

Matija Bucic | Curriculum Vitae

Department of Mathematics – Princeton University

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Employment

- **Princeton University** **Princeton**
Assistant Professor *Jul. 2023 – present*
- **Princeton University and Institute for Advanced Study** **Princeton**
Veblen Research Instructor *Sep. 2021 – Jun. 2023*
- **ETH Zürich** **Zürich**
Research and Teaching Assistant *Sep. 2016 – Aug. 2021*

Education

- **ETH Zurich** **Zurich**
Ph.D. in Mathematics, Advisor: Prof. Benny Sudakov *Sep. 2016 – May. 2021*
- **University of Cambridge, Trinity College** **Cambridge**
Master of Mathematics, with distinction *Oct. 2015 – Jun. 2016*
- **University of Cambridge, Trinity College** **Cambridge**
Bachelor of Arts in Mathematics, awarded first class in each year *Oct. 2012 – Jun. 2015*

Research interests

My research is primarily based in the field of Discrete Mathematics. However, I have a broad range of research interests. These include, but are not limited to: Ramsey Theory, Algebraic and Probabilistic Methods in Combinatorics, Extremal Set Theory, Directed Graph Theory, Theoretical Computer Science, and Random Structures and applications of these to other fields.

Awards and scholarships

Grants

- I was awarded an SNSF Grant (\$84000) for a project titled “Local to Global Problems in Extremal and Probabilistic Combinatorics”, which unfortunately I had to reject.

Prizes and competitions

- I have been awarded an ETH Medal 2022 for my PhD thesis (\$2000).
- I have received a Woods Prize 2014 for my mathematical essay on “Random Evolution of Graphs”.
- 2 silver and 1 bronze medal at International Mathematical Olympiads (2010-2012).

Scholarships

- Senior Scholarship from Trinity College (2013-2016)
- Cambridge Summer Research Scholarship (2015)
- Trinity Overseas Bursary and Cambridge Overseas Trust (2012-2016) – full scholarship (£26254 p.a.)

Travel awards

- I was awarded a SIAM Student Travel Award 2021, Oberwolfach Leibniz Travel Grant 2020,2023 and a BCC 2019 travel award from the Clay Mathematics Institute.

Teaching and supervising experience

Teaching:

- Lecturer for Combinatorial Mathematics course at Princeton (2021/2022, 2023/2024)
- I gave an invited mini-course on “Recent progress towards the Erdős-Hajnal conjecture” aimed at graduate students at the Structural Graph Theory Bootcamp in Warsaw (2023).
- Lecturer for Linear Algebra with Applications course at Princeton (2021/2022)
- Organised a reading course on Ramsey Theory at Princeton (2021/2022)
- Course organiser for Graph Theory course at ETH (2018/2019, 2019/2020, 2020/2021)
- Course organiser for Probabilistic Method in Combinatorics at ETH (2020/2021)
- Course organiser and teaching assistant for Algebraic Methods in Combinatorics at ETH (2019/2020).
- Teaching assistant for Graph Theory course at ETH (2017/2018, 2018/2019, 2019/2020)

Mentoring students:

- Summer Research Project of Pablo Blanco-Hinojosa:
Towards the Erdős-Hajnal Conjecture for P_5 -free graphs, **accepted in RMSB**.
- Summer Research Project of Icey Siyi Ai: Edge Reconstruction Number for Regular Graphs.
- Junior Paper of Robert Rubin resulting in a paper: Ramsey numbers of nK_4 , in preparation.
- Junior Paper of George Bentley titled: On unavoidable r -uniform hypergraphs.
- Senior Thesis of Judah Koslowe titled: Uniformly biased tournaments.
- Master Thesis of Domagoj Bradač resulting in a paper:
Covering Random Graphs with Monochromatic Trees, **published in RS&A**.
- Master Thesis of Sven Heberle, resulting in the following publication:
Monochromatic trees in random tournaments, **published in CPC**.
- Bachelor Thesis of Erik Jahn, resulting in a paper:
2-factors with k cycles in Hamiltonian graphs, **published in JCTB**.
- Master Thesis of Michelle Sweering: Covering Problems in Hypergraphs.
- Semester project of Michelle Sweering: Combinatorial Perspective on the Log-rank Conjecture.
- Master Thesis of Vedran Mihal titled: Generalised Ramsey Theories.

