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A cavity optomechanical system for a microwave to optical quantum link THOMAS PURDY, JILA, National Institute of Standards and Technology and University of Colorado, Boulder, CO, RAY SIMMONDS, National Insttute of Standards and Technology, Boulder, CO, KONRAD LEHNERT, CINDY REGAL, JILA, National Institute of Standards and Technology and University of Colorado, and Department of Physics, University of Colorado, Boulder, CO — Cavity mechanics in both the optical and microwave domains is rapidly progressing to where the quantum interactions between photons and a micromechanical resonator are evident. If microwave and optical photons can both be coupled to a single mechanical resonator, one application is the coherent transfer of quantum information from the microwave to the optical field or vice versa. We present progress toward such a hybrid system where a thin, partially-metalized dielectric membrane forms one plate of a capacitor in a superconducting microwave LC circuit and is dispersively coupled to a high-finesse optical cavity. Vibrations induced in the membrane by microwave coupling may be transduced onto the optical field, if environmental decoherence is small. In our current research on the optical side of the experiment, we are developing an optical cavity that realizes the required coupling to the dielectric membrane. Such an optomechanical system must be compatible with a cryogenic environment that is necessary both for superconducting circuits and to reduce thermal decoherenece in the mechanical resonator.

Thomas Purdy
JILA, National Institute of Standards and Technology
and University of Colorado, Boulder, CO

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