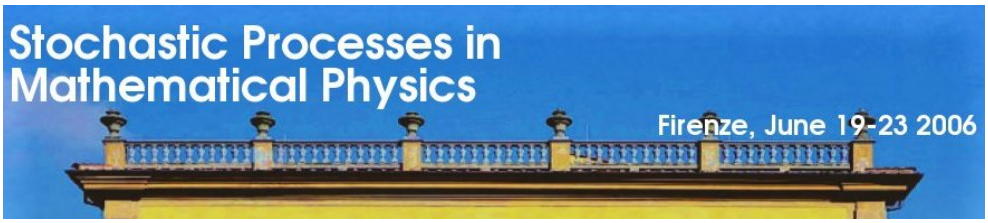

Random Polymer Models: Disorder and Localization Phenomena

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The lectures will focus on a class of models of directed polymers in interaction with an environment. Disordered interactions will play a central role.

Two examples included in the general class are

1. A copolymer, that is a polymer made up of two types of monomers (A and B), fluctuating close to the interface between two solvents. The affinity of a monomer for a solvent depends on its type so A-monomers prefer to be on one side of the interface and B-monomers prefer the other side. If the monomer types alternate along the chain (either in a repetitive or in a disordered way), the interaction monomer-solvent tends to glue the polymer to the interface. But gluing means suppressing fluctuations and it is not evident that such a phenomenon takes place (and, if it does, in which way).
2. The copolymer fluctuates in a medium that is neutral, except for a *defect* line, that repels A-monomers, but attracts B-monomers. Understanding when and how the polymer localizes on the defect line is one of our purposes.

In general, if one does not observe localization, it the opposite effect, *delocalization*, that takes over and understanding the details of delocalized regimes is often rather challenging.

I plan to start by introducing the general class of models and by analyzing the basic homogeneous model: localization and delocalization phenomena, together with the borderline critical phenomena, are almost completely understood in this homogeneous set-up. Then I will analyze how inhomogeneities enter the picture and I will focus in particular on explaining

- ⋆ how the disorder plays in favor of localization;
- ⋆ how the disorder plays in favor of a smoother transition;
- ⋆ the (only partially understood) character of the delocalized trajectories.

While not all these arguments will be touched in depth, I will try to go into the details of one of the main techniques of analysis. This technique, the *rare stretch strategy*, is based on selecting polymer trajectories on the base of the location of atypical regions of monomer types.

I will also try to discuss the relevance of these results for some domains that may be familiar to the audience, like $(1+1)$–dimensional models for wetting phenomena and the Poland-Scheraga model of DNA denaturation.

In order to have a more precise idea of the content of the lectures one may have a look at the notes *Localization phenomena in random polymer models* that can be downloaded from my web-page or at my publications of the last two years (collaborations with T. Bodineau, F. Caravenna, M. Gubinelli, F.L. Toninelli and L. Zambotti). I have however more recent and more detailed notes that I can send upon request (just send me an e-mail if interested: `giacomin@math.jussieu.fr`).