Organisational skills and service to the community

- I am currently one of the organisers of the Princeton Discrete Mathematics Seminar.
- Organised a Minisymposium titled “Extremal Problems Involving Colouring”, at SIAM DM 2020, 2021.
- I participated in the organisation of Random Structures and Algorithms conference in Zürich 2019 and Bennyfest, a one day conference celebrating Benny Sudakov’s 50th birthday.
- I have co-founded The European Mathematical Cup, and was a member of its Central Jury for five years. During this time the competition grew to over 200 high school students, from 14 countries.
- I have refereed or provided quick opinions for: Annals of Mathematics, Proceedings of LMS, Advances in Mathematics, Transactions and Proceedings of AMS, American Mathematical Monthly, Advances in Combinatorics, Combinatorica, RS&A, JCTB, Combinatorial Theory, JCTA, SIAM Journal on Discrete Mathematics, Journal of Graph Theory, Stud. Sci. Math. Hung., European Journal of Combinatorics, Electronic Journal of Combinatorics, Discrete Mathematics, Utilitas Mathematica.
- Leader of the Croatian International Mathematics Olympiad team at the IMO 2018
- Member of the Croatian International Competitions Team Selection Committee (2016-2021)

Languages

- Croatian (native speaker)
- English (full professional proficiency)
- German (limited working proficiency)

Research Talks

Invited talks.....

- Combinatorics Day at TAU, Tel Aviv, 2023.
- CanaDAM, Winnipeg, 2023,
- EXCILL IV, UIUC, 2023,
- Combinatorics Workshop in Oberwolfach Institute, *Oberwolfach Institute*, Germany, 2023.
- Graph Theory Workshop, McGill research centre, Barbados, 2022
- AMS Special Session on Ramsey Theory, Amherst, USA, 2022
- Recent advances in probabilistic and extremal combinatorics workshop, Ascona, Switzerland, 2022.
- SIAM Conference on Discrete Mathematics, *CMU*, USA, 2022.
- Combinatorics, Probability and Computing Workshop in *Oberwolfach Institute*, Germany, 2022.
- Graph Theory Workshop in *Oberwolfach Institute*, Germany, 2022.
- Joint Berlin-Tel Aviv workshop on Ramsey theory, *Tel-Aviv University*, Israel, 2020.
- Combinatorics Workshop in Oberwolfach Institute, *Oberwolfach Institute*, Germany, 2020.
- Workshop on Probabilistic and Extremal Combinatorics, *Banff Research Station*, Canada, 2019.
- British Combinatorial Conference, *University of Birmingham*, UK, 2019.
- SIAM Conference on Discrete Mathematics, *University of Colorado Denver*, USA, 2018.

Contributed talks.....

- Random Structures and Algorithms, *CMU*, USA, 2023.
- Eurocomb, *online*, 2021
- SIAM Conference on Discrete Mathematics, *online*, 2021.
- Random Structures and Algorithms, *ETH Zürich*, Switzerland, 2019.
- European Conference on Combinatorics, *TU Wien*, Austria, 2017.
- Random Structures and Algorithms, *Adam Mickiewicz University in Poznań*, Poland, 2017.

Seminar and colloquium talks.....

