# Raphaël URFIN

## About me

I am a first year PhD student at École Normale Supérieure - PSL in Paris supervised by Giulio Biroli (ENS) and Marc Mézard (Bocconi University) working on the theory of diffusion models. My background is theoretical physics in particular statistical physics.

## 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) and Marc Mézard(Bocconi University)
- **ENS Diploma** — **ENS-PSL, Paris**
  *Interdisciplinary Diploma validating my studies at ENS.* — *2021-2025*
- **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*

## 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 accepted at 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*. NeurIPS 2025, **Best Paper Award (4 papers among +20000 submissions)**
`https://openreview.net/forum?id=BSZqpqgqM0`

## Events

- **EurIPS 2025** — **Copenhagen, Danemark**
  *Conference* — *December 2025*
  - Poster+Oral Presentation of our paper accepted at NeurIPS 2025.
- **NeurIPS in Paris 2025** — **Paris, France**
  *Workshop* — *November 2025*
  - Poster+Oral Presentation of our paper accepted at NeurIPS 2025.
- **Machine Learning & Signal Processing @ ENS Lyon** — **Lyon, France**
  *Invited Seminar* — *November 2025*
  - 1 hour invited talk on the Memorization/Generalization transition in diffusion models.
- **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 in English with Marylou Gabrié. Fall 2025
- TA Mathematics Tutoring for first year student in Physics at ENS. 36h. Taught in French with Amir-Kian Kashani-Poor. Fall 2025
- TA Machine Learning (M2, Master ICFP, ENS-PSL), taught with Marc Lelarge and Leonardo Defilippis. Spring 2026.