Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

Implementing large momentum transfer in an Ytterbium BEC contrast interferometer for photon recoil and α.[1] DANIEL GOCHNAUER, BENJAMIN PLOTKIN-SWING, KATIE MCALPINE, SUBHADEEP GUPTA, Univ of Washington — We operate an ytterbium (Yb) Bose-Einstein condensate (BEC) contrast interferometer designed to make a precision measurement of the fine structure constant, α, via a measurement of h/m, where h is Plancks constant and m is the mass of Yb [1]. Our interferometer is insensitive to both magnetic fields, due to the electronic structure of bosonic Yb, and physical vibrations, due to the symmetry of the interferometer geometry. In this geometry the total phase accumulation and therefore measurement sensitivity scales as N^2, where N is the number of photon pairs which accelerate one of the interfering paths. We have observed contrast interferometer fringes after imparting $2N\hbar k$ momentum from photon recoils for N>1. We have also separately demonstrated Yb BEC acceleration by up to $200\hbar k$ by using Bloch oscillations. The laser pulses for these atom-optics are precisely controlled with analog intensity stabilization and direct digital synthesis generation of frequencies. We are working on implementing acceleration to high N values within the interferometer, and will report on our work towards demonstrating quadratic increase with recoil number in the total phase accumulation and thus interferometer sensitivity. [1] A. Jamison et. al, Phys. Rev. A 90, 063606 (2014)

[1]Funding: National Science Foundation

Daniel Gochnauer
Univ of Washington

Date submitted: 29 Jan 2017 Electronic form version 1.4