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Force sensitivity of a nanomechanical oscillator in a microwave cavity JENNIFER HARLOW, JOHN TEUFEL, TOBIAS DONNER, KONRAD LEHNERT, JILA, University of Colorado and NIST — We describe our efforts to realize ultrasensitive force detection based on sensing the motion of nanomechanical oscillators embedded in superconducting resonant microwave cavities. Such a force sensor requires a readout mechanism quiet enough that the sensitivity is limited by thermal noise of the oscillator, as we recently demonstrated [1]. Force sensitivity is optimized by low mass, high-Q mechanical oscillators which have been cooled to dilution refrigeration temperatures. With this goal in mind, we fabricate high-Q ($Q > 10^5$), picogram mechanical beams with MHz resonance frequencies. We report measurements with sub-$aN/\sqrt{Hz}$ force sensitivity and discuss prospects for further progress. [1] C. A. Regal, J. D. Teufel, and K. W. Lehnert, Nature Physics 4, 555 (2008).

Jennifer Harlow
JILA, University of Colorado and NIST

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