Abstract Submitted
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Observation of the dynamics of two-state parametric fluctuators in superconducting flux qubits[1] ADRIAN LUPASCU, MUSTAFA BAL, MOHAMMAD ANSARI, Institute for Quantum Computing, Department of Physics and Astronomy, and Waterloo Institute for Nanotechnology, University of Waterloo — Spectroscopic measurements of a few persistent current qubit samples yield data in which the spectroscopic lines are doublets. The doublet splitting decreases with increasing qubit transition frequency. In three devices with a relatively low Josephson to charging energy ratio E_J/E_c, the maximum splitting ranges between 30 and 270 MHz. The splitting value is found to have variations over time scales of the order of days. The doublet structure was not observed in two other samples with larger E_J/E_c. Assuming a model in which the qubit experiences a parametric fluctuation that changes its frequency, we perform an experiment to probe the time scale of this fluctuation. We repeat a sequence in which the qubit is reset by energy relaxation, then driven with weak Rabi π pulses on one of the spectroscopy lines, and finally measured. The time correlation of the series of measurement results displays an exponential decay, consistent with a telegraph noise component in the qubit frequency. The correlation does not depend on time if the qubit is either not excited or driven with a strong Rabi pulse. The transition rate was found to vary between 8 kHz and 38 kHz for temperatures between 43 and 165 mK. We discuss quasiparticle poisoning and other possible source of this effect.

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