Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Towards proving non-classicality with a 3-qubit GHZ state in circuit QED LEV S. BISHOP, Yale University, JAY M. GAMBETTA, University of Waterloo, ERAN GINOSSAR, STEVEN M. GIRVIN, Yale University, ANDREW A. HOUCK, Princeton University, JENS KOCH, ANDREAS NUNNENKAMP, DAVID J. PRICE, ROBERT J. SCHOELKOPF, Yale University, LARS TORNBERG, Chalmers University of Technology, YALE CIRCUIT QED TEAM — The demonstration of violation of Bell-type inequalities remains challenging for superconducting qubits, due to short coherence times and limited measurement fidelity. Here, we propose to utilize 3-qubit GHZ states in a circuit QED system to accomplish this key step. In contrast to other schemes where the qubits are measured individually, circuit QED offers the advantage that a single dispersive measurement can directly reveal the parity $\langle \sigma_z^1 \otimes \sigma_z^2 \otimes \sigma_z^3 \rangle$. When combined with appropriate 1-qubit rotations, this provides the necessary ingredients to obtain an effective measurement of Mermin's Bell operator with less stringent requirements on the measurement fidelity. Generation of the GHZ state can proceed via either 1- and 2-qubit gates or preparation by measurement. We present results from quantum trajectory calculations and estimate the resulting violation of the Mermin inequality, based on experimentally feasible parameters.

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Date submitted: 28 Nov 2008 Electronic form version 1.4