Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Tracking errors of a logical qubit comprised of superpositions of cat states in a superconducting resonator A. PETRENKO, N. OFEK, R. HEERES, P. REINHOLD, Y. LIU, Z. LEGHTAS, B. VLASTAKIS, L. FRUNZIO, LIANG JIANG, Yale University Department of Applied Physics, M. MIRRAHIMI, INRIA Paris-Rocquencourt, M.H. DEVORET, R.J. SCHOELKOPF, Yale University Department of Applied Physics — QEC schemes involve redundantly encoding a qubit into a larger space of states that has symmetry properties that allow one to measure error syndromes. Traditional approaches involve encodings that employ large numbers of physical qubits, enhancing decay rates significantly and requiring considerable hardware overhead to realize. A hardware-efficient proposal [1,2], which we term the cat code, sheds much of this complexity by encoding a qubit in superpositions of cat states in a superconducting resonator, which has one dominant error syndrome: single photon loss. As these cat states are eigenstates of photon number parity, the loss of a photon changes the parity without corrupting the encoded information. In a superconducting cQED architecture, we demonstrate that we track these errors in real-time with repeated single shot parity measurements and map their occurrence onto applications of a unitary rotation of an arbitrary encoded state in the logical space. Our results illustrate the utility of long-lived resonators in the context of a full QEC system by highlighting the advantages of employing the cat code to suppress decoherence. [1]Leghtas et.al. PRL 111 120501 2013 [2]Mirrahimi et.al. NJP 16 045014 2014

Andrei Petrenko
Yale University Department of Applied Physics

Date submitted: 06 Nov 2015 Electronic form version 1.4