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Non-Equilbrium Behavior and Thermalization in 1D Bose Gases

ROBERT KONIK, Brookhaven National Lab, JEAN-SEBASTIEN CAUX, University of Amsterdam — Using a new numerical renormalization group based on exploiting an underlying exactly solvable nonrelativistic theory, we study the equilibrium properties and out-of-equilibrium dynamics of interacting many-body quantum systems. Focusing on the example of the Lieb-Liniger model we study quantum quenches with a focus on protocols in which the gas is released from a parabolic trap. Our method allows one not only to accurately describe the equilibrium state of the gas in the trap, but also to track the post-quench dynamics all the way to infinite time. Exploiting integrability, we are also able to exhibit a general protocol for the explicit construction of the generalized Gibbs ensemble, which is a candidate to govern the equilibriation of the trapped gas after its release. This construction does not rely on the underlying Hamiltonian being quadratic and works for arbitrary initial conditions. By comparing the predictions of equilibration from this ensemble against the long time dynamics observed in our method, we find that it is considerably more accurate than the effective grand canonical ensemble. See J.S. Caux and R. M. Konik, PRL 109, 175301 (2012).

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