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Experimental Study of the Weak Field Zeeman Spectra of Rb 85 and Rb 87

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We report on the measurement and analysis of the magnetic sub-levels of Rubidium 85 and 87 observed in the presence of a weak magnetic field. Included is the standard hyperfine interaction which is a prerequisite measurement for this analysis. The experiment was performed using a saturated absorption spectroscopy setup. A solenoid was placed around the Rb vapour cell in order to generate the magnetic field, and the polarisation of the light was manipulated in order to observe the relevant magnetic sub-levels. This experiment is part of an effort to cool Rb atoms using lasers that need to be frequency locked to a specific energy level in the spectra observed via the saturated absorption spectroscopy setup.

An external cavity diode laser was frequency modulated and split into three beams, two weak probe beams and a strong pump beam; the pump beam counter-propagates and overlaps one of the probe beams. These beams are sent through a rubidium vapour cell where a magnetic field was applied. A portion of the modulated laser beam was analysed using a Michelson interferometer. Intensities of the probe beams and the output beam of the interferometer were monitored by photodetectors and the output signals were recorded using a digital oscilloscope.

The time axis of each oscilloscope capture was converted to frequency using a calibration factor determined by analysing the output signal of the Michelson interferometer. The converted spectra were fitted with Lorentzian curves to estimate energy level separation and lifetimes, and the magnetic sub-level separation was plotted as a function of the magnetic field strength. A comparison with numerical analysis is also provided.

Summary

We report on the measurement and analysis of the magnetic sub-levels of Rubidium 85 and 87 observed in the presence of a weak magnetic field.

Apply to be considered for a student award (Yes / No)?

Yes

Level for award (Hons, MSc, PhD, N/A)?

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Main supervisor (name and email) and his / her institution

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Would you like to submit a short paper for the Conference Proceedings (Yes / No)?

Yes

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