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Universal dynamics of a soliton after a quantum quench ANDREA TROMBETTONI, CNR-IOM DEMOCRITOS Simulation Center and SISSA and INFN, Sezione di Trieste, FABIO FRANCHINI, SISSA and INFN, Sezione di Trieste and Center for Theoretical Physics, Massachusetts Institute of Technology, ANDREY GROMOV, Stony Brook University, MANAS KULKARNI, New York City College of Technology, City University of New York — In a quantum quench, one prepares a system in an eigenstate of a given Hamiltonian, and then lets it evolve after suddenly changing a control parameter of the Hamiltonian. By observing this evolution, one aims at understanding whether and how a quantum system reaches a (thermal) equilibrium. Typically, the initial state is taken to be the ground state and/or in an extended state: we propose a different experimentally feasible protocol, in which the system is prepared in an excited state corresponding to a collective solitonic excitation. If we are interested only in the single particle density, in the hydrodynamic regime the time evolution can be reduced to a semi-classical non-linear differential equation. The study of such equation shows that the short time dynamics after the quench is universal, and simple analytical predictions can be given for the velocities and profiles. Numerical support for these results is presented using the Calogero model and the non-linear Schrodinger equation (NLSE), relevant for the implementation of the proposed protocol with ultracold bosons. The effect of non-integrable terms (power-law non-linearity and a parabolic potential) in the NLSE is also investigated, and shown to not spoil the universality.

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