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Fluctuation Reduction in a Si Micromechanical Resonator Tuned to Nonlinear Internal Resonance B. SCOTT STRACHAN, Michigan State Univ, DAVID CZAPLEWSKI, CHANGYAO CHEN, Argonne National Labs, MARK DYKMAN, Michigan State Univ, DANIEL LOPEZ, Argonne National Labs, STEVEN SHAW, Michigan State Univ — We describe experimental and theoretical results on an unusual behavior of fluctuations when the system exhibits internal resonance. We study the fundamental flexural mode (FFM) of a Si microbeam. The FFM is electrically actuated and detected. It is resonantly nonlinearly coupled to another mode, which is not directly accessible and has a frequency nearly three times the FFM frequency. Both the FFM and the passive mode have long lifetimes. We find that the passive mode can be a "sink" for fluctuations of the FFM. This explains the recently observed dramatic decrease of these fluctuations at nonlinear resonance [1]. The re-distribution of the vibration amplitudes and the fluctuations is reminiscent of what happens at level anti-crossing in quantum mechanics. However, here it is different because of interplay of the dependence of the vibration frequency of the FFM on its amplitude due to internal nonlinearity and the nonlinear resonance with the passive mode. We study both the response of the system to external resonant driving and also the behavior of the system in the presence of a feedback loop. The experimental and theoretical results are in good agreement. [1] D. Antonio, *Nat. Comm.*, {**3**}, 806 (2012).

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