6.3 Trapping of Cesium Atoms with Radiation Pressure

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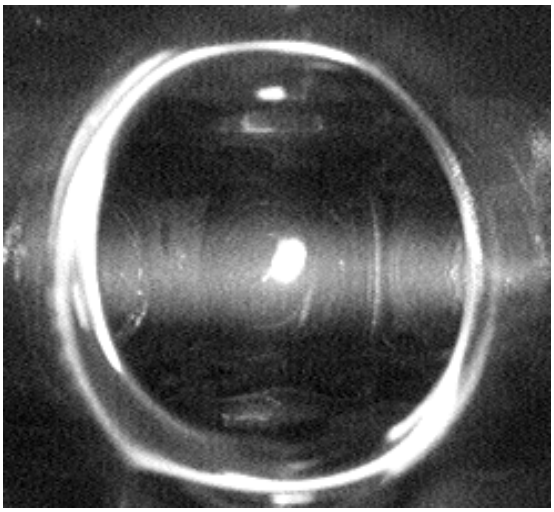
We have built a magnetooptic trap for Cs atoms. In a UHV glass cell we trap and cool Cs atoms with resonant laser light. We measured temperatures of 1mK and total number of atoms close to 10^8. With a video system that images the laser light scattered from the atoms, they can be observed as a bright cloud, as shown in the figure below. The position of this cloud is controlled by the external magnetic field.

The capturing and cooling process is the result of a net momentum transfer from photons of three pairs of counterpropagating laser beams to the Cs atoms, modified by the Doppler and Zeeman effect. The Doppler effect makes the force velocity-dependent, thus allowing to decelerate the atoms. In a similar way, a space-dependent magnetic field modifies the radiative pressure as a function of the location of the atoms and allows us to confine the atoms to the region of vanishing magnetic field. This scheme will allow us to perform spectroscopic experiments on Cs atoms that are not disturbed by the Doppler effect or collisions.



The bright spot in the center of the picture is the fluorescence of a cloud of cold Cs atoms.