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Ewan Davies

Positions

Colorado State University (CSU) — **Fort Collins, Colorado, USA**
Assistant Professor in Department of Computer Science — August 2022 – Present

University of Colorado Boulder (CU Boulder) — **Boulder, Colorado, USA**
Postdoc in the CS Theory group with Alexandra Kolla — October 2019 – August 2022

Simons Institute for the Theory of Computing — **Berkeley, California, USA**
Research Fellow at *Geometry of Polynomials* program — January 2019 – May 2019

University of Amsterdam (UvA) — **Amsterdam, Netherlands**
Postdoc in the *AFMIDMOA* group with Lex Schrijver — October 2017 – December 2018

Education

London School of Economics and Political Science (LSE) — **London, UK**
Ph.D. Mathematics — October 2013 – September 2017
Thesis title: *Extremal and probabilistic results for regular graphs*
Supervisors: Jozef Skokan, Peter Allen

Jesus College, University of Cambridge — **Cambridge, UK**
M.Math. Mathematics, Distinction — September 2012 – June 2013
B.A. (Hons) Mathematics, First Class — September 2009 – June 2012

Research Interests

Algorithms for approximate counting, stochastic local search, graph colouring. Topics at the intersection of probabilistic combinatorics, algorithms, and statistical physics.

Awards

2023	Jun	**Sampling and Optimization under Global Constraints**, NSF Grant #2309707
2020	Jul	**PhD Prize for Outstanding Academic Performance**, London School of Economics
2016	Jan	**Santander Scholarship**, Santander Travel Research Fund at LSE
2015	Oct	**Cyril Offord Trust Award**, London School of Economics
2014	Jul	**Mathematics Department New Teacher Prize**, London School of Economics
2013	Sep	**Ph.D. Studentship**, London School of Economics
	Jun	**Foundation Scholarship and R.A. Watchman Prize**, Jesus College, Cambridge
2012	Jun	**Foundation Scholarship and Sir Harold Spencer Jones Prize**, Jesus College, Cambridge
2011	Jun	**Foundation Scholarship and Ware Prize**, Jesus College, Cambridge
2010	Jun	**Foundation Exhibition and Bronowski Prize**, Jesus College, Cambridge

Papers

Preprints

[28] C. Carlson, E. Davies, A. Kolla, and A. Potukuchi. Approximately Counting Independent Sets in Dense Bipartite Graphs via Subspace Enumeration (July 2023). arXiv: 2307.09533.

[27] S. Cambie, W. Cames van Batenburg, E. Davies, and R. J. Kang. List Packing Number of Bounded Degree Graphs (Mar. 2023). arXiv: 2303.01246.

[26] E. Davies, R. J. Kang, F. Pirot, and J.-S. Sereni. An algorithmic framework for colouring locally sparse graphs (Apr. 2020). arXiv: 2004.07151.

[25] E. Davies, R. J. Kang, F. Pirot, and J.-S. Sereni. Graph structure via local occupancy (Mar. 2020). arXiv: 2003.14361.

[24] P. Allen, E. Davies, and J. Skokan. Regularity inheritance in hypergraphs (Jan. 2019). arXiv: 1901.05955.

Publications

[23] C. Carlson, E. Davies, and A. Kolla. Efficient algorithms for the Potts model on small-set expanders. *Chicago Journal of Theoretical Computer Science* (2023), to appear. arXiv: 2003.01154.

[22] E. Davies and W. Perkins. Approximately Counting Independent Sets of a Given Size in Bounded-Degree Graphs. *SIAM Journal on Computing* 52.2 (2023), 618–640. DOI: 10.1137/21M1466220. arXiv: 2102.04984.

[21] C. Carlson, E. Davies, N. Fraiman, A. Kolla, A. Potukuchi, and C. Yap. Algorithms for the Ferromagnetic Potts Model on Expanders. *2022 IEEE 63rd Annual Symposium on Foundations of Computer Science (FOCS)*. 2022, pp. 344–355. DOI: 10.1109/FOCS54457.2022.00040. arXiv: 2204.01923.

[20] C. Carlson, E. Davies, A. Kolla, and W. Perkins. Computational Thresholds for the Fixed-Magnetization Ising Model. *Proceedings of the 54th Annual ACM SIGACT Symposium on Theory of Computing*. Rome Italy: ACM, 2022, pp. 1459–1472. DOI: 10.1145/3519935.3520003. arXiv: 2111.03033.

