

# Shoham Letzter

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## Research interests

Extremal and probabilistic combinatorics, Ramsey theory, graph theory.

## Positions

- 2023– **Royal Society University Research Fellow and Associate Professor**, University College London.
- 2020–2023 **Royal Society University Research Fellow and Lecturer**, University College London.
- 2020 **Royal Society University Research Fellow**, University of Cambridge.
- 2016–2019 **Junior Fellow**, ETH Institute for Theoretical Studies, ETH Zürich.
- 2015–2018 **Junior Research Fellow**, Murray Edwards College, University of Cambridge.

## Education

- 2012–2015 **PhD in Mathematics**, University of Cambridge.  
Supervisor: Prof. Béla Bollobás.
- 2011–2012 **MASt in Pure Mathematics**, University of Cambridge.  
With Distinction, average of 95%, Ranked 4<sup>th</sup>.
- 2008–2010 **MSc in Mathematics**, Hebrew University of Jerusalem.  
Cum Laude, average of 97.9%.  
Supervisor: Prof. Ehud Friedgut.
- 2006–2008 **BA in Mathematics with Computer Science**, Technion – Israel Institute of Technology.  
Summa Cum Laude, average of 96.7%.

## Awards

- 2014 **First Smith-Knight Prize**, University of Cambridge.  
**Everard Verheyden Dutch Prize**, Trinity College.
- 2012 **Leslie Walshaw Award**, Trinity College.
- 2012–2015 **CHESS Award and EPSRC Research Studentship**, University of Cambridge.  
**Research Scholar**, Trinity College.
- 2011–2015 **Studentship in Mathematics**, Trinity College.
- 2009 **Klein Award**, Hebrew University.

- Yuval Levy Award**, Technion.
- 2008, 2009 **Bronze and Silver Medals**, International Mathematics Competition for University Students.
- 2008 **Suzy Mondrian Lieberman Award**, Technion.
- 2006–2008 **President’s List**, Technion.
- 2006–2008 **Chais Excellence Program**, Technion.

## Teaching

- 2023 **Probabilistic Methods in Combinatorics**, Lecturer, University College London.
- 2020–2021 **Algebra 1 and 2**, Tutor, University College London.
- 2012–2020 **Analysis, Coding and Cryptography, Graph theory, Numbers and Sets, Probability**, Supervisor, University of Cambridge.
- 2018 **Probabilistic Methods in Combinatorics**, Teaching Assistant, ETH Zürich.
- 2017 **Algebraic Methods in Combinatorics**, Teaching Assistant, ETH Zürich.
- 2009–2010 **Linear Algebra II**, Hebrew University.
- 2009 **Linear Algebra for Physicists**, Hebrew University.

## Mentoring

- 2022– Amedeo Sgueglia, Postdoctoral Fellow, UCL.
- 2021– Kyriakos Katsamaktsis, PhD student, UCL.
- 2021–2022 Fangyan Ge, MSci project, UCL.
- 2018 Sven Heberle (with Benny Sudakov), Master’s thesis project, ETH Zürich.
- 2017 Mancho Clemens (with Benny Sudakov), Master’s thesis project, ETH Zürich.

## Grants

- 2020–2028 **Royal Society University Research Fellow**.
- 2021–2023 **Research Fellows Enhanced Research Expenses**, Royal Society.

## Organisation and community service

- 2020– **Associate Editor**, Discrete Mathematics.
- 2016 **Co-organiser** of Minisymposium on Extremal Problems Involving Cycles and Trees, SIAM Conference on Discrete Mathematics, Denver.

**Refereeing:** Advances in Mathematics  
Bulletin of the London Mathematical Society

Combinatorica  
 Combinatorics, Probability and Computing  
 Discrete Mathematics  
 Discrete & Computational Geometry  
 European Journal of Combinatorics  
 Graphs and Combinatorics  
 Israel Journal of Mathematics  
 Journal of Combinatorial Theory B  
 Journal of the American Mathematical Society  
 Journal of Graph Theory  
 Random Structures & Algorithms  
 SIAM Journal on Discrete Mathematics  
 The Electronic Journal of Combinatorics.

