Abstract Submitted
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Progress towards a precision measurement of atomic recoil frequency using an echo interferometer B. BARRETT, A. CAREW, S. BEATTIE, I. CHAN, C. MOK, R. BERTHIAUME, A. KUMARAKRISHNAN, York University — We discuss progress toward a precision measurement of the atomic recoil frequency in ^{85}Rb using an echo-type atom interferometer and a new technique [Phys. Rev. A **79**, 021605(R) (2009)]. At time $t = 0$, a standing wave pulse (swp) creates a superposition of momentum states. The coherence of these p-states decays quickly due to the velocity distribution of the laser cooled sample. At $t = T$, a 2nd swp diffracts the p-states again and a density grating associated with the interference of p-states differing by multiples of the 2-photon recoil momentum ($n\hbar q = 2n\hbar k$) is formed in the vicinity of $t = 2T$. A traveling wave readout pulse Bragg scatters light only from the grating with spatial periodicity $\lambda/2$ (associated with interfering p-states differing by $\hbar q$). The backscatterd light is detected as the signal. A 3rd swp (applied at $t = 2T - \delta T$) converts the difference between interfering p-states from $n\hbar q$ to $\hbar q$. All interfering orders of p-states contribute to the signal at $t = 2T$. As a function of δT, the signal shape exhibits narrow fringes that revive periodically at the 2-photon recoil period, π/ω_q. We have achieved a single measurement precision of ~ 500 ppb on a timescale of $2T \sim 48$ ms. Further improvements are anticipated by extending the timescale and narrowing the fringe width. This work is supported by CFI, OIT, NSERC, OCE, and York University.

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