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On-demand single-electron transfer between distant quantum dots with nanosecond pulses of surface acoustic waves R.P.G. MCNEIL, M. KATAOKA[1], C.J.B. FORD, C.H.W. BARNES, J.P. GRIFFITHS, G.A.C. JONES, I. FARRER, D.A. RITCHIE, University of Cambridge — Quantum dots (QDs) provide a useful system for manipulating and storing quantum information. Methods for moving quantum information (spin) between processor and storage, or to a region of holes for conversion to photon qubits, will be required. Tunnelling of electrons over long distances between QDs is not viable. We show controlled long-range transfer of single electrons between QDs through a depleted 1D channel using pulses of surface acoustic waves (SAWs). In our device, two QDs are connected by a 4μm channel with QD occupancy monitored by 1D charge detectors. Electrons may be trapped and raised above the Fermi energy by stepping gate voltages. Having set the first QD to be 'full' and the other QD 'empty', a short SAW pulse is sent to transfer the electron to the opposite QD. This bi-directional process may be repeated over 100 times with the same electron. SAW power and pulse-width dependences suggest that transfer is achieved during the first few SAW cycles allowing sub-20ns pulses to be used.

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