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**Suppression of Quantum Fluctuations in a Josephson Junction Coupled to a Nanomechanical Resonator**[1] YASER HELAL, Ohio Wesleyan University, JOSHUA SCHIFFRIN, Carnegie Mellon University, BRAD TREES, Ohio Wesleyan University — The behavior of a Josephson junction (JJ) in parallel with a nanomechanical resonator was studied. The JJ was treated as a particle trapped in a quadratic potential well, and the problem could thus be characterized as two coupled harmonic oscillators. The Feynman path integral technique was used to find the density matrix and partition function for the system. When coupled to the resonator, the square of the uncertainty in the position of the JJ particle was suppressed, i.e. quantum fluctuations of the JJ were reduced by the resonator. The uncertainty principle was obeyed in that the square of the uncertainty in the JJ's momentum was enhanced with resonator coupling. We also included the effects of environmental damping. Damping the junction enhanced the suppression of quantum fluctuations beyond that due to resonator coupling alone. Damping the resonator, however, weakened the effect of JJ-resonator coupling and thus resulted in less suppression of quantum fluctuations. Preliminary results for the effects on quantum fluctuations of a weak nonlinear term in the JJ's potential energy have also been obtained.

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