Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Entangling distant resonant exchange qubits via circuit quantum electrodynamics VANITA SRINIVASA, Laboratory for Physical Sciences/University of Maryland, College Park, MD, JACOB M. TAYLOR, Joint Center for Quantum Information and Computer Science/Joint Quantum Institute/National Institute of Standards and Technology, Gaithersburg, MD, CHARLES TAHAN, Laboratory for Physical Sciences, College Park, MD — Enabling modularity within a quantum information processing device relies on robust entanglement of coherent qubits at macroscopic distances. To address this challenge, we investigate theoretically a hybrid quantum system consisting of spatially separated resonant exchange qubits, defined in three-electron semiconductor triple quantum dots, that are coupled via a superconducting transmission line resonator. By analyzing three specific approaches drawn from circuit quantum electrodynamics and Hartmann-Hahn double resonance techniques for implementing resonator-mediated two-qubit entangling gates in both dispersive and resonant regimes, we show that methods for entangling superconducting qubits map directly to resonant exchange qubits. We also calculate the rate of relaxation via phonons for resonant exchange qubits in silicon triple dots and show that such an implementation is particularly well-suited to achieving the strong coupling regime. Our approach combines the robustness of encoded spin qubits in silicon with the rapid and robust long-range entanglement provided by circuit QED systems.

Vanita Srinivasa
Laboratory for Physical Sciences/University of Maryland, College Park, MD

Date submitted: 06 Nov 2015 Electronic form version 1.4