## Languages

**Hebrew**, native speaker.

**English**, full professional proficiency.

**Dutch, French, German, Italian, Spanish**, limited working proficiency.

## Talks

### Invited talks

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| 2024<br>(upcoming) | British Combinatorial Conference, Queen Mary University of London.  |
| 2024               | Warwick-Oxbridge-Manchester-Bristol-London (WOMBL) 1-day meeting, Cambridge.  |
| 2023               | European Conference on Combinatorics, Graph Theory and Applications (EUROCOMB'23),<br>Prague, Czech Republic.<br>Trinity 200, Cambridge.<br>Postgraduate Combinatorial Conference, University of Birmingham.<br>New Perspectives in Pure Mathematics Conference, University of Bristol.   |
| 2022               | Workshop on Combinatorics, Oberwolfach.<br>Minisymposium on Extremal and Probabilistic Combinatorics, DMV meeting, Berlin (online).<br>Recent Advances in Probabilistic and Extremal Combinatorics, Ascona, Switzerland.<br>Armenian Workshop On Graphs, Combinatorics, Probability, and their application to machine<br>learning, Yenokavan, Armenia.<br>Workshop on Combinatorics, Probability and Computing, Oberwolfach.<br>Workshop on Directed minors and digraph structure theory, online. |
| 2021               | British Early Career Mathematicians' Colloquium, University of Birmingham (online).   |

- Minisymposium on randomness and order in geometric, extremal and structural graph theory, Moscow Conference on Combinatorics and Applications (online).
- Minisymposium on Extremal Combinatorics, The Canadian Discrete and Algorithmic Mathematics Conference (CanaDAM), online.
- 2020 Minisymposium on Extremal and Probabilistic Combinatorics mini symposium, DMV Annual meeting, TU Chemnitz (online).
- Young Researchers in Combinatorics online primer, International Centre for Mathematical Studies, Edinburgh.
- 2019 Workshop on Probabilistic and Extremal Combinatorics, Banff International Research Station.
- Minisymposium on Extremal Combinatorics, British Combinatorial Conference, University of Birmingham.
- 2018 Workshop on Recent Advances in Extremal Combinatorics, University Oxford.
- ICM Satellite meeting on Combinatorics: Extremal, Probabilistic and Additive, University of São Paulo.
- Workshop on Probabilistic and Extremal Combinatorics, Harvard University.
- 2017 Colloquia in Combinatorics, LSE.
- 2016 Workshop on the polynomial method, Hebrew University.
- Workshop on Combinatorics and Probability, Oberwolfach.
- Combinatorics session, British Mathematical Colloquium, University of Bristol.

## Seminars

- 2023 University of Victoria Discrete Math Seminar.
- Oxford Combinatorial Theory Seminar.
- Research seminar in Discrete Mathematics, Tsinghua University, Beijing (online).
- Umeå Discrete Mathematics Seminar (online).
- Bar-Ilan Combinatorics Seminar (online).
- 2022 Hebrew University Combinatorics Seminar.
- Tel Aviv Research Seminar in Combinatorics.
- Bristol Combinatorics Seminar.
- 2022 Warwick Combinatorics Seminar.
- Combinatorial Mathematics Society of Australasia (online).
- TU Ilmenau Combinatorics seminar (online).
- TU Graz Combinatorics Seminar (online).
- 2021 LSE Seminar on Combinatorics, Games and Optimisation.
- Ariel University CS Colloquium (online).
- Tel Aviv Research Seminar in Combinatorics.
- Copenhagen-Jerusalem Combinatorics Seminar (online).
- Illinois Graph Theory and Combinatorics Seminar (online).
- Princeton Discrete Mathematics Seminar (online).