- IBS Korea, Discrete Math Seminar, October 2023.
- Budapest Big Combinatorics + Geometry (BBC+G) Seminar, April 2023.
- Combinatorics Learning Seminar, Princeton, April 2023
- Modern Coding Theory and Expanders Seminar, Princeton and IAS, April 2023.
- Emory Colloquium in Combinatorics, March 2023.
- UCSD Department of Mathematics Colloquium, February 2023.
- *IAS* Computer Science and Discrete Mathematics Seminar, February 2023.
- *Rutgers* Discrete Math Seminar, February 2023.
- *MIT-Harvard-MSR* Combinatorics Seminar, November 2022.
- *Graz* Colloquium in Combinatorics, November 2022.
- *IAS* Computer Science and Discrete Mathematics Seminar, September 2022.
- *IAS* Short Talks, September 2022.
- *Graz* Combinatorics Seminar, May 2022.
- *IAS* Computer Science and Discrete Mathematics Seminar, March 2022.
- *Princeton* Applied and Computational Mathematics Colloquium, March 2022.
- *Delaware* Discrete Mathematics and Algebra Seminar, March 2022.
- *Birmingham* Combinatorics and Probability Seminar, January 2022.
- *Rutgers* Discrete Math Seminar, November 2021.
- *Oxford* Discrete Mathematics and Probability Seminar, November 2021.
- *Princeton* Discrete Mathematics Seminar, October 2021.
- *ETH Zürich* Mittagsseminar, March 2021.
- *Tel Aviv* Combinatorics Seminar, November 2020.
- *Stanford* Online Combinatorics Seminar, May 2020.
- Extremal and Probabilistic Combinatorics Webinar, May 2020.
- *Warwick* Combinatorics seminar, November 2019.
- *ETH Zürich* Mittagsseminar, November 2019.
- *ETH Zürich* Mittagsseminar, May 2019.

- *ETH Zürich* Mittagsseminar, October 2018.
- *Cambridge* Combinatorics Seminar, May 2018.
- *ETH Zürich* Graduate Seminar in Probability, 2018.
- *ETH Zürich* Mittagsseminar, 2018.
- *ETH Zürich* Mittagsseminar, 2017.
- *Cambridge* Part III Seminar, 2016.

Publications list

Submitted:.....

37. N. Alon, M. Bucić, L. Saueremann
Unit and distinct distances in typical norms
36. N. Alon, M. Bucić, L. Saueremann, Dmitrii Zakharov, Or Zamir
Essentially tight bounds for rainbow cycles in proper edge-colourings
35. M. Bucić, T. Nguyen, A. Scott, P. Seymour
Induced subgraph density I. A loglog step towards Erdos-Hajnal.
34. R. Bourneuf, M. Bucić, L. Cook, J. Davies
On polynomial degree-boundedness.
33. N. Alon, M. Bucić, M. Christoph, M. Krivelevich
Power of many colours.
32. M. Bucić, R. Montgomery
Towards the Erdős-Gallai cycle decomposition conjecture.
Appeared in **STOC 2023**. Accepted in **Advances in Mathematics**.
31. P. Blanco-Hinojosa, M. Bucić
Towards the Erdős-Hajnal conjecture for P_5 -free graphs.
Research in the Mathematical Sciences (RMSB), accepted.

Published:.....

30. M. Bucic, B. Sudakov, T. Tran
Erdős-Szekeres theorem for multidimensional arrays.
JEMS, 25(8), (2023), 2927–2947.
29. M. Bucić, J. W. Cooper, D. Král', S. Mohr, D. Munhá Correia
Uniform Turán density of cycles.
Transactions of AMS, 376(7), (2023), 4765–4809.
28. D. Bradač, M. Bucic, B. Sudakov
Turán number of sunflowers,
Proceedings of AMS, 151 (2023), 961–975.
27. D. Bradač, M. Bucic
Covering random graphs with monochromatic trees,
Random Structures and Algorithms, 62.3 (2023), 545–563.
26. M. Bucic, O. Janzer, B. Sudakov
Counting H -free orientations of graphs.
Mathematical Proceedings of the Cambridge Philosophical Society, 174(1) (2023), 79–95.
25. M. Bucic, B. Sudakov
Tight Ramsey bounds for multiple copies of a graph.
Advances in Combinatorics, no. 1, (2023), 1–22.
24. M. Bucic, B. Sudakov
Large independent sets from local considerations.
Combinatorica, 43, (2023), 505–546.
23. M. Bucic, A. Khamseh
The $(t - 1)$ -chromatic Ramsey number for paths
Journal of Graph Theory, 102(4), (2023), 784–796.

