Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Quantum transducer in circuit optomechanics[1] NICOLAS DIDIER, ROSARIO FAZIO, Scuola Normale Superiore, NEST and Istituto NanoScienze-CNR, Pisa, Italy — Mechanical resonators are becoming macroscopic quantum objects with great potential. It is however difficult to measure and manipulate the phonon state due to the tiny motion in the quantum regime. We show that a superconducting microwave resonator linearly coupled to the mechanical mode constitutes a powerful probe and an interesting quantum source. This coupling is rendered much stronger than the usual radiation pressure interaction by adjusting a gate voltage and gives rise to coherent oscillations between phonons and photons. The phenomenon of phonon blockade is detected from the statistics of the light field [1] and a quantum tomography of the mechanical resonator is obtained after transferring the state to the microwave cavity. Quantum phonon states can also be synthesized from the cavity and hybrid entanglement can be engineered between phonons and photons. Mechanical resonators can furthermore be coupled to a large variety of quantum systems such as spins, optical photons, cold atoms, and Bose Einstein condensates. They act as a quantum transducer between an auxiliary quantum system and a microwave resonator, which is used as a quantum bus. The quantum communications are controlled with the individual gate voltages.
[1] N. Didier et al., Phys. Rev. B 84, 054503 (2011).

[1]This work is supported by the QNEMS European project.

Nicolas Didier
Scuola Normale Superiore, NEST and
Istituto NanoScienze-CNR, Pisa, Italy

Date submitted: 19 Nov 2011 Electronic form version 1.4