

Igor Balla

Curriculum Vitae

Leipzig University
Faculty of Mathematics and Computer Science
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Research Interests

I am broadly interested in combinatorics and linear algebra, as well as their interplay with other fields. A significant portion of my research has focused on extremal problems lying at the intersection of these areas. Apart from being beautiful and interesting in their own right, these problems have connections to probability, geometry, topology, applied mathematics, theoretical computer science, and quantum physics.

Employment & Education

- 2025 – 2026 **Postdoc**, Leipzig University
 - 2025 **Strauch Postdoctoral Fellow**, Simons Laufer Mathematical Sciences Institute (SLMath)
 - 2024 **Research Specialist - Postdoc**, Masaryk University
- 2021 – 2023 **Postdoctoral Fellow**, Hebrew University of Jerusalem
- 2019 – 2021 **Postdoctoral Fellow**, Tel Aviv University
- 2015 – 2019 **Doctor of Science in Mathematics**, ETH Zürich
 - Advisor: Benny Sudakov
- 2012 – 2014 **Master of Science in Mathematics**, Courant Institute, New York University
- 2008 – 2012 **Bachelor of Science in Mathematics**, Carnegie Mellon University
 - Minor in Computer Science

Teaching Experience

- 2024 - 2025 **Organizer**
 - Algebra and Combinatorics Seminar, Leipzig University Fall 2025
 - Reading group on Graph Theory and Additive Combinatorics, Masaryk University Fall 2024
- 2024 **Lecturer**
 - Graph Theory, Masaryk University Fall 2024
 - Advanced Combinatorics, Masaryk University Spring 2024
- 2016 – 2019 **Teaching Assistant**
 - Graph Theory, ETH Zürich Spring 2019
 - Algebra I, ETH Zürich Fall 2018
 - Graph Theory, ETH Zürich Spring 2017
 - Seminar on Elementary Number Theory, ETH Zürich Spring 2016
- 2012 – 2015 **Tutor**, Educational Tutoring and Consulting Center, Staten Island, NY
 - Conducted private and group lessons at the middle school to college level, as well as preparation for standardized tests. Installed and implemented the learning management system Moodle.
- 2010 – 2012 **Teaching Assistant**
 - Matrix Theory, Carnegie Mellon University Spring 2012
 - Graph Theory, Carnegie Mellon University Spring 2010

Awards and Scholarships

- 2025 Strauch Postdoctoral Fellowship, Simons Laufer Mathematical Sciences Institute
- 2019 – 2021 Swiss National Science Foundation Early Postdoc.Mobility Fellowship
- 2012 – 2014 Henry M. MacCracken Graduate Fellowship, New York University
- 2012 Mellon College of Science Research Honors, Carnegie Mellon University
- 2008 Award for Mathematical Research, Stuyvesant High School

Publications

Submitted

- *Curves on the torus with few intersections.* Balla, I., Filakovský, M., Kielak, B., Král', D., & Schlomberg, N. (2024). arXiv:2412.18002. Submitted.
- *Equiangular lines in the exponential regime.* Balla, I., & Bucić, M. (2024). arXiv:2409.16219. Submitted.

Accepted

- *Factorization norms and an inverse theorem for MaxCut.* Balla, I., Hambardzumyan, L., & Tomon, I. (2025).
Mathematische Annalen, to appear.
Accepted to **the 66th Annual Symposium on Foundations of Computer Science (FOCS 2025)**.

Published

- *Equiangular lines via matrix projection.* Balla, I. (2025).
Advances in Mathematics, 482 Part B, 110620.
- *Orthonormal representations, vector chromatic number, and extension complexity.* Balla, I. (2024).
Bulletin of the London Mathematical Society, 56 (9), 2911–2921.
- *Small codes.* Balla, I. (2024).
Bulletin of the London Mathematical Society, 56 (5), 1680–1686.
- *On MaxCut and the Lovász theta function.* Balla, I., Janzer, O., & Sudakov, B. (2024).
Proceedings of the American Mathematical Society, 152 (05), 1871–1879.
- *Orthonormal Representations of H -Free Graphs.* Balla, I., Letzter, S. & Sudakov, B. (2020).
Discrete & Computational Geometry, 64 (3), 654–670.
- *The Minrank of Random Graphs over Arbitrary Fields.* Alon, N., Balla, I., Gishboliner, L., Mond, A., & Mousset, F. (2020).
Israel Journal of Mathematics, 235 (1), 63–77.
- *Equiangular subspaces in Euclidean spaces.* Balla, I., & Sudakov, B. (2019).
Discrete & Computational Geometry, 61 (1), 81–90.
- *Ramsey goodness of bounded degree trees.* Balla, I., Pokrovskiy, A., & Sudakov, B. (2018).
Combinatorics, Probability and Computing, 27 (3), 289–309.
- *Equiangular Lines and Spherical Codes in Euclidean Space.* Balla, I., Dräxler, F., Keevash, P., & Sudakov, B. (2018).
Inventiones Mathematicae, 211 (1), 179–212.
- *A remark on Hamilton cycles with few colors.* Balla, I., Pokrovskiy, A., & Sudakov, B. (2017).
Moscow J. Combinatorics and Number Theory, 7 (3), 259–263.
- *Union-closed families of sets.* Balla, I., Bollobás, B., & Eccles, T. (2013).
Journal of Combinatorial Theory Series A, 120 (3), 531–544.

