Invariants of the single impurity Anderson model and implications for conductance functionals

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The single impurity Anderson model (SIAM) is one of the key laboratories for theoretical investigations of correlated fermions systems. Analytical solutions of several ground state properties, such as the spin- and charge-susceptibilities are available. In addition, many numerical studies – predominantly employing the numerical renormalization group – have revealed important additional information, most notably on the impurity's spectral function and associated transport properties.

In our presentation we will investigate a new observable, RR, that has not been addressed before. RR denotes a ratio of density changes, that occur in the left and right leads after coupling to the impurity. RR has several interesting invariance properties. They can be derived from lead-invariants of the SIAM that seem to have not received a lot of attention, before. For instance, RR does not depend on microscopic model parameters, such as the interaction strength. Most importantly, however, RR equals the conductance of the SIAM at maximum transmission. Therefore, similar to the Friedel phase shift, RR establishes a parameter-free link between the ground-state density and the transport current.

The second part of the talk is devoted to the fate of RR under modifications of the SIAM that break the symmetries protecting the lead invariants. Our focus will be on lead disorder. A DMRG-study will be presented that strongly suggests that even under moderate disorder strength RR retains much of its (clean) properties. Therefore, we propose to put our theoretical arguments to an experimental test.