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Competition between Coulomb localization and barrier modulation of the exchange energy in two-electron laterally coupled quantum dots DMITRIY MELNIKOV, JEAN-PIERRE LEBURTON, Beckman Institute for Advanced Science and Technology, University of Illinois at Urbana-Champaign, Urbana, IL 61801 — We present calculations of the singlet-triplet energy separation (exchange energy) in the two-electron system confined in the double quantum dot system used in recent experiments on coherent manipulation of coupled electron qubits. The hybrid multiscale approach where the confined electrons are described by the direct diagonalization of the Schrödinger equation within the full quantum dot device environment was used to perform the calculations. We analyze the behavior of the exchange in the magnetic fields and find large changes from meV to sub-μeV value as the confinement gate biases (effective barrier) are varied, while the singlet-triplet transition magnetic field remains at about 1 T independently of the gate biases. The small values of the exchange in this structure are attributed to the large separation between the electrons leading to an almost classical description of the system due to the dominance of the Coulomb repulsion.

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