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Quantum nondemolition measurement of a nonclassical state of a massive object FLORENT LECOCQ, JEREMY CLARK, RAYMOND SIMMONDS, JOSE AUMENTADO, JOHN TEUFEL, NIST - Boulder — By coupling a macroscopic mechanical oscillator to two microwave cavities, we simultaneously prepare and monitor a nonclassical steady state of mechanical motion [1]. In each cavity, correlated radiation pressure forces induced by two coherent drives engineer the coupling between the quadratures of light and motion. We first demonstrate the ability to perform a continuous quantum nondemolition measurement of a single mechanical quadrature at a rate that exceeds the mechanical decoherence rate, while avoiding measurement backaction by more than 13dB. Second, we apply this measurement technique to independently verify the preparation of a squeezed state in the mechanical oscillator, resolving quadrature fluctuations 20% below the quantum noise. [1] F.Lecocq, et al, ArXiv 1509.01629 (2015)

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