Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Quantum measurement in action with the transmon qubit[1] M. HATRIDGE, S. SHANKAR, F. SCHACKERT, K. GEERLINGS, T. BRECHT, K. SLIWA, B. ABDO, L. FRUNZIO, R.J. SCHOELKOPF, M.H. DEVORET, Applied Physics Dept., Yale University — High fidelity, rapid quantum non-demolition readout of superconducting qubits greatly facilitates tests of single qubit measurement theory. We have realized such readout in an experiment comprised of a transmon coupled to a compact resonator, which is in turn connected via an isolator and circulator to a tunable Josephson parametric converter (JPC) operated as a phase-preserving parametric amplifier. When the qubit state is measured with an rf tone corresponding to an average cavity circulating power of 5 photons, fidelity exceeds 90% for a measurement duration of 240 ns ($\sim$0.1 T1). This performance allows the observation of quantum trajectories of the qubit, showing discrete jumps and a bimodal distribution of measurement results, despite the linear character of the amplifier. This provides further support for the quantum nature of superconducting artificial atoms. We have conducted Stern-Gerlach type experiments, in which the qubit is repeatedly measured along different axes. Results are in good agreement with theoretical predictions of the effect of partial measurement on qubit state evolution.

[1]Work supported by IARPA, ARO, and NSF.

M. Hatridge
Applied Physics Dept., Yale University

Date submitted: 10 Nov 2011 Electronic form version 1.4