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Parametric Cooling of Ultracold Atoms MATTHEW BOGUSLAWSKI, BHARATH H. M., MARYROSE BARRIOS, MICHAEL CHAPMAN, Georgia Inst of Tech — An oscillator is characterized by a restoring force which determines the natural frequency at which oscillations occur. The amplitude and phase-noise of these oscillations can be amplified or squeezed by modulating the magnitude of this force (e.g. the stiffness of the spring) at twice the natural frequency. This is parametric excitation; a long-studied phenomena in both the classical and quantum regimes. Parametric cooling, or the parametric squeezing of thermo-mechanical noise in oscillators has been studied in micro-mechanical oscillators [1] and trapped ions [2]. We study parametric cooling in ultracold atoms. This method shows a modest reduction of the variance of atomic momenta, and can be easily employed with pre-existing controls in many experiments. Parametric cooling is comparable to delta-kicked cooling [3], sharing similar limitations. We expect this cooling to find utility in microgravity experiments where the experiment duration is limited by atomic free expansion. [1] D. Rugar and P. Grütter, Phys. Rev. Lett., 67:699 (1991) [2] V. Natarajan, et al., Phys. Rev. Lett., 74:2855(1995) [3] H. Ammann, N. Christensen, Phys. Rev. Lett., 78:2088 (1997) T. Kovachy, et al., Phys. Rev. Lett., 114:143004 (2015)

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