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Colin McSwiggen

appointments

Assistant Research Fellow (tenure track), Academia Sinica, 2024–Present.

Courant Instructor & NSF Postdoctoral Fellow, New York University, 2021–2024.
Mentor: Sylvia Serfaty.

Postdoctoral Researcher, University of Tokyo, 2020–2021.
Mentor: Yasuyuki Kawahigashi.

Chateaubriand Fellow, Sorbonne University, 2018–2019.
Mentor: Jean-Bernard Zuber.

education

Ph.D., Applied Mathematics, Brown University, 2020.
Dissertation: *Theory and Applications of Harish-Chandra Integrals.*
Advisor: Govind Menon.

M.A.+M.Sc., Industrial Design Engineering, RCA/Imperial College London, 2013.

S.B., Physics, MIT, 2011.

S.B., Mathematics, MIT, 2011.
Completed Mathematics Tripos Part II at Cambridge University, UK, 2009-2010.

publications

Accepted papers: pure math and mathematical physics

J. Huang, C. McSwiggen (2024). "Asymptotics of generalized Bessel functions and weight multiplicities via large deviations of radial Dunkl processes." *Probab. Theory Relat. Fields.* arXiv:2305.04131

S. Matsumoto, C. McSwiggen (2023). "Moments of random quantum marginals via Weingarten calculus." *Int. Math. Res. Not. IMRN.*: rnad105. arXiv:2210.11349

B. Collins, C. McSwiggen (2023). "Projections of orbital measures and quantum marginal problems." *Trans. Amer. Math. Soc.* **376**: 5601–5640. arXiv:2112.13908

C. McSwiggen, J. Novak (2021). "Majorization and spherical functions." *Int. Math. Res. Not. IMRN.*: rnaa390. arXiv:2006.08541

C. McSwiggen (2021). "Box splines, tensor product multiplicities and the volume function." *Algebr. Comb.* **4**: 435–464. arXiv:1909.12278

C. McSwiggen (2021). "The Harish-Chandra integral: An introduction with examples." *Enseign. Math.* **67**: 229–299. arXiv:1806.11155

R. Coquereaux, C. McSwiggen, J.-B. Zuber (2020). "On Horn's problem and its volume function." *Comm. Math. Phys.* **376**: 2409–2439. arXiv:1904.00752

R. Coquereaux, C. McSwiggen, J.-B. Zuber (2019). "Revisiting Horn's problem." *J. Stat. Mech.: Theory Exp* **2019**: 094018. arXiv:1905.09662

C. McSwiggen (2019). "A new proof of Harish-Chandra's integral formula." *Comm. Math. Phys.* **365**: 239–253. arXiv:1712.03995

Accepted papers: algorithms, cryptography, data science

M. Chidambaram, H. Lee, C. McSwiggen, S. Rezchikov (2024). "How flawed is ECE? An analysis via logit smoothing." *ICML 2024: Proceedings of the 41st International Conference on Machine Learning*, PMLR **235**:8417–8435. arXiv:2402.10046

J. Leake, C. McSwiggen, N. Vishnoi (2021). "Sampling matrices from Harish-Chandra–Itzykson–Zuber densities with applications to quantum inference and differential privacy." *STOC 2021: Proceedings of the 53rd Annual ACM SIGACT Symposium on Theory of Computing*: 1384–1397. arXiv:2011.05417

J. Raber, I. Miers, C. McSwiggen, Y. Zhu, D. Lai, M. Green, S. He, A.S. Raja (2021). "A cryptographic framework for lotteries in medical triage: secure and transparent randomized allocation of scarce healthcare resources." AMIA 2021 Virtual Clinical Informatics Conference.

U. França, H. Sayama, C. McSwiggen, R. Daneshvar, Y. Bar-Yam (2015). "Visualizing the 'heartbeat' of a city with tweets." *Complexity* **21**: 280–287. arXiv:1411.0722

Submitted papers

S. Johntston, C. McSwiggen (2024). "On the limiting Horn inequalities." arXiv:2410.08907

J. Leake, C. McSwiggen, N. Vishnoi (2022). "Sampling matrices from Harish-Chandra-Itzykson-Zuber densities with applications to quantum inference and differential privacy." (Expanded journal version of published STOC paper.)

grants, honors, & awards

National Science and Technology Council Project Grant (113WIA0110762), 2024.

NSF Mathematical Sciences Postdoctoral Research Fellowship (DMS-2103170), 2021.
Host institution: Courant Institute for Mathematical Sciences, New York University.
Mentor: Sylvia Serfaty.

Dunmu Ji Award, Brown University Division of Applied Mathematics, 2020.
Awarded "in recognition of a particularly original and independent thesis."

Chateaubriand Fellowship of the Embassy of France in the United States, 2018-2019.
Host institution: Laboratoire de Physique Théorique et Hautes Énergies, Sorbonne University.
Mentor: Jean-Bernard Zuber.

