

Lab 3: Micro Ring Resonators

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Abstract

In this experiment we simulated a micro ring resonator, an optical device with similar properties to a whispering gallery mode. The two main properties that make this device work are constructive interference and total internal reflection. We simulated a micro ring resonator device and then characterized its behavior by analyzing its frequency response.

In the case of a micro ring resonator, at a certain narrow range of wavelengths light will interfere constructively. At all other wavelengths it will not, and output will be low. In this way, these resonators are well suited for the filtering of particular wavelengths of light.

V of the quantity X for two different sample temperatures. Our experimental measurements confirmed the quadratic dependence $V = kX^2$ predicted by Someone's first law. The value of the mystery parameter $k = 15.4 \pm 0.5$ s was extracted from the fit. We found that this value is 20% below theoretically predicted $k_{theory} = 17.34$ s. We attribute this discrepancy to low efficiency of our V -detector.

1 Introduction

Here give a brief summary of the physical effect of interest and provide necessary equations. Here is how you insert an equation. According to references [1–3] the dependence of interest is given by

$$u(\lambda, T) = \frac{8\pi hc\lambda^{-5}}{e^{hc/\lambda kT} - 1}, \quad (1)$$

where T is temperature in Kelvin, c is the speed of light, etc. Don't forget to explain what each variable in the equation means, when you introduce it for the first time!

2 Experimental setup and procedures

Note: LaTeX will put figures and tables at the locations where it thinks it is the best. Do not fight it, unless you really need it.

Give a schematic of the experimental setup(s) used in the experiment (see figure 1). Give the description of abbreviations either in the figure caption or in the text. Write a description of what is going on.

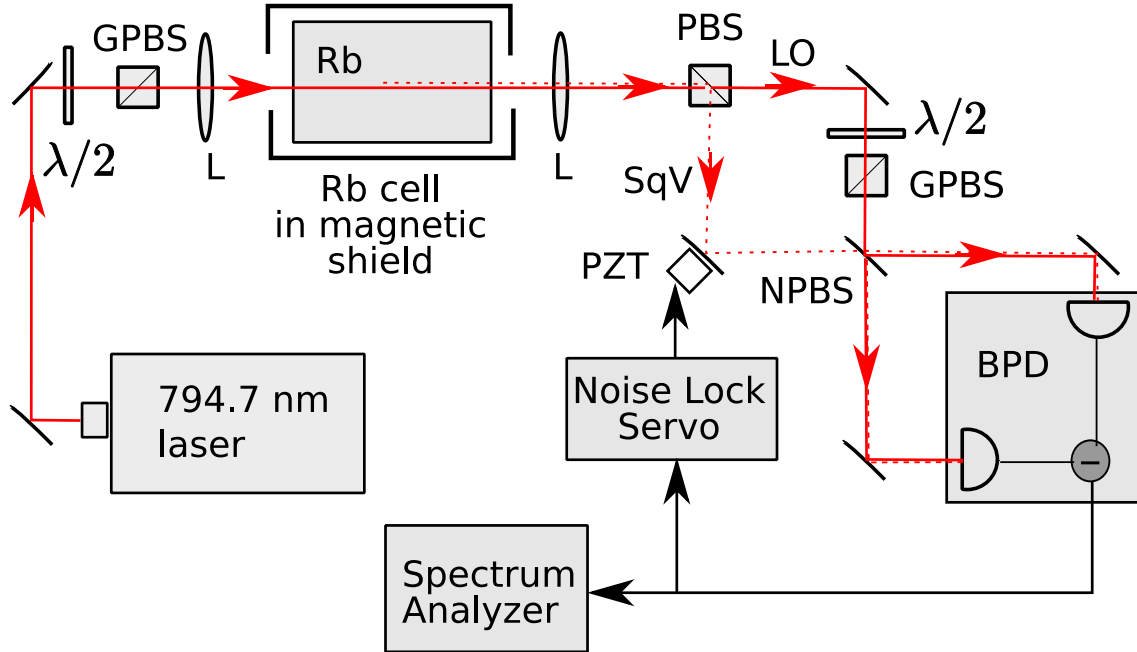


Figure 1: **Every figure MUST have a caption.** Experimental setup. SMPM fiber depicts single-mode polarization-maintaining fiber, $\lambda/2$ is half-wave plate, PhR is phase-retarding wave plate, PBS is polarizing beam splitter, GP is Glan-laser polarizer, and BPD is balanced photodetector.

Don't forget to list all important steps in your experimental procedure!

