Introduction to statistical mechanics and interacting particle systems

**ECTS** : 6

**Volume horaire** : 30

**Description du contenu de l'enseignement :**

The aim of statistical mechanics is to understand the macroscopic behavior of a physical system by using a probabilistic model containing the information for the microscopic interactions. The goal of this course is to give an introduction to this broad subject, which lies at the intersection of many areas of mathematics: probability, graph theory, combinatorics, algebraic geometry...
In the first part of the course we will introduce the key notions of equilibrium statistical mechanics. In particular we will study the phase diagram of the following models: Ising model (ferromagnetism), dimer models (crystal surfaces) and percolation (flow of liquids in porous materials). In the second part we will introduce interacting particle systems, a large class of Markov processes used to model dynamical phenomena arising in physics (e.g. the kinetically constrained models for glasses) as well as in other disciplines such as biology (e.g. the contact model for the spread of infections) and social sciences (e.g. the voter model for the dynamics of opinions).

**Document susceptible de mise à jour - 09/12/2025**
**Université Paris Dauphine - PSL -** Place du Maréchal de Lattre de Tassigny - 75775 PARIS Cedex 16