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**Enhanced Macroscopic Quantum Tunneling of a Damped Metastable System Coupled to a Nanomechanical Resonator** BRIAN SILLER, BRAD TREES, Ohio Wesleyan University — Recent work in the field of quantum computing has focused to a large extent on viable qubit candidates. One such candidate is an underdamped, current-biased Josephson junction, called a phase cubit, coupled to a nanomechanical resonator. At a bias current just below the critical current of the junction, the system is metastable, and tunneling out of a local minimum in the washboard potential describing the junction could become a concern with regard to controlling the operation of a qubit. We report on calculations of the tunneling rate of such a Josephson system coupled to a nanomechanical resonator. We have looked at both strongly damped and weakly damped junctions, modeling the damping of the junction by the harmonic-oscillator bath method made popular by Caldeira and Leggett. We were interested to see if a resonance between the junction and the resonator, when one of the resonator's natural frequencies matches the plasma frequency of the junction, would result in an enhancement of the tunneling rate. We report on our findings of the tunneling rate in these systems.

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