

Abstract Submitted  
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**Simultaneous conjugate large area atom interferometers for a precision photon recoil measurement** SHENG-WEY CHIOW, SVEN HERMANN, HOLGER MUELLER, Stanford University, STEVEN CHU, Stanford University — We report on progress towards a precision measurement of the photon recoil of a cesium atom. We present large area atom interferometers with up to 24-photon Bragg diffraction as beam splitters, which increase the phase shift 12-fold for Mach-Zehnder and 144-fold for Ramsey-Bordé (RB) geometries. As the atom's internal state is not changed, important systematic effects such as ac Stark shifts and Zeeman shifts can cancel. This dramatic increase in sensitivity and precision opens the door to improved measurements of the fine structure constant, inertial forces, and tests of relativity and quantum electrodynamics. We also demonstrate simultaneous conjugate large area atom interferometers (SCI) in RB geometry for measuring the photon recoil. Conjugate interferometers feature the same phase shift due to local gravity, but opposite phase shift due to the photon recoil. Performing them simultaneously allows a direct measurement of the photon recoil, while local gravity, vibrational noise, and some laser noise are common mode and cancel. We present SCI fringes that determine the recoil frequency with ppm precision in 20 mins integration time. We expect to reach our goal of sub-ppb accuracy in determining the fine structure constant in the near future.

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