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Long-distance spin-spin coupling via floating gates LUKA TRIFUNOVIC, University of Basel, OLIVER DIAL, Harvard University, MIRCEA TRIF, JAMES WOOTTON, University of Basel, REDIET ABEBE, AMIR YACOBY, Harvard University, DANIEL LOSS, University of Basel — The electron spin is a natural two level system that allows a qubit to be encoded. When localized in a gate defined quantum dot, the electron spin provides a promising platform for a future functional quantum computer. The essential ingredient of any quantum computer is entanglement—between electron spin qubits commonly achieved via the exchange interaction. Nevertheless, there is an immense challenge as to how to scale the system up to include many qubits. Here we propose a novel architecture of a large scale quantum computer based on a realization of long-distance quantum gates between electron spins localized in quantum dots. The crucial ingredients of such a long-distance coupling are floating metallic gates that mediate electrostatic coupling over large distances. We show, both analytically and numerically, that distant electron spins in an array of quantum dots can be coupled selectively, with coupling strengths that are larger than the electron spin decay and with switching times on the order of nanoseconds.

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