Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

Lukewarm lithium recoil interferometer ERIC COPENHAVER, KAYLEIGH CASSELLA, BRIAN ESTEY, UC Berkeley, YANYING FENG, Tsinghua University, CHEN LAI, UC San Diego, MLLER HOLGER, UC Berkeley —
We demonstrate recoil-sensitive atom interferometry with laser-cooled lithium-7 at 50 times the recoil temperature. The large bandwidth of 160-ns beam-splitter pulses drives conjugate interferometers simultaneously with nearly equal contrast. Two-photon Raman transitions spectrally resolve the outputs, which thermally expand too quickly to be spatially resolved. Two images captured during a single exposure of a camera with slow readout detects both output ports. Optical pumping to a magnetically insensitive state using the well-resolved D_1 line suppresses magnetic dephasing and extends coherence time. Sensitivity comparable to interferometers utilizing large momentum transfer pulses is attainable at interrogation times on the order of 10 ms due to lithiums high recoil frequency and the increased available atom number. Vibration noise is mitigated at this time scale and is converted to amplitude noise in our detection scheme, isolating the the recoil frequency from what is conventionally phase noise. These techniques relax requirements for cooling in recoil-sensitive interferometry, broadening the choice of species to particles that remain difficult to trap and cool, like electrons.

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Date submitted: 27 Jan 2017 Electronic form version 1.4