

Natalie Behague

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Education

- PhD**, Queen Mary University of London, UK Sep 2016 – Aug 2020
‘*Topics in Extremal and Probabilistic Combinatorics*’, supervised by Robert Johnson
- BA with MMath**, Trinity College, University of Cambridge, UK Oct 2012 – Jun 2016
Distinction (Part III)
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Employment

- University of Warwick**, UK Nov 2023 – present
Research Fellow, working with Richard Montgomery
- University of Victoria**, Canada Jan 2022 – Oct 2023
PIMS Postdoctoral Fellow, working with Natasha Morrison and Jonathan Noel
- Toronto Metropolitan University (formerly Ryerson)**, Canada Oct 2020 – Oct 2021
Postdoctoral Research Fellow, Graphs at Ryerson Research Group
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Publication List

I work on a variety of problems under the umbrella of extremal and probabilistic combinatorics.

Published and Accepted

- [1] **2024**, “Improved bounds for cross-Sperner systems”, with Akina Kuperus, Natasha Morrison, and Ashna Wright, *Electron. J. Comb.* 31.2, P2.4, (15 pages), DOI: [10.37236/11860](https://doi.org/10.37236/11860).
- [2] **2024**, “Layered subgraphs of the hypercube”, with Imre Leader, Natasha Morrison, and Kada Williams, *Electron. J. Comb.*, (accepted) (11 pages), arXiv: [2404.18014](https://arxiv.org/abs/2404.18014).
- [3] **2024**, “Off-Diagonal Commonality of Graphs via Entropy”, with Natasha Morrison and Jonathan A. Noel, *SIAM J. Discrete Math.* 38.3, 2335–2360, (26 pages), DOI: [10.1137/23M1625342](https://doi.org/10.1137/23M1625342).
- [4] **2024**, “Subgraph Games in the Semi-Random Graph Process and Its Generalization to Hypergraphs”, with Trent G. Marbach, Paweł Prałat, and Andrzej Ruciński, *Electron. J. Comb.* 31.3, P3.30, (18 pages), DOI: [10.37236/11859](https://doi.org/10.37236/11859).
- [5] **2024**, “The Rainbow Saturation Number Is Linear”, with Tom Johnston, Shoham Letzter, Natasha Morrison, and Shannon Ogden, *SIAM J. Discrete Math.* 38.2, 1239–1249, (11 pages), DOI: [10.1137/23M1566881](https://doi.org/10.1137/23M1566881).
- [6] **2024**, “Thresholds for constrained Ramsey and anti-Ramsey problems”, with Robert Hancock, Joseph Hyde, Shoham Letzter, and Natasha Morrison, *European J. Combin.*, (accepted) (27 pages), arXiv: [2401.06881](https://arxiv.org/abs/2401.06881).
- [7] **2023**, “The iterated local transitivity model for hypergraphs”, with Anthony Bonato, Melissa A. Huggan, Rehan Malik, and Trent G. Marbach, *Discrete Appl. Math.* 337, 106–119, (14 pages), DOI: [10.1016/j.dam.2023.04.006](https://doi.org/10.1016/j.dam.2023.04.006).
- [8] **2022**, “Synchronizing times for k -sets in automata”, with Robert Johnson, *Electron. J. Comb.* 29.3, P3.41, (23 pages), DOI: [10.37236/9819](https://doi.org/10.37236/9819).
- [9] **2022**, “The localization capture time of a graph”, with Anthony Bonato, Melissa A. Huggan, Trent G. Marbach, and Brittany Pittman, *Theor. Comput. Sci.* 911, 80–91, (12 pages), DOI: [10.1016/j.tcs.2022.02.007](https://doi.org/10.1016/j.tcs.2022.02.007).
- [10] **2022**, “Tight Bounds on Probabilistic Zero Forcing on Hypercubes and Grids”, with Trent G Marbach and Paweł Prałat, *Electron. J. Comb.* 29.1, P1.3, (20 pages), DOI: [10.37236/10585](https://doi.org/10.37236/10585).
- [11] **2019**, “Semi-perfect 1-factorizations of the hypercube”, *Discrete Math.* 342.6, 1696–1702, (7 pages), DOI: [10.1016/j.disc.2019.01.035](https://doi.org/10.1016/j.disc.2019.01.035).
- [12] **2018**, “Hypergraph saturation irregularities”, *Electron. J. Comb.* 25.2, P2.11, (13 pages), DOI: [10.37236/7727](https://doi.org/10.37236/7727).

