extremal results in sparse pseudorandom graphs,  
*Adv. Math.* 256 (2014), 206–290.
  8. Y. Zhao, The bipartite swapping trick on graph homomorphisms,  
*SIAM J. Discrete Math.* 25 (2011), 660–680.
  7. Y. Zhao, Sets characterized by the number of missing sums and differences,  
*J. Number Theory* 11 (2011), 2107–2134.
  6. D. Galvin and Y. Zhao,  
The number of independent sets in graphs with small maximum degree,  
*Graphs Combin.* 27 (2011), 177–186.
  5. Y. Zhao, Counting MSTD sets in finite abelian groups,  
*J. Number Theory* 130 (2010), 2308–2322.
  4. Y. Zhao, Constructing numerical semigroups of a given genus,  
*Semigroup Forum* 80 (2010), 242–254.
  3. Y. Zhao, Constructing MSTD sets using bidirectional ballot sequences,  
*J. Number Theory* 130 (2010), 1212–1220.
  2. Y. Zhao, The number of independent sets in a regular graph,  
*Combin. Probab. Comput.* 19 (2010), 315–320.
  1. Y. Zhao, The coefficients of a truncated Fibonacci power series,  
*Fibonacci Quart.* 46/47 (2009), 53–55.

**Invited Talks**

2018	Manchester workshop: Arithmetic Ramsey Theory	Manchester, UK
	ICM satellite workshop — Combinatorics: Extremal, Probabilistic and Additive	São Paulo, Brazil
	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 and Probability	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

Spr 2019	MIT	G	18.218 The Probabilistic Method
Fall 2018	MIT	U	18.A34 Mathematical Problem Solving Seminar
Fall 2018	MIT	U	18.211 Combinatorial Analysis
Fall 2017	MIT	U	18.A34 Mathematical Problem Solving Seminar
Fall 2017	MIT	G	18.S997 Graph Theory and Additive Combinatorics

MT 2016 Oxford U Geometry (tutorial)  
TT 2016 Oxford G Polynomial Method in Combinatorics  
Spr 2013 MIT U 18.03: Differential Equations (recitation)

[U = Undergraduate, G = Graduate]

### **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., Summer 2015  
MIT PRIMES Mentor — 2013–2015 (Lusztig PRIMES Mentor in 2015)  
Research Experience for Undergraduates at Duluth (mentor: Joe Gallian) — Summer 2009  
Deputy Leader for Canadian IMO Team — 2008  
Instructor at Canadian IMO Training Camps — various summers and winters  
Mentor at AwesomeMath Summer Program — Summer 2007  
Trainer at Math Olympiad Summer Program — Summer 2007  
Teacher at Spirit of Math Schools in Toronto — 2005–2006