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Optomechanics in a Fiber-Cavity NATHAN E. FLOWERS-JACOBS, SCOTT W. HOCH, ALEXEY B. SHKARIN, Dept of Physics, Yale University, JACK C. SANKEY, McGill University, ANNA KASHKANOVA, ANDREW M. JAYICH, Dept of Physics, Yale University, CHRISTIAN DEUTSCH, JAKOB REICHEL, Laboratoire Kastler Brossel, ENS/UPMC, JACK G.E. HARRIS, Dept of Physics and Dept of Applied Physics, Yale University — In an optical displacement measurement, the quantum back-action is radiation pressure shot noise (RPSN), which is the Poissonian noise in the momentum transferred by reflecting photons. In an attempt to measure RPSN at room temperature, we have made an optomechanical device consisting of a fiber-based optical cavity containing a silicon nitiride membrane. In comparison with typical free-space cavities, the fiber-cavity's small mode size (10 micron waist, 60 micron length) allows the use of smaller, lighter membranes and increases the cavity-membrane linear coupling to 3 GHz/nm. This device is also intrinsically fiber-coupled and uses v-grooves for passive alignment; these improvements greatly simplify the use of optomechanical devices. Based on the parameters demonstrated by this device, we expect it to be able to detect RPSN at room temperature. The increased coupling in this system also makes it an excellent testbed for investigating optomechanical coupling between mechanical modes, and for demonstrating quadratic coupling between a single mechanical mode and the cavity.

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