

Louis Carillo

PhD Student in Mathematical Physics

CERMICS, École Nationale des Ponts et Chaussées, Champs-sur-Marne

louis-carillo.github.io | louis.carillo@enpc.fr

Research Interests

Metastability, stochastic processes, molecular dynamics sampling, and partial differential equations. Current focus on the *narrow escape problem* as a prototypical model of entropic metastability: the asymptotic analysis of the exit event of Brownian motion from a bounded domain with reflecting boundary except for small absorbing windows.

Current Position

PhD Student — *CERMICS, École Nationale des Ponts et Chaussées*, Oct. 2024 – present
Marne-la-Vallée, France

Supervisors: Tony Lelièvre, Urbain Vaes, Gabriel Stoltz.

Topic: Metastability in statistical physics: a mathematical and numerical analysis.

Developing analytical and numerical tools to study metastable phenomena, with emphasis on the narrow escape problem and the derivation of precise asymptotic formulas for mean exit times.

Publications

- [1] N. Blassel, **L. Carillo**, S. Darshan, R. Gastaldello, A. Iacobucci, E. Marini, R. Santet, X. Shang, G. Stoltz, U. Vaes. *Mathematical analysis and numerical methods for the computation of transport coefficients in molecular dynamics*. Preprint (2026). [arXiv:2605.10507](https://arxiv.org/abs/2605.10507).
- [2] M. Benedetti, **L. Carillo**, E. Marinari, M. Mézard. *Eigenvector Dreaming*. *Journal of Statistical Mechanics: Theory and Experiment* (2024). [arXiv:2308.13445](https://arxiv.org/abs/2308.13445).
- [3] B. Li, Y. Nishikawa, P. Hoellmer, **L. Carillo**, A. C. Maggs, W. Krauth. *Hard-disk computer simulations — a historic perspective*. *Journal of Chemical Physics* (2022). [arXiv:2207.07715](https://arxiv.org/abs/2207.07715).

Research Experience

M2 Internship — Microcanonical Langevin Monte Carlo — *CER-* Spring/Summer 2024
MICS, ENPC, Marne-la-Vallée, France

Supervised by Gabriel Stoltz. Analytical and numerical study of a stabilized variant of Langevin dynamics. Investigated its theoretical properties and implementation efficiency for high-dimensional sampling.

Gap Year — Dreaming in Hopfield Networks — *Sapienza Università di Roma*, 2022 – 2023
Rome, Italy

Supervised by Enzo Marinari. Analytical and numerical study of Hopfield models and novel training methods; focus on spectral properties. Resulted in a published paper in *J. Stat. Mech.*

M1 Internship — Symmetries in Quantum Physics — *Ludwig-* Spring/Summer 2022
Maximilians-Universität, Munich, Germany

Supervised by Ulrich Schollwöck. Implemented $U(1)$ and $SU(2)$ symmetry support in a numerical solver for quantum spin-chain Hamiltonians using tensor-network methods.

Bachelor Internship — Hard Disks in 2D — ENS Paris, Laboratoire de Physique Statistique, Paris, France Summer 2021

Supervised by Werner Krauth. Historical survey and computation of the equation of state for 2D hard-sphere systems. Resulted in a published paper in *J. Chem. Phys.*

Education

M2 — Physics of Complex Systems (PCS) — ENS Paris-Saclay & Université Paris-Cité, France 2023 – 2024

Advanced topics in statistical physics: disordered systems, out-of-equilibrium dynamics, and complex systems.

Licence & M1 — Fundamental Physics — ENS Paris-Saclay, Gif-sur-Yvette, France 2021 – 2023

Statistical mechanics, quantum electrodynamics, and general relativity.

Classes Préparatoires MPSI/PSI — Lycée Michel de Montaigne, Bordeaux, France 2018 – 2020

Intensive preparatory program in mathematics, physics, and engineering sciences.

Conferences, Workshops & Seminars

(*T = talk, P = poster, O = organiser*)

Summer School MINT (T) Institut de Mathématiques de Toulouse, France — June 2026

Conference ANR DySLoS (T) INRIA, Paris, France — June 2026

Summer School "Point Configurations: from Statistical Physics to Potential Theory" (T) CIRM, Marseille, France — May 2026

Conference GAMM 2026 (T) Stuttgart, Germany — March 2026

CJC-MA 2026 (O) CERMICS, Marne-la-Vallée, France — March 2026

Journées de la physique statistique (T) ENS Paris, France — January 2026

Seminar, University of Ulm (T) Ulm, Germany — January 2026

CECAM-Moser 1-Day Symposium (T) ESPCI Paris, France — December 2025

Seminar of the Young Researcher (T) CERMICS, Marne-la-Vallée — July 2025

Summer School on Sampling High-Dimensional Probability Measures (T) University of Birmingham, UK — July 2025

Workshop "Journées QSD and Related Fields" (T) CERMICS, Marne-la-Vallée — May 2025

Workshop "Stochastic Processes: Inferences in Complex Systems" (T) CECAM-HQ, Lausanne, Switzerland — May 2025

Journées de la physique statistique (T) ENS Paris, France — January 2025

Workshop "Uncertainty Quantification in Molecular Simulation" Max Planck Institute, Magdeburg, Germany — August 2024

Workshop "Synergies between Mathematics, University of Birmingham, UK — July 2024
Data Science, and Molecular Simulations" (P)

Workshop "Kinetic Equations, Mathematical Physics BCAM, Bilbao, Spain — June 2024
and Probability"

Teaching/supervision Experience

All teaching at ENPC (École Nationale des Ponts et Chaussées) unless otherwise noted.

Supervisor — 1st year Master — ENPC, France 2026

Supervised a student in their 3-month research internship in CERMICS. We are aiming at benchmarking the usual tools from molecular dynamics for the entropic metastability problems.

Teaching Assistant — Modeling and PDEs — ENPC, France 2025/2026 & 2026/2027

Bachelor-level course covering ODEs, classical PDEs (heat, transport), and numerical methods implemented in Python.

Teaching Assistant — Scientific Computing — ENPC, France 2024/2025

Advanced programming for STEM students: numerical integration, ODE solvers, linear systems. Taught in Julia.

Project Supervisor — Hopfield Networks — ENPC, France 2024/2025

Supervised a group of 4 students implementing dreaming algorithms for Hopfield networks, based on original research conducted during the Rome internship.

Teaching Assistant — Python Programming — ENPC, France 2024/2025

Advanced Python for STEM students: object-oriented programming, error handling, and interfaces.

Teaching Assistant — Scientific Foundations of Energy Transition — ENPC, France 2024/2025 & 2025/2026

Introduction to physics of renewable energies: radiation theory and semiconductor physics.

Private Tutor — , Bordeaux & Paris 2019 – 2021

Mathematics, physics, and piano; secondary and preparatory school levels.

Technical Skills

Programming Python, Rust, C/C++, Julia

Languages French (native), English (fluent), German (intermediate), Italian (intermediate)

Tools L^AT_EX, Git, Linux/Bash

Last updated: June 2026 | louiscarillo.github.io