Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

**A Very Small Logical Qubit** ELIOT KAPIT, Tulane University — Superconducting qubits are among the most promising platforms for building a quantum computer. However, individual qubit coherence times are not far past the scalability threshold for quantum error correction, meaning that millions of physical devices would be required to construct a useful quantum computer. Consequently, further increases in coherence time are very desirable. In this letter, we blueprint a simple circuit consisting of two transmon qubits and two additional lossy qubits or resonators, which is passively protected against all single qubit quantum error channels through a combination of continuous driving and engineered dissipation. Photon losses are rapidly corrected through two-photon drive fields implemented with driven SQUID couplings, and dephasing from random potential fluctuations is heavily suppressed by the drive fields used to implement the multi-qubit Hamiltonian. Comparing our theoretical model to published noise estimates from recent experiments on flux and transmon qubits, we find that logical state coherence could be improved by a factor of forty or more compared to the individual qubit $T_1$ and $T_2$ using this technique.

Eliot Kapit
Tulane University

Date submitted: 05 Nov 2015 Electronic form version 1.4