Study of quench dynamics in Kondo systems using time-dependent NRG method

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We have studied dynamical properties of one- and two-channel Kondo systems after different quenches in Hamiltonian variables. Electronic structure of initial Hamiltonian (before quench) and final Hamiltonian (after quench) was calculated using density matrix numerical renormalization group method implemented using matrix product states formalism [1]. We show spectral properties and static averages of operators of impurity local variables. Quench dynamics was studied as real-time evolution of operators of interest calculated as time-dependent expectation values. We study behavior of Loschmidt echo, measuring the possibility of system returning to its initial state after some quench.

We have considered multiple quench protocols in Kondo systems as for example: switching on/off the Kondo couplings between impurity and metallic band states, varying of J coupling to one channel while keeping constant the second one, or simultaneous quench of both coupling constants. Particularly interesting are quenches around non-Fermi liquid critical point in the two-channel Kondo model. We systematically study quenches when varying strength from very small (aka continuous quench limit [2]) to large one (discrete, pulse-like quenches), focusing on dependence of system response due to quench on the boundary conditions. Furthermore we study such dynamics in the presence of applied external magnetic field. We also discuss stability of system properties with the increase of temperature. Finally, we compute the conductance for most relevant examples above, showing the influence of dynamics and stability of the Kondo correlated state on current properties.

References:

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