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Toward a precision force sensor based on Bloch oscillations of atoms in an optical lattice ROBERT NIEDERRITER, CHANDLER SCHLUPF, KAYLA RODRIGUEZ, PAUL HAMILTON, Univ of California - Los Angeles —
Precision force sensors have potential for exploring and constraining unknown forces such as dark energy candidates [1]. We are developing a precision sensor that measures the force on ytterbium atoms optically trapped inside an optical cavity. The trapped and cooled atoms undergo Bloch oscillations which can be monitored for 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) overlapping the TEM00 mode of an optical cavity, and then suspended in the optical lattice of the cavity after the MOT is turned off. We present progress towards the development of a precision force sensor and tests of new fundamental forces. [1] P. Hamilton, M. Jaffe, P. Haslinger, Q. Simmons, H. Mller, J. Khoury, Science 349, 849 (2015). [2] B. Prasanna Venkatesh, M. Trupke, E. A. Hinds, and D. H. J. O'Dell, Phys. Rev. A 80, 063834 (2009).

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