Laboratoire de Physique i

Laboratory Report

Title of Your Experiment

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Contents

1 Introduction

In the Introduction, you want to catch the interest of the reader. You explain what you did, why you did it and illustrate roughly, what the result are you found. In the introduction, you normally do not add figures and/or equations. But if it helps for the understanding and overall appearance, you are free to do so.

LaTeX has similarities to other coding languages. This sometimes means, that including comments in the "Main Text.tex" file helps you to structure your commands. It also helps you to understand what you have written if you reopen an old project from some time ago.
Comments are done by simply adding an % before you write anything. The text colour will then appear in a blue font.

2 Theory

2.1 Equations and Math Mode

In this section you go into detail what you did and why in terms of showing the science of it. This includes equations, figures and pictures of your experimental set-up.

Here an example of an equation:

$$m_s = \pm\frac{1}{2} \tag{1}$$

Here a little more complicated equation:

$$\mu_B = -\frac{e \cdot \hbar}{2 \cdot m_e} = 9.274 \cdot 10^{-24}\ \mathrm{Am}^2. \tag{2}$$

And another one, which includes some more syntax, which you might need for your reports:

$$\epsilon = \left|\frac{\partial B}{\partial z}\right| \frac{a}{B} \qquad \text{mit} \qquad \bar{\epsilon} = 0.953 \pm 0.0026 \tag{3}$$

If you want to use any equations or physical/mathematical expressions within the text, you need to write them in "math mode"which is done by simply using the $-symbol in the beginning and ending. Like here which the equation: $E = mc^2$, written as $E = m^2$.

2.2 Figures

Figures in Latex are called floats (which is the figure itself in "coding" language) and simply means, it can be moved arround - different to normal text for example. Important for figures is, that you add the right path, where the file is located. Here we have all the figures in a separate folder named "Figures" and the file name of the figure is "flugbahn" the number of the figure, as you can see, is **??**.

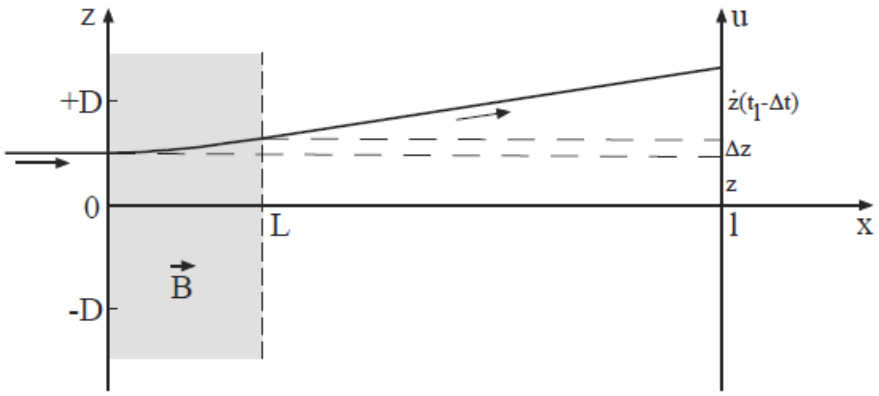

Figure 1: Here we can write the caption text. Remember, every figure needs a caption text as well as a number. The numbering is done automatically by LaTeX. Further, you shouldn't use any figures which are not refereed to in the text somewhere.

[!*h*] tells the floating object to stay exactly where it is. There are also other commands and you can find them all online.

\centering tells the float to be centered in the middle of the page.

$\backslash includgraphics[height = 6cm]$ tells the float to be 6 cm in height. This can be changes as you want and need it of course.

3 Experimental

In the experimental section, you show the experimental setup which was used for the experiment. Only show what is important to understand what you did and to be able to repeat the experiment from your report.

This could look like this:

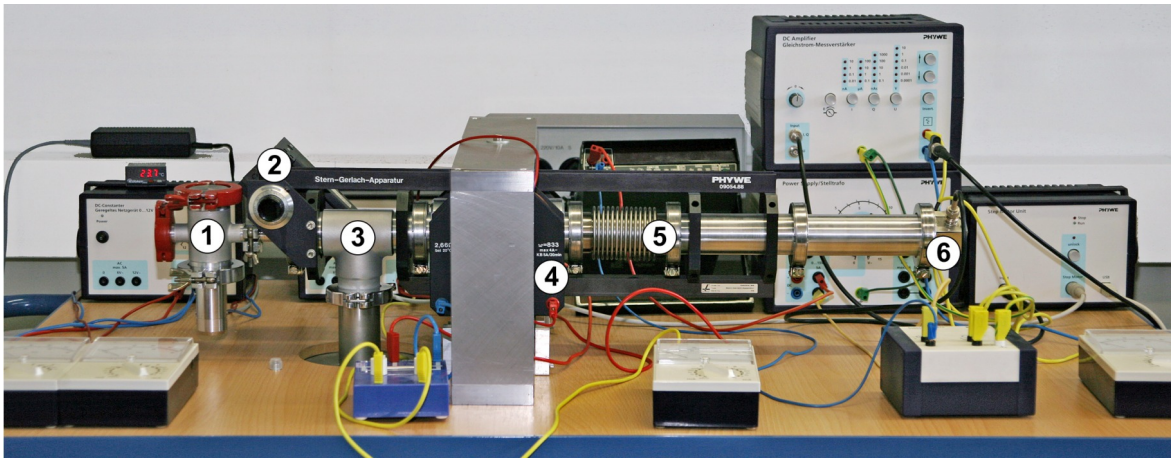

Figure 2: Aufbauübersicht des Experiments

This here is a simple numerating list. If you want to create such lists yourself, go goodle it. You will find everything there.

