Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Investigation of Limiting Decoherence Mechanisms in Xmon Qubits C. M. QUINTANA, UC Santa Barbara, R. BARENDS, Google, Santa Barbara, B. CAMPBELL, UC Santa Barbara, Y. CHEN, Google, Santa Barbara, Z. CHEN, B. CHIARO, A. DUNSWORTH, UC Santa Barbara, A. G. FOWLER, Google, Santa Barbara, I.-C. HOI, UC Santa Barbara, E. JEFFREY, Google, Santa Barbara, J. KELLY, A. MEGRANT, UC Santa Barbara, J. MUTUS, Google, Santa Barbara, C. NEILL, P. J. J. O'MALLEY, UC Santa Barbara, P. ROUSHAN, D. SANK, Google, Santa Barbara, A. VAINSENCHER, J. WENNER, T. C. WHITE, A. N. CLELAND, UC Santa Barbara, J. M. MARTINIS, University of California and Google, Santa Barbara — Xmon-style transmon qubits have demonstrated a high level of coherence and controllability, enabling high-fidelity quantum gates and measurement at the levels required for surface code error correction. However, decoherence is still a limiting factor for fidelities, and further improvements to coherence could significantly reduce the overhead required to build a fault-tolerant quantum computer. We report on relaxation and dephasing mechanisms relevant to the Xmon qubit. In particular, we discuss dielectric loss from stray Josephson junctions and the dependence of dephasing on qubit temperature.

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Date submitted: 14 Nov 2014 Electronic form version 1.4