Preprints

- *Note on the second eigenvalue of regular graphs.* Balla, I., Rätty, E., Sudakov, B., & Tomon, I. (2023). arXiv:2311.07629.

- *Minimum density of union-closed families.* Balla, I. (2011). arXiv:1106.0369.

Services

Journal Referee

- Forum of Mathematics, Sigma
- Bulletin of the London Mathematical Society
- Experimental Mathematics
- Combinatorica
- The Journal of Combinatorial Theory, Series A
- The Journal of Combinatorial Theory, Series B
- ACM Transactions on Computation Theory
- Combinatorics, Probability and Computing
- The European Journal of Combinatorics
- The Electronic Journal of Combinatorics
- Discrete Mathematics
- Journal of Graph Theory
- Moscow Journal of Combinatorics and Number Theory

Conference Review

- Symposium on Computational Geometry (SoCG)
- International Conference on Randomization and Computation (RANDOM)

Workshops and Programs

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| ○ Algebraic and Analytic Methods in Combinatorics, SLMath, Berkeley | March 2025 |
| ○ Graph Theory: Extremal, Probabilistic and Structural, SLMath, Berkeley | February 2025 |
| ○ Connections Workshop: Extremal Combinatorics, SLMath, Berkeley | February 2025 |
| ○ Probability and Statistics of Discrete Structures, SLMath, Berkeley, | January 2025 |
| ○ FUB–TAU Workshop on Ramsey Theory, Tel Aviv | March 2020 |
| ○ FUB–TAU Workshop on Graph and Hypergraph Coloring Problems, Berlin | August 2018 |
| ○ Oberwolfach Workshop: Combinatorics | January 2017 |
| ○ Graph Limits, Groups, and Stochastic Processes, Rényi Institute, Budapest | Summer 2014 |
| ○ cSplash, Courant Institute, NYU | April 2014 |
| ○ DIMACS REU, Rutgers University | Summer 2010 |

Talks

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| ○ Seminar on Nonlinear Algebra, Leipzig University, | 2025 |
| ○ Graz Combinatorics Seminar, TU Graz | 2025 |
| ○ Random Structures and Algorithms, TU Wien, Vienna | 2025 |
| ○ Sampling Theory and Applications (SampTA), University of Vienna | 2025 |
| ○ Extremal Combinatorics Seminar, SLMath, Berkeley | 2025 |
| ○ Research seminar in Discrete Mathematics, BIMSA, Beijing | 2025 |
| ○ Combinatorics Seminar, Alfréd Rényi Institute of Mathematics, Budapest | 2024 |
| ○ Discrete Mathematics Seminar, Princeton University | 2024 |
| ○ (Invited speaker) Analysis Seminar (conference), Innsbruck | 2024 |
| ○ Codes and Expansions (CodEx) Seminar | 2024 |
| ○ Summit280, Budapest | 2024 |
| ○ Recent Progress on Optimal Point Distributions and Related Fields, ICERM, Brown University | 2024 |
| ○ (Invited speaker) Czech-Slovak Conference on Graph Theory, Czech Republic | 2024 |
| ○ Seminar on Foundations of Computing, Masaryk University | 2024 |

- Discrete Mathematics Seminar, Princeton University 2023
- Richard P. Stanley Seminar in Combinatorics, MIT/Harvard 2023
- Combinatorics Seminar, Technion 2023
- Combinatorics Seminar, Bar Ilan University 2023
- Combinatorics Seminar, Hebrew University of Jerusalem 2023
- KU-Jerusalem Lunch Seminar, Hebrew University of Jerusalem 2022
- Random Structures and Algorithms, Gniezno 2022
- Codes and Expansions (CodEx) Seminar 2022
- Combinatorics, Physics and Probability Seminar, CMSA, Harvard University 2022
- Combinatorics Seminar, Hebrew University of Jerusalem 2021
- Research Seminar in Combinatorics, Tel Aviv University 2021
- Combinatorics Research Seminar, The Free University of Berlin 2021
- Research Seminar in Combinatorics, Tel Aviv University 2019
- Discrete Mathematics Seminar, Princeton University 2019
- Random Structures and Algorithms, ETH Zürich 2019
- Mittagsseminar, ETH Zürich 2019
- Mittagsseminar, ETH Zürich 2017
- Eurocomb, Vienna 2017
- Random Structures and Algorithms, Gniezno 2017
- Oberwolfach Workshop: Combinatorics 2017
- SIAM Conference on Discrete Mathematics, Georgia State University 2016
- Mittagsseminar, ETH Zürich 2016
- CS Student Seminar, Courant Institute, NYU 2014
- Discrete Mathematics Seminar, Rutgers University 2012
- Algorithms, Combinatorics, and Optimization Seminar, CMU 2012