Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Ground state cooling of nanomechanical resonator via linear coupling in a superconducting circuit[1] LIN TIAN, School of Natural Sciences, University of California, Merced, CA 95344 — In recent experiments, it has been demonstrated that radiation pressure-like coupling between a nanomechanical resonator and a superconducting resonator can be explored for the cooling of the nanomechanical mode. In this work, We present a ground state cooling scheme for a nanomechanical resonator linearly coupled with a superconducting LC oscillator. The linear coupling, when periodically modulated at red detuning, up-converts the low-frequency nanomechanical mode to the high- frequency LC oscillator mode and generates backaction force that can cool the nanomechanical mode to its ground state in the resolved-sideband regime. Compared with schemes using radiation pressure-like coupling, the LC oscillator mode doesn't need to be driven to high photon occupation number in our scheme. We calculate the cooling rate and the stationary occupation number of the nanomechanical mode and show that ground state can be reached with practical device parameters. A detailed study of our model shows that the quantum backaction noise that limits the cooling process is due to the counter rotating terms in the linear coupling. The scheme can be compared with laser cooling for the atomic systems as well.

[1]The work is in part supported by the Karel Urbanek Fellowship at Stanford University.

Lin Tian
School of Natural Sciences, University of California, Merced, CA 95344

Date submitted: 21 Nov 2008 Electronic form version 1.4