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**Sub-Doppler Laser Cooling With Planar-Geometry Optics And a Single Laser Beam** PAUL GRIFFIN, MATTHIEU VANGELEYN, ERLING RIIS, AIDAN ARNOLD, University of Strathclyde — We have realized a new magneto-optical trap geometry using a single laser beam incident on planar optics. In this arrangement we trap $10^6$ $^{87}$Rb atoms and have achieved temperatures of 40 $\mu$K. We have been inspired by the continued interest in miniaturizing the technology for ultra-cold atomic physics, particularly for applications concerning sensing. Work towards the achievement of small scale, all-integrated magneto-optical traps (MOT) has been very active, such as the realization of MOTs in a microfabricated pyramidal structure. Here we present an new design with significant advantages as a compact source of cold atoms. A triplet of diffraction gratings splits a laser beam such that four beams cross a tetrahedral configuration in the MOT region. This arrangement offers a uniformly balanced radiation pressure area, and becomes suitable for efficient sub-Doppler cooling. The planar configuration offers maximal optical access to the atomic cloud and can be easily turned into an integrated micro-trap, benefiting from standard lithography processes. In addition, a micro-fabricated tetrahedral configuration offers an ideal tool for a high phase stability optical lattice, with the benefit of fixed lattice geometry.

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