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Adiabatic optical two-qubit operation with electron spins in separate quantum dots[1] SEMION SAIKIN, University of California, San Diego, La Jolla, CA 92093, CLIVE EMARY, Institut für Theoretische Physik, TU Berlin, D-10623 Berlin, Germany, DUNCAN STEEL, University of Michigan, Ann Arbor, MI 48109, LU SHAM, University of California, San Diego, La Jolla, CA 92093 — We develop an adiabatic scheme to control the entanglement of two electron spins localized in separate InAs/GaAs quantum dots via the Coulomb interaction between two negative trions optically excited in the different dots. The scheme gives a unitary operation in the spin subspace and can be used as a two- qubit gate for quantum information processing. The slowly- varying adiabatic pulses drive the system in a such way that effects of pulse imperfections and relaxation of the trion states are minimized. For spin dynamics we provide an exact numerical solution that accounts for dissipation and analyze the essential processes within a "dressed state" model. Our calculations for vertically-stacked quantum dots show that for a broad range of dot parameters a two-spin state with the concurrence $C > 0.85$ can be prepared coherently from an initially polarized state by four optical fields with the pulse duration $\Delta t \sim 1$ ns.

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