Abstract Submitted
for the DAMOP12 Meeting of
The American Physical Society

Progress towards a test of the universality of free fall using a ^{6}Li-^{7}Li atom interferometer PAUL HAMILTON, TOM BARTER, GEENA KIM, BISWAROOP MUKHERJEE, HOLGER MÜLLER, University of California at Berkeley — Measurements of the acceleration of gravity for bodies of differing compositions have long been used to test the universality of free fall (UFF), one part of the equivalence principle underlying general relativity. A ^{6}Li-^{7}Li matter wave interferometer test of UFF would have high sensitivity to new physics because of the relatively large difference between ^{6,7}Li nuclei [1]. An optical lattice will be loaded with ^{6}Li and ^{7}Li atoms from a dual species 2D/3D-magneto-optical trap. The lattice will then be employed both as a waveguide to prevent atom losses due to the high thermal velocity of Li, and as large momentum transfer beam splitters in analogy to the Bloch-Bragg-Bloch beam splitters already developed by us [2,3]. We anticipate an accuracy of $10^{-14}g$ for the differential acceleration measurement. We discuss investigations of novel all-optical cooling of lithium using degenerate Raman sideband cooling as well as recent progress towards a demonstration of the first ultracold lithium interferometer.

[1] M. Hohensee et al., J. Mod. Optics **58**, 2021 (2011)
[2] H. Müller et al., Phys. Rev. Lett. **100**, 180405 (2008)
[3] H. Müller et al., Phys. Rev. Lett. **102**, 240403 (2009)

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Date submitted: 31 Jan 2012 Electronic form version 1.4