

Bhargav Narayanan

Born October 11, 1989

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RESEARCH

- Extremal, probabilistic and topological combinatorics.
- Discrete probability and related areas in statistical physics.
- Applications of combinatorial and probabilistic techniques to theoretical computer science.

POSITIONS

- **Assistant Professor**, Rutgers University, 2017–Present.
- **Consulting Researcher**, Microsoft Research, 2018–2022.
- **Research Fellow**, St John’s College, Cambridge, 2015–2017.

EDUCATION

- **PhD in Mathematics**, University of Cambridge, 2012–2015.
Supervised by Prof. Béla Bollobás.
- **MASt in Mathematics (Part III)**, University of Cambridge, 2011–2012.
Ranked 1st in the year with an average of 97.2%.
- **BTech in Computer Science**, Indian Institute of Technology Madras, 2007–2011.
Ranked 1st in the year with a GPA of 9.86/10.

GRANTS

- NSF CAREER Grant DMS-2237138, 2023–2028.
- Sloan Research Fellowship, 2023–2025.
- NSF Grant CCF-1814409, 2021–2024.
- Research Council Grant, Rutgers University, 2021–2022.
- NSF Grant DMS-1800521, 2018–2022.

AWARDS & PRIZES

- Simons Visiting Professorship, EPFL, Lausanne, 2021.
- Smith–Knight Prize, Cambridge, 2014.
- Leslie Walshaw Prize and Part III Examination Prize, Trinity College, Cambridge, 2012.
- Ramanujan Studentship, Trinity College, Cambridge, 2011.
- President’s Gold Medal, Indian Institute of Technology, Madras, 2011.
- Honourable Mention, International Mathematical Olympiad, 2007.

SELECTED PUBLICATIONS

A complete list of publications may be found at sites.math.rutgers.edu/~narayanan/pub_list.pdf.

- *Antichain codes*, **submitted**. With B. Gunby, X. He and S. Spiro.
This paper uses coding-theoretic, combinatorial and probabilistic techniques to prove an abstract, purely combinatorial generalisation of the results of Sárközy–Szemerédi and Halász connecting arithmetic structure and anticoncentration.
- *Thresholds versus fractional expectation-thresholds*, **Annals of Mathematics**, 194 (2021). With K. Frankston, J. Kahn and J. Park.
Down-set thresholds, **Random Structures & Algorithms**, to appear. With B. Gunby and X. He.
These papers settle various questions about thresholds raised by Kahn, Kalai and Talagrand in the 2000s. In particular, the first paper proves Talagrand’s ‘threshold conjecture’ from 2010 about increasing events in product probability spaces, and related conjectures of Martin, Mézard and Rivoire in statistical physics from 2005.
- *Friendly bisections of random graphs*, **Communications of the American Mathematical Society**, 2 (2022). With A. Ferber, M. Kwan, A. Sah and M. Sawhney.
This paper proves an old conjecture of Füredi from 1988 about bisecting random graphs; interest in this problem was recently renewed owing to its inclusion in Green’s list of ‘100 open problems’ (as Problem 91).
- *Spanning surfaces in 3-graphs*, **Journal of the European Mathematical Society**, 24 (2022). With A. Georgakopoulos, J. Haslegrave and R. Montgomery.
This paper resolves a problem posed by Gowers in 2005 on finding spanning surfaces in two-dimensional simplicial complexes.
- *Simplicial homeomorphs and trace-bounded hypergraphs*, **Discrete Analysis**, 2022:6 (2022). With J. Long and C. Yap.
A universal exponent for homeomorphs, **Israel Journal of Mathematics**, 243 (2021). With P. Keevash, J. Long and A. Scott.
These papers prove Nati Linial’s ‘geometric exponent’ conjectures from 2006 about finding homeomorphs in simplicial complexes, and strengthen combinatorial results of Conlon, Fox and Sudakov along the way.
- *Subgraphs of large connectivity and chromatic number*, **Bulletin of the London Mathematical Society**, 54 (2022). With A. Girão.
This paper resolves a problem raised by Alon, Kleitman, Thomassen, Saks and Seymour in 1987 about the interplay between graph colouring and connectivity.
- *The threshold for the square of a Hamilton cycle*, **Proceedings of the American Mathematical Society**, 149 (2021). With J. Kahn and J. Park.
This paper proves a conjecture due to Kühn and Osthus from 2012 about Hamiltonian cycles in random graphs.
- *Coalescence on the real line*, **Transactions of the American Mathematical Society**, 371 (2019). With P. Balister, B. Bollobás and J. Lee.
This paper answers various questions raised by Holroyd in 2010 about a non-monotone spin model for coalescence.
- *On regular 3-wise intersecting families*, **Proceedings of the American Mathematical Society**, 146 (2018). With K. Frankston and J. Kahn.
On symmetric 3-wise intersecting families, **Proceedings of the American Mathematical Society**, 145 (2017). With D. Ellis.
These papers resolve various problems raised by Babai, Cameron, Frankl and Kantor in the late 1970s and early 1980s about the dichotomy between symmetry and structure in extremal set theory.

