

Abstract Submitted
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Exchange interaction between distant spins mediated by a multielectron quantum dot¹ F. K. MALINOWSKI, F. MARTINS, P. D. NISSEN, C. M. MARCUS, F. KUEMMETH, Center for Quantum Devices, Niels Bohr Institute, University of Copenhagen, Denmark, G. C. GARDNER, S. FALLAHI, M. J. MANFRA, Department of Physics and Astronomy, Birck Nanotechnology Center, and Station Q Purdue, Purdue University, USA, T. SMITH, A. C. DOHERTY, S. D. BARTLETT, Centre for Engineered Quantum Systems, School of Physics, The University of Sydney, Australia — We demonstrate coherent exchange interactions between two separated electron spins in a GaAs heterostructure, mediated by a central multielectron quantum dot. We observe three different regimes of spin exchange. First, long-range superexchange, mediated by virtual occupations of the multielectron dot. Second, direct exchange, induced by moving one of the electrons onto the multielectron dot. Finally, on-site exchange, with both electrons transferred to the multielectron dot. Using independent readout of both spins, we further show that this interaction mechanism can be used for a fast and high-fidelity square-root-SWAP entangling gate for single electronic spins.

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