Optical Pumping of Lithium 6 Atomic Beam

Shlykov P. Y.[1*], Khoruzhii K. A.[2]

[1]Moscow Institute of Physics and Technology, Dolgoprudny, Moscow Region, Russia
[2]Russian Quantum Center, Moscow, Russia

*Corresponding author
Keywords: ^{6}Li, atomic beam, optical pumping, laser spectroscopy

1. Introduction

Optical pumping plays the main role in slowing atoms in Zeeman slower, which provides the opportunity of interacting with atoms for longer time because of energy level shift. For better deceleration it is essential to change the state of atoms in the beam to the state with the greatest projection of total atomic angular momentum, that is where pumping plays a great role. This will allow to increase the number of trapped atoms in future experiments.

2. Experiment

For this reason, the experiment was conducted to observe the dependence of populations of energy levels on frequency and intensity of pumping laser beam (Fig.1).

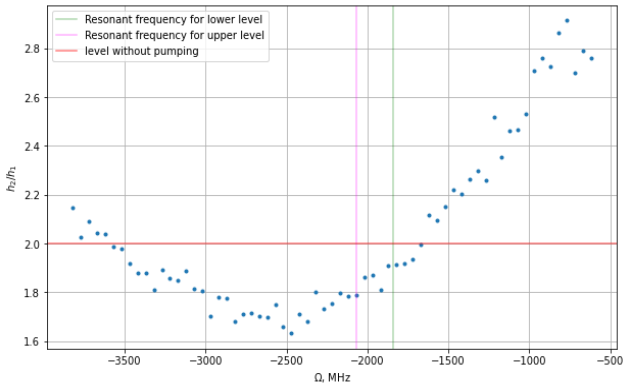

Fig.1: *Pump dependency on frequency*

Atoms were vaporized in the oven and collimated into the narrow beam (Fig.2). The experiment was carried out with the use of two lasers. One of which was pumping atoms in a beam with stable wavelength and intensity, second one was used for scanning state of the beam by various frequencies. The pumping laser was directed towards the propagation of atoms and covered the whole atomic beam, from its parameters the main dependencies were measured. The second laser was directed perpendicular to the line of atomic beam. Small variety for speed of atoms in the beam gave less Doppler shift for frequency. This provided better possibility for collecting data over the distribution of atoms. This was observed by the power of fluorescence of the $^2S_{1/2} \rightarrow {}^2P_{3/2}$ transition.

Fig.2: *Experimental setup*

Part of second laser intensity was used for frequency stabilization with saturated spectroscopy. Also, numerical modeling of the pumping process was performed.

DOI: 10.21467/abstracts.149 ISBN: 978-81-961472-1-1 (eBook)

3. Results

Collected data showed main dependencies of effectiveness of pumping on laser frequency in the interval close to resonance wavelength of $^2S_{1/2} \rightarrow {}^2P_{3/2}$ transition and dependency on intensity showed plateau entry. Numerical modeling showed approximate time for the system to enter the steady state and approximate number of atoms, which are being pumped at fixed laser frequencies. Also, it showed dynamic change of the system in the process.

ISBN: 978-81-961472-1-1

Series: AIJR Abstracts

DOI: 10.21467/abstracts.149