From discrete models to condensed matter

Rapport sur les contributions

https://indico.math.cnrs.fr/e/fdmcm

ID de Contribution: **1** Type: **Non spécifié**

Bootstrap percolation and kinetically constrained models: universality results

mercredi 17 janvier 2024 13:30 (1 heure)

Recent years have seen a great deal of progress in understanding the behavior of bootstrap percolation (BP) models, a particular class of monotone cellular automata. In the initial configuration sites are occupied with probability p. The evolution of BP occurs at discrete times: empty sites stay empty and occupied sites are emptied iff a certain model dependent neighborhood is already empty. In the Euclidean lattice there is now a complete understanding of the large time evolution with a universality picture for the critical behavior. Much less is known for their non-monotone stochastic counterpart, namely kinetically constrained models (KCM). In KCM each vertex is updated independently at rate p (respectively 1-p) to occupied (respectively empty) iff it could be emptied in the next step by the bootstrap model. In the last two decades KCM have been the subject of intensive research both in physics and mathematics literature. The main motivation is that, for certain choices of the constraints, when p goes to zero KCM display some of the most striking features of the liquid/glass transition. Indeed, they were originally introduced in the 80's to support the free volume theories and later on used as the simplest lattice models reproducing the dynamical facilitation scenario. In this seminar I will discuss some recent rigorous results on the characteristic time scales of KCM as p goes to zero as well as the connection with the critical behavior of the corresponding BP models.

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ID de Contribution: **2** Type: **Non spécifié**

Proving Propagation of Chaos and Mean-field Limits

mercredi 17 janvier 2024 15:00 (1 heure)

Consider a system of N particles, described via a system of Stochastic Differential Equations (SDEs), interacting in a mean field way. We are interested in the limit, as N goes to infinity, of this particle system, and try to derive from a microscopic point of view (i.e. particle dynamics) a mesoscopic point of view (i.e. a statistical description of the system). The notion of propagation of chaos refers to the phenomenon according to which, as the number of particles N grows, two given particles become « more and more » statistically independent.

The aim of this talk is to discuss more or less recent methods to prove this phenomenon for different types of particle systems, notably in singular Riesz-type interaction, with ideas ranging from Probability theory to analysis of Partial Differential Equations (PDEs). We focus in particular on quantitative and uniform in time propagation of chaos.

This talk is based on joint works with A. Guillin (université Clermont-Auvergne) et P. Monmarché (Sorbonne Université).

Orateur: LE BRIS, Pierre (IHES - Université Paris-Saclay)

ID de Contribution: **3** Type: **Non spécifié**

Partition function for string-net models

mercredi 17 janvier 2024 16:30 (1 heure)

The string-net models were introduced by Levin and Wen (1) as exactly solvable models of topological order in two dimensions. The latter appears in strongly interacting or frustrated systems and is characterized by the presence of point-like excitations, called anyons, with exotic (i.e. neither fermionic nor bosonic) exchange statistics. Built from a unitary fusion category, the string-net models realize a topological order corresponding to the Drinfeld center of the category. The energy spectrum of these models is trivial but the degeneracies are not. In particular, they depend on the genus of the surface on which the model is defined. After introducing the models, I will show how to compute these degeneracies and obtain the exact partition function of these models, opening the way to their study at finite temperature (2, 3).

(1) M. A. Levin and X.-G. Wen, Phys. Rev. B 71, 045110 (2005)

(2) J. Vidal, Phys. Rev. B 105, L041110 (2020)

(3) A. Ritz-Zwilling, J.-N. Fuchs, J. Vidal, S. H. Simon, https://arxiv.org/abs/2309.00343

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