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Bichromatic Cooling used to Achieve a Large Number of Cold Atoms in a Compact Volume TARA CUBEL LIEBISCH, ELIZABETH DONLEY, ERIC BLANSHAN, JOHN KITCHING, NIST, Boulder — For cold atomic samples to be used in emerging technologies such as compact atomic clocks and sensors it is necessary to achieve small sample sizes with a large number of cold atoms. This is a challenge because in a magneto-optical trap (MOT) the number of cooled and trapped atoms scales as d^4, where d is the diameter of the laser beams (Gibble et.al.OL**17**, 526 (1992)). In a MOT the maximum radiation force is limited by spontaneous emission to $hk\gamma/2$. Bichromatic cooling first studied by Söding et.al. (PRL**78**,1420(1997)), takes advantage of stimulated emission and driven Rabi oscillations to cool atoms over a broad velocity range with forces >> $hk\gamma/2$. With the faster cooling rates, larger atom numbers can be obtained in very small cooling volumes. We report on preliminary results of cooling a thermal beam down to MOT capture velocities over distances of <1cm, our experimental set up, and theoretical results using our experimental parameters. We expect to be able to load a MOT with 1mm diameter beams with a factor of 100 more atoms than if loaded from a background vapor. With this atom sample we estimate we could achieve a clock stability of 1E-12 @ 1s with a Ramsey time of 4ms, a cycle time of 10ms, and a clock transition frequency of 6.8GHz.
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