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SEMICLASSICAL THEORY OF QUANTUM QUENCHES

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Abstract:

We study coherent time-evolution of quantum systems after a sudden quench, when parameters of the Hamiltonian are modified, either globally or locally. This type of phenomena can be experimentally realized with ultra-cold atomic gases in optical lattices. We calculate the nonequilibrium dynamics of the system, in particular the evolution of the entanglement entropy, relaxation of the local magnetization or the correlation function. The behavior of the system during relaxation as well as the properties of the stationary state are explained through a semi-classical theory in terms of quasi-particles, which are created during the quench. Incoherent quasi-particles cause relaxation of the ferromagnetic order, whereas entangled quasi-particles result in the increase of the entanglement entropy and the reconstruction of the magnetization in finite systems. We point out the differences between the relaxation in homogeneous and in random systems.

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