ROLE OF INTER–DOT COULOMB REPULSION AND EXCHANGE INTERACTIONS ON TRANSPORT IN DOUBLE QUANTUM DOT

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Effects of inter–dot many–body electronic correlations on the coherent transport through double quantum dots (2QD) connected in series are studied. Conductance as well as another physical quantity are calculated by means of Green's functions. The many–body electronic correlations are treated in the slave–boson (SB) mean field approach, developed by Kotliar and Ruckenstein. Results are obtained by solving of a set of self–consistent nonlinear equations. The conductance in the model is characterized by competition between the dot–dot tunnelling coupling and the level broadening (dot–lead coupling). An interesting behavior was found for a double occupation of the 2QD system. In the case, when the inter–dot coupling is weaker than the dot–lead coupling each dot accommodates one electron and forms the Kondo resonant state with conducting electrons in a lead. In the opposite limits, when the inter–dot coupling exceeds level broadening, the conductance vanishes for sufficiently low gate voltages, which means the Kondo effect disappeared. A generalization of the SB method allow us to show the role of inter–dot Coulomb repulsion and exchange interactions on the gate–voltage dependence of the differential conductance in both the limits as well as for the intermediate dot–dot couplings. The resonance region is broadened with increasing inter–dot Coulomb repulsion as well as with decreasing exchange interactions.

9.7 cm

13.4 cm

Subject category :

2. Magnetic Films, Surfaces, Multilayers and Nanostructures

Presentation mode :
poster

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