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Tunneling Current Switching in the Coupled Quantum Dots by Means of External Field

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Abstract : We investigated the tunneling current peculiarities in the system of two coupled by means of the external field quantum dots (QDs) weakly connected to the electrodes in the presence of Coulomb correlations between localized electrons by means of Heisenberg equations for pseudo operators with constraint. Special role of multi-electronic states was demonstrated. Various single-electron levels location relative to the sample Fermi level and to the applied bias value in symmetric tunneling contact were investigated. Rabi frequency tuning results in the single-electron energy levels spacing. We revealed the appearance of negative tunneling conductivity and demonstrated multiple switching "on" and "off" of the tunneling current depending on the Coulomb correlations value, Rabi frequency amplitude and energy levels spacing. We proved that Coulomb correlations strongly influence the system behavior. We demonstrated the presence of multi-stability in the coupled QDs with Coulomb correlations when single value of the tunneling current amplitude corresponds to the two values of Rabi frequency in the case when both single-electron energy levels are located slightly above eV and are close to each other. This effect disappears when the single-electron energy levels spacing increases.

Keywords : Coulomb correlations, negative tunneling conductivity, quantum dots, rabi frequency
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