Transport through correlated nanostructures: Towards steady state dynamics

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Recent advances in simulating the time evolution of correlated electron systems led to progress, even giving access to the full counting statistics of charge transport [1]. However, in order to treat strongly correlated systems numerically one has to resort to lattice models with a finite number of sites. In this talk I will start with discussing finite size and finite time effects resulting from the finite character of the model systems. The most obvious finite size effect is the finite transit time of the leads. By adding absorbing terms to the time evolution operator one can actually achieve a quasi stationary state, which is not interrupted by the the finite transit time.

While this presents a step forward towards steady state dynamics on finite systems, this approach does not solve the problem of finite time effects which are not induced by the finiteness of the system [2]. In order to circumvent those one should resort to scattering approaches like the Lippmann-Schwinger equation [3]. There, one switches on the perturbation adiabatically in the distant past which leads to a resolvent equation for the scattering state. However, the finite model systems always posses a finite size gap leading to a breakdown of this so called adiabatic state evolution. Here I present an adiabatic state evolution scheme which allows to track states in the spirit of the adiabatic state evolution of the scattering theory which can be applied to finite size systems.

[1] Sam T. Carr, Dmitry A. Bagrets, and Peter Schmitteckert, Phys. Rev. Lett. 107, 206801 (2011).

[2] Peter Schmitteckert, Hubert Saleur, and Sam T. Carr, preprint.

[3] B.A. Lippmann and Julian Schwinger, Phys. Rev. 79, 469 (1950).

[4] Marion Moliner and Peter Schmitteckert, preprint.