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 ($6^2S_{1/2}$, $4^2D_{3/2}$, $5^2P_{1/2}$ and $5^2P_{3/2}$) (Fig. 1)

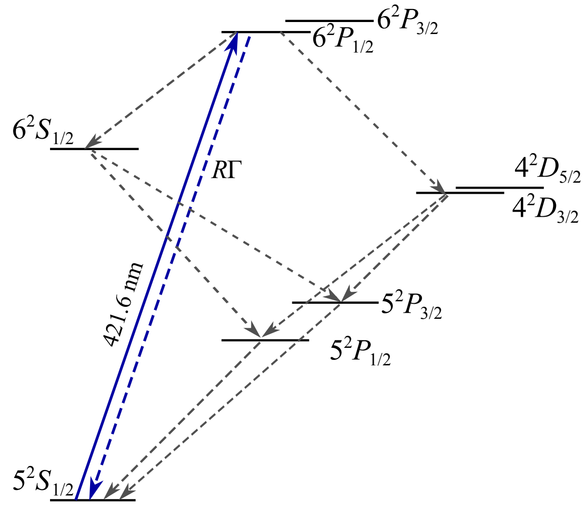

Figure 1: *Relevant energy levels and transitins of Rb atom excited by resonant radiation at 421.6 nm.*

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.

The authors would like to thank Simon Rochester for his role in the development of the theoretical model of NMOR. LB and MA acknowledge support from ERAF project Nr. 2010/0242/2DP/2.1.1.1.0/10/APIA/VIAA/036, NATO Science for Peace and Security Programme project SfP983932, and the Latvian Council of Science project 119/2012. SP acknowledges support from the Polish Ministry of Science and Higher Education within the grant Iuventus Plus.

References

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