Nonlinear Magneto-Optical Rotation in Rubidium Vapor Excited to $6^2P_{1/2}$ State

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Most commonly nonlinear magneto-optical rotation (NMOR) has been extensively studied at strong $D_1$ or $D_2$ lines. In such systems, a good agreement between theoretical predictions and experimental observations has been demonstrated [1]. The wide range of successful applications of the method results in a demand for its extension to different optical transitions.

We present research of NMOR under different physical conditions, i.e., we explore the effect in rubidium atoms excited to higher-energy states (the $6^2P_{1/2}$ state). This results in more complex repopulation of the ground-state levels. In addition to the direct repopulation of the ground state hyperfine levels, these levels may be repopulated via several intermediate states ($6^2S_{1/2}$, $4^2D_{5/2}$, $5^2P_{1/2}$ and $5^2P_{3/2}$) (Fig. 1).

![Figure 1: Relevant energy levels and transitions of Rb atom excited by resonant radiation at 421.6 nm.](image)

A specific goal of this research is a comparison of the experimental results of the, so-called, blue NMOR, where excitation and probing at the $5^2S_{1/2} \rightarrow 6^2P_{1/2}$ absorption line is performed using 421 nm light, with the results of theoretical calculations performed based on the model developed in Ref. [2]. In the theoretical model, NMOR is described as a three-stage process, consisting of pumping, evolution and probing of quantum states of atoms, constituting a medium interacting with light.

It is verified that the real (complex but closed) system can be adequately described with a single relaxation parameter responsible for ground-state repopulation as it was assumed in the model.

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