Abstract Submitted
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Scaling up precision in an Ytterbium BEC contrast interferometer for photon recoil and α.[1] BENJAMIN PLOTKIN-SWING, DANIEL GOCHNAUER , KATHERINE MCALPINE, SUBHADEEP GUPTA, Univ of Washington — Building on our earlier demonstration [1], we are now operating a second-generation Ytterbium (Yb) Bose-Einstein condensate (BEC) contrast interferometer. The device is designed to measure h/m, where h is Planck's constant and m is the mass of a Yb atom, in order to determine the fine structure constant α. The use of the non-magnetic Yb atom and the symmetric geometry of the interferometer make the measurement immune to several error sources. The narrow momentum and position spread of a BEC help improve the coherence length and signal strength of our measurement. A key advantage of the contrast interferometer is that the total phase accumulation and therefore the measurement sensitivity scales quadratically with the momentum separation of the interfering states. We have demonstrated the laser pulse atom-optics required to increase the momentum splitting, including using Bloch oscillations to impart 200 photon recoils with .5% atom loss per recoil. We have implemented the first steps in applying these high momentum transfer techniques to our interferometer, and will report on our progress towards achieving quadratically increased precision.

[1] Alan O. Jamison, Benjamin Plotkin-Swing, and Subhadeep Gupta, Phys. Rev. A 90, 063606 (2014)

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