


Genetic aetiology of the persistently lean phenotype, exposed to an unhealthy environment.

Gunnar Källén

Department of Astronomy and Theoretical Physics, Lund University

Bachelor/Master thesis supervised by Johan Bijnens



logocLUeng-eps-converted-to.pdf

Abstract

The abstract is a short summary describing the content of the main text. This should give enough information about the contents to decide for the intended audience whether further reading will be useful. The size should be about half a page, best written at the end, after most of the thesis is written. This is a \LaTeX template for a bachelor/master thesis in theoretical physics at Lund University. It contains examples of most needed structures and discusses other relevant aspects of writing a thesis.

Populärvetenskapligt sammanfattning

This is meant to be popular *introduction* to and *description* of your thesis, preferably written in Swedish. The name is unfortunately misleading. It is not a summary but mainly an introduction to what you have done. A good idea is to write this when you are about one third through the time allotted for the thesis work.

Especially important here are the context of your project and why this is an interesting project to do. This should be about half a page as well.

Contents

1	Introduction	3
2	L^AT_EX	3
3	Comments	3
4	Labeling	3
4.1	A subsection of Section 1	4
4.1.1	A subsubsections	4
5	An example computer code	4
6	Figures	5
7	Tables	5
8	Equations	5
9	The list environment	6
10	References	7
11	Conclusions	7
A	This is an appendix	7
B	This is another appendix	7
B.1	An appendix subsection	8

List of Figures

1	CMD of Draco	5
---	------------------------	---

List of Tables

1	This is a table of variable stars	5
---	---	---

1 Introduction

This is a template L^AT_EX file for a bachelor or master thesis in theoretical physics at Lund University. It has an example front page and in the L^AT_EX file itself there are many comments. The introduction should contain the background of why you are doing this and a short description of the general area.

Writing a thesis is a time consuming project. Especially in theoretical physics where a bachelor/master thesis typically contains a large number of equations. These are very difficult to handle using more standard programs or applications.

2 L^AT_EX

There are very many introductions to L^AT_EX around. A simple one is “A not-so-short introduction to L^AT_EX” [1]. Inclusion of graphics is done with the package `graphicx` [2]. The sections below will contain examples of most of the things that might be needed in writing a thesis and a number of hints and comments. Pay especially heed to the latter. you will be grateful when hunting for typing errors and other mistakes later. Before reading the remainder of this template, make sure you have a basic knowledge of L^AT_EX.

3 Comments

The comments below are done with a simple listing environment called `itemize`.

- In the template file itself there are many comments as well, it will probably pay off to look at those as well.
- Type cleanly, especially equations. It will make life easier hunting for errors.
- Both T_EX and L^AT_EX themselves classify as a full programming language, so you can do some really fancy stuff with it. However, if not needed, it can lead to very funny behaviour if you don't exactly know what the funny commands do and a small change messes up things.
- You probably already have, but have a look at earlier bachelor or master theses, for examples.
- Examples of useful things all over in the file, look at them.

4 Labeling

Latex is very nice because it can help you to refer to the right table, figure, item section or page. Just remember that you need to compile with latex or pdflatex twice (!) before it has updated all the cross references. This is also true for references (see Sect.10). If you

use some special packages, sometimes it requires even more times processing with latex or pdflatex.

In item 3a on page 7 you can find some important information that was not covered in Eq. (8.1) or in Table 1. That covers the most important references¹

L^AT_EX allows to use labels for references, tables, sections,... Use this consistently. If you do not, you will have to go through the entire manuscript by hand if you add an equation or a figure and change all the numbers. You will for sure forget some. Add the command `\usepackage{showkeys}` at the top of the file. It will make labels and where they are used visible which is very useful while writing. The labels can be (almost) anything but choosing them wisely and easier to remember helps very much.

The actual referring can be done in many ways. The words equation, tabke, figure and section can be included or not, as well as capitalized or not. There is no preferred way of doing this but be consistent. Use the same style throughout. Citations to the literature are in our field put at the end and the most common style is ordering by appearance and a number in square brackets like [3]. That, by the way, is the real reference for the first part of the title.

You can refer to a section as Sect. 1 and a subsection as Sect. 4.1.

4.1 A subsection of Section 1

4.1.1 A subsubsections

Paragraphs are not numbered Paragraphs are allowed but usually not used.

5 An example computer code

When we write down computer code we might want it to look just like it does in the editor (using a fixed with font). This is done using the *verbatim* environment.

```
PROGRAM myfortran

IMPLICIT NONE

REAL*8 mag(20)
REAL flux(20)
INTEGER nstar

WRITE(*,*) "This program calculates a magnitude"
READ(*,*) flux(1)
mag(1)=-2.5*LOG(flux(1))
```

¹If you want to learn more – read more.

