LEVEL OCCUPANCY ANOMALIES IN A DOUBLE QUANTUM DOT SYSTEM

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9.7 cm

A double-dot system is considered in the presence of the electron intra-Coulomb U interactions within the dots and inter-Coulomb U_{12} interactions between them. For spinless electrons, when U_{12} is the only interaction, the double-dot Hamiltonian is formally equivalent to spin-degenerate Anderson impurity Hamiltonian embedded in the host metal and is solved within Hubbard approximation. The self-consistently calculated occupancy numbers of the dots levels vs. gate voltage show two kinds of non-monotonic behavior strongly deviating from usual level filling at Coulomb blockade: one when the levels have different widths and the second when a finite splitting between them is present. These non-monotonicities originate from dynamical correlations between electrons. For the spin-full case a two step procedure is applied to the Hamiltonian due to the different physical nature of inter- and intra-Coulomb interactions. The first one is non-local and pure electrostatic, thus treated in Hartree-Fock approximation. Then, intra-Coulomb interactions, as local and of many-body nature, are treated in Hubbard approximation. It is shown that in the spin-full case the level occupancy anomalies are also present and are caused by electrostatic interactions between the dots. Surprisingly, these interactions also modify the auto-correlators of the dots levels.

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