Fluctuation properties and effective temperature of strongly interacting 1d bosons after a quench

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Abstract

We make use of the exact mapping of hardcore bosons onto free fermions to investigate their fluctuations properties in momentum space, both in the equilibrium Gibbs ensemble (GE), as well as in the generalized Gibbs ensemble (GGE) describing the long-time evolution after a quantum quench. For the system at equilibrium we test the validity of a fluctuation-dissipation relation connecting the momentum distribution gradient with noise correlations in momentum space. This relation offers a fundamental tool for primary thermometry in weakly interacting, homogeneous systems, and it is found to be useful for the thermometry of hardcore bosons as well, over a broad temperature range. We then turn to the GGE description of the post-quench stationary state, showing that a similar thermometric scheme can provide a close estimate of the effective temperature of the system, which is generally defined by matching the internal energy of the system after the quench with the thermal one. Our results demonstrate the effectiveness of primary noise thermometry in the GGE without previous knowledge of the equation of state of the target Hamiltonian, and offer detailed insights into the fluctuation properties of non-equilibrium stationary states realized by strongly correlated quantum systems.

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