University of Leipzig

Advanced Labs

Lab report

Doppler-free Rb saturation spectroscopy with an external cavity diode laser

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Contents

1 Introduction

$$\mathscr{F} = \frac{\nu_{\text{FSR}}}{\delta\nu} \tag{1}$$

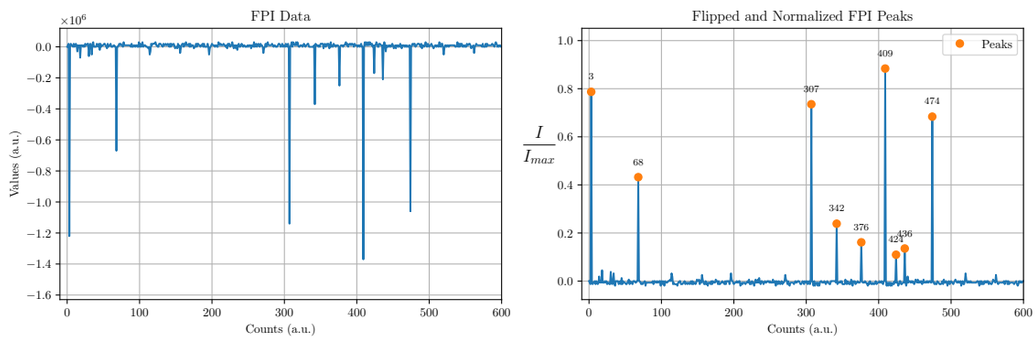
2 Analysis

2.1 Task 1

We were instructed to scale our measurement data using the FPI peaks in addition to determining the finesse.

2.1.1 Scaling the data

From [**?**], we know that our FSR is 1 GHz. Therefore, if the average spacing between peaks is calculated, we can determine the conversion factor and scale our data accordingly.



(a) (b)

Figure 1: FPI peaks. 1a Raw data. 1b Flipped and normalized data, with peaks highlighted

The average spacing between peaks was calculated to be ≈ 56.15, meaning there are

$\approx \frac{1 \text{ GHz}}{56.15 \text{ counts}} \approx 0.0178 \frac{\text{GHz}}{\text{count}}$

Scaling the data using this conversion factor, we obtain the following plot:

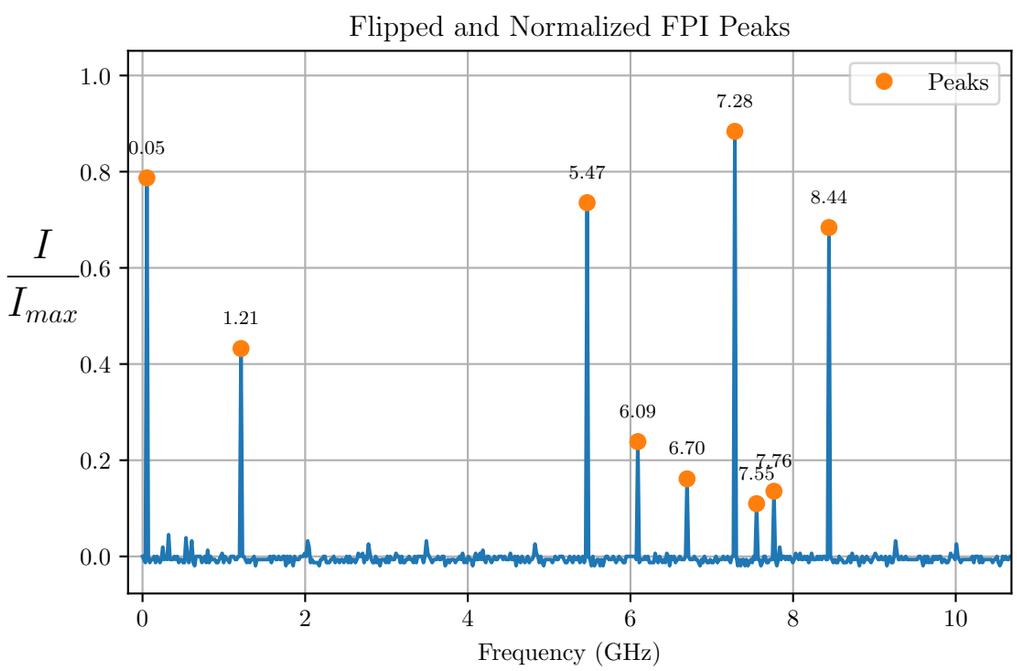


Figure 2: Scaled data using the FPI peaks.

2.1.2 Determining the finesse

Using equation 1, the FWHM for a selected FPI peak can be used to find the finesse. The following shows a Lorentzian fit on a selected peak:

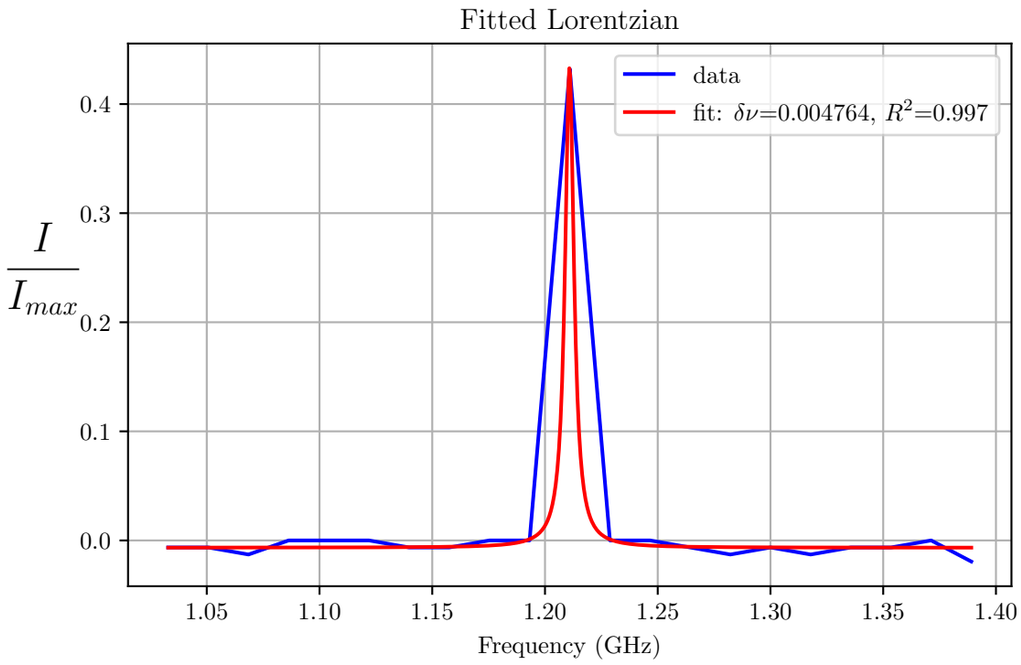


Figure 3: Lorentzian fit on a selected FPI peak.

From the fit, $\delta\nu \approx 0.00476$ GHz Hence, the finesse is

$$\mathscr{F} = \frac{\nu_{\text{FSR}}}{\delta\nu} = \frac{1 \text{ GHz}}{0.00476 \text{ GHz}} \approx 209.9$$

2.2 Task 2

2.3 Task 3

2.4 Task 4

3 Conclusion

Appendices