Rencontres de Probabilités 2025
Rouen, 6-7 novembre 2025

Programme (TBA)

Abstracts

Mini-courses

Quentin Berger (Université Sorbonne, Paris Nord)
Title: *Modèle de polymère dirigé, limite d'échelle et équation de la chaleur stochastique*

Abstract: In this mini-course, I will present the directed polymer model, which describes a random walk in dimension *d* that interacts with a random environment (i.i.d. in time-space). The goal is to present some recent results on this model and to explore its relation with the Stochastic Heat Equation (SHE) with multiplicative noise.
We will start with the simpler case of dimension *d=1*: in this case, by normalising properly the parameters of the model, one can obtain a non-trivial scaling limit, which is intimately related to the SHE in dimension 1. We will then turn to the case of dimension *d=2*, where important results have been obtained in the last couple of years. In that case, one needs to tune the parameters of the model in some very delicate manner (in a *critical window*) to obtain an interesting limit: the limiting object that one obtains is then a natural candidate for the solution of the SHE in dimension 2, which is a priori ill-defined.

Dimitrios Tsagkarogiannis (Università Dell'Aquila)
Title: *Combinatorial species and thermodynamic quantities*

Abstract: In this mini-course we first review some recent progress in deriving power series representations for various thermodynamic quantities such as pressure, free energy and correlation functions for inhomogeneous systems of interacting particles in a continuous medium. We use cluster expansion techniques in the context of generating functions of various combinatorial species. In the second part of the course, we specialize in the case of hard spheres for two different species modelling colloidal particles (large spheres) within a substrate (small spheres). One interesting phenomenon is that despite the originally repulsive forces between all particles, when we look at the effective system of only large spheres, an attractive force emerges between them, usually referred to as "depletion attraction". We will discuss a sufficient condition for the convergence of the related cluster expansion that involves the surface of the large spheres rather than their volume (as it would have been the case in a direct application of existing methods to the binary system).

Some relevant references:
S. Jansen, T. Kuna, D. Tsagkarogiannis, Virial inversion and density functionals, J. Funct. Anal. 284 (2023).

S. Jansen, D. Tsagkarogiannis, Cluster expansions with renormalized activities and applications to colloids, Ann. Henri Poicaré 21 (2020).

D. Tsagkarogiannis, Cluster expansions, trees, inversions and correlations, Ensaios Matemáticos 38 (2023).

Talks (TBA)