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Suppression of macroscopic quantum tunneling in a large Josephson junction coupled to a resonator[1] BRAD TREES, Ohio Wesleyan University, JOSHUA SCHIFFRIN, Carnegie-Mellon University, YASER HELAL, Ohio Wesleyan University, BRIAN SILLER, University of Illinois at Urbana-Champaign
— We calculated the zero-temperature macroscopic quantum tunneling rate of a current-biased Josephson junction weakly coupled to a resonator. We allow for the effects of environmental dissipation on both the junction and the resonator, and we consider both cases of weak and strong junction damping. We find that coupling to the resonator has a suppressive effect on the junction's tunneling: the stronger the coupling strength between the junction and resonator, the greater the reduction of the tunneling rate. Including damping to the junction also suppresses tunneling, but damping the resonator partially *counteracts* the suppression provided directly by the junction-resonator coupling. Modeling the dependence of the junction-resonator coupling on the resonator's frequency ω_R in a power law fashion $U_{int} \propto (\omega_R)^n$, we find that for $0 < n < 1$ the tunneling rate exhibits a *nonmonotonic* dependence on ω_R, and for $n = 1/2$, the tunneling rate is maximally suppressed for $\omega_R/\omega_J \approx 1$, where ω_J is the bias current-dependent plasma frequency of the junction.

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