Dark states in spin-polarized transport through triple quantum dots

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ABSTRACT

The spin-polarized transport through a triple quantum dot is analyzed theoretically by means of the real-time diagrammatic technique. The quantum dots are arranged in a triangular geometry and weakly coupled to two ferromagnetic leads. Two collinear magnetic configurations of the device are considered: the parallel and antiparallel one. The calculations are performed in the first and second order of perturbation expansion with respect to the tunnel coupling, which allows us to study transport in the sequential and cotunneling regimes. We analyze the behavior of the current, differential conductance, tunnel magnetoresistance and Fano factor in both linear and nonlinear response regimes. In particular, we focus on the transport regime where the system is trapped in a dark state [1, 2] - a state formed due to destructive interference of electronic wavefunctions, the presence of which results in a strong current blockade and negative differential conductance. We discuss the influence of dark states on spin-resolved transport properties as well as the role of various parameters in the occurrence of this nontrivial effect.

References

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