Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Mechanically mediated amplification of microwave fields at the quantum limit JOHN TEUFEL, FLORENT LECOCQ, RAYMOND SIMMONDS, JOSE AUMENTADO, NIST Boulder — In cavity opto- and electro-mechanical devices, the parametric interaction between the electromagnetic and mechanical modes can strongly modify both the motional degree of freedom and the light field emerging from the cavity. For example, by driving the cavity at the sum frequency of the two modes, one naturally amplifies both the light and the motion. Unfortunately, in this method of operation, the finite linewidth and temperature of the mechanical mode limit the gain-bandwidth product and the added noise, respectively. Here we use a microwave optomechanical circuit to demonstrate experimentally a novel form of parametric amplification that goes beyond these traditional limits. In order to quantify the ideality of the microwave amplification, we integrate a normal-metal tunnel junction as an in situ, calibrated noise source. In this way, we demonstrate parametric gain in excess of 80 dB and show that the amplification process adds only the minimum noise required by quantum mechanics.

John Teufel
NIST Boulder

Date submitted: 15 Nov 2013 Electronic form version 1.4