Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Phonon-Mediated Quasiparticle Poisoning of Superconducting Microwave Resonators U. PATEL, IVAN V. PECHENEZHSKIY, Department of Physics, University of Wisconsin, Madison, Wisconsin 53706, K. R. DODGE, B. L. T. PLOURDE, Department of Physics, Syracuse University, Syracuse, New York 13244, M. G. VAVILOV, R. MCDERMOTT, Department of Physics, University of Wisconsin, Madison, Wisconsin 53706 — Classical Josephson digital logic based on Single Flux Quantum (SFQ) pulses offers a path to high-fidelity coherent control of large-scale superconducting quantum machines. However, an SFQ pulse driver generates nonequilibrium quasiparticles that contribute to qubit relaxation, and steps must be taken to protect the qubit from this decoherence channel. Here we investigate the mechanism of quasiparticle poisoning in devices subjected to local quasiparticle injection. We use NIS junctions to controllably inject quasiparticles into the groundplane of superconducting resonator chips, and we characterize the quasiparticle contribution to dissipation. We examine the effectiveness of groundplane cuts and normal metal quasiparticle traps at protecting the quantum modes against quasiparticle loss. We find that quasiparticle poisoning is dominated by the propagation of pair-breaking phonons across the chip. We characterize the energy dependence of the timescale for quasiparticle poisoning. Finally, we observe that incorporation of extensive normal metal quasiparticle traps leads to a more than order of magnitude reduction in quasiparticle loss for a given injected quasiparticle power.

Umeshkumar Patel
Department of Physics, University of Wisconsin, Madison, Wisconsin 53706

Date submitted: 11 Nov 2016 Electronic form version 1.4