MENTORING

- **Postdoctoral Researchers:** Sam Spiro (NSF Postdoctoral Fellow, 2022–Present) Benjamin Gunby (Hill Assistant Professor, 2021–Present), Sophie Spirkl (NSF Postdoctoral Fellow, 2018–2019).
- **Graduate Students:** Corrine Yap (2019–Present), Quentin Dubroff (2020–Present, with J. Kahn).
- **Undergraduate Students (summer research):** Aaditya Raghavan (2021), Filip Čermák (2020), David Fitzpatrick (2020), Jakub Gubáš (2020), Lenka Kopfova (2020), Radek Olsak (2020), Mikhail Beliaev (2019), Petr Chmel (2019), Jan Petr (2019), Adam Jamil (2019), Tony Zheng (2019).

SERVICE

- **Refereeing:** Annals of Mathematics; Journal of the AMS; Advances in Mathematics; Proceedings and Transactions of the AMS, International Mathematics Research Notices; Discrete Analysis; Journal of Combinatorial Theory, Series A and Series B; Combinatorica; Random Structures and Algorithms; Combinatorics, Probability and Computing.
- **Committees:** Hiring Committee, Rutgers (2020–2022), Admissions Committee, Rutgers (2019–2020), REU Committee, DIMACS (2018–2020).

RECENT TALKS

- *Antichain codes*, Colloquium, University of Illinois, Chicago, 12/2022.
- *Friendly bisections of random graphs*, Atlanta Combinatorics Colloquium, Georgia Tech–Emory University–Georgia State, 10/2022.
- *Down-set thresholds*, Combinatorics Meeting, Oberwolfach, 4/2022.
- *Probabilistic Bézout and its applications*, Colloquium, Emory University, 2/2022.
- *Probabilistic Bézout and its applications*, CS-DM Seminar, IAS, Princeton, 2/2022.
- *Finding homeomorphs*, PIMS Discrete Mathematics Seminar, University of Victoria, 1/2021.
- *The threshold for the square of the Hamilton cycle*, Combinatorics Conference, MIPT, Moscow, 9/2020.
- *Thresholds*, Discrete Mathematics and Probability Seminar, Oxford University, 4/2020.
- *Thresholds*, Joint Colloquium of the Berlin Mathematical Schools, TU Berlin–FU Berlin–HU Berlin, 1/2020.
- *Intersecting families of vectors*, Combinatorics Meeting, Oberwolfach, 1/2020.
- *Disproportionate division*, Geometry Seminar, Courant Institute, 10/2019.
- *Intersecting families, product spaces and thresholds*, Combinatorics Seminar, Stanford University, 10/2019.
- *Disproportionate division*, Combinatorics Meeting, BIRS, Banff, 9/2019.
- *Disproportionate division*, Brazilian Mathematical Colloquium, IMPA, 8/2019.
- *Infinite mazes and exceptional graphs for the random walk*, Horowitz Seminar, Tel Aviv University, 6/2019.
- *Infinite mazes and exceptional graphs for the random walk*, Colloquium, University of Illinois, Chicago, 3/2019.

- *Coalescence on the real line*, Mathematical Physics Seminar, Rutgers University, 11/2018
- *Exceptional subgraphs for the random walk*, Discrete Mathematics Seminar, MIT, 10/2018.
- *Exceptional subgraphs for the random walk*, Discrete Mathematics Seminar, Yale University, 10/2018.
- *Symmetric intersecting families*, ICM Combinatorics Meeting, São Paulo, 7/2018
- *Symmetric intersecting families*, Atlanta Lecture Series, Georgia Tech–Emory University, 4/2018.
- *Hamiltonian surfaces in 3-graphs*, Discrete Mathematics Seminar, Princeton University, 2/2018.
- *Hamiltonian surfaces in 3-graphs*, Combinatorics Meeting, CMSA, Harvard University, 2/2018.

TEACHING

- Recent Developments in Discrete Mathematics, Graduate course, Rutgers University, 2022–2023.
- Combinatorics I, Graduate course, Rutgers University, 2022–2023.
- Combinatorics II, Graduate course, Rutgers University, 2021–2022.
- Combinatorics I, Graduate course, Rutgers University, 2021–2022.
- Additive Combinatorics, Rutgers University, 2020–2021.
- Putnam Problem Solving Seminar, Rutgers University, 2020–2021.
- Combinatorics II, Graduate course, Rutgers University, 2019–2020.
- Combinatorics, Undergraduate course, Rutgers University, 2019–2020.
- Linear Algebra, Undergraduate course, Rutgers University, 2019–2020.
- Methods in Combinatorics, Graduate course, Rutgers University, 2018–2019.
- Graph Theory, Undergraduate course, Rutgers University, 2018–2019.
- Putnam Problem Solving Seminar, Rutgers University, 2018–2019.
- Topics in Graph Theory, Graduate course, Rutgers University, 2017–2018.
- Combinatorics, Undergraduate course, Rutgers University, 2017–2018.
- Ramsey Theory, Part III course, University of Cambridge, 2016–2017.
- Topics in Ramsey Theory, Part III Graduate course, University of Cambridge, 2015–2016.