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Towards a test of the universality of free fall using a ^{6}Li-^{7}Li atom interferometer DENNIS SCHLIPPERT, University of California Berkeley, GEENA KIM, PAUL HAMILTON, HOLGER MÜLLER — We present a dual species guided matter-wave interferometer for performing a differential measurement of the acceleration of free fall for ^{6}Li and ^{7}Li atoms to test the universality of free fall (UFF). Use of this combination of atoms leads to a high sensitivity to new physics because of the relatively large difference difference between ^{6,7}Li as compared with Be-Ti or ^{85,87}Rb. 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 [1,2]. This allows for high sensitivies as the interferometer's phase shift scales as $k_{\text{eff}}T^2$, where $\hbar k_{\text{eff}}$ is the transferred momentum and T the time of evolution between the beam splitters. We anticipate an accuracy of $10^{-14}g$ for the differential acceleration measurement. Systematic effects, in particular gravity gradients, are adressed in our design. Furthermore, novel cooling techniques for Li such as Raman sideband cooling are investigated.

[1] H. Müller et al., Phys. Rev. Lett. **100**, 180405 (2008)
[2] H. Müller et al., Phys. Rev. Lett. **102**, 240403 (2009)

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