Use active voice either in past or present through all the report and be consistent with it: The laser light comes from to ... and eventually arrived to the balanced photodiode as seen in the figure 1.

Sentences in the past voice while correct generally considered hard to read in large numbers. The laser light was directed to ..., wave plates were set to ... etc.

3 Experimental data and the data analysis

In this section you will need to show your experimental results. Use tables and graphs when it is possible. Table 1 is an example.

3.1 Error analysis

Analysis of equation 1 shows ...

Note: this section can be integrated with the previous one as long as you address the issue. Here explain how you determine uncertainties for different measured values. Suppose that in the experiment you make a series of measurements of a resistance of the wire R for different applied voltages V , then you calculate the temperature from the resistance using a known equation and make a plot temperature vs. voltage squared. Again suppose that this dependence is expected to be linear [2], and the proportionality coefficient is extracted

Table 1: Every table needs a caption

Polarization	Target	Bin	$\langle x \rangle$	$\langle Q^2 \rangle$	A_{\perp}^{meas}	ΔA_{\perp}
−	LiD	1	0.0233323	0.8429978	0.0044151	0.0030871
		2	0.0638046	1.5017358	0.0021633	0.0021343
		3	0.1892825	3.1877837	0.0006640	0.0022467
		4	0.4766562	7.1827556	-0.0197585	0.0085528
	NH ₃	1	0.0232572	0.8454089	0.0003600	0.0018642
		2	0.0633156	1.4870013	0.0023831	0.0013287
		3	0.1923955	3.1753302	-0.0024246	0.0013771
		4	0.4830315	7.3245904	-0.0284834	0.0047061
+	LiD	1	0.0233503	0.8340932	-0.0086018	0.0031121
		2	0.0638688	1.4785886	-0.0018465	0.0021452
		3	0.1892192	3.1277721	-0.0017860	0.0022525
		4	0.4778486	7.0313856	-0.0041773	0.0084659
	NH ₃	1	0.0232964	0.8439092	-0.0022961	0.0018851
		2	0.0633764	1.4814540	0.0021355	0.0013354
		3	0.1924094	3.1580557	-0.0065302	0.0013775
		4	0.4825868	7.3191291	-0.0290878	0.0047329

from the graph. Then what you need to explain is that for the resistance and the voltage the uncertainties are instrumental (since each measurements in done only once), and they are Then give an equation for calculating the uncertainty of the temperature from the resistance uncertainty. Finally explain how the uncertainty of the slop of the graph was found (computer fitting, graphical method, *etc.*)

If in the process of data analysis you found any noticeable systematic error(s), you have to explain them in this section of the report.

It is also recommended to plot the data graphically to efficiently illustrate any points of discussion. For example, it is easy to conclude that the experiment and theory match each other rather well if you look at Fig. 1 and Fig. 2.

4 Necessary remarks

Context of this template is out of sync with figures, tables, references, etc. It is just a template with examples how to use particular L^AT_EX features.

5 Conclusions

Here your briefly summarize your findings.

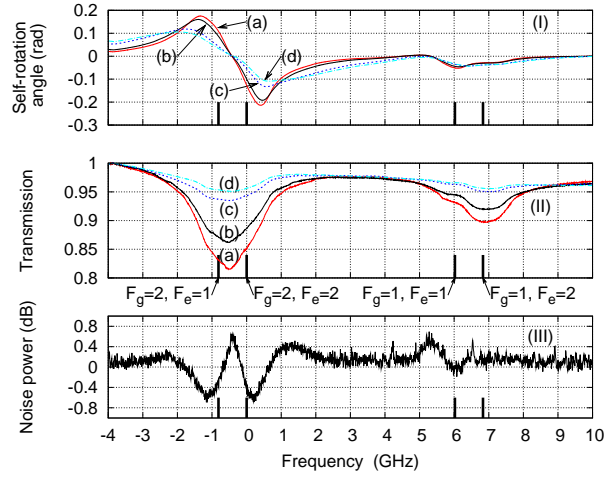


Figure 2: **Every figure MUST have a caption. Every plot MUST have axes labeled.** The dependence of self rotation and squeezing on the laser detunings.

References

- [1] A. C. Melissinos and J. Napolitano, *Experiments in Modern Physics*, (Academic Press, New York, 2003).
- [2] N. Cyr, M. Têtu, and M. Breton, IEEE Trans. Instrum. Meas. **42**, 640 (1993).
- [3] *Expected value*, available at http://en.wikipedia.org/wiki/Expected_value.