Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Quasiparticle tunneling in a single-junction transmon qubit[1] DIEGO RISTÉ, JOSEPHINE VAN LEEUWEN, LEONARDO DICARLO, Kavli Institute of Nanoscience, Delft University of Technology — The recent increase in transmon qubit quality factor into the million range [1] makes non-equilibrium quasiparticle tunneling a potentially limiting mechanism for qubit coherence. We investigate the dynamics of quasiparticle tunneling in a single-junction transmon qubit with relaxation time $T_1 = 85$ μs ($Q = 2.6$ million). The qubit operates at moderate ratio of Josephson to charging energy, $E_J/E_C \sim 30$, where charge parity in the qubit islands is encoded in the qubit transition frequency. Using Ramsey-type and stimulated echo experiments, we investigate quasiparticle tunneling across the qubit junction on time scales short and long compared to T_1. We observe that the quasiparticle tunneling time for the single-junction qubit is at least as long as T_1, but shorter than the 1 ms repetition rate. This result is consistent with recent theory and qualitatively different from the two-junction transmon. The dephasing time $T_2^* = 10$ μs is limited by slow background charge fluctuations and extended to $T_2 = 95$ μs using dynamical decoupling.

[1] Paik et al. arXiv:1105.4652v4

[1]Research supported by NWO, FOM, and EU Project SOLID.

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Date submitted: 12 Nov 2011 Electronic form version 1.4