

27th Rencontres ITZYKSON : Fluctuations far from Equilibrium



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Benjamin DOYON - Ballistic macroscopic fluctuation theory and long-range correlations

Friday, June 2, 2023 9:30 AM (45 minutes)

Evaluating fluctuations and correlations at large scales of space and time in quantum and classical many-body systems, in and out of equilibrium, is one of the most important problems of emergent physics. I will explain how basic hydrodynamic principles give access to exact results at the ballistic scale, solely from the data of the Euler-scale hydrodynamic equations of the many-body system. This is based on a new theory that we developed recently (with G. Perfetto, T. Sasamoto and T. Yoshimura), dubbed the ballistic macroscopic fluctuation theory (BMFT), an adaptation of the well-known macroscopic fluctuation theory that has been very successful for purely diffusive systems. A surprising result from the BMFT is that generically, long-range spatial correlations develop over time if the initial state of the many-body system is spatially inhomogeneous. Therefore, the fluid cells of Euler hydrodynamics are in fact generically correlated amongst each other, something which had not been appreciated before. I will give examples of integrable systems based on generalised hydrodynamics, and present numerical confirmations of the results in the hard rod gas.

Presenter: DOYON, Benjamin (King's College)