Introduction to statistical mechanics

ECTS : 6

Volume horaire : 24

Description du contenu de l'enseignement :

The aim of statistical mechanics is to understand the macroscopic behavior of a physical system using a probabilistic model containing information about its 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 course we will study several important models from the theory of equilibrium statistical mechanics. In particular we will study the phase diagram of the Ising model (ferromagnetism) and of dimer models (crystal surfaces). We will also study uniform spanning trees, including their links to electrical networks, sampling algorithms and connectivity properties.

Compétence à acquérir :

- Formulate Boltzmann measures to define various examples of statistical mechanics models (Ising model, dimers and uniform spanning trees).
- Understand how microscopic interactions on graphs or lattices lead to phase transitions and large-scale phenomena in these models.
- Use combinatorial and graph-theoretic techniques to count configurations, study connectivity, and understand macroscopic structure in these models.

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