Submitted

- [13] **2024**, “A note on the invertibility of oriented graphs”, with Tom Johnston, Natasha Morrison, and Shannon Ogden, (10 pages), arXiv: [2404.10663](https://arxiv.org/abs/2404.10663).
 - [14] **2024**, “Creating Subgraphs in Semi-Random Hypergraph Games”, with Paweł Prałat and Andrzej Ruciński, (39 pages), arXiv: [2409.19335](https://arxiv.org/abs/2409.19335).
 - [15] **2023**, “An Approximate Counting Version of the Multidimensional Szemerédi Theorem”, with Joseph Hyde, Natasha Morrison, Jonathan A. Noel, and Ashna Wright, (19 pages), arXiv: [2311.13709](https://arxiv.org/abs/2311.13709).
 - [16] **2023**, “Common Pairs of Graphs”, with Natasha Morrison and Jonathan A. Noel, (27 pages), arXiv: [2208.02045](https://arxiv.org/abs/2208.02045).
 - [17] **2023**, “Sidorenko-Type Inequalities for Pairs of Trees”, with Gabriel Crudele, Jonathan A. Noel, and Lina M. Simbaqueba, (53 pages), arXiv: [2305.16542](https://arxiv.org/abs/2305.16542).
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Awards and Funding

PIMS Postdoctoral Fellowship , University of Victoria	2022 – 2023
EPSRC Doctoral Studentship , Queen Mary University of London	2016 – 2020
Clay Mathematics Institute Funding US\$1,120 to support conference travel	Jul 2022
QMUL Postgraduate Research Fund £400 to support conference travel	Jun 2019
LMS Funding £100 to support conference travel	Jun 2019
School of Mathematical Sciences Presentation Prize , Queen Mary University of London	2019
Ann Cook Poster Presentation Prize , Queen Mary University of London	2018
Undergraduate Summer Research Scholarship , Trinity College, Cambridge (£2000) <i>‘The Representation Theory of the Symmetric Group’</i> , supervised by Stuart Martin	2015
Senior Scholar , Trinity College, University of Cambridge	2014
European Girls’ Mathematical Olympiad Bronze Medal	2012

Talks

Invited Conference and Colloquia Talks

Colloquia in Combinatorics, UCL (upcoming)	May 2025
Liverpool Discrete Mathematics Colloquium (upcoming)	Nov 2024
IBL60 (for Imre Leader’s 60th birthday), University of Cambridge, <i>‘Bounding cross-Sperner families’</i>	Sep 2023
CanadAM, Combinatorics and Algebra minisymposium, University of Winnipeg,	Jun 2023
MoCCA ’20, Adventures in Probabilistic and Extremal Combinatorics minisymposium, MIPT	Jul 2021

Invited External Seminar and Workshop Talks

University of Bristol, <i>‘Common pairs of graphs’</i>	Sep 2024
University of Oxford, <i>‘The rainbow saturation number’</i>	May 2024
University of Bristol, <i>‘Counting copies with containers’</i>	Jan 2024
Birmingham–Warwick Joint Combinatorics Day, <i>‘Counting copies with containers’</i>	Dec 2023
Workshop on Spanning Subgraphs in Graphs, University of Warwick	Jul 2023
One World Combinatorics on Words Seminar, <i>‘Synchronizing times for k-sets in automata’</i>	Oct 2022
Young Researchers in Combinatorics workshop, ICMS	Jul 2022
Cross-community Collaborations in Combinatorics workshop, BIRS	Jun 2022
PIMS Emergent Research Seminar, <i>‘Subgraphs in semi-random graphs’</i>	May 2022
University of Bristol, <i>‘Subgraph games in the semi-random graph process’</i>	Nov 2021
Graphs and Matroids Seminar via Matroid Union blog, <i>‘Subgraphs in semi-random graphs’</i>	Oct 2021
Queen Mary University of London, <i>‘Subgraphs in semi-random graphs (and hypergraphs)’</i>	Oct 2021
TU Ilmenau, <i>‘Subgraphs in semi-random graphs’</i>	Jul 2021
University of Bristol, <i>‘Synchronizing Times for k-sets in Automata’</i>	Apr 2021
Women in Combinatorics Virtual Colloquium, <i>‘Synchronizing times for k-sets in automata’</i>	Feb 2021
Workshop on Graph Theory & Combinatorics in Thuringia	Jul 2020
Birkbeck University of London, <i>‘Semi-perfect 1-factorizations of the hypercube’</i>	Oct 2019
LSE, <i>‘Semi-perfect 1-factorizations of the hypercube’</i>	Oct 2019
University of Bristol, <i>‘Semi-perfect 1-factorizations of the hypercube’</i>	Feb 2019
Open University Winter Combinatorics Meeting, <i>‘Semi-perfect 1-factorizations of the hypercube’</i>	Feb 2019
University of Warwick, <i>‘Hypergraph saturation irregularities’</i>	Oct 2018
University of Cambridge, <i>‘Hypergraph saturation irregularities’</i>	Feb 2018

Select Other Talks

British Combinatorial Conferences, QMUL/Lancaster/Durham/Strathclyde	Jul 2024/2022/2021/2019
Random Structures and Algorithms, Institute of European Culture in Gniezno	Aug 2022
CanadAM	May 2021
BYMAT (Bringing Young Mathematicians Together)	Dec 2020

Workshops

Workshop on Spanning Subgraphs in Graphs (2), University of Warwick	Aug 2024
Early-Career Researchers in Combinatorics, International Centre for Mathematical Sciences	Jul 2024
Extremal Graphs and Hypergraphs, Institut Mittag-Leffler	Jul 2024
Algebraic, extremal, & struct. methods & problems in graph colouring, Sparse Graphs Coalition	Feb 2024
Workshop on Spanning Subgraphs in Graphs, University of Warwick	Jul 2023
Young Researchers in Combinatorics, International Centre for Mathematical Sciences	Jul 2022
Cross-community Collaborations in Combinatorics, Banff International Research Station	May 2022
Graduate Research Workshop in Combinatorics (online)	Jun 2021
Workshop on Graph Theory & Combinatorics in Thuringia (online)	Jul 2020

