

Paris, Decembre 2014

**PhD thesis proposal in Theoretical Physics (2015):
Disordered systems and out-of equilibrium: avalanches, interface growth and applications**

The study of disordered systems reveals deep connections to physics and mathematics in other domains: fluid turbulence, interface growth, optimisation problems, random matrices, population dynamics, extreme events statistics (in finance, in physics). Common universal laws emerge in these apparently disconnected domains. Avalanche and jump phenomena also arise everywhere.

This thesis proposes to study some of these connections. Possible themes are:

- Recent progress in exact solutions of growth models in the universality class of the KPZ (Kardar-Parisi-Zhang) equation and their connections to quantum integrable systems.
- Avalanche phenomena in disordered elastic systems and their connections to "sandpile" cellular automata models, reaction diffusion models, as well as the theory (yet to be build) of "plastic" avalanches.
- The effect of rare but large events in disordered systems and optimisation problems, in directed polymers and large deviations in random matrices: applications to population dynamics and in finance.

The methods are: Field theory, integrable systems, numerical simulations.

Possible co-directions: depending on the subject chosen, either with J.P. Bouchaud (CFM), A. Rosso (LPTMS) or Kay Wiese (LPTENS).

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The official application can be found on the web site of Ecole Doctorale at
<https://www.edpif.org/fr/recrutement/prop.php>
You can also contact me directly at ledou@lpt.ens.fr