Thesis Title

by
Student Name

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A thesis submitted in partial fulfillment
of the requirements for the
Degree of Bachelor of Arts with Honors
in Physics

WILLIAMS COLLEGE
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Abstract

Your abstract will summarize your thesis in one or two paragraphs. This brief summary should emphasize methods and results, not introductory material.

Executive Summary

Your executive summary will give a detailed summary of your thesis, hitting the high points and perhaps including a figure or two. This should have all of the important take-home messages; though details will of course be left for the thesis itself, here you should give enough detail for a reader to have a good idea of the content of the full document. Importantly, this summary should be able to stand alone, separate from the rest of the document, so although you will be emphasizing the key results of your work, you will probably also want to include a sentence or two of introduction and context for the work you have done.

Acknowledgments

The acknowledgment section is optional, but most theses will include one. Feel free to thank anyone who contributed to your effort if the mood strikes you. Inside jokes and small pieces of humor are fairly common here ...

Contents

List of Figures

Chapter 1

Introduction

The introduction is one of the most important pieces of your thesis. Here is a place for you to introduce the problem(s) on which you have worked and place them in the larger context of your field. You should aim to ensure that this section is completely understandable to virtually anyone - and certainly anyone with a sophomore-level grasp of physics. Presumably this will include references to the literature.

In addition to setting your work into context, a second good idea for your introduction is to give a short outline for what the rest of your thesis will discuss. This is often done in the closing paragraph(s) of the introduction with sentences like "In the following chapters ..." and "Chapter 2 discusses ..." Tremendous detail is not required in this outline, but rather just a brief road map for the rest of the document.

1.1 A section

The `\section` tag will create a new section within a chapter. Sections will be sequenced with digits following a decimal point in the table of contents, i.e. this is section 1.1.

1.2 Another section

This second section is, obviously, 1.2.

1.2.1 A subsection

Subsections are created using the `\subsection` delineate smaller pieces of your document, and will appear after a second decimal point; this is subsection 1 of section 2 of chapter 1, i.e. 1.2.1.

A subsubsection

Subsubsections are still smaller sections. By default, this is the finest subdivision of a chapter in LaTeX, and they will *not* appear in the table of contents.

1.2.2 A useful command

This is a margin note.

One command I often ask my students to use is `\marginpar`, which can be used to create a margin note. These are super helfpul if there's something to which you need to return later (say, after you've looked up a number), as notes in the margin are really easy to find quickly.

1.3 Some figures

You will surely want to add figures to your thesis to help explain your ideas. There are a number of different ways to include such things, but the most typical way would be to generate the figure in another piece of software (`MATLAB, Mathematica, Adobe Illustrator, ...` and simply include it in your LaTeX code. This will require use of the *figure* environment.[1] See this document's LaTeX code for details . . .

Here, back in the main body of the text, we can create a reference to figure 1.1. This is automatic; the actual numbers are not typed into the code, but rather the `\ref` tag has been used. Always always always use the `\ref` command to reference figures, or invariably at some point you'll move something and all of your references will be incorrect and you'll have to fix them manually.

As an alternative to the ordinary figure environment, you might deem it desirable to tuck a figure in more closely amongst the text. This has a separate environment known as *wrapfig*. Here we will include the same figure as above a second

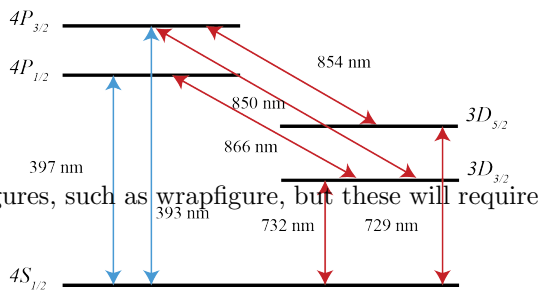

Figure 1.2: A figure included using the wrapfig environment

[1] there are many other possible environments to include figures, such as wrapfigure, but these will require including additional packages . . .

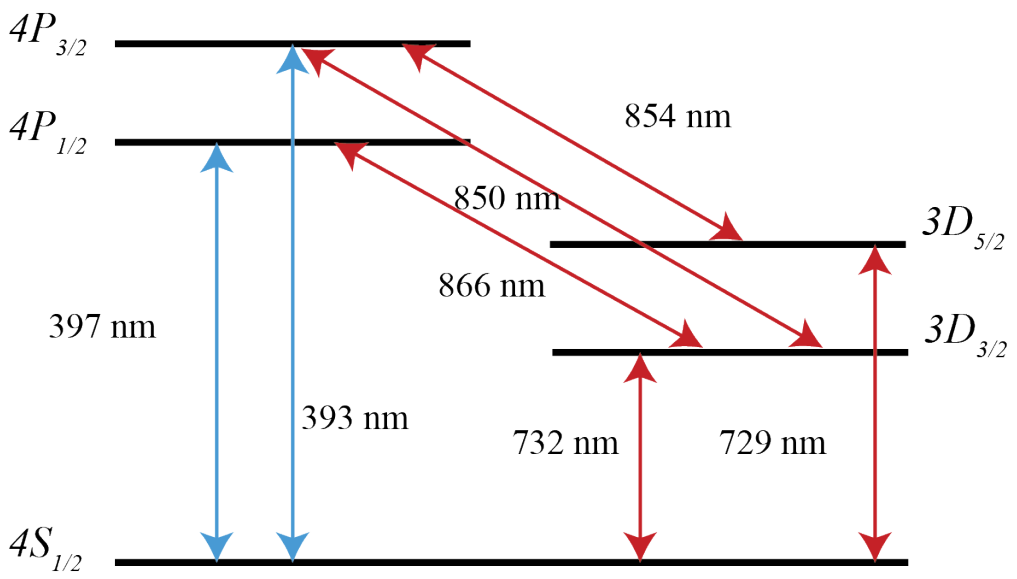

Figure 1.1: Long-form caption that appears in main body of the document

time, but this time using the *wrapfig* environment. This will insert the figure into your document with the text wrapping around the perimeter, rather than offsetting it into its own separate chunk of page, as above. As before, we can use an automated reference to the figure using the `\ref` tag; here we have figure 1.2. Working with the wrapfigure environment sometimes requires a little bit of massaging to ensure that everything lines up properly in your document, but with a small amount of work you will find that you can get the text to box the figure quite nicely.

