

# COLLOQUIUM FÉDÉRATION FRIEDEL JACQUINOT

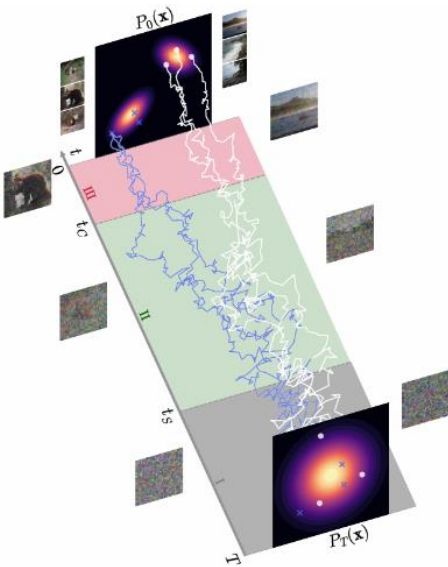
**Mercredi 19 Novembre 2025 – Amphi A1 du Bâtiment Hbar**

12h00 : Lunch Box

12h30 : Séminaire de Giulio Biroli

## Generative AI, Diffusion Models and Statistical Physics

Generative AI represents a groundbreaking development within the broader “Machine Learning Revolution,” significantly influencing technology, science, and society. In this colloquium, I will discuss remarkable connections between generative AI, in particular diffusion models, and statistical physics.



Diffusion models are the state of the art to generate images, videos, and sounds. They are very fascinating algorithms for physicists, as they are very much connected to concepts from stochastic thermodynamics, particularly time-reversed Langevin dynamics. These diffusion models start from a simple white noise input and make it evolve through a Langevin process to generate complex outputs such as images, videos, and sounds. I will show that statistical physics provides principles and methods to characterise this generation process. Specifically, I will discuss how phenomena such as the transition from memorization to generalization and the emergence of features can be understood through the lens of symmetry breaking, phase transitions, disordered systems, and dynamics in complex energy landscapes.

Giulio Biroli is professor of theoretical physics at the École Normale Supérieure in Paris.

From 2002 to 2018 he held a researcher position at the Institute for Theoretical Physics (CEA) Giulio Biroli has a long-standing interest in slow dynamics of classical and quantum systems, in disordered and glassy systems and in inter-disciplinary applications of statistical physics ranging from computer science, probability theory, and theoretical ecology. In recent years, part of his research has been devoted to the theory of machine learning leveraging ideas and methods rooted in statistical physics.

