Project:
Hot and Cold Rubidium

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Summary

The main objective of this project is to study and manipulate the index of refraction of a Rubidium vapour through the interaction with laser light of two different wavelengths. Using a theoretical, numerical and experimental approach, we aim to understand and characterize the Rubidium vapour and the effects of light interacting with this system. The project will be divided into three main stages: theoretical study, numerical simulations, and experimental validation. The theoretical study will focus on the fundamentals of atomic quantum optics, with emphasis on the interaction between light and matter. The numerical simulations will be used to model the interaction between light and Rubidium vapour, and to predict the behaviour of the system under different conditions. Finally, the experimental validation will involve the construction of an experimental setup to measure the index of refraction of the Rubidium vapour and compare the results with the theoretical and numerical predictions. The expected results of this project include a better understanding of the interaction between light and matter, and the development of new techniques for manipulating the index of refraction of Rubidium vapour. This research has the potential to have a significant impact on the field of quantum optics and quantum information processing, and to open up new possibilities for the development of quantum technologies.

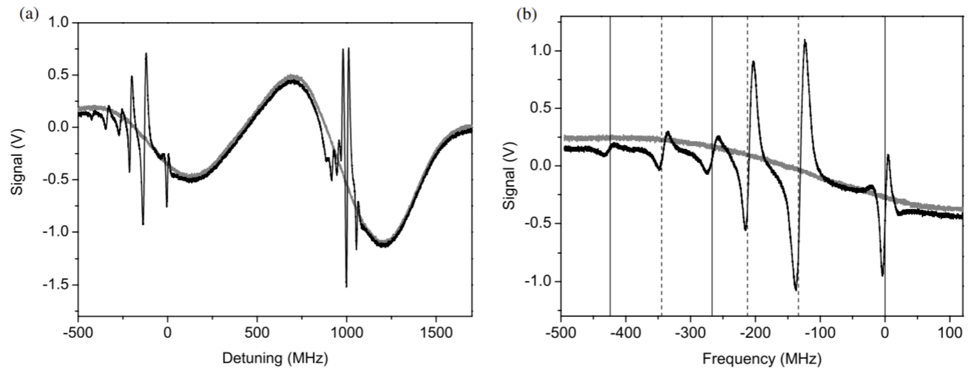

Figure 1: (a) Typical sub-Doppler DAVLL spectra recorded for the F = 2 → F line in 87Rb and F = 3 → F 85Rb (black line). The sub-Doppler features are superimposed on the conventional DAVLL signal (grey line) obtained by blocking the pump beam. (b) A zoomed-in section of (a) showing the sub-Doppler DAVLL signal for the F = 2 → F transitions of 87Rb. Vertical lines indicate the expected line centres of the three transitions (solid lines) and three crossovers (dashed lines). Small discrepancies in the location of spectral features relative to the line centres arise from the slightly nonlinear laser scan. Spectra were taken at a magnetic field of 9.5 G, a pumppower of 154 µW and a probe power of 20 µW. doi:10.1088/0953-4075/41/8/085401

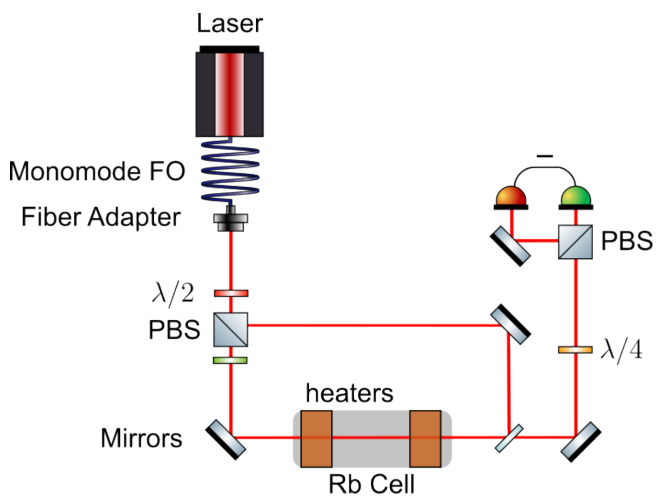

Figure 2: Set up for Laser 1. Dicroich atomic vapor laser lock (DAVLL) system.

Rubidium

Atomic Structure

Laser 1

1. Osciloscope
2. Signal Generator
3. TEC: Temperature Control
4. Control of Control : Lockbox
5. Laser Control : Negative Current Control
6. Current Control
7. Rubidium Heater for Glass Cell

Laser 2

Laser 3

Bragg Reflections in Rubidium Vapours

Objectives

Experimental Set Up

Rubidium Borosilicate Reference Cell, Ø25.4 mm x 71.8 mm SM1FCA - FC/APC Fiber Adapter Plate with External SM1 (1.035"-40) Threads, Wide Key (2.2 mm)

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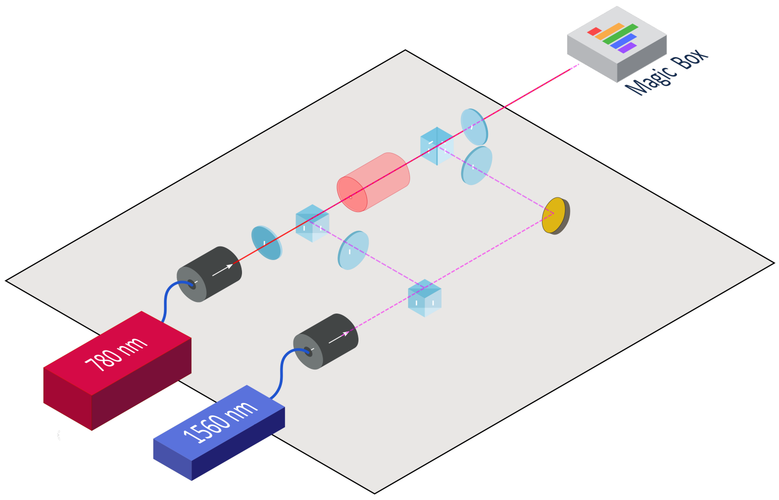

Figure 3: Set up for the experiment of the bragg Vapours.

Bragg Reflections in Cold Rubidium

Objectives

Experimental Set Up

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References