Abstract Submitted
for the DAMOP12 Meeting of
The American Physical Society

Enhancement of mechanical Q-factors by optical trapping[1] J.D. HOOD, K.-K. NI, R. NORTE, D.J. WILSON, S.P. YU, A.M. JAYICH, O. PAINTER, H.J. KIMBLE, California Institute of Technology, Pasadena, CA 91125 — The quality factor (Q) of a mechanical resonator is an important figure of merit for observing quantum behavior. We demonstrate a technique to push the quality factor of a micro-mechanical resonator beyond conventional material and fabrication limits by using an optical lattice to trap a particular motional mode. A majority of the resonator's energy is stored in the lossless optical potential, thereby strongly diluting the effect of material dissipation. The pendulum-like mechanical resonator consists of a suspended 10 μm diameter, 140 nm thick $Si0_2$ disk attached to the substrate by a single thin tether. The disk is trapped at the intensity maximum of an optical lattice, and we observe a frequency increase of the center of mass from 6.2 KHz to 145 KHz with a 50 fold Q increase to a final value of 5.8×10^5. This technique shows a strong potential in bringing other micro-mechanical resonators, such as SiN membranes, into a low-loss regime where observation of quantum behavior in macroscopic devices at room temperature becomes possible.

[1]Research Supported by the DARPA ORCHID program, by the DoD NSSEFF program, by NSF Grant PHY-0652914, and by the Institute for Quantum Information and Matter.

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Date submitted: 25 Jan 2012 Electronic form version 1.4