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Novel cooling and matter wave beam splitters of lithium for atom interferometry PAUL HAMILTON, GEENA KIM, BISWAROOP MUKHERJEE, University of California at Berkeley, TRINITY PRADHANANGA, California State University–East Bay, DANIEL TIARKS[1], CHENGHUI YU, HOLGER MÜLLER, University of California at Berkeley — The cooling of lithium to near recoil-limited temperatures is a step towards our goal of a dual species ^{6,7}Li interferometer for testing Einstein's equivalence principle. We first discuss our demonstration of a novel cooling method for lithium combining Sisyphus cooling and adiabatic expansion. Lithium's unresolved hyperfine structure was thought to make it impossible to reach sub-Doppler temperatures via the optical molasses typically used for other alkali atoms. We achieve cooling of a substantial fraction ($30 - 50\%$) of our ^{7}Li atoms to < 3 times the recoil velocity. Our scheme requires only a single cooling laser with modest power (< 100 mW) and detuning (1-5 GHz) and should be applicable to all alkali atoms. Next we report on our efforts to demonstrate the first ultracold lithium atom interferometer. While lithium's light mass increases its sensitivity to possible violations of the equivalence principle [1], its large velocity, even near the recoil temperature, and lack of a simple cycling transition for fluorescence detection make interferometry challenging. We discuss our recent investigation of novel beam splitters to increase the sensitivity of a typical Raman interferometer.

[1] M. Hohensee et al., J. Mod. Optics **58**, 2021 (2011).

[1]Current affiliation Max-Planck Institut für Quantenoptik

Paul Hamilton
University of California at Berkeley

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