Continuous Fountain of Yb atoms

K. D. Rathod, Alok K. Singh and Vasant Natarajan

Department of Physics, Indian Institute of Science, Bangalore, India
ket@physics.iisc.ernet.in

We demonstrate a continuous fountain of ^{174}Yb atoms [1], which has significant advantages over the pulsed fountain [2] for precision measurements. For example, in experiments that search for permanent electric dipole moment (EDM) in an atom [3], the electric field plates can be closely spaced as the launch beams are off-axis [4]. For optical clocks, a continuous fountain avoids limitations due to intermodulation effects, also known as the Dick effect [5]. In our experiment, atoms from a thermal beam are Zeeman slowed to a low velocity, then captured in a two-dimensional magneto-optic trap (2D-MOT). The atoms in the 2D-MOT are launched using two sets of moving-molasses beams inclined at $\pm 15^{o}$ w.r.t the vertical. We capture about 7×10^{6} atoms in the 2D-MOT. The atoms are launched with a mean velocity of 13 m/s having a longitudinal velocity spread of 3.5 m/s corresponding to a temperature of 125(6) mK. The experiment was done using the strongly allowed $^{1}S_{0} \rightarrow {}^{1}P_{1}$ transition at 399 nm. We hope to get a lower longitudinal temperature using the $^{1}S_{0} \rightarrow {}^{3}P_{1}$ intercombination line at 556 nm, since it has a lower Doppler-cooling limit of 4.4 μK.

References:
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