Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Quantum State Tomography of a Cooper-pair Box SERGEY NOVIKOV, V. ZARETSKEY, B. SURI, Z. KIM, Dept. of Physics, Univ. of Maryland, B.S. PALMER, Lab. for Physical Sciences, F.C. WELLSTOOD, JQI, CNAM, Dept. of Physics, Univ. of Maryland — A 4-8 GHz microwave pulse shaping system with 3 ns Gaussian pulse rise time, arbitrary pulse envelope and phase control has been implemented. The system utilizes a two-channel 1 GSa/s DAC board[1] to supply control voltages to an IQ mixer. The signals to the mixer have been optimized to obtain an on-off ratio of > 85 dB and phase deviations $< 5\%$. The setup has been used to manipulate an $Al/AlO_x/Al$ Cooper-pair box (CPB) qubit coupled to a lumped-element microwave resonator ($f_0 = 5.446$ GHz). The CPB has a charging energy $E_C/h = 6.25$ GHz and a maximum $E_J/h = 19$ GHz which was decreased to an effective $E_J/h = 6.1$ GHz by an external magnetic field. By measuring the microwave transmission at f_0 in a pulsed-probe scheme, we perform a dispersive readout of the qubit. We present tomography data on the $|g\rangle$, $|e\rangle$, $(|g\rangle + |e\rangle)/\sqrt{2}$ and $(|g\rangle + i|e\rangle)/\sqrt{2}$ states. We find good agreement with theory, confirming that we have achieved the desired microwave pulse control.

[1]Designed by J. Martinis at UCSB and fabricated by HSCC.

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Date submitted: 30 Dec 2010 Electronic form version 1.4