INTERNSHIP PROPOSAL

Laboratory name: LPSM (Laboratoire de Probabilités, Statistique et Modélisation)
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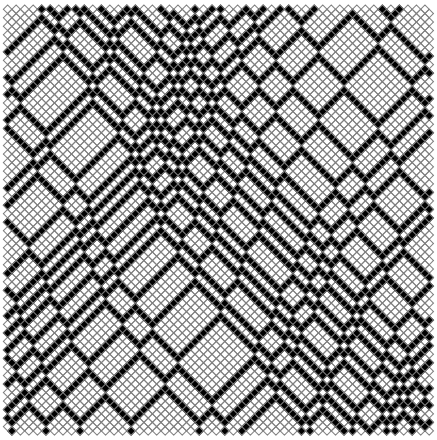
Internship location: Paris, Campus des Grands Moulins

Thesis possibility after internship: YES
Funding: YES If YES, which type of funding: Emergence Recherche/ANR

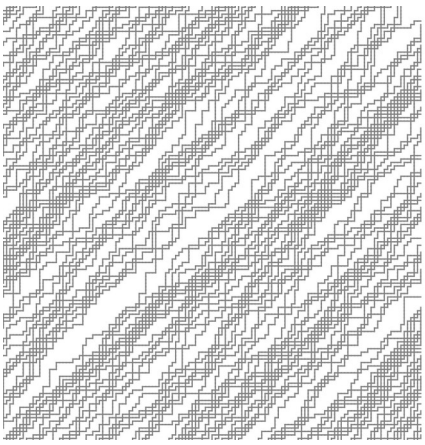
Exactly solvable quantum and stochastic models

The exactly solvable models of statistical mechanics play an essential role in our understanding of the emergence of macroscopic laws from microscopic ones, for instance in the study of phase transitions [1]. The field of exactly solvable, or *quantum integrable* models, has deep algebraic ramifications, and applications range from two-dimensional statistical models of various kinds (percolation, polymers, classical magnetism...) to many-body quantum systems or stochastic models in 1+1 dimensions.

The goal of this internship is to get acquainted with the usual tools of integrability (Yang-Baxter equations, transfer matrices) through the study of the Rule 54 cellular automaton, a model of deterministic classical evolution which, despite its simplicity, allows to study a great deal of interesting physics (transport properties,etc...) [2]. While this model has attracted a lot of attention over the last 10 years, the underlying integrable structure is poorly understood. We will try to bridge this gap by relating the Rule 54 model to a very well-studied integrable model, the six-vertex model. The expected results include direct applications to concrete problems of transport in quantum or stochastic models.



The rule 54 cellular automaton



The six-vertex model

[1] R. J. Baxter, *Exactly Solved Models in Statistical Mechanics* Academic Press (1982).
[2] Prosen & Meja-Monasterio J Phys A 49, 2017

Condensed Matter Physics: YES Soft Matter and Biological Physics: NO
Quantum Physics: YES Theoretical Physics: YES