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Circuit QED transducers for quantum electromechanical systems
GERARD MILBURN, The University of Queensland, HSI-SHENG GOAN, National Taiwan University, LOUISE KETTLE, MATTHEW WOOLEY, The University of Queensland — We consider a very high frequency nano-mechanical oscillator coupled to a superconducting co planar microwave resonator. The microwave cavity is modeled as a single mode cavity coupled to the nano-mechanical oscillator displacement. In this configuration the microwave cavity acts as a transducer for the motion of the nano-mechanical oscillator. If the coupling is strong the system may exhibit sub/second harmonic generation in analogy to optical second order nonlinear behavior. We also show how the bifurcation of the steady state to limit cycle dynamics in this system could be used as a bifurcation amplifier for readout of a single solid state qubit. We calculate the noise on the limit cycle and assess how well it can function as a single qubit readout device. We also consider the case of weak coupling with parametric driving of the nano-mechanical resonator. In this case mechanical squeezing occurs and may be detected in the microwave field. We calculate the observed noise power spectrum for the microwave field with realistic experimental parameters.

Gerard Milburn
The University of Queensland

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