Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Vacuum Rabi Mode Splitting at High Drive Powers and Elevated Temperatures J.M. FINK, Department of Physics, ETH Zurich, A. BLAIS, Departement de Physique, Universite de Sherbrooke, R.J. SCHOELKOPF, Departments of Applied Physics and Physics, Yale University, A. WALLRAFF, Department of Physics, ETH Zurich, ETH QUANTUM DEVICE TEAM, YALE CIRCUIT QED TEAM — The circuit QED architecture [1, 2] is ideal to probe the nonlinearity of a strongly coupled cavity QED system at high drive powers populating the cavity with a controllable average photon number in the range from $0.1 < n < 100$. While in atomic cavity QED the radiation pressure exerted on the atoms by the drive tends to expel the atoms from the cavity, superconducting qubits remain at a fixed position and maintain constant coupling. This enables us to explore the cross-over from the quantum to the classical regime in the single qubit-field interaction by measuring vacuum Rabi mode splitting spectra. We also investigate the effect of thermal radiation in the cavity leading to a thermal population of excited states in the Jaynes-Cummings ladder, which was theoretically studied in Ref. [3]. Simulations have been carried out in order to determine the optimal set of qubit and resonator parameters needed for first experiments.

[1] A. Blais *et al.* Phys. Rev. A **69**, 062320 (2004).
[2] A. Wallraff *et al.* Nature **431**, 162 (2004).
[3] I. Rau *et al.* Phys. Rev. B **70**, 054521 (2004).

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Date submitted: 04 Dec 2007 Electronic form version 1.4