Polymer, Folding and Phase Transition.
Titles and Abstract.

Mini-courses: 2x4h

Hubert Lacoin
Title: Wetting and Layering for Solid-on-Solid.
Abstract: In these lectures, we provide a complete description of the low temperature wetting transition for the two dimensional Solid-On-Solid model, which is an integer-valued field $(\varphi(x), x \in \mathbb{Z}^2)$ associated to the energy functional

$$V(\varphi) = \beta \sum_{x\sim y} |\varphi(x) - \varphi(y)| - \sum_{x} \big(h 1_{\varphi(x)=0} - \infty \cdot 1_{\varphi(x)<0}\big).$$

Chiranjib Mukherjee
Title: Large Deviation and Compactness. Application to Brownian Occupation Measures.
Abstract: In proving large deviation estimates, the lower bound for open sets and upper bound for compact sets are essentially local estimates. On the other hand, the upper bound for closed sets is global and compactness of space or an exponential tightness estimate is needed to establish it. In dealing with the occupation measure $L_t(A) = \frac{1}{t}\int_0^t 1_A(W_s)ds$ of the d-dimensional Brownian motion, which is not positive recurrent, there is no possibility of exponential tightness. The space of probability distributions $\mathcal{M}_1(\mathbb{R}^d)$ can be compactified by replacing the usual topology of weak convergence by the vague toplogy, where the space is treated as the dual of continuous functions with compact support. This is essentially the one point compactification of $\mathbb{R}^d$ by adding a point at ∞ that results in the compactification of $\mathcal{M}_1(\mathbb{R}^d)$ by allowing some mass to escape to the point at ∞.

The main drawback of this compactification is that it ignores the underlying translation invariance. We consider the space of equivalence classes of orbits $\widetilde{\mathcal{M}}_1 = \widetilde{\mathcal{M}}_1(\mathbb{R}^d)$ under the action of the translation group $\mathbb{R}^d$ on $\mathcal{M}_1(\mathbb{R}^d)$. There are problems for which it is natural to compactify this space of orbits. We will provide such a compactification, prove a large deviation principle there and give an application to relevant problems.

Lectures: 50mn

Francis Comets
Title: Two-dimensional Brownian random interlacement.
Abstract: The cover time is the time needed for the Wiener sausage of radius 1 to cover the torus of linear size n. In dimension $d \geq 3$, A. Sznitman introduced random interlacements to describe the local covering picture at a fixed intensity; They still give a good account at large densities, bridging up to cover time. In dimension 2, with S. Popov and M. Vachkovskaia, we construct random interlacements to describe the neighborhood of an unvisited site at times proportional to the cover time. In this talk, I will explain the Brownian case. (Joint work with Serguei Popov.)

Niccolò Torri
Title: Local and Global constraints in the last passage percolation problem with applications to the directed polymer model

Abstract: In this talk we consider two related models : (i) the last passage percolation problem and (ii) the directed polymer model. This is reflected in the organization of the talk. In the first part we recall the Hammersleys Last Passage Percolation (LPP) and we introduce a generalization of this standard LPP, in order to allow for more general constraints which can be local or global. In the second part of the talk we show how these results can be applied to study the directed random polymer model in a heavy-tailed random environment. — joint work with Quentin Berger

Nina Gantert
Title: The speed of biased random walk among random conductances
Abstract: We consider biased random walk among random conductances, and we investigate the speed of the walk as a function of the bias. In particular, we state the Einstein relation and we discuss the monotonicity of the speed as a function of the bias. We also mention recent results about Mott walks. The results we present come from joint work(s) with Noam Berger, Alessandra Faggionato, Xiaoqin Guo, Jan Nagel and Michele Salvi.

Serguei Popov
Title:On the range of a two-dimensional conditioned random walk
Abstract: We consider the two-dimensional simple random walk conditioned on never hitting the origin. This process is a Markov chain, namely it is the Doob h-transform of the simple random walk with respect to the potential kernel. It is known to be transient and we show that it is "almost recurrent" in the sense that each infinite set is visited infinitely often, almost surely. We prove that, for a "large" set, the proportion of its sites visited by the conditioned walk is approximately a Uniform$[0, 1]$ random variable. Also, given a set $G \subset \mathbb{R}^2$ that does not "surround" the origin, we prove that a.s. there is an infinite number of ks such

that $kG \cap \mathbb{Z}^2$ is unvisited. These results suggest that the range of the conditioned walk has "fractal" behavior. This is a joint work with Nina Gantert and Marina Vachkovskaia.

Francesco Caravenna
Title: Moment asymptotics for 2d directed polymer and stochastic heat equation in the critical window

Abstract: The partition function of the directed polymer model on $\mathbb{Z}^2$ undergoes a phase transition when the disorder strength is rescaled logarithmically with the system size. In this talk we focus on a suitable window around the critical point. Exploiting renewal theorems for families of random walks with infinite mean, we determine the asymptotic behavior of the second and third moments of the partition function. This yields, as a corollary, the existence of non-trivial limits for the diffusively rescaled partition function, viewed as a random distribution on R^2. Analogous results hold for the solution of the stochastic heat equation on $\mathbb{R}^2$, with multiplicative space-time white noise convoluted with a smooth kernel, in the regime of vanishing mollification and noise strength. Based on joint works with R. Sun and N. Zygouras

Nicolas Pétrelis
Title: Scaling limit of the Intercating Partially-Directed Self-Avoiding walk (IPDSAW) at criticality

Abstract: The IPDSAW undergoes a collapse transition between an extended phase (high temperature) and a collapsed phase (low temperature). Deriving the scaling limit of a typical trajectory at a given temperature requires to introduce two auxiliary random processes: the center-of-mass walk and the profile. At criticality those two processes have fluctuations of the same magnitude and once properly rescalled they allow us to reconstruct the scaling limit of IPDSAW which is truly two dimensional random set.