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Magneto-optical trapping of lithium using a nanofabricated diffraction grating D. S. BARKER, E. B. NORRGARD, N. N. KLIMOV, J. A. FEDCHAK, J. SCHERSCHLIGT, S. ECKEL, Sensor Science Division, National Institute of Standards and Technology, Gaithersburg, MD 20899 — We demonstrate a compact system for laser cooling and trapping atoms from a heated dispenser source. Our system uses a nanofabricated diffraction grating to generate a magneto-optical trap (MOT) using a single input laser beam. An aperture in the grating allows atoms from the dispenser to be loaded from behind the grating chip, increasing the interaction distance of atoms with the cooling light. To take full advantage of the increased cooling distance, we extend the magnetic field gradient of the MOT into the region behind the chip to create a Zeeman slower. The MOT traps approximately 10^6 ^{7}Li atoms emitted from an effusive source with loading rates greater than 10^6 s^{-1}. A model of the MOT loading dynamics agrees with the experimental data and suggests several improvements to the apparatus. Our design is portable to a variety of atomic and molecular species and could be a principal component of miniaturized cold-atom-based technologies.

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