Abstract Submitted
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Long-range, low-noise gates for dopant and quantum dot spin qubits[1] V. SRINIVASA, H. XU, Joint Quantum Institute/NIST, J. MEDFORD, Northrop Grumman, J. M. TAYLOR, Joint Quantum Institute/NIST — Coupling spins by exchange interactions provides a rapid, tunable method of entanglement generation. However, this necessarily occurs only at short distances, and often incurs susceptibility to charge noise. To address these challenges, we consider two approaches. First, we investigate the coupling of two qubits localized on spatially separated impurity atoms or quantum dots. We show that a third multi-electron, multi-level quantum dot can mediate an exchange interaction between the qubits that is tunable via gate voltage control of level splittings and tunneling amplitudes. This approach suggests an experimentally accessible method for coupling donor electron spins in silicon via a hybrid impurity-dot system. Second, we discuss the resonant exchange (RX) qubit, defined within a triple quantum dot in the three-electron regime. Electric field control of the dipole moment of the RX qubit at microwave frequencies enables single-qubit and two-qubit gates that are protected against low-frequency charge noise.

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