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Conductance Through Coupled Quantum Dots

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Using three supplementary numerical methods: a) quantum Monte Carlo algorithm based on the constrained path method, b) variational approach, and c) numerical renormalization group technique we compute zero-temperature conductance through different interacting regions. We first test all methods on a single quantum dot system coupled to the leads. Comparison of our results with those obtained with the essentially exact Bethe ansatz method reveals excellent agreement. We then extend our calculations to two and three coupled quantum dots and study the effect of various strengths of inter-dot overlap on the shape of Kondo plateaus that appear as a function of the gate voltage. Our results for conductance are further supplemented with calculations of various correlation functions such as: total number of electrons, charge susceptibility, spin-spin correlation functions and the moment of the interacting region vs. gate voltage. For the case of the side-coupled double quantum dot we present the evolution of the spectral function vs. gate voltage in different regimes of the inter-dot coupling strength. Finally, we discuss the condition for the appearance of the Fano resonance.

Keywords : quantum dots, conductance, Kondo effect