Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Thermally induced parametric instability in back-action evading measurement of micromechanical quadrature near the zero-point level JUNHO SUH, MATT SHAW, AARON WEINSTEIN, KEITH SCHWAB, California Institute of Technology — Back-action evading (BAE) measurement of mechanical resonators allows, in principle, detection of a single quadrature of motion with sensitivity far below the standard quantum limit, limited in practice only by the non-idealities in the measurement. We report the results of experiments utilizing two-tone BAE in a tightly coupled cavity quantum electro-mechanical system (ω_c=7.1GHz, ω_m=10MHz, g=14MHz/nm). Due to excess dissipation in the microwave cavity, we observe a parametric instability induced by the thermal shift of mechanical resonance frequency. This bounds the minimum position imprecision on one quadrature and we measure the imprecision reaching twice the zero-point motion. We discuss the device requirements to avoid this thermal mechanism and perform measurements below the zero-point level.

Junho Suh
California Institute of Technology

Date submitted: 10 Nov 2011 Electronic form version 1.4