Address

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Education

University of California Santa Cruz Ph.D. 2010-2014 Thesis title: *Quantitative spectral gap for thin groups of hyperbolic isometries* Advisor: Alexander Gamburd University of Cambridge C.A.S.M. (Part III), Distinction, 2007-2008 B.A. Mathematics, First Class, 2004-2007

Appointments

Professor, Durham University, July 2021-present. (*Parental leave 01/04/2021-04/18/2021*) Assistant Professor, Durham University, September 2017-June 2021. Associate Research Scientist, Yale University, July 2017-August 2017. Gibbs Assistant Professor, Yale University, July 2015-June 2017. Member, School of Mathematics, Institute for Advanced Study Princeton, September 2014-July 2015.

Awards

Philip Leverhulme Prize, 2023 Von Neumann Fellowship, IAS Princeton, 2023 Whitehead prize (London Math. Society) 2021 ERC Starting Grant UBIQGAP 'The ubiquity of optimal spectral gaps', €1,437,000, 2020 LMS Scheme 2 grant for Alex Gamburd's visit to UK, £1,440, 2018 N.S.F. award DMS-1701357 "Thin counting in moduli spaces" (Algebra and Number Theory), total amount \$145,295, 2017 University of California Chancellor's Fellowship, \$54,000 2010 M.T. Meyer Scholarship, University of Cambridge, 2005-2008 International Physics Olympiad, Bronze medal, 2004

Journal articles

22. $SL(4, \mathbb{Z})$ is not purely matricial field. With Mikael de la Salle. Comptes Rendus Mathématique, to appear. 21. Explicit spectral gap for Schottky subgroups of SL(2, Z). With Irving Calderón. Journal of the European Mathematical Society, to appear. 20. Quantum Unique Ergodicity for Cayley graphs of quasirandom groups, with J. Thomas and Y. Zhao. Communications in Mathematical Physics, Commun. Math. Phys. 402, 3021-3044 (2023). 19. Random Unitary Representations of Surface Groups II: The large n limit. Geometry and Topology, to appear. 18. The asymptotic statistics of random covering surfaces, with D. Puder. Forum of Mathematics, Pi, 11, E15. doi:10.1017/fmp.2023.13r. (2023) 17. Near optimal spectral gaps for hyperbolic surfaces, with W. Hide. Annals of Mathematics, 198(2): 791-824 (September 2023). DOI: 10.4007/annals.2023.198.2.6. 16. Matrix Group Integrals, Surfaces, and Mapping Class Groups II: O(n) and Sp(n), with D. Puder. Math. Annalen, https://doi.org/10.1007/s00208-022-02542-1. (2022) 15. A random cover of a compact hyperbolic surface has relative spectral gap $\frac{3}{16} - \varepsilon$, with F. Naud and D. Puder. Geometric and Functional Analysis (GAFA), 32 (3). pp. 595-661 (2022). 14. Core surfaces, with D. Puder. Geometriae Dedicata, 216(4):46 (2022). 13. Random Unitary Representations of Surface Groups I: Asymptotic expansions. **Communications in Mathematical Physics** vol. 391, pages 119–171 (2022) 12. Explicit spectral gaps for random covers of Riemann surfaces, with F. Naud. Publications mathématiques de l'IHÉS 132, pages 137–179 (2020). 11. *Kesten-McKay law for the Markoff surface mod p*, with M. de Courcy-Ireland. Annales Henri Lebesgue Volume 4 (2021), pp. 227-250. 10. Surface words are determined by word measures on groups, with D. Puder. Israel Journal of Mathematics, 241, pages 749–774 (2021). 9. On Selberg's Eigenvalue Conjecture for moduli spaces of abelian differentials, Compositio Mathematica 155(12): 2354-2398 (2019) 8. The cycle structure of a Markoff automorphism over finite fields, with A. Cerbu, E. Gunther, L. Peilen. Journal of Number Theory (2019) 7. An asymptotic formula for integer points on Markoff-Hurwitz varieties, with A. Gamburd and R. Ronan. Annals of Mathematics 190(3): 751-809 (2019) 6. Counting saddle connections in a homology class modulo q, with R. Rühr. (includes an Appendix by R. Gutiérrez-Romo) Journal of Modern Dynamics 15: 237-262 (2019) 5. Matrix Group Integrals, Surfaces, and Mapping Class Groups I: U(n), with D. Puder, Inventiones mathematicae 218(2): 341-411 (2019) 4. Counting one sided simple closed geodesics on Fuchsian thrice punctured projective planes. I.M.R.N. rny112, https://doi.org/10.1093/imrn/rny112 (2018)

