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Signal transport and finite bias conductance in and through correlated nanostructures

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The problem of calculating the finite bias conductance through an interacting system has been formally solved by Meir and Wingreen using non-equilibrium Green function techniques [1]. In practice, the evaluation of these formulas for interacting systems is generally based on approximative schemes. Time dependent density matrix renormalization group methods (t-DMRG) [2] allow for an exact solution of the time-dependent evolution of many-body wavefunctions. We apply this technique to the problem of calculating the differential conductance of a strongly correlated nanostructure attached to one-dimensional noninteracting leads. By carefully monitoring the finite-size effects and the time-dependent dynamics, the differential conductance can be extracted from the t-DMRG results [3]. This talk will give an introduction to t-DMRG and its application to the calculation of transport properties. We present examples of signal propagation through interacting systems and how the linear and differential conductance varies for interacting systems tuned from weak to strong coupling.
Refs: [1] Y. Meir and N. S. Wingreen, Phys. Rev. Lett. 68, 2512 (1992). [2] K. A. Hallberg, Adv. Phys. 55,, 477 (2006) and references therein. [3] G. Schneider and P. Schmitteckert, Conductance in strongly correlated 1D systems: Real-Time Dynamics in DMRG, condmat/0601389.