Abstract Submitted
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Toward a precision force sensor based on Bloch oscillations of atoms in an optical lattice ROBERT NIEDERRITER, CHANDLER SCHLUPF, PAUL HAMILTON, University of California, Los Angeles — Precision force sensors have potential for exploring and constraining unknown forces and particles such as dark matter and dark energy candidates [1]. We present progress towards a precision sensor that measures the force on ytterbium atoms suspended in the lattice formed by an optical cavity. The trapped and cooled atoms undergo Bloch oscillations, which causes modulation of the optical lattice at the Bloch frequency. Monitoring the modulation of the cavity transmission provides a continuous force measurement [2]. Using trapped atoms allows long measurement times in a small volume. Continuous measurement enables detection of time-varying forces and reduces sensitivity to vibrations. The atoms for the force sensor are cooled and trapped in a magneto-optical trap (MOT) within the optical cavity, then cooled to the ground state of the optical lattice. [1] P. Hamilton, M. Jaffe, P. Haslinger, Q. Simmons, H. Müller, J. Khoury, Science 349, 849 (2015). [2] B. Prasanna Venkatesh, M. Trupke, E. A. Hinds, and D. H. J. ODell, Phys. Rev. A 80, 063834 (2009).

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