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Fluctuation relations in a micromechanical oscillator driven far from thermal equilibrium COREY STAMBAUGH, HO BUN CHAN, University of Florida — We explore fluctuation relations in a micromechanical torsional oscillator. In the linear regime when the modulation is weak, we verify that the ratio of the work variance to the mean work is independent of the driving frequency, consistent with standard fluctuation relations for a steady state system near thermal equilibrium. We then apply a strong drive to force the system into nonlinearity. Here the system displays bistability and the relationship between the work and variance is expected to deviate from the linear regime. For a bistable system the total variance has two distinct contributing components. The first results from small fluctuations about a stable state. The work variance is expected to diverge as the system approaches the bifurcation point where the state disappears. The other part of the variance results from the system switching between coexisting states. This part of the variance is expected to show a sharp peak near the kinetic phase transition when the populations of the two states are comparable. We compare our experimental results to theoretical predictions that distinguish nonlinear oscillators from equilibrium systems.

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