Dr Matthias Allard

PhD (Mathematics) | MSc (Theoretical Physics) | Diplôme d'Ingénieur (Photonics, MSc level)

Melbourne, Australia | allard.matthias@gmail.com | French

Research Interests

I work at the interface of probability theory, random matrix theory, and mathematical physics. My research focuses on universal phenomena in random matrix ensembles, including eigenvalue and singular value correlations, hard-edge asymptotics, and determinantal structures. I am particularly interested in the connections between random matrices, Coulomb gases, and integrable probability, developing analytical approaches based on complex analysis, orthogonal polynomials, and asymptotic methods.

Technical Skills

- **Programming Languages** : Python, Mathematica, C++, MATLAB, LaTeX
- **Scientific Computing** : Numerical Simulation, Mathematical Modeling, Asymptotic Analysis, Scientific Computing, Image Processing
- **Scientific Areas** : Random Matrix Theory, Probability, Complex Analysis, Statistical Physics, Optical Engineering, Signal Processing
- **Languages** : French (native), English (fluent), Spanish (intermediate)

Education

Joint PhD in Random Matrices and Complex Analysis 2021 – 2025
University of Melbourne & KU Leuven *Australia / Belgium*

- Joint PhD under the supervision of Mario Kieburg (University of Melbourne) and Arno Kuijlaars (KU Leuven)
- Research topics: Random Matrix Theory, Probability, Harmonic Analysis, Orthogonal Polynomials, Measure Theory, Coulomb Gases
- Recipient of the Melbourne Research Scholarship

MSc Physics (Double Diploma), with Distinction 2019 – 2020
Imperial College London *London, UK*

- Quantum Information, Quantum Field Theory, Unification, General Relativity
- Mathematical Methods for Physicists, Plasmonics and Metamaterials, Group Theory

Diplôme d'Ingénieur Photonics & MSc Fundamental Physics, (concurrent) 2018 – 2019
Institut d'Optique Graduate School & Université Paris-Saclay *Paris, France*

- **IOGS (Engineering / Photonics):** Fourier Optics, Nonlinear Optics, Radiometry, Optical System Design, Light–Matter Interaction
- **Université Paris Saclay (Physics):** Atomic Physics, Plasma Physics, Particle Physics

Diplôme d'Ingénieur Photonics & BSc Fundamental Physics, (concurrent) 2017 – 2018
Institut d'Optique Graduate School & Université Paris-Saclay *Paris, France*

- **IOGS (Engineering / Photonics):** Signal Processing, Polarization, Laser Physics, Scientific Computing, Optical Physics
- **Université Paris Saclay (Physics):** Quantum Physics, Statistical Physics, Special Relativity, Analytical Mechanics, Electromagnetism

Classe Préparatoire aux Grandes Écoles 2015 – 2017
Lycée Chaptal *Paris, France*

- Two-year intensive undergraduate preparation in Mathematics (14h/week), Physics (12h/week), and Engineering (12h/week)

Baccalauréat S (Science), Engineering Option, with Distinction 2015
France

Research and Engineering Experience

Research Project 2020
Imperial College London *London, UK*
- Studied Directed Acyclic Graphs, Minkowski distances, and percolation models

Research Engineering Intern 2019
Thales Alenia Space *Cannes, France*
- Modeled optical fiber components within an imaging spectrometer
- Conducted calibration and modeling of an imaging Fourier-transform spectrometer
- Studied speckle phenomena and optical signal processing

Engineering Project 2018 – 2019
Institut d'Optique Graduate School *France*
- Designed and implemented an industrial vision system
- Worked on programming, mechanical engineering, and electrical engineering components

Research Intern 2018
Observatoire des Hauts de Provence *France*
- Worked on image processing, speckle analysis, infrared detectors, and astronomical observations

Sports Activities Coordinator 2018 – 2019
Institut d'Optique Graduate School *France*
- Organized events, coordinated teams, and planned student activities

Selected Publications

- Allard, M., Kieburg, M. *Correlation functions between singular values and eigenvalues.* Random Matrices: Theory and Applications, 15 (2025), 2550024
- Allard, M. *Hard edge asymptotics of correlation functions between singular values and eigenvalues.* Journal of Physics A: Mathematical and Theoretical, 58 (2025), 215204
- Allard, M., Lahiry, S. *Critical phenomena in Coulomb gas: birth of a gap.* arXiv:2509.24529. To appear in Communications in Mathematical Physics.
- Allard, M., Forrester, P., Lahiry, S., Shen, B. *Partition function of 2D Coulomb gases with radially symmetric potentials and a hard wall.* arXiv:2506.14738

Teaching Experience

Tutor 2023 – 2026
University of Melbourne *Australia*
- Taught Calculus 1, Calculus 2, Linear Algebra, and Physics laboratories

Tutor 2021 – 2022
KU Leuven *Belgium*
- Taught Calculus 1 and Differential Equations

Scientific Conferences

- 2026
  - Gathering Advances in Random Matrices and Beyond (IHP, France)
- 2025
  - ANZAMP 2025 (Bendigo)
  - Integrability, Random Matrices, and All That (ENS Lyon)
  - Log-gases in Caeli Australi (MATRIX, Creswick)
  - Randomness in Physics and Mathematics Summer School (Bielefeld)
- 2024
  - Asymptotics, Randomness, Nonlinearity, Orthogonality (ARNO, KU Leuven)
  - Random Matrices and Related Topics in Jeju (Jeju)
- 2022
  - Random Matrices and Beyond (KTH, Stockholm)
  - Probability and Mathematical Physics (University of Helsinki, Helsinki)
  - Randomness in Physics and Mathematics Summer School (Bielefeld)