[19] S. Cambie, W. Cames van Batenburg, E. Davies, and R. J. Kang. Packing list-colourings. *Random Structures & Algorithms* (2023), to appear. DOI: 10.1002/rsa.21181. arXiv: 2110.05230.

[18] E. Davies and F. Illingworth. The χ-Ramsey Problem for Triangle-Free Graphs. *SIAM Journal on Discrete Mathematics* 36.2 (2022), 1124–1134. DOI: 10.1137/21M1437573. arXiv: 2107.12288.

[17] E. Davies and W. Perkins. Approximately Counting Independent Sets of a Given Size in Bounded-Degree Graphs. *48th International Colloquium on Automata, Languages, and Programming (ICALP 2021)*. Ed. by N. Bansal, E. Merelli, and J. Worrell. Vol. 198. Leibniz International Proceedings in Informatics (LIPIcs). Dagstuhl, Germany: Schloss Dagstuhl – Leibniz-Zentrum für Informatik, 2021, 62:1–62:18. DOI: 10.4230/LIPIcs.ICALP.2021.62. arXiv: 2102.04984.

[16] P. Allen, J. Böttcher, E. K. Hng, J. Skokan, and E. Davies. An Approximate Blow-up Lemma for Sparse Hypergraphs. Vol. 195. Proceedings of the XI Latin and American Algorithms, Graphs and Optimization Symposium. 2021, pp. 394–403. DOI: 10.1016/j.procs.2021.11.048.

[15] E. Davies, M. Jenssen, and W. Perkins. A Proof of the Upper Matching Conjecture for Large Graphs. *Journal of Combinatorial Theory, Series B* 151 (2021), 393–416. DOI: 10.1016/j.jctb.2021.07.005.

[14] E. Davies, R. de Joannis de Verclos, R. J. Kang, and F. Pirot. Occupancy Fraction, Fractional Colouring, and Triangle Fraction. *Journal of Graph Theory* 97.4 (2021), 557–568. DOI: 10.1002/jgt.22671.

[13] F. Bencs, E. Davies, V. Patel, and G. Regts. On Zero-Free Regions for the Anti-Ferromagnetic Potts Model on Bounded-Degree Graphs. *Annales de l'Institut Henri Poincaré D* 8.3 (2021), 459–489. DOI: 10.4171/AIHPD/108. arXiv: 1812.07532.

[12] E. Davies, R. de Joannis de Verclos, R. J. Kang, and F. Pirot. Colouring triangle-free graphs with local list sizes. *Random Structures & Algorithms* 57.3 (2020), 730–744. DOI: 10.1002/rsa.20945. arXiv: 1812.01534.

[11] E. Davies. Counting proper colourings in 4-regular graphs via the Potts model. *Electronic Journal of Combinatorics* 25.4 (2018), P4.7. DOI: 10.37236/7743. arXiv: 1801.07547.

[10] E. Davies, M. Jenssen, W. Perkins, and B. Roberts. Tight bounds on the coefficients of partition functions via stability. *Journal of Combinatorial Theory Series A* 160 (2018), 1–30. DOI: 10.1016/j.jcta.2018.06.005. arXiv: 1704.07784.

[9] E. Davies, M. Jenssen, W. Perkins, and B. Roberts. Extremes of the internal energy of the Potts model on cubic graphs. *Random Structures & Algorithms* 53.1 (2018), 59–75. DOI: 10.1002/rsa.20767. arXiv: 1610.08496.

[8] E. Davies, M. Jenssen, W. Perkins, and B. Roberts. On the average size of independent sets in triangle-free graphs. *Proceedings of the American Mathematical Society* 146 (2018), 111–124. DOI: 10.1090/proc/13728. arXiv: 1606.01043.

[7] E. Davies, M. Jenssen, and B. Roberts. Multicolour Ramsey numbers of paths and even cycles. *European Journal of Combinatorics* 63 (2017), 124–133. DOI: 10.1016/j.ejc.2017.03.002. arXiv: 1606.00762.

[6] E. Davies, M. Jenssen, W. Perkins, and B. Roberts. Independent Sets, Matchings, and Occupancy Fractions. *Journal of the London Mathematical Society* 96 (2017), 47–66. DOI: 10.1112/jlms.12056. arXiv: 1508.04675.

