Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Control of a mechanical resonator mode by cavity-enhanced light scattering AKO CHIJIOKE, JOHN LAWALL, NIST — Reaching the quantum regime of a mechanical resonator is facilitated by using a resonator with a small mass and high frequency. On the other hand, optical interferometry fails if the dimensions of the resonator are not significantly larger than the optical wavelength. Here we discuss and demonstrate an alternative optical technique employing scattering losses within an optical cavity to sense the motion of a resonator that can have dimensions well below the optical wavelength. We place a wavelength-scale mechanical resonator at the waist of a high-finesse optical cavity, lock the cavity to a resonance, and monitor the transmission. As the resonator vibrates, it modulates the cavity loss and thereby the transmitted power. We calibrate the sensitivity to resonator position by means of a known static displacement. We then sense the thermal motion of the resonator, and employ active feedback to cool, heat, and stiffen the mechanical mode.

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Date submitted: 21 Nov 2008 Electronic form version 1.4