

Magnetization Dynamics and Exchange Field Evolution in Serial Double Quantum Dot Coupled to Ferromagnetic Lead

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We investigate a system of two quantum dots coupled in series, specifically focusing on a configuration where only one quantum dot is tunnel-coupled to an external ferromagnetic lead. The central goal of this work is to study the nonequilibrium dynamics induced by quantum quenches, with particular emphasis on the time-dependent magnetization of the dots. This magnetization results from an effective exchange field generated by spin-dependent tunneling between the quantum dot and the ferromagnetic electrode.

Using the time-dependent numerical renormalization group (tdNRG) to provide a nonperturbative treatment and include strong correlations, we analyze the real-time evolution following sudden parameter changes in Hamiltonian. Our results show that quenches in the orbital levels can induce fast dynamics leading to a sign change of the exchange field, while quenches in the tunnel coupling to the electrode result in oscillatory magnetization dynamics on both quantum dots. Finally, we examine how Kondo correlations on the quantum dot influence discussed dynamics.