 Uniform congruence counting for Schottky semigroups in SL₂(Z), with H. Oh and D. Winter. (includes an Appendix written jointly with J. Bourgain and A. Kontorovich)
Journal für die reine und angewandte Mathematik (Crelle's Journal) (753): 89-135 (2019)
Arithmetic, zeros, and nodal domains on the sphere,
Communications in Mathematical Physics 338, No. 3, 919-951 (2015)
Quantitative spectral gap for thin groups of hyperbolic isometries,
Journal of the European Mathematical Society (JEMS) No. 1, 151-187 (2015)

Conference articles

1. Automorphism-invariant positive definite functions on free groups, with B. Collins and D. Puder. **Proceedings of the 27th International Conference on Operator Theory** (2021) arXiv:1906.01518

Conference and Colloquium talks

Stanford University, Bay Area Algebraic Number Theory and Arithmetic Geometry Day, 04/26/2014 Rutgers University, A.M.S. Eastern Sectional Meeting, 11/14/2015 M.S.R.I., Berkeley, Advances in Homogeneous Dynamics workshop, 05/12/2015 I.A.S. Princeton, Emerging topics workshop: 'Quantum chaos and fractal uncertainty principle', 10/11/2017 27th International Conference in Operator Theory, Timişoara, Romania, 07/05/2018 Groups and Geometry in the South East (Warwick University), 06/01/2018 University of St Andrews, Colloquium, 11/29/2018 C.R.M. Montreal, Workshop: Free Probability: the theory, its extensions, 03/05/2019 H.I.M. Bonn, Transfer operators in number theory and quantum chaos, 02/04/2020 University of Paderborn, Spectra and dynamics on (locally) symmetric spaces, 02/14/2022 Princeton University, Colloquium, 04/06/2022 Northwestern University, Laplacians on random hyperbolic surfaces and on random graphs, 06/02/2022 Technion (Haifa), Summer School 'Paroles Paroles', 4 lectures, 17-21 July 2022 University of Zurich, Groups and Dynamics (meeting of Swiss Math Soc.), 09/15/2022 Institut Henri Poincaré, Combinatorics of finite index subgroups, 11/03/2022 LMS Regional Meeting, Invited talk, Warwick, 03/27/2023 North British Geometric Group Theory meeting, Glasgow, 04/21/2023 Burton Randol Memorial, CUNY, 10/19/2023 Yau Mathematical Sciences Center, Colloquium, 11/17/2023 Rutgers Colloquium 11/29/2023 I.A.S. Princeton Member's Colloquium 01/29/2024 Yale, Mathematics Colloquium 02/28/2024 Princeton, Visions in Arithmetic and Beyond: Celebrating Peter Sarnak, 06/03/2024 Manchester, British Mathematical Colloquium, Invited Morning Talk, 06/19/2024 Sevilla, European Congress of Mathematicians, Invited Talk, 07/19/2024 ICMS Edinburgh, UK Workshop on Spectral Theory, 09/09/2024

Invited seminar talks

Yale University, Group Actions and Dynamics seminar, 02/10/2014 Stanford University, Number Theory seminar, 05/23/2014 Institute for Advanced Study, Princeton, Postdoctoral talk, 10/01/2014 Rutgers University, Number Theory seminar, 10/14/2014 University of Wisconsin-Madison, Number Theory seminar, 11/06/2014 Bryn Mawr College, Number Theory seminar, 01/28/2015 Boston College, Number Theory seminar, 03/12/2015 Institute for Advanced Study, Princeton, Spectral Geometry seminar, 04/06/2015 M.I.T., Analysis Seminar, 10/13/2015 Yale University, Geometry and Topology Seminar, 01/26/2016 U.I.U.C, Number Theory Seminar, 03/03/2016 Yale University, Group Actions and Dynamics Seminar, 04/04/2016 Penn State University, Dynamics Seminar, 09/19/2016 U. Chicago, Dynamics Seminar, 10/31/2016 U. Chicago, Danny Calegari's topics class on scl, 11/01/2016 University of Bristol, Ergodic Theory and Dynamical Systems Seminar, 12/15/2016 Tel Aviv University, Number Theory Seminar, 01/04/2017 Temple University, Geometry and Topology Seminar, 04/05/2017 I.A.S. Princeton, Analysis/Math. Physics seminar, 04/19/2017 University of Rome II (Tor Vergata), Seminar, 09/20/2017 Cardiff University, Analysis Seminar, 10/23/2017 Warwick University, Ergodic Theory and Dynamical Systems seminar, 11/7/2017 Warwick University, Geometry and Topology seminar, 11/9/2017 Glasgow University, Geometry and Topology seminar, 11/13/2017 Durham University, Colloquium, 11/20/2017 Weizmann Institute of Science, Midrasha on groups (2 talks), 01/10/2018 Durham University, Geometry and Topology seminar, 01/18/2018 Cambridge University, Geometry and Topology seminar, 01/31/2018 University of Manchester, Analysis and Dynamics Seminar, 04/16/2018 Loughborough University, Dynamical Systems Seminar, 05/23/2018 University of Bristol, Ergodic Theory and Dynamical Systems Seminar, 05/24/2018 R.I.M.S. Operator Algebras Seminar, Kyoto, Japan, 10/02/2018 University of Vienna, Geometry and Analysis on Groups Seminar (2 talks), 11/13/2018 University of Leeds, Geometry seminar, 11/21/2018 Institut Henri Poincaré, 'Plat' seminar, Paris, 03/13/2019 FRUMAM, 'Teich' seminar, Marseille, 03/29/2019 University of Oxford, Topology seminar, 06/10/2019 Durham University, Arithmetic study group, 11/19/2019 Zurich Ergodic Theory and Dynamical Systems seminar, 05/18/2020 Montreal Analysis Seminar, 07/15/2020 U.C. Berkeley Probabilistic Operator Algebras Seminar, 03/29/2021

