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**Resolved-Sideband Cooling of Nanomechanical Motion within a Microwave Cavity** JOHN TEUFEL, JENNIFER HARLOW, TOBIAS DONNER, MICHAEL DEMORET, KONRAD LEHNERT, JILA, University of Colorado and NIST — We present recent experiments in which we couple the motion of a high-Q nanomechanical oscillator to the microwave fields in a superconducting resonant circuit [1]. This microwave optomechanical system is operated in the resolved-sideband regime in which the mechanical resonance frequency exceeds the cavity bandwidth. In this regime, the dynamical backaction of the microwave radiation further cools the mechanical motion from dilution refrigerator temperatures to even lower thermal occupancy. Recent improvements increase both the optomechanical coupling strength and the power handling capability of the cavity. We report progress toward cooling to the mechanical ground state with this system. [1] J. D. Teufel, J. W. Harlow, C. A. Regal and K. W. Lehnert, Phys. Rev. Lett., 101, 197203 (2008).

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