Abstract Submitted
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Mitigating the effects of charge noise and improving the coherence of a quantum dot hybrid qubit BRANDUR THORGRIMSSON, Univ of Wisconsin, Madison, DOHUN KIM, Seoul National University, South Korea, YUAN-CHI YANG, C.B. SIMMONS, DANIEL R. WARD, RYAN H. FOOTE, D. E. SAVAGE, M. G. LAGALLY, MARK FRIESEN, S. N. COPPERSMITH, M. A. ERIKSSON, Univ of Wisconsin, Madison — The quantum dot hybrid qubit, which can be viewed as a hybrid between a charge and spin qubit, is formed with three electrons in a double dot. The qubit is operated without any magnetic fields and exhibits both spin-qubit-like stability and charge-qubit-like speeds. Here we show that charge noise is the main source of decoherence for the hybrid qubit, and demonstrate that its effect can be mitigated in two ways: by modifying the qubits internal parameters or by changing its operating regime. By combining these methods, we have increased a hybrid qubits free induction decay time from 11 ns to 127 ns, and its Rabi decay time from 33 ns to over 1 μs. Additionally, we show that the longest Rabi decay times are not limited by fluctuations of the qubit energy but by fluctuations of the Rabi frequency (both of which arise from charge noise). This work was supported in part by ARO (W911NF-12-0607) and by NSF (DMR-1206915 and PHY-1104660). Development and maintenance of the growth facilities used for fabricating samples was supported by DOE (DE-FG02-03ER46028). This research utilized NSF-supported shared facilities at the University of Wisconsin-Madison.

Brandur Thorgrimsson
Univ of Wisconsin, Madison

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