Séminaire de Probabilités et Statistique

Mardi 2 Octobre à 14h00

Laboratoire Dieudonné

Salle de Conférences

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Cloning algorithm to measure large deviation functions of dynamical quantities : principles & applications

Large deviations of non-equilibrium time-extensive quantities have been extensively studied in the last decade in systems ranging from (a)thermally fluctuating particles (Brownian particles, biological motors, Granular particles...), exactly solvable lattice gas models (ASEP, KPZ, KCMs...) as well as high-dimensional chaotic dynamics (FPU chain, climate model,...). By definition, studying large deviations is difficult since the fluctuations leading to their occurrence are hardly observed. In this seminar, I will present an algorithm which allows the observation of these rare events in numerical simulations. The algorithm is based on population dynamics (a.k.a. splitting or diffusion quantum Monte-Carlo method) [1] : an ensemble of copies of the system is simulated and the dynamics of the population includes a selection-mutation process. Namely, rare copies are multiplied (have descendants) but typical ones are killed (become extinct) to select atypical trajectories of interest. After introducing this algorithm in a pedagogical way, I will present recent applications of the algorithm to active Brownian particles, a model of self-propelled particles, which show unexpected dynamical phase transitions to flocking/jammed states in their rare events [2].

[1] Cristian Giardinà, Jorge Kurchan and Luca Peliti, Phys. Rev. Lett. 96, 120603 (2006).
[2] T.N., Étienne Fodor, Michael E. Cates, Robert L. Jack and Julien Tailleur, arXiv :1805.02887 (2018).