Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Quantum manipulation of low-frequency fluctuators with a superconducting resonator[1] LIN TIAN, School of Natural Sciences, University of California, Merced, CA 95344, KURT JACOBS, Department of Physics, University of Massachusetts at Boston, 100 Morrissey Blvd, Boston, MA 02125 USA — Spurious two-level systems (fluctuators) in superconducting devices have demonstrated long coherence time and can be considered as qubits instead of sources of decoherence. Coherent coupling between two-level system (TLS) and superconducting phase qubit has been observed in experiments. Here, we show that universal quantum logic gates on the TLS qubits can be implemented via the coupling between the TLSs and a superconducting microwave resonator in a cavity QED setup. By adjusting the driving on the resonator mode, parameters of individual TLS can be controlled to realize single qubit gates. Meanwhile, effective coupling can be generated between TLSs via their simultaneous coupling to the resonator mode. We present concrete designs for the gate operations and our numerically simulation shows that high fidelity can be achieved for the gate operations in the presence of resonator decay even at decay rates of a few megahertz. The nonlocal nature of the resonator mode also makes the TLSs intrinsically scalable for testing quantum algorithms.

[1]KJ was supported by the Army Research Office and the Intelligence Advanced Research Projects Activity.

Lin Tian
School of Natural Sciences, University of California, Merced, CA 95344

Date submitted: 21 Nov 2008 Electronic form version 1.4