Teaching

Graph Theory – Masters course with 50 to 60 students Included lecturing, writing problem sheets, writing and marking the exam	Autumn 2023, Autumn 2024
Matrix Algebra I – 2nd year undergraduate course with approx. 130 students Included lecturing, office hours, writing homework assignments, writing and marking the exam	Autumn 2022

Teaching Assistant Roles

Random Processes – 3rd year undergrad course (running tutorials)	Autumn 2019
Calculus I – 1st year undergrad course (running tutorials, marking)	Autumn 2019
Coding Theory – 3rd year undergrad course (tutorial assistant, marking)	Spring 2019
Geometry I – 1st year undergrad course (running tutorials)	Spring 2018
Coding Theory – 3rd year undergrad course (tutorial assistant, marking)	Spring 2018
Mathematical Writing – 2nd year undergrad course (marking)	Autumn 2017
Differential and Integral Analysis – 2nd year undergrad course (tutorial assistant, marking)	Spring 2017

Research Students

Neil Mukerji, Masters R-Project, ‘ <i>Progress on the List Colouring Conjecture</i> ’	2023 – 2024
Rob Phillips, MSc Research Project, ‘ <i>Edge partitioning graphs of high degree</i> ’	2023 – 2024

Select Outreach and Engagement

Imagining UVic , ‘ <i>The Catalan Numbers</i> ’ Wrote and delivered 2 hour workshop for small group of girls aged 16–18.	Oct 2022
QMUL Girls in Maths Taster Days , ‘ <i>Graph Theory</i> ’ Wrote and delivered 45 minute lecture to 140 girls aged 16–17.	Mar 2019, 2020
Royal Institution Mathematics Masterclass , QMUL, ‘ <i>Geometry in the 4th Dimension</i> ’ Delivered a 2.5 hour masterclass for 90 children aged 16–17.	Feb 2019
LMS Newsletter Microthesis , ‘ <i>Hypergraph Saturation Irregularities</i> ’ Invited to write exposition on part of my PhD work for the LMS newsletter.	Sept 2019
International Mathematical Olympiad , Coordinator Co-created a mark scheme, marked scripts and coordinated marks with team leaders.	Jul 2019
QMUL Year 11 Maths Summer Schools , Wrote and helped to deliver three day extended research project on ‘Codes and Ciphers’ for ages 15–16. Wrote and delivered hour-long interactive class for 40 children on ‘The Catalan Numbers’.	2017, 2018, 2019
Winchester Mathematics Summer School , ‘ <i>Double Counting</i> ’ Wrote and delivered hour-long interactive class for 30 children aged 16–17.	2018
UKMT Summer Schools and ‘Summer School for Girls’ , ‘ <i>Modular Arithmetic</i> ’ and ‘ <i>Graphs</i> ’ Wrote and delivered 1.5-hour interactive classes for groups of 20 to 30 children aged 13–16.	2013 – 2018
UKMT Maths Circles , ‘ <i>The Catalan Numbers</i> ’ Wrote and delivered 1.5-hour interactive classes for 30 children aged 13–15.	2016, 2018
UKMT Mentoring Scheme Mentor for gifted children aged 16–18, via email correspondence.	2012 – 2020

Administrative Experience and Academic Service

Organiser , Early Career Mathematicians in Combinatorics Workshop, ICMS In addition to scientific organising, the organising committee won £36,500 in funding from various sources: <ul style="list-style-type: none">£24,000 and hosting from the ICMS£4,000 from the Heilbronn Institute,£3,000 from the London Mathematical Society,£3,000 from the Glasgow Math. Journal Trust,£1,500 from the Edinburgh Mathematical Society,£1,000 from the British Combinatorial Committee.	2024
Organiser , Warwick Combinatorics Seminar	2024
Supervisor , Royal Institution Mathematics Masterclasses, QMUL Included directing undergraduate volunteers, liaising with speakers, set up and child safety.	2018, 2019
Clearing hotline adviser , QMUL, with particular responsibility for non-standard cases	2018, 2019
Organiser , Queen Mary Postgraduate Seminar	2017–2018
Journal referee For <i>JCTA</i> , <i>JCTB</i> , <i>Eur. J. Combin.</i> , <i>SIAM J. Discrete Math.</i> , <i>Combinatorica</i> , <i>Electron. J. Comb.</i> , <i>Discrete Mathematics</i> , and <i>Mathematika</i> .	2018 – present
Treasurer , Emmy Noether Society – student society to promote women in mathematics. Secured an LMS Small Grant for Education for the society.	2014

Other Skills

Professional Programming Experience Software developer at Metaswitch for summers of 2013 and 2014. Was awarded a bonus and a paid scholarship to return for a second summer.
Music ABRSM Grade 8 piano and violin
