Abstract Submitted
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Quantum hybrid platform using electrons and superconducting electronics[1] N. DANIILIDIS, D. GORMAN, Department of Physics, University of California Berkeley, L. TIAN, School of Natural Sciences, University of California, Merced, H. HAEFFNER, Department of Physics, University of California Berkeley; Materials Sciences Division, Lawrence Berkeley National Laboratory — We describe a quantum information processing (QIP) architecture based on single trapped electrons and superconducting electronics. The electron spins function as quantum memory elements, and the electron motion is used to couple the electrons to microwave circuits. To achieve this, we propose a parametric coupling mechanism which utilizes the non-linearity of the electrostatic potential of a sharp electrode placed $10\,\mu$m from a single trapped electron. This mechanism allows parametric coupling rates higher than 350 kHz for electrons with trap frequency of 300 MHz, coupled to a 7 GHz resonant circuit. We discuss state transfer and entangling operations between distant electrons, as well as between electrons and superconducting qubits, e.g. transmon qubits. The coupling to high frequency superconducting electronics enables initialization as well as state read-out of the electron motion. In addition, the electron's $\{|0\rangle, |1\rangle\}$ motional manifold can be mapped onto its spin using a non-linear oscillating magnetic field, completing all requirements for quantum computing with the electron spin. We estimate that all involved operations can be carried out with fidelities on the order of 0.999 enabling fault-tolerant quantum computing.

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