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Electron population control of an isolated quantum dot using surface-acoustic-wave pulses CHRIS FORD, ROBERT SCHNEBLE, MASAYA KATAOKA, ADAM THORN, CRISPIN BARNES, DAVID ANDERSON, GEB JONES, IAN FARRER, DAVID RITCHIE, MICHAEL PEPPER, University of Cambridge — In developing quantum information technology, isolation from the environment is a key for long coherence times. However, many quantum-dot (QD) experiments require a fair degree of coupling to electron reservoirs. The electron number becomes progressively difficult to control as the degree of isolation increases and the electron dwell time exceeds the timescale of experiments. In such a system, a means to transfer electrons on demand between a QD and another QD or reservoir is desirable. We report our recent experiments on sending surface acoustic waves (SAWs) past a QD that is isolated from the leads by strong barriers, such that electrons take hundreds of seconds to tunnel. A short pulse of SAWs is used to characterize the electronic structure of the QD, and to transport electrons in and out of the QD. The mechanism of electron transfer from dynamic QDs defined by the SAWs themselves into a gate-defined static QD is investigated. This has applications for quantum information transfer and processing.

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