(1) Atomstrahlquelle (Ofen mit Kaliummetall)

(2) Schrittmotor zum bewegen des Detektors

(3) Anschluss zur Vakuumpumpe

(4) Magnetischer Analysator (Spulen, Polschuhe)

(5) Atomstrahlrohr

(6) Langmuir-Taylor-Detektor

4 Results and Discussion

This is the most important part of your report. Here you show all the results and discuss them.

4.1 Aparatus and Callibration

Probably the most annoying and tedious thing to do in Latex, are tables. It is annoying, complex and one loses easily the overview. Fortunately, there are online-tools which can be used to create tables like you would do in Excel and which generate the Latex code automatically for you. Just be aware that sometimes it is necessary to load some additional "$\backslash usepackage$". Here you can find such a tool: $https://www.latex-tables.com/$

Here is an exemplary table:

Länge der Pole L	$(7.000 \pm 0.001) \cdot 10^{-2}$ m
Radius des konvexen Pols a	$(0.250 \pm 0.001) \cdot 10^{-2}$ m
Distanz Magnetfeldeintritt - Detektor l	$(4.550 \pm 0.012) \cdot 10^{-1}$ m

Table 1: Also here, always put in a caption and describe what is illustrated.

You can also do a normal table in Excel, export it as a picture and add it as a floating figure.

4.2 Measurement Results

Bei jeder Messung wurden nebst den Messergebnissen die später für die Berechnung benötigt wurden, auch noch wichtige Umgebungsdaten aufgezeichnet.

Messung	Druck [mbar]	Temperatur [K]	Strom Elektromagnet [mA]
1	$(5.1 \pm 0.1) \cdot 10^{-6}$	405.9 ± 0.1	305 ± 5
2	$(5.0 \pm 0.1) \cdot 10^{-6}$	405.9 ± 0.1	400 ± 5
3	$(4.9 \pm 0.1) \cdot 10^{-6}$	405.8 ± 0.1	505 ± 5
4	$(4.9 \pm 0.1) \cdot 10^{-6}$	405.8 ± 0.1	600 ± 5
5	$(4.8 \pm 0.1) \cdot 10^{-6}$	405.9 ± 0.1	705 ± 5
6	$(4.8 \pm 0.1) \cdot 10^{-6}$	405.8 ± 0.1	800 ± 5
7	$(4.7 \pm 0.1) \cdot 10^{-6}$	405.8 ± 0.1	900 ± 5
8	$(4.7 \pm 0.1) \cdot 10^{-6}$	405.7 ± 0.1	1005 ± 5

Table 2: Umgebungsdaten für die durchgeführten Messungen

4.3 Analysis

Another example of a little more complicated table:

Messung	$\frac{\partial B}{\partial z}$ [T·m^{-2}]	Parameter q [m]
1	90.989 ± 3.448	1.990 ± 0.261
2	120.959 ± 4.573	2.667 ± 0.282
3	154.418 ± 6.163	3.344 ± 0.341
4	184.159 ± 7.949	3.905 ± 0.451
5	215.489 ± 10.347	4.752 ± 0.571
6	241.606 ± 12.934	5.359 ± 0.689
7	265.938 ± 16.124	5.973 ± 0.820
8	287.038 ± 20.030	6.490 ± 0.915

Table 3: Caption Text.

4.4 Error Calculation

Here you will formulate the equations which you used to calculate and determine the error in your experiment.

The equation looks complicated in LaTeX code, I know... but the way it is built up is very logic. So don't worry, you will very quickly get into it and learn how it works simply by doing it and if there is a problem, you can always ask.

$$m_{\frac{\partial B}{\partial z}} = \sqrt{\left(\frac{\partial \frac{\partial B}{\partial z}}{\partial \epsilon} m_\epsilon\right)^2 + \left(\frac{\partial \frac{\partial B}{\partial z}}{\partial B} m_B\right)^2 + \left(\frac{\partial \frac{\partial B}{\partial z}}{\partial a} m_a\right)^2} \tag{4}$$

5 Conclusion

Summarise all you results and emphasize what is important and what can be learned from it. Normally, there are no figures or equations in the conclusion, but if you find it necessary or important, you can do it.

6 Literatur

LaTeX has a very sophisticated way to list all the literature and references. But for now, we will not go further into detail with that. If you are interested, you can contact me at any time and I will show it to you.

This here is a simple list in which you can add more lines by adding: "*item Some Text* \\"

[1] *Lisa Felker*, Bachelorarbeit, Aufbau und Inbetriebnahme einer Stern-Gerlach-Apparatur, Universität Aachen, 2009

[2] Anleitung zum VP-Versuch: Das Stern-Gerlach Experiment, Versuchsanleitung, Universität Zürich, 2019.

[3] Stern-Gerlach-Apparatur, Manual der PHYWE Systeme GmbH, Göttingen.

7 Appendix

7.1 Tables With All The Measured Data

Here you can add as many subsections as you need to display all the data, figures, tables and so on which are less important and belong in the appendix.