[5] M. Coulson, E. Davies, A. Kolla, V. Patel, and G. Regts. Statistical Physics Approaches to Unique Games. *35th Computational Complexity Conference (CCC 2020)*. Ed. by S. Saraf. Vol. 169. Leibniz International Proceedings in Informatics (LIPIcs). Dagstuhl, Germany: Schloss Dagstuhl–Leibniz-Zentrum für Informatik, 2020, 13:1–13:27. DOI: 10.4230/LIPIcs.CCC.2020.13.

[4] E. Davies, M. Jenssen, W. Perkins, and B. Roberts. Tight bounds on the coefficients of partition functions via stability (extended abstract). *Electronic Notes in Discrete Mathematics* 61 (2017), 317–321. DOI: 10.1016/j.endm.2017.06.054.

[3] E. Davies. Counting in hypergraphs via regularity inheritance (extended abstract). *Electronic Notes in Discrete Mathematics* 49 (2015), 413–417. DOI: 10.1016/j.endm.2015.06.058.

Other publications

[2] E. Davies. Extremal and probabilistic results for regular graphs. PhD thesis. The London School of Economics and Political Science, 2017. DOI: 10.21953/lse.bijk2dsj3hlb.

[1] E. Davies. Counting the number of ways a gas can fill a room. *Maths at LSE Blog* (2016). eprint: http://eprints.lse.ac.uk/65145. URL: http://blogs.lse.ac.uk/maths/2016/01/14/ewan-davies-counting-the-number-of-ways-a-gas-can-fill-a-room-3.

Talks

Conferences and workshops

2023	Aug	Random Theory	Estes Park, CO
	May	8th Lake Michigan Workshop on Combinatorics and Graph Theory (invited)	Notre Dame, IN
2022	May	AMS Spring Western Sectional Meeting 2022 (invited), Special Session on Enumerative and Extremal Problems in Chromatic Graph Theory	Denver, CO (Online)
2021	Jul	48th International Colloquium on Automata, Languages, and Programming (ICALP 2021)	Glasgow, UK (Online)

	Mar	Entropy compression and related methods, Sparse Graphs Coalition (invited)	Online
2020	Jul	35th Computational Complexity Conference (CCC 2020)	
			Saarbrücken, Germany (Online)
2018	Aug	Algorithmic and Combinatorial Aspects of Partition Functions	
			Amsterdam, Netherlands
	Mar	Workshop on Graph Limits in Bohemian Switzerland	Janov, Czechia
2017	Aug	European Conference on Combinatorics, Graph Theory and Applications (EUROCOMB 2017)	Vienna, Austria
	May	Two one-day Colloquia in Combinatorics, LSE (invited)	London, UK
2016	Aug	Student Combinatorics Day (invited)	Birmingham, UK
2015	Aug	European Conference on Combinatorics, Graph Theory and Applications (EUROCOMB 2015)	Bergen, Norway
	Jul	Novi Sad Workshop on Foundations Of Computer Science	Novi Sad, Serbia
	Apr	Postgraduate Combinatorial Conference, QMUL	London, UK
2014	Jul	SUMMIT 190: Balogh, Csaba, Hajnal, and Pluhar are 190 (invited)	Szeged, Hungary

Seminars

2022	Mar	CS Colloquium (BMAC), Colorado State	Fort Collins, Colorado
2021	Dec	Mathematics Lunchtime Seminar, LSE	London, UK
	Sep	Combinatorics and Probability Seminar, University of Illinois Chicago	Chicago, Illinois
	Feb	Discrete Math and Combinatorics Seminar, University of South Carolina	Colombia, South Carolina (Online)
2020	Feb	Discrete Mathematics Seminar, KdVI / CWI	Amsterdam, Netherlands
	Jan	CS Theory Seminar, CU Boulder	Boulder, Colorado
2019	Sep	CS Theory Seminar, CU Boulder	Boulder, Colorado
	Apr	Geometry of Polynomials Seminar, Simons Institute	Berkeley, California
2018	May	Applied Stochastics Seminar, Radboud University	Nijmegen, Netherlands
	Jan	Discrete Mathematics Seminar, KdVI / CWI	Amsterdam, Netherlands
2017	Oct	Discrete Mathematics Seminar, KdVI / CWI	Amsterdam, Netherlands
	Feb	Combinatorics Seminar	Oxford, UK
	Feb	Discrete Mathematics Seminar, KdVI / CWI	Amsterdam, Netherlands
	Jan	PhD Seminar on Combinatorics, Games and Optimisation, LSE	London, UK
2016	Apr	Seminário de Teoria da Computação, Combinatória e Otimização	São Paulo, Brazil
2015	Nov	Discrete Geometry and Combinatorics Seminar, UCL	London, UK
	Oct	Mathematics Lunchtime Seminar, LSE	London, UK
	Apr	Combinatorics Seminar, Freie Universität	Berlin, Germany
2013	Nov	Mathematics Lunchtime Seminar, LSE	London, UK