- Warwick DIMAP Seminar (online).  
University of Victoria Discrete Math Seminar (online).  
Hebrew University Combinatorics Seminar (online).
- 2020 Karlsruhe Discrete Mathematics Seminar (online).  
Oxford Discrete Mathematics and Probability Seminar (online).  
Queen Mary Combinatorics Study Group (online).  
Extremal and Probabilistic Combinatorics Webinar (online).
- 2019 Cambridge Combinatorics Seminar.  
ETH Zürich Mittagsseminar.  
Birmingham Combinatorics Seminar.
- 2018 ETH Zürich Mittagsseminar.  
Warwick DIMAP Seminar.  
Warwick Combinatorics Seminar.
- 2017 Bar-Ilan Combinatorics Seminar.  
Tel Aviv Research Seminar in Combinatorics.  
ETH Zürich Mittagsseminar.  
Cambridge Combinatorics Seminar.  
ETH Zürich Mittagsseminar.
- 2016 ETH–ITS Fellows Seminar.
- 2015 Queen Mary Combinatorics Study Group.  
Birmingham Combinatorics Seminar.  
Cambridge Combinatorics Seminar.  
Oxford Combinatorial Theory Seminar.  
Bristol Combinatorics Seminar.
- 2014 Cambridge Combinatorics Seminar.
- 2010 Hebrew University Combinatorics Seminar.

## Contributed talks

- 2022 International Colloquium on Automata, Languages and Programming (ICALP), Paris (online).
- 2021 SIAM Conference on Discrete Mathematics, Minisymposium on Extremal Graph Theory and Combinatorics (online).
- 2019 Random Structures & Algorithms, ETH Zürich.
- 2018 Minisymposium on Extremal Problems Involving Cycles and Trees, SIAM Conference on Discrete Mathematics, Denver.
- 2017 Random Structures & Algorithms, Gniezno, Poland.  
European Conference on Combinatorics, Graph Theory and Applications (Eurocomb), Vienna.
- 2016 Minisymposium on Monochromatic Covering and Ramsey-Type Problems, SIAM Conference on Discrete Mathematics, Atlanta, Georgia.

- 2014 International Conference on Probability Theory and Mathematical Statistics, Vilnius, Lithuania.  
Erdős Research Students' Day, Memphis University.

## Publications

### Preprints

- [1] K. Katsamakis and S. Letzter, *Building graphs with high minimum degree on a budget*, arXiv:2401.15812 (2024).
- [2] N. Behague, R. Hancock, J. Hyde, S. Letzter, and N. Morrison, *Thresholds for constrained ramsey and anti-ramsey problems*, arXiv:2401.06881 (2024).
- [3] S. Letzter and A. Sgueglia, *On a problem of Brown, Erdős and Sós*, arXiv:2312.03856 (2023).
- [4] K. Katsamakis, S. Letzter, and A. Sgueglia, *Rainbow subgraphs of uniformly coloured randomly perturbed graphs*, arXiv:2310.18284 (2023).
- [5] K. Katsamakis, S. Letzter, and A. Sgueglia, *Rainbow Hamiltonicity in uniformly coloured perturbed digraphs*, arXiv:2304.09155 (2023).
- [6] K. Katsamakis, S. Letzter, A. Pokrovskiy, and B. Sudakov, *Ascending subgraph decomposition*, arXiv:2308.11613 (2023).
- [7] S. Letzter, *Pancyclicity of highly connected graphs*, arXiv:2306.12579 (2023).
- [8] S. Letzter and N. Morrison, *Directed cycles with zero weight in  $\mathbb{Z}_p^k$* , arXiv:2306.09033 (2023).
- [9] S. Letzter, *Separating paths systems of almost linear size*, arXiv:2211.07732 (2022).
- [10] A. Girão and S. Letzter, *Partitioning a tournament into sub-tournaments of high connectivity*, arXiv:2210.17371 (2022).
- [11] G. Kronenberg, S. Letzter, A. Pokrovskiy, and L. Yepremyan, *Decomposing cubic graphs into isomorphic linear forests*, arXiv:2210.11458 (2022).
- [12] J. Lee, S. Letzter, and A. Pokrovskiy, *Chi-boundedness of graphs containing no cycles with  $k$  chords*, arXiv:2208.14860 (2022).
- [13] S. Letzter, A. Pokrovskiy, and L. Yepremyan, *Size-Ramsey numbers of powers of hypergraph trees and long subdivisions*, arXiv:2103.01942 (2021).
- [14] V. Gruslys and S. Letzter, *Fractional triangle decompositions in almost complete graphs*, arXiv:2008.05313 (2020).
- [15] V. Gruslys and S. Letzter, *Monochromatic triangle packings in red-blue graphs*, arXiv:2008.05311 (2020).
- [16] V. Gruslys and S. Letzter, *Almost partitioning the hypercube into copies of a graph*, arXiv:1612.04603 (2016).

