Raphaël URFIN

Education

- **PhD in Physics** — **ENS-PSL, Paris**
  Subject: Generative Diffusion and Statistical Physics — *2025 - 2028(exp.)*
  LPENS & Centre de Sciences des Données
  Supervisors: Giulio Biroli (ENS)
- **M2 ICFP Theoretical Physics Track** — **ENS-PSL, Paris**
  First Class Honors, 17.38/20 — *2023 - 2024*
  Relevant classes: Advanced Statistical Physics, Disordered Systems, Machine Learning
- **M1 ICFP** — **ENS-PSL, Paris**
  First Class Honors, 17.8/20 — *2022 - 2023*
  Relevant classes: Phase Transitions, Introduction to Quantum Field Theory, General Relativity
- **Bachelor in Physics and Mathematics** — **ENS-PSL, Paris**
  First Class Honors, 17.38/20 (Physics) and 16.36/20 (Mathematics) — *2021 - 2022*
- **Classes Préparatoires** — **Lycée Stanislas**
  *PCSI-PC** — *2019 - 2021*

Relevant Experience

- **Statistical Physics and Diffusion Models** — **Bocconi University, Milano, Italy**
  Research Internship — *February 2025-May 2025*
  - Supervisor: Marc Mézard, Departement of Computing Sciences.
  - The Memorization/Generalization transition in diffusion models.
  - Resulted in a publication submitted to Neurips 2025
- **Statistical Physics and Diffusion Models** — **École Normale Supérieure-PSL, France**
  Research Internship — *April 2024-January 2025*
  - Supervisor: Giulio Biroli, Centre de Sciences des Données.
  - The effect of implicit regularization in diffusion models.
- **Emergent behaviors in large ecosystems** — **University of Cambridge, UK**
  Research Internship — *January-July 2023*
  - Supervisor: Camille Scalliet, Soft Matter Group, Department of Applied Mathematics and Theoretical Physics.
  - Using tools from disordered systems (Cavity Method, Random Matrix Theory...) to understand emergent collective behaviors in ecological systems.
- **Transport of Anisotropic Particles in a Vortex Flow** — **ESPCI, Paris**
  Research Internship — *July 2022*
  - Supervisors: Anke Lindner, Marinne Aulnette, 'Complex Suspensions' team, PMMH
  - Measurements of the vector field of the vortex flow with the PIV method and data analysis with Matlab.

Publications

- Tony Bonnaire*, **Raphaël Urfin***, Giulio Biroli, Marc Mézard.
  Why Diffusion Models Don't Memorize: The Role of Implicit Dynamical Regularization in Training.
  The Thirty-ninth Annual Conference on Neural Information Processing Systems, **Oral Presentation**
  `https://openreview.net/forum?id=BSZqpqgqM0`

Events

- **StatPhys 29** — **Florence, Italy**
  Conference — *July 2025*
  - 15-minute contributed talk on the Memorization/Generalization transition in diffusion models.
- **Youth in High Dimensions** — **Trieste, Italy**
  Workshop — *July 2025*
  - 15-minute contributed talk on the Memorization/Generalization transition in diffusion models.
- **Beg Rohu Summer School of Statistical Physics** — **Beg Rohu, France**
  Summer School — *June 2025*
  - Lectures on Machine Learning and Statistical Physics by international researchers (e.g. Yann Lecun, Julia Kempe, Stéphane Mallat, Marc Mézard).
  - Poster presentation on the Memorization/Generalization transition in diffusion models.
- **Journées de Physique Statistique 2025** — **Paris, France**
  Conference — *January 2025*
  - 4-minute flash talk presenting results from my M2 internship.
- **Complex and Glassy Systems** — **Cargese, France**
  Summer School — *July 2024*
  - Lectures on Statistical Physics and interdisciplinary applications by international researchers (e.g. Marc Mézard, Eric Vanden-Eijnden, Valentina Ros, Guy Bunin).

Skills

- Languages: French (Native), English (Fluent), Italian (Fluent).
- Software skills: Python (Pytorch), Matlab, Latex.

Teaching Experience

- Private tutoring in undergraduate mathematics (2021-)
- "Khôlles" (Preparation for the oral Exam for French "Grandes Écoles") in Mathematics and Physics for Classes Préparatoires PC, Lycée Stanislas (2022–2024)
- TA Stochastic Processes for physics (M1 level, Master ICFP, ENS-PSL), 16 hours, class taught with Marylou Gabrié