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Efficient implementation of a gray optical molasses for sub-Doppler cooling of lithium-6 atoms CHRISTINE SATTER, SENMAO TAN, KAI DIECKMANN, Natl Univ of Singapore — Alkali-metal atoms are prime candidates for studies of degenerate quantum gases and standard magneto-optical trapping and cooling of these elements to the Doppler limit is conventionally done on the D_2 transition. However, standard sub-Doppler cooling techniques are not effective for lithium because of this species' unresolved hyperfine structure in the excited state. In our experiment, a gray optical molasses operating on the D_1 atomic transition is applied to cool a cloud of Li-6 atoms to sub-Doppler temperatures. A new laser set-up was constructed to produce the light on the D_1 wavelength. For convenient integration into the pre-existing laser system, a scheme is used where D_2- and D_1-frequency light beams rapidly take turns injection seeding the same diode laser. A beat system is set up that allows us to monitor the correct seeding of the diode laser during the different stages of the experimental sequence, in a fast, time-resolved manner. We observe cooling of the atoms from 380 to 32 μK. A characterization of the gray molasses is presented and the results are compared to those previously reported in gray molasses experiments. Finally, we discuss the efficacy of atomic transfer from the molasses into a two-beam crossed optical dipole trap.

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