Figure 1: This colour-magnitude diagram shows the giant branch of the Draco dwarf spheroidal galaxy as seen in the Strömgren filter system (also known as *uvby*). Are the lines thick enough to read? Did you find out how to make nice postscript fonts with your plotting program?

Computer languages are, usually but not always, written in the smallcaps font like FORTRAN.

6 Figures

Figures are of course very important in the thesis. Make sure that your figures have thick lines that stand out in the printed version, that the axes are labelled and explained and that colours are distinguishable in a black and white printout as well (this is helpful for the not insignificant fraction of the population who are colorblind).

7 Tables

This section contains a table which shows the most basic elements and a simple layout. The table can be seen in Table 1. Make sure to make your labeling system easy. Maybe `table:1` is not so smart – what if you move the table somewhere else, and it is not any longer the first table or you add a table before this one. Perhaps a label like `table:varstars` would have been better?

Table 1: This is a table of variable stars

Id of star	I	V	Var.?
1234	15.6	17.3	No
5677	13.4	12.3	Yes

Here we managed to place the table directly in the text (using the `!h` option). Generally we should let latex control the positions of figures and tables – if you are unhappy with their placement then try to move them around in the raw text or experiment with `!h` and `!t`.

8 Equations

Writing mathematical formular in latex is not always so easy at first. But it does look good! There are several environments that we can use, and we can get numbers for all the equations etc. Very neat. If I want simply to have a small equation or some expression in the text I can just do `$ \mathbf{x+a} \cdot \mathbf{b} = \mathbf{f(x)}. Which, when latexed, gives us the formula`

$$x + a \cdot b = f(x).$$

If we want an equation by itself, we just add one more `$` at each side:

$$g(x, y) = \sin(x) + 10 \log(y \cdot 20 \cdot 10^{-2x})$$

It is also possible to use an *environment* especially for equations. Remember that equations should be integrated in the flow of the text, even if they are on separate lines. Therefore we should use punctuation in equations as well, for example in the equation which reads

$$\sum_{k=i}^n (x - \bar{x})^2 + \sqrt{x^2 + y^3} = h(x, y). \quad (8.1)$$

Remember that the `equation` environment does not like empty lines. This is the same in `tabular`, by the way. You can do many more things in the maths-mode. If you are going to write lots of equations you will learn it very quickly.

You should also look at the American Mathematical Society package `amsmath` [4]. It is very useful for lining up equations and has a lot more symbols than the base `LATEX` set.

Equations are typeset in a separate font, but note that units, abbreviations and names should not be typeset in this font. This way we can distinguish `m` for meter from *m* for mass. Inside an equation the `\mathrm{...}` command can be used to typeset in the normal font, e.g. m_{eff} rather than m_{eff} (unless *m* is a tensor with three indices).

9 The list environment

If you want to make good looking lists, short or long, latex can do it for you.

- This is the first entry
- and the second one
 - lets go down one level
 - and stay there
 - * And one more
 - * very deep

But you can also do other types of lists. For example with numbers. Very useful as you can refer to them later with labels.

1. First entry
2. Second entry
3. Third entry

- (a) First entry
- (b) Second entry
- And you can mix the listings
- like this

10 References

You also need to cite all the thick and good papers that you have read during your thesis work. There are several ways. Here we will use the standard style given by \LaTeX as that one is the one that most resembles the way we write references in high energy physics journal papers.

You can add the references in a so called bibtex file. This file contains all the information latex needs about a single paper in order to make an entry in the reference list and to write the correct reference inside your text. Alternatively we can add a list of bibitems directly in the latex file. This is what we will do here, and probably the most useful for you.

Finding references can be done by many means, Google, your supervisor, etc.. In particle physics there is a very good database called INSPIRE [5]. They also allow to get the \LaTeX code for a reference directly. We use the style Latex EU, see [3] in the references how their output looks like.

11 Conclusions

Acknowledgements

There is no acknowledgements section in the regular latex, but you can easily make one yourself. The * makes in the command makes it not have a number

A This is an appendix

You can put long mathematical derivations or tables in appendices.

$$x = y. \tag{A.1}$$

B This is another appendix

Subsections etc. are also allowed here

B.1 An appendix subsection

References

- [1] T. Oetiker et al., “The Not So Short Introduction to L^AT_EX2e,”
<http://www.ctan.org/tex-archive/info/lshort/english/>
- [2] <http://ctan.org/pkg/graphicx>
- [3] G. Kallen, *Helv. Phys. Acta* **25** (1952) 417.
- [4] “User’s guide for the `amsmath` package,” <http://www.ctan.org/pkg/amsmath>
- [5] High-Energy Physics Literature Database, <http://inspirehep.net>