Nonequilibrium Kondo effect under finite thermal bias: An accurate treatment of electronic correlations

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Quantum dot systems have been considered as prospective heat engines that can provide high efficiency due to the considerable thermoelectric figure-of-merit they can achieve. Theoretical description of such nanoscale systems in the presence of strong correlations have been limited to the linear response regime or with serious approximations on the correlations. A recent method incorporating the Numerical Renormalization Group (NRG) and the time-dependent Density Matrix Renormalization Group (tDMRG) based on a thermofield quench approach has been shown to be able to treat strong correlations exactly out of equilibrium far from the linear response regime [1,2]. By reaching sufficiently long time windows, this permits us to extract steady-state non-equilbrium behavior. We use this hybrid NRG-tDMRG method to study the thermoelectric and heat transport through a quantum dot coupled to metallic leads kept at different temperatures and/or potential bias. In particular, we focus on the regime where Kondo effect emerges, and examine how the nonlinear conditions affect the Kondo resonance and its thermoelectric signatures. We present the first quantitatively accurate results for the nonequilibrium Kondo effect under finite thermal bias and its dependence on the potential and temperature on each individual leads.

References:

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