ELECTRON MEDIATED Mn-Mn INTERACTION IN QUANTUM DOTS

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9.7 cm

We present a theoretical study of magnetic interaction in a spintronic device composed of a few semiconductor, disc-shaped quantum dots with magnetic in dot impurities. We show that gate voltage applied to the quantum dot shifts the centers of electron clouds. The exact formulas for the perturbed spin density allow us to derive an expression for the change of the strength of the $sp-d$ coupling. Estimations show that $sp-d$ exchange integral is very sensitive to the gate voltage variations. The formulas for the change of the effective exchange integrals are derived. As the spin coded qubits are elements of a the RAM memory part of the energy stored in magnetic coupling will be dissipated when the information is written or erased. The dissipated energy stemming from magnetic interactions is supplemented by the energy loss due to parasitic electric dipoles. We estimate this energy and find that it is sufficiently large to destroy quantum coherence during quantum computing. Finally, we discuss the interdot spin coupling and show effect of gate voltage operations on the spin intra- and interdot RKKY coupling.

13.4 cm

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