Coherent effects in a cold atomic gas

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We studied coherent effects in a cold atomic gas of rubidium isotope ^{87}Rb interacting with two laser beams. A theoretical background on the interaction of two lasers with an atom in lambda configuration is presented. One of the lasers is a continuous-wave laser, while the other is a pulsed, femtosecond laser. Also presented is a short theory of laser cooling and trapping, which is used to make a cloud of cold rubidium atoms for the experiment of coherent effects. We introduce the methods of frequency stabilization of continuous-wave and femtosecond lasers, needed for measurements of high precision.

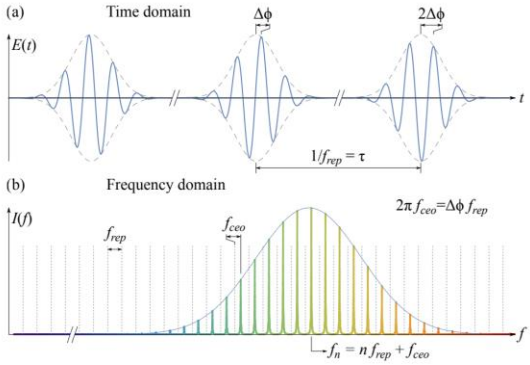

Figure 1: In time domain (a) a pulsed laser produces a train of femtosecond pulses while in the frequency domain (b) it generates a frequency comb.

The results were acquired by measuring laser radiation force on a rubidium cloud, as well as by measuring laser induced fluorescence of the cloud interacting with the lasers. We compared the measurements to theoretical predictions and they correspond well to numerical models. We conclude that the femtosecond laser is a useful tool which can be used in the experiments focused on coherent effects, as it behaves as a large number of continuous-wave lasers.

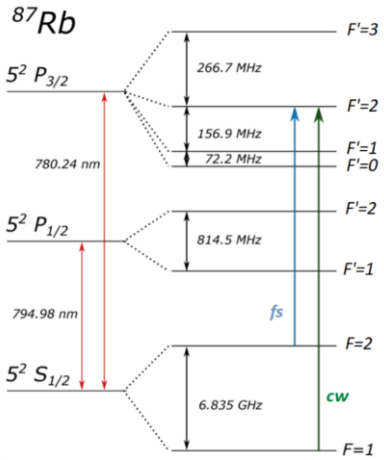

Figure 2 : Rubidium levels used as a lambda system for investigation of coherent effects.

Keywords: COHERENCE, FEMTOSECOND LASER, LAMBDA CONFIGURATION, RUBIDIUM ATOMS, RADIATION FORCE

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