Graduate Fellowship, Brown University, 2015–2016.

conference and seminar presentations

Colloquium lecture, Department of Mathematics, National Tsing Hua University, Hsinchu, Taiwan, April 2025.

"Large deviations and multivariable special functions," Probability Seminar, Hong Kong University of Science and Technology, April 2025.

"Spherical integrals in probability and beyond," One World Probability Seminar, April 2025.

"Calibration and continuity," *Interdisciplinary Data Science: Bridging Theory and Applications*, NYU Abu Dhabi, December 2024.

Colloquium lecture, Department of Applied Mathematics, National Yang Ming Chiao Tung University, Hsinchu, Taiwan, December 2024.

"Limiting Horn inequalities in infinite dimensions," Operator Algebras Seminar, University of Tokyo, November 2024.

"The many incarnations of cyclic spherical integrals," *Algebraic Aspects of Random Matrices*, CIRM, Marseille, October 2024.

Probability Seminar, UW Madison, April 2024.

Randomness and Lie-Theoretic Structures, University of Virginia, March 2024.

Probability Seminar, Columbia University, February 2024.

Probability Seminar, University of Cincinnati, November 2023.

Analysis Seminar, Yale University, November 2023.

Bielefeld–Melbourne Random Matrix Theory Seminar, October 2023.

"Dunkl theory at large N." *Stochastic Processes and their Applications (SPA2023)*, Invited Session on Integrable Probability, University of Lisbon, July 2023.

"Dunkl theory at large N." *Random Matrices and Applications*, Research Institute for Mathematical Sciences, Kyoto University, June 2023.

Colloquium lecture, Institute of Mathematics, Academia Sinica, Taipei, February 2023.

"Sampling from unitary orbits, and an application to differential privacy." Applied Math Seminar, Brandeis University, December 2022.

Analysis and Probability Research Group Seminar, Indian Institute of Science, March 2022.

"Sampling matrices from Harish-Chandra–Itzykson–Zuber distributions." Simons Institute Workshop on Optimization Under Symmetry, UC Berkeley, November 2021.

"Random matrix models arising from projections of orbital measures." Probability and the City Seminar, October 2021.

"Cousins and ancestors of the arithmetic-geometric inequality." CUNY Representation Theory Seminar, October 2021.

"An extremely distant look at the arithmetic-geometric inequality." Tokyo–Kyoto Online Operator Algebras Seminar, January 2021.

"Horn's problem, polytope volumes and tensor product decompositions." Operator Algebras Seminar, University of Tokyo, January 2020.

Kyoto Operator Algebra Seminar, Kyoto University, January 2020.

"From random matrices to multiplicities and back." Combinatorics Seminar, Brown University, November 2019.

"From random matrices to multiplicities and back." *AMS Fall Western Sectional Meeting, Special Session on Random Matrices and Related Structures*, UC Riverside, November 2019.

"Multiplicities from volumes." *Integrability, Combinatorics, and Representations*, Giens, France, September 2019.

"Large-N asymptotics of Harish-Chandra integrals." *Randomness and Symmetry* (poster session), University College Dublin, June 2018.

teaching

Instructor of record

Discrete Mathematics (MATH-UA 120), New York University, Fall 2022.

Recitation leader

Introduction to Stochastic Differential Equations (APMA 1930U), Brown University, Fall 2019.

Operations Research: Probabilistic Methods (APMA 1200), Brown University, Spring 2017.

Monte-Carlo Simulation with Applications to Finance (APMA 1720), Brown University, Fall 2016.

further training

Program on Dyson-Schwinger equations, topological expansions, and random matrices, Columbia University, 2017.

Graduate Summer School on Random Matrices, Park City Mathematics Institute, 2017.

Summer School in Analysis, University of Chicago, 2017.

Brown-ICERM-Kobe High Performance Computing Summer School, Kobe University, 2015.

service to the profession

Journal refereeing

Journal of the European Mathematical Society
International Mathematics Research Notices (IMRN)
Communications on Pure and Applied Mathematics
Probability Theory and Related Fields
Annales de l'Institut Henri Poincaré
Journal of Functional Analysis

SIAM Journal of Mathematical Analysis
Notices of the American Mathematical Society
American Mathematical Monthly
Bulletin of the Institute of Mathematics, Academia Sinica
Annals of Physics
Journal of Mathematical Physics
Journal of Physics: Complexity
European Journal of Physics

Conference organization

"Random Theory 2025," workshop on probability in computer science and physics, Estes Park, CO, August 2025 (upcoming).
"Special Session on Categorical Generalizations of Conditionalization," AMS Joint Mathematics Meetings, Seattle, WA, January 2025.
"Random Theory 2024," Estes Park, CO, August 2024.
"Random Theory 2023," Estes Park, CO, August 2023.
"Random Theory 2022," Estes Park, CO, August 2022.
"Random Theory 2017," Estes Park, CO, August 2017.