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Electrical control of spin qubit shuttling between a donor and a quantum dot PEIHAO HUANG, GARNETT BRYANT, Joint Quantum Institute, National Institute of Standards and Technology and University of Maryland — Shuttling an electron spin qubit through coherent tunneling adiabatic passage is a promising way to transfer quantum information and achieve two-qubit gate among spatially separated qubits. The controllability of tunneling rate is essential for the shuttling of an electron while preserving quantum information that the electron spin carries. We study the tunneling between a donor atom and a gate-defined, near-surface quantum dot in silicon by using atomistic tight-binding simulation. We show the role that valley degrees of freedom, quantum-dot size and dot-donor separation play in the tunneling rate and how electric field can be employed to tune the tunneling rate and increase the spin transfer fidelity.

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