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Study of Dissipation in Phase Qubits Using High-Q Resonators<sup>1</sup> K. D. OSBORN, K. CICAK, S. OH, D. P. PAPPAS, J. A. STRONG, R. W. SIM-MONDS, National Institute of Standards and Technology, R. MCDERMOTT, M. STEFFEN, K. B. COOPER, MARKUS ANSMANN, JOHN M. MARTINIS, University of California at Santa Barbara — The coherence time in a qubit is adversely affected by dissipation. Superconducting phase qubits are made with microelectronic circuits that have finite dissipation due to losses from dielectrics, radiation, and the barrier of the aluminum-oxide-based Josephson junction. We have measured coplanar-waveguide and lumped-element high-Q microwave resonators operating at the transition frequency of phase qubits. The coplanar-waveguide resonator is used to test the quality of the silicon dioxide used in the qubit circuit, whereas the lumpedelement resonator is used to test losses associated with the qubit inductor. These resonator experiments suggest that our phase qubits are not currently limited by dissipation from the dielectrics or radiation loss.

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