Characterization and dynamics of rubidium magneto-optical trap induced by pushing beam

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Since its first experimental realization by Raab et al. [1] in 1987 magneto-optical trap (MOT) has became the most reliable source of cold atoms. The properties of the trap can be modeled by Doppler and sub-Doppler cooling mechanisms. By applying an external force onto the atom cloud, we can observe the trap dynamics and conclude about the cooling processes and the trap parameters [2].

We have worked on ^{87}Rb MOT in standard six beams configuration. We have characterized the main parameters of our trap and have investigated how the number of trapped atoms changes with the trapping beam intensity, detuning and magnetic field gradient of the trap. We are studying time-dependent center of mass oscillation of rubidium cold cloud induced by on-resonance pushing beam. This chopped pushing beam presents an external force which acts on atoms translating the atom cloud along one horizontal direction. Induced trap oscillations are monitored through changes in the probe beam absorption. By fitting the free oscillation signals the values of damping coefficient and the spring constant can be determined and subsequently the temperature of the cloud. Further investigations are based on parametric resonance of the rubidium MOT.

[1] E. L. Raab, M. Prentiss, A. Cable, S. Chu, and D. E. Pritchard, Phys. Rev. Lett. **59**, 2631 (1987)

[2] X. Xu, T. H. Loftus, J. L. Hall, A. Gallagher, and J. Ye, Phys. Rev. A **65**, 041401 (2002)