22. M. Bucic, S. Glock, B. Sudakov
The intersection spectrum of 3-chromatic intersecting hypergraphs.
Proceedings of LMS, 124.5 (2022), 680–690.
21. M. Bucic, L. Gishboliner, B. Sudakov
Cycles of many lengths in Hamiltonian graphs.
Forum of Mathematics, Sigma, 10, E70, (2022).
20. M. Bucic, J. Fox, B. Sudakov
Clique minors in graphs with forbidden subgraphs and other restrictions.
Random Structures and Algorithms, 60.3 (2022), 327–338.
19. M. Bucic, N. Draganic, B. Sudakov
Universal and unavoidable graphs.
Combinatorics, Probability and Computing, 30 (2021), 942–955.
18. M. Bucic, N. Draganic, B. Sudakov, T. Tran
Unavoidable hypergraphs.
Journal of Combinatorial Theory Series B. 151 (2021), 307–338.
17. N. Alon, M. Bucic, B. Sudakov
Large cliques and independent sets all over the place.
Proceedings of AMS, 149 (2021), 3145–3157.
16. M. Bucic, D. Korándi, B. Sudakov
Covering random graphs by monochromatic trees and Helly-type results for hypergraphs.
Combinatorica, 41 (2021), 319–352.
15. M. Bucic, P. Devlin, M. Hendon, D. Horne, B. Lund
Perfect matchings and derangements on graphs.
Journal of Graph Theory, 97.2 (2021), 340–354.
14. M. Bucic, E. Long, A. Shapira, B. Sudakov
Tournament quasirandomness from local counting.
Combinatorica, 41 (2021), 175–208.
13. N. Alon, M. Bucic, T. Kalvari, E. Kuperwasser, T. Szabó
List Ramsey numbers.
Journal of Graph Theory, 96.1 (2021), 109–128.
12. M. Bucic, M. Kwan, A. Pokrovskiy, B. Sudakov,
Halfway to Rota's basis conjecture
IMRN (International Mathematics Research Notices), 21 (2020), 8007–8026.
11. M. Bucic, M. Kwan, A. Pokrovskiy, B. Sudakov, T. Tran, A. Z. Wagner
Nearly-linear monotone paths in edge-ordered graphs.
Israel Journal of Mathematics 238 (2020), 663–685.
10. M. Bucic, E. Jahn, A. Pokrovskiy, B. Sudakov
2-factors with k cycles in Hamiltonian graphs,
Journal of Combinatorial Theory Series B. 144 (2020) 150–166
9. M. Bucic, S. Heberle, S. Letzter, B. Sudakov
Monochromatic trees in random tournaments.
Combinatorics, Probability and Computing 29.3 (2020), 318–345.
8. M. Bucic, S. Letzter, B. Sudakov
Multicolour bipartite Ramsey number of paths.
The Electronic Journal of Combinatorics 26 (2019), P3.60.

7. M. Bucic, M. Ornik, U. Topcu
Graph-Based Controller Synthesis for Safety-Constrained, Resilient Systems,
56th Annual Allerton Conference on Communication, Control, and Computing (2019).
6. M. Bucic, B. Lidicky, J. Long, A. Z. Wagner
Partition problems in high dimensional boxes,
Journal of Combinatorial Theory, Series A 166 (2019), 315–336.
5. M. Bucic, S. Letzter, B. Sudakov
Three colour bipartite Ramsey number of cycles,
Journal of Graph Theory 92.4 (2019), 445–459.
4. M. Bucic, S. Letzter, B. Sudakov
Directed Ramsey number for trees.
Journal of Combinatorial Theory, Series B 137 (2019), 145–177.
3. M. Bucic, S. Letzter, B. Sudakov
Monochromatic paths in random tournaments.
Random Structures and Algorithms 54.1 (2019), 69–81.
2. M. Bucic, S. Letzter, B. Sudakov, T. Tran
Minimum saturated families of sets,
Bulletin of the London Mathematical Society 50.4 (2018), 725–732.
1. M. Bucic
An Improved Bound for Disjoint Directed Cycles.
Discrete Mathematics 341.8 (2018), 2231–2236.