Bologna Workshop on:

CFT AND INTEGRABLE MODELS

and their applications from gauge/gravity dualities to statistical mechanics and quantum information

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One-particle density matrix of the out-of-equilibrium Tonks-Girardeau gas: exact results from Quantum Generalized Hydrodynamics

Wednesday, 6 September 2023 16:40 (20 minutes)

Understanding the non-equilibrium dynamics of many-body quantum systems is a notoriously hard task due to the exponential increase of the Hilbert space dimension with the number of the system's components. This prevented, for a long time, a direct comparison between theory and the available experimental measures with ultracold atoms and ions. In recent years, the advent of Generalized Hydrodynamics enabled significant steps forward, allowing quantitative predictions for some transport properties (e.g. density and current profiles during the dynamics) of experimentally-feasible quantum setups. But despite its great predictive power, Generalized Hydrodynamics (like any hydrodynamic theory) does not capture important quantum effects, such as equal-time correlations among different points and zero-temperature entanglement. A way to account for these missing quantum effects is established by the so-called Quantum Generalized Hydrodynamics, where an effective field theory description of the leading quantum fluctuations is incorporated over the evolving background set by Generalized Hydrodynamics. In this talk, I will present some progresses in the calculation of the out-of-equilibrium one-particle density matrix enabled by the framework of Quantum Generalized Hydrodynamics and comment on their experimental relevance. The focus will be mainly on the 1D Bose gas in the limit of strong repulsion (or Tonks-Girardeau limit).

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