

Raphaël URFIN

Centre de Sciences des Données, 45 rue d'Ulm – 75005 Paris – France

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 in theoretical physics.

Education

- PhD in Physics** ENS-PSL, Paris
2025 - 2028(exp.)
 - *Subject: Generative Diffusion and Statistical Physics*
LPENS & Centre de Sciences des Données
Supervisors: Giulio Biroli (ENS) and Marc Mézard(Bocconi University)
- ENS Diploma** ENS-PSL, Paris
2021-2025
 - *Interdisciplinary Diploma validating my studies at ENS.*
- M2 ICFP Theoretical Physics Track** ENS-PSL, Paris
2023 - 2024
 - *First Class Honors, 17.38/20*
Relevant classes: Advanced Statistical Physics, Disordered Systems, Machine Learning.
- M1 ICFP** ENS-PSL, Paris
2022 - 2023
 - *First Class Honors, 17.8/20*
Relevant classes: Phase Transitions, Introduction to Quantum Field Theory, General Relativity.
- Bachelor in Physics and Mathematics** ENS-PSL, Paris
2021 - 2022
 - *First Class Honors, 17.38/20 (Physics) and 16.36/20 (Mathematics)*

Publications

- * denotes equal contribution.
- 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=BSZqpqgqMO>

Conferences, Workshops and Seminars

Invited Talks

- Scattering Club** Online
February 2026
 - *Invited Seminar*
 - 45 min invited talk on the Memorization/Generalization transition in diffusion models. Webinar organized by the data science for astrophysics group of LPENS.
- Voxel51 Best of NeurIPS 2025** Online
January 2026
 - *Invited Seminar*
 - 45 min invited talk on the Memorization/Generalization transition in diffusion models.
- Machine Learning & Signal Processing @ ENS Lyon** Lyon, France
November 2025
 - *Invited Seminar*
 - 1 hour invited talk on the Memorization/Generalization transition in diffusion models.

Contributed Talks.....

- **Journées de Physique Statistique 2026** Paris, France
January 2026
 - Conference
 - 4-minute flash talk on the Memorization/Generalization transition in Diffusion Models.
- **EurIPS 2025** Copenhagen, Danemark
December 2025
 - Conference
 - Poster+Oral Presentation of our paper accepted at NeurIPS 2025.
- **NeurIPS in Paris 2025** Paris, France
November 2025
 - Workshop
 - Poster+Oral Presentation of our paper accepted at NeurIPS 2025.
- **StatPhys 29** Florence, Italy
July 2025
 - Conference
 - 15-minute contributed talk on the Memorization/Generalization transition in diffusion models.
- **Youth in High Dimensions** Trieste, Italy
July 2025
 - Workshop
 - 15-minute contributed talk on the Memorization/Generalization transition in diffusion models.
- **Journées de Physique Statistique 2025** Paris, France
January 2025
 - Conference
 - 4-minute flash talk presenting results from my M2 internship.

Summer Schools.....

- **Beg Rohu Summer School of Statistical Physics** Beg Rohu, France
June 2025
 - Summer School
 - 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.
- **Complex and Glassy Systems** Cargese, France
July 2024
 - Summer School
 - Lectures on Statistical Physics and interdisciplinary applications by international researchers (e.g. Marc Mézard, Eric Vanden-Eijnden, Valentina Ros, Guy Bunin).

Awards and Grants

- 2025: Recipient of one of the four best paper awards at NeurIPS 2025. (**4 papers among +20000 submissions**)
- 2025: CDSN, PhD scholarship for ENS students

Reviewing

Reviewer for: EurIPS 2025 Workshop Principles of Generative Modeling (PriGM)

Skills

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

Teaching Experience

- TA Machine Learning (M2, Master ICFP, ENS-PSL), taught with Marc Lelarge and Leonardo Defilippis. Spring 2026.
- TA Mathematics Tutoring for first year student in Physics at ENS. 36h. Taught in French with Amir-Kian Kashani-Poor. Fall 2025

- TA Stochastic Processes for physics (M1 level, Master ICFP, ENS-PSL), 16 hours, class taught in English with Marylou Gabré. Fall 2025
- "Khôlles" (Preparation for the oral Exam for French "Grandes Écoles") in Mathematics and Physics for Classes Préparatoires PC, Lycée Stanislas (2022–2024)

Relevant Experience

- | | |
|---|---|
| Statistical Physics and Diffusion Models | Bocconi University, Milano, Italy |
| ○ <i>Research Internship</i> | 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 |
| ○ <i>Research Internship</i> | 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 |
| ○ <i>Research Internship</i> | 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 |
| ○ <i>Research Internship</i> | 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. | |