## Accepted

- [17] N. Behague, T. Johnston, S. Letzter, N. Morrison, and S. Ogden, *The rainbow saturation number is linear*, **SIAM Journal on Discrete Mathematics** (2024), accepted.
- [18] S. Letzter, *Sublinear expanders and their applications*, Surveys in Combinatorics 2024, to appear.
- [19] N. Kamčev, S. Letzter, and A. Pokrovskiy, *The Turán density of tight cycles in three-uniform hypergraphs*, **International Mathematics Research Notices**, to appear.
- [20] T. Jiang, S. Letzter, A. Methuku, and L. Yepremyan, *Rainbow subdivisions of cliques*, **arXiv:2108.08814** (2023), [doi.org/10.1002/rsa.21186](https://doi.org/10.1002/rsa.21186).
- [21] A. Girão and S. Letzter, *Immersion of complete digraphs in Eulerian digraphs*, **Israel Journal of Mathematics** (2023), [doi.org/10.1007/s11856-023-2572-y](https://doi.org/10.1007/s11856-023-2572-y).

## Published

- [22] S. Letzter, *Hypergraphs with no tight cycles*, **Proceedings of the American Mathematical Society** 151 (2023), 455–462.
- [23] E. Aigner-Horev, O. Danon, D. Hefetz, and S. Letzter, *Large rainbow cliques in randomly perturbed dense graphs*, **SIAM Journal on Discrete Mathematics** 36 (2022), 2975–2994.
- [24] O. Ben-Eliezer, S. Letzter, and E. Waingarten, *Finding monotone patterns in sublinear time, adaptively*, **ICALP** (2022), 17:1–17:19.
- [25] S. Letzter, *An improvement on Łuczak’s connected matchings method*, **Bulletin of the London Mathematical Society** 54 (2022), 609–623.
- [26] E. Aigner-Horev, O. Danon, D. Hefetz, and S. Letzter, *Small rainbow cliques in randomly perturbed dense graphs*, **European Journal of Combinatorics** 101 (2022), 103452.
- [27] J. Han, Y. Kohayakawa, S. Letzter, G. O. Mota, and O. Parczyk, *The size-Ramsey number of 3-uniform tight paths*, **Advances in Combinatorics** (2021).
- [28] V. Gruslys and S. Letzter, *Cycle partitions of regular graphs*, **Combinatorics, Probability and Computing** 30 (2021), 526–549.
- [29] V. Gruslys, S. Letzter, and N. Morrison, *Hypergraph Lagrangians II: when colex is best*, **Israel Journal of Mathematics** 242 (2021), 637–662.
- [30] D. Korándi, R. Lang, S. Letzter, and A. Pokrovskiy, *Minimum degree conditions for monochromatic cycle partitions*, **Journal of Combinatorial Theory, Series B** 146 (2021), 96–123.
- [31] I. Balla, S. Letzter, and B. Sudakov, *Orthonormal representations of  $H$ -free graphs*, **Discrete & Computational Geometry** 64 (2020), 654–670.
- [32] S. Letzter and B. Sudakov, *The oriented size Ramsey number of directed paths*, **European Journal of Combinatorics** 88 (2020), 103103.
- [33] M. Bucić, S. Heberle, S. Letzter, and B. Sudakov, *Monochromatic trees in random tournaments*, **Combinatorics, Probability and Computing** 29 (2020), 318–345.
- [34] S. Letzter and J. Sahasrabudhe, *On existentially complete triangle-free graphs*, **Israel Journal of Mathematics** 236 (2020), 591–601.