London Geometry and Topology Seminar, 05/14/2021 Tel Aviv, Doron Puder's seminar, 05/25/2021, 06/01/2021 (2 talks) IRMA (Strasbourg), Analysis seminar, 06/22/2021 University of Michigan, Geometry seminar, 07/12/2021 Durham University Research day, 09/24/2021 Tel Aviv, Groups and Dynamics seminar 10/21/2021 Brown University Algebra and Number Theory seminar 11/01/2021 NYC Joint Number Theory Seminar 11/04/2021 Spectral Geometry in the Clouds 11/22/2021 Yale University, Group Actions and Dynamics Seminar, 02/21/2022 Irish Geometry Seminar 03/01/2022 Warwick Ergodic Theory and Dynamical Systems seminar, 03/08/2022 London Number Theory Seminar 03/23/2022 University of Wisconsin-Madison, Analysis seminar, 09/27/2022 U.C. Berkeley Probabilistic Operator Algebras seminar, 11/18/2022 Bristol University Geometry and Topology seminar, 01/24/2023 Princeton University, special seminar, two lectures 10/25, 11/01/2023 Caltech, Geometry and Topology seminar (online) 11/10/2023 M.I.T. Probability seminar, 12/11/2023 Temple University, Geometry and Topology Seminar, 03/27/2024 Maryland (UMD) Dynamics Seminar, 04/25/2024

PhD student supervision

Postdoc mentoring

Will Hide 2020-2024 Ewan Cassidy 2021-present Anitej Banerjee 2022-present

Irving Calderón 2021-2024 Joe Thomas 2021-present

Conference/workshop organization

(With Tuomas Sahlsten) Mini-workshop on random surfaces, (online workshop), September 2020. Durham Symposium 2023: Spectral gaps, August 7-11 2023.

Departmental responsibilities

Founding organizer of Durham Spectra/Moduli seminar, October 2021-Organizer of Pure Mathematics Colloquium, July 2019-July 2020 Internal examiner, Ph.D. thesis of Robert Little (May 2019) Internal examiner, Ph.D. thesis of John Blackman (July 2020)

External service

External examiner, Ph.D. thesis of Stephen Cantrell, Warwick (June 2020)

Reader, Ph.D. thesis of Pratyush Sarkar, Yale (April 2022) Grant review panel for DFG Collaborative Research Center (September 2022) External Examiner, Master's thesis of Yaron Brodsky, Tel Aviv University (Oct 2022)

Professional qualifications

Postgraduate Certificate in Learning and Teaching in Higher Education, Durham University (2020) Fellow of the UK Higher Education Academy

Teaching experience

Lecturer

Durham University, *Complex Analysis*, Epiphany 2018-Easter 2020. Yale University, *Number theory*, Spring 2017 Yale University, *Group expansion and number theory*, Spring 2017 Yale University, *Linear Algebra with Applications*, Fall 2016 Yale University, *Spectral Geometry*, Spring 2016 Yale University, *Introduction to Functional Analysis*, Spring 2016 Yale University, *Ordinary Differential Equations*, Fall 2015 UC Santa Cruz, *Calculus with applications*, August 2013 UC Santa Cruz, *Calculus with applications*, August 2012 **Teaching assistant** UC Santa Cruz, *Various undergraduate classes*, 2012-2014

Reviews and opinions

For many venues including all top journals.

Non academic work

From 2008-2010 I worked as a software engineer (Manchester, UK, and Irvine, CA, USA).