FP: Checklist for Writing a Report

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In physics, communicating about your research is almost as important as research itself. Writing articles, giving oral presentations, presenting posters, and discussing results is the only way for researchers to become familiar with the work of their colleagues and communicate their own discoveries. As the Nature magazine puts it: "So many papers deserve to be better written than they are" [1]. However, writing about science is not an easy job and it is important to practice it. The FP2 course aims at providing you with an opportunity to practice and improve these skills. This checklist is meant as a guide to help you think what to write about and how.

THINK BEFORE YOU WRITE

The aim of a report is to convey a message, discuss results and increase your, as well as your colleagues, understanding of physics. To implement this, think about the following questions. What message do you want to communicate? What is the motivation? Which audience are you writing for? What is the physics of the experiment you want to describe? Have a look at the data and do the analysis before starting to write. This will indicate which topics need to be covered in the introduction and which theory needs to be discussed. It will also provide you with the main theme of the report to which everything can be related. Once you know what to discuss in the report, make sure you organize it such that it makes sense. What needs to be explained and in which order? In the science community, there are many guides on how to write and how to structure a report and we encourage you to have a look at them e.g. Ref. [2–4]. In the end make sure that you have thought about what you want to present and how to organize the report.

PHYSICS CONTENT

- ☐ Is the physics message of the experiment described?
- ☐ Is all the relevant physics discussed? Note that relevant does not mean all the physics you can think of, but what is really necessary for the report.
- ☐ Are the graphs, figures, and data presented necessary? Every graph should make a point related to the experiment, otherwise there is no need to include it.
- ☐ Are the experimental setup and methods explained such that one can repeat the measurements?
- ☐ Are the results and analysis presented in clear, logical and understandable way? Could the analysis be repeated by a third party?
- ☐ Are the results consistent with the conclusion? Would someone else reach the same conclusion?
- ☐ Are the results representing physical quantities and are they explained?
- ☐ Are the results discussed and compared with literature, theory, fellow students and your own thoughts?
- ☐ Are the possible error sources indicated and included in the results?
- ☐ Are all variables unique and defined?

STRUCTURE

- ☐ Is the text logically divided in sections and paragraphs? Is everything in the right place e.g. theory with theory, setup with setup etc.?
- ☐ Is there a general theme to your writings that connects the report from beginning to end?
- ☐ Is there a clear motivation for the experiment?
- ☐ Are the graphs, figures etc. at the right place in the right order and are they referenced in the text?
- ☐ Is there an abstract that summarizes the experiment performed and the main results? This should indicate to the reader if the report is worthwhile reading.
- ☐ Is there an introduction that introduces the goal of the experiment, the field, and provides general interest in the topic? It should encourage the reader to read on.
- ☐ Is there a title, name and date on the report?
- ☐ Is there a need for an appendix?

REFERENCES

- ☐ Are all the text and figures properly referenced? In order for the scientific community to know what is your work and which of it is original, it is important to always give a reference when using someone else's data and words.

☐ Are the references referring to books, articles or other forms of literature? Please note that wikipedia is not accepted as a proper form of literature. Wikipedia is an open source which is not peer-reviewed and anyone could change its content.

☐ Is the report is written in your own words, unless otherwise explicitly stated? Plagiarism is a form of dishonesty and is unacceptable.

☐ Are acknowledgements appropriate?

GENERAL REMARKS

☐ Is the report written for the appropriate audience? For FP2 the audience are you, your fellow students and of course the teachers grading you.

☐ Can a fellow student understand and repeat the experiment based on the report? We would like to encourage you to discuss the report while writing with your colleagues and group members. In our experience this helps a lot in clarifying your own understanding of the physics involved and it is a good test to see if your writing and thinking can be understood by others.

☐ Is everything discussed that was unclear while doing the experiment? Has everything been clarified that was unclear to you while carrying out the experiment?

☐ Is the report of the right size? Write as much as necessary and as little as possible. A length of approximately 10 pages is reasonable, however it is not a fixed number since it depends on the figures and text style. Keep in mind that the experiment determines what you need to emphasize and how much pages it takes.

☐ Did someone proofread the report?

STYLE AND FORMATTING

To be able to focus on the content of an article, consistent style and formatting is a must. Many publishers provide strict guidelines on notations and styles for writing articles e.g. Physical Review Letters (PRL) provides their own style guide [5]. We recommend using LaTeX as a typesetting system for making the report. It is easy to include mathematical expressions and it will be needed later for writing scientific articles. The world wide web is full of useful guides on how to use LaTeX [6] as well as how to include word count and grammar and spelling checkers. Almost every typesetting problem can be solved by using this pool of knowledge.

☐ Are the style and formatting consistent throughout the whole report?

☐ Are the numbers, errors, units and mathematical expressions written in the right format? It is important to use a "standard" style so that when talking about the results one does not get distracted by formatting. See for instance the style of PRL [5] as well as in the section "Common Errors" below.

☐ Are the figures, graphs and tables in the right place? Do they have captions and labeling? Tables and figures should be numbered and contain a comprehensive caption, starting with a title. Reading the caption should enable the reader to understand what is seen in the figure without reading any of the main text. However, the discussion of the data shown in the figure as well as the conclusions from the figure should only be discussed in the text. Correct: "Figure 1: Measurement of the speed of light. The dashed line indicates (...)."

☐ Is the text in the figures (axes labels, ticks, legend etc.) readable? Is the formatting right?

☐ Is everything explained that is depicted in the graph and is there a visual distinction between the different datasets and curves? Is a legend needed?

☐ Is the spelling and grammar correct? The report can be handed-in in English or German, but make sure the English/German is readable.

☐ Are the references presented in a uniform style? Using the PRL reference style [5], an article is referred to as follows: Author, journal **volume**, page (year)

COMMON ERRORS

To finalize we would like to point out some common pitfalls.

- Check the file after compiling for the location of the graphs and figures. LaTeX might displace them, depending on the settings.
- Units should NOT be written in *italic*. Correct: "$s = 2\,\mathrm{m}$"
- Symbols that represent physical quantities should be written in *italic*. Correct: "The height h of the house."
- There should be a small space between numbers and units and no line break. Correct: "25 kg". Incorrect: "25 kg". Tip: use the \, command in LaTeX.
- Mathematical expressions should be embedded in the text and treated as sentences or parts of sentences. Use the appropriate punctation. Correct: "the equation $x = a\,y + b$, where a is"

- Mathematical expressions can either be put inline with the text or on a new line and should always be labeled if you want to refer to them later. Correct: "we show that the equation

$$x = a\,y + b, \tag{1}$$

  where a is"

- References to mathematical expressions are always noted in brackets. Correct: "equation (1) shows"

- Errors can be indicated with brackets or the $\pm$ sign. Correct "$l = 0.9(1)\,\mathrm{m}$ or $0.9 \pm 0.1\,\mathrm{m}$"

- Take care that numbers have the right units and right significant digits.

- References should be in square brackets. Correct "the theory of relativity [9] explains"

- Do not start sentences with an abbreviation or a physical quantity. Correct: "The length l shows" Incorrect: "l shows"

- Only use abbreviations when they are previously defined. Correct: "as was shown in the magneto-optical trap (MOT). During the MOT stage"

- Which versus that [7]. "That" is used before a restrictive clause and "which" is used before everything else. A restrictive clause restricts the meaning of another part of the sentence. Correct: The apple that looks green is tasteful. The apple, which is a fruit, is tasteful. In the first sentence the apple is restricted to be green.

Comments and additions to the checklist are welcome and can be addressed to rianne.lous@uibk.ac.at and slava.tzanova@uibk.ac.at.

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