Abstract Submitted
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**Macroscopic quantum tunneling in a damped Josephson junction coupled to a nanomechanical resonator**[1] JOSHUA SCHIFFRIN, Carnegie Mellon University, BRAD TREES, YASER HELAL, Ohio Wesleyan University, BRIAN SILLER, University of Illinois at Urbana-Champaign — Motivated by work in the field of quantum computation, we studied the tunneling rate in a damped Josephson junction (JJ) coupled to a nanomechanical resonator. The Josephson phase difference was treated as the coordinate of a particle trapped in a metastable cubic potential well, and the resonator was considered to be a simple harmonic oscillator. The damping on the system by the environment was modeled as two reservoirs of simple harmonic oscillators, one of which was coupled to the JJ, and the other coupled to the resonator. We found that damping the JJ suppresses the tunneling rate, a result already predicted by theory and verified by experiment for a single JJ. We also find that increasing the coupling strength between the JJ and the resonator suppresses the tunneling rate, while adding damping to the resonator actually enhances the tunneling rate. These results are important, as a full understanding of the tunneling rate's dependence on system parameters is essential for the proper operation of quantum bits.

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