Research Visits

2022	Nov	**Dagstuhl Workshop on Counting and Sampling**, Leibniz Center for Informatics	
		Seminar no. 22482	Wadern, Germany
	Aug	**New tools for optimal mixing of Markov chains**, University of California Santa Barbara	
			Santa Barbara, CA
2021	Sep	**University of Illinois Chicago**, Dept. of Mathematics, Statistics, and Computer Science	
		with Will Perkins	Chicago, Illinois
	May	**Sparse Graphs Coalition Workshop**	
		Extremal and algorithmic aspects of partition functions	Online
	Mar	**Sparse Graphs Coalition Workshop**	
		Entropy compression and related methods	Online
2019	Jan	**Simons Institute for the Theory of Computing**	
		Geometry of Polynomials Program	Berkeley, California
2018	Feb	**Instituto Nacional de Matemática Pura e Aplicada**	
		Graphs and Randomness Workshop	Rio de Janeiro, Brazil
2016	Apr	**Universidade de São Paulo**, Departamento de Ciência da Computação	
		with Yoshiharu Kohayakawa	São Paulo, Brazil
	Mar	**Instituto Nacional de Matemática Pura e Aplicada**	
		with Rob Morris	Rio de Janeiro, Brazil
2015	Sep	**Group Workshop**, Institute of Mathematics, Freie Universität Berlin	
		with Tibor Szabó	Děčín, Czech Republic
	Jul	**Regularity and Analytic Methods in Combinatorics**	
		University of Warwick	Coventry, UK
2014	Jun	**Budapest Summer School in Discrete Mathematics**	
		Eötvös Loránd University	Budapest, Hungary

Teaching

2020	**Algorithms (CSCI 3104)**, design, lecture and manage course with >350 students	CU Boulder
2018	**Representation Theory**, teaching assistant, exam setting, exam marking	UvA
	Algebraic Methods in Combinatorics, seminar teaching assistant	UvA
2016	**Mathematics Support Centre**, one-to-one tuition in a variety of courses	LSE
2015	**Mathematics Support Centre**, one-to-one tuition in a variety of courses	LSE
	Real Analysis (MA203), class teacher for 2 groups of 15 students	LSE
2014	**Graph Theory (MA316)**, class teacher for 1 group of 15 students	LSE
	Further Mathematical Methods (MA212), class teacher for 3 groups of 15 students	LSE
2013	**Mathematical Methods (MA100)**, class teacher for 3 groups of 15 students	LSE

Academic Service

Peer review

IEEE Symposium on Foundations of Computer Science (FOCS); ACM Symposium on Theory of Computing (STOC); International Colloquium on Automata, Languages and Programming (ICALP); International Conference on Randomization and Computation (RANDOM); ACM-SIAM Symposium on Discrete Algorithms

(SODA)

Inventiones Mathematicae; Bulletin of the London Mathematical Society; SIAM Journal on Discrete Mathematics; Combinatorica; Combinatorics, Probability and Computing; European Journal of Combinatorics; Journal of Graph Theory; Electronic Journal of Combinatorics; Discrete Optimization; Transactions on Algorithms

Session Chair/Co-chair

IEEE Symposium on Foundations of Computer Science (FOCS 2021)

Other Experience

Athena Swan Assessment Team Member, London School of Economics and Political Science   Jan 2016
Worked to lower barriers to entry into PhD program for women in mathematics

Green Impact Team Member, London School of Economics and Political Science   Sep 2015
Audited and improved environmental impact of department and members

Intern, NRICH Project, University of Cambridge   Jun 2012
Full-stack software developer for educational website

Volunteer Mathematics Tutor, STIMULUS, Fen Ditton Community Primary   Oct 2011
Taught gifted junior/primary school students

Intern, Centre for Sports Engineering Research, Sheffield Hallam University   Sep 2011
Application developer and machine learning researcher