- [35] M. Kwan, S. Letzter, B. Sudakov, and T. Tran, *Dense induced bipartite subgraphs in triangle-free graphs*, **Combinatorica** 40 (2020), 283–305.
- [36] V. Gruslys, S. Letzter, and N. Morrison, *Hypergraph Lagrangians I: the Frankl-Füredi conjecture is false*, **Advances in Mathematics** 365 (2020), 107063.
- [37] I. Leader, S. Letzter, B. Narayanan, and M. Walters, *Product-free sets in the free semigroup*, **European Journal of Combinatorics** 83 (2020), 103003.
- [38] S. Letzter, *Many  $H$ -copies in graphs with a forbidden tree*, **SIAM Journal on Discrete Mathematics** 33 (2020), 2360–2368.
- [39] O. Ben-Eliezer, C. Canonne, S. Letzter, and E. Waingarten, *Finding monotone patterns in sublinear time*, **FOCS** (2019).
- [40] M. Bucić, S. Letzter, and B. Sudakov, *Multicolour bipartite Ramsey number of paths*, **The Electronic Journal of Combinatorics** 26 (2019), P3.60.
- [41] M. Bucić, S. Letzter, and B. Sudakov, *3-colour bipartite Ramsey number of cycles and paths*, **Journal of Graph Theory** 92 (2019), 445–459.
- [42] A. Girão, S. Letzter, and J. Sahasrabudhe, *Partitioning a graph into monochromatic connected subgraphs*, **Journal of Graph Theory** 91 (2019), 353–364.
- [43] M. Bucić, S. Letzter, and B. Sudakov, *Directed Ramsey number for trees*, **Journal of Combinatorial Theory, Series B** 137 (2019), 145–177.
- [44] S. Letzter, *Monochromatic cycle partitions of 2-coloured graphs with minimum degree  $3n/4$* , **The Electronic Journal of Combinatorics** 26 (2019), P1.19.
- [45] S. Letzter and R. Snyder, *The homomorphism threshold of  $\{C_3, C_5\}$ -free graphs*, **Journal of Graph Theory** 90 (2019), 83–106.
- [46] M. Bucić, S. Letzter, and B. Sudakov, *Monochromatic paths in random tournaments*, **Random Structures & Algorithms** 54 (2019), 69–81.
- [47] M. Bucić, S. Letzter, B. Sudakov, and T. Tran, *Minimum saturated families of sets*, **Bulletin of the London Mathematical Society** 50 (2018), 725–732.
- [48] V. Gruslys and S. Letzter, *Minimizing the number of triangular edges*, **Combinatorics, Probability and Computing** 27 (2018), 580–622.
- [49] B. Bollobás, J. Lee, and S. Letzter, *Eigenvalues of subgraphs of the cube*, **European Journal of Combinatorics** 70 (2018), 125–148.
- [50] B. Bollobás and S. Letzter, *Longest common extension*, **European Journal of Combinatorics** 68 (2018), 242–248.
- [51] S. Letzter, *Radon numbers for trees*, **Journal of Discrete Mathematics** 340 (2017), 333–344.
- [52] S. Letzter, *Path Ramsey number for random graphs*, **Combinatorics, Probability and Computing** 25 (2016), 612–622.
- [53] S. Letzter, *Large monochromatic triple stars in edge colourings*, **Journal of Graph Theory** 80 (2015), 323–328.
- [54] V. Falgas-Ravry, T. Kittipassorn, D. Korándi, S. Letzter, and B. Narayanan, *Separating path systems*, **Journal of Combinatorics** 5 (2014), 335–354.



- [55] S. Letzter, *The property of having a  $k$ -regular subgraph has a sharp threshold*, **Random Structures & Algorithms** 42 (2012), 509–519.