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Exact non-equilibrium dynamics in 1D integrable quantum many-body models

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We discuss several features in the exact dynamics of the isolated integrable quantum many-body systems in one-dimension (1D). In particular, we consider the 1D Bose gas with the delta-function interactions and the anti-ferromagnetic Heisenberg spin chain (the XXX spin chain). We evaluate the expectation value of the local density operator numerically exactly and perform the exact time evolution of any given initial state over a very long period of time. We show relaxation behavior for any typical initial state and the exact time evolution of an initially localized state, which can be interpreted as a soliton in the quantum system [1]. We can also study the exact dynamics of a Kondo-like quantum impurity [2]. The performance of the exact dynamics in the XXX spin chain is based on the recent study of "string solutions" of the Bethe ansatz equations [3]. We also suggest some possible effects of the non-integrable perturbation on the dynamical features observed in the exact dynamics of the 1D integrable models.

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