Here I have added a table, because tables are also useful. This table has nothing to do with the rest of the material in this thesis template, but you should probably only add relevant tables.

Name	SpT	Dist. (pc)	Age (Myr)	3σ M_{dust} limit ($M_\oplus$)	3σ CO(3-2) limit (mJy km s^{-1})	Disk indicator
J0226	L0	46.5	45	0.01	24	Paβ, IR
J0501	M4.5	47.8	42	0.01	23	Hα, IR
J1546	M5	59.2	55	0.01	14	HeI, [OI], Hα, IR
J0446 A/B	M6/M6	82.6/82.2	42	0.027	18	Hα, IR
J0949 A/B	M4/M5	79.2/78.1	45	0.024	17	Hα, IR
LDS 5606 A/B	M5/M5	84/84	30-44	0.027	19	Hα, IR, UV

Chapter 2

A second chapter

Here is a second mock chapter. As far as the LaTeX is concerned, it is in no way different from the introduction excepting that it appears after it in the main .tex file. As before, it can be populated with sections, subsections, figures, etc. as you see fit.

In fact, you will probably write perhaps three to six chapters for your thesis depending on how your work is most effectively organized. Most theses will contain an introduction, at least one 'body' chapter, and some sort of conclusions/future directions chapter. Most theses will also include an appendix or two ...

Chapter 3

Transformers

3.1 Before the Transformers

The Recurrent Neural Networks or RNN dates from 1986 based on the work of Rumelhart [1]. The Recurrent Neural Networks or RNN dates from 1986 based on the work of Rumelhart. These networks are specialized to work with data that contains temporal information and therefore the results obtained improve against other types such as FeedForward or Convolutional networks.

The main idea behind these models is the concept of Parameter Sharing. Con Parameter Sharing un modelo puede generalizar mejor cuando la información esta contenida en diferentes partes de una secuencia. Así, el modelo no necesita aprender independientemente todas las reglas que forman la secuencias, sino que ahora, la salida para cada elemento en el tiempo esta determinada por la salida del elemento anterior. Resultando en una recurrencia con las mismas reglas de actualización aplicadas a cada elemento en el tiempo. La ecuación 3.1 representa este proceso; $h^{(t)}$ es el estado de la recurrencia aplicada por alguna función f a un elemento $x^{(t)}t$ de la secuencia x en el tiempo t, θ son los parámetros compartidos.

$$h^{(t)} = f(h^{(t-1)}, x^{(t)}; \theta) \tag{3.1}$$

En una RNN vista como un gráfo computacional dirigído y acíclico, cada nodo representa un estado en la recurrencia y procesa la información de la secuencia x con los mismos parámetros θ en cada paso, observe la figura 3.1.

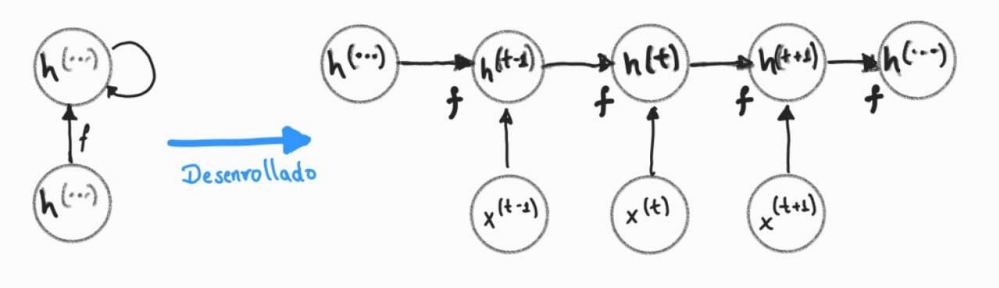

Figure 3.1: Grafo computacional generado por una RNN al "desenrrollar" la recurrencia. Usando los parámetros compartidos en cada nodo, con cada elemento $x^{(t)}$ de la secuencia genera un nuevo estado oculto $h^{(t)}$ para retroalimentar nuevamente la entrada del siguiente nodo.

Appendix A

An appendix

Appendices are a good idea for almost any thesis. Your main thesis body will likely contain perhaps 40-60 pages of text and figures. You may well write a larger document than this, but chances are that some of the information contained therein, while important, does *not* merit a place in the main body of the document. This sort of content - peripheral clarifying details, computer code, information of use to future students but not critical to understanding your work . . . - should be allocated to one or several appendices.

A.1 About the bibliography

What follows this is the bibliography. This has its own separate environment and syntax; check out the comments in the .tex files for details. Worth nothing, though, is that you may find it helpful to use automated bibliography management tools. BibTeX will automatically generate a bibliography from you if you create a database of references. Other software - for example JabRef on a pc - can be used to make managing the reference database easy. Regardless, once you've created a .bib file you can cite it in the body of your thesis using the `\cite` tag. For example, one might wish to cite a reference by Bermudez [2]. If you use BibTeX, you can put the relevant information into a referencedatabase (called bibliography.bib here), and then BibTeX will compile the references into a .bbl file ordered appropriately for your thesis based on when the citations appear in the main document.

Bibliography

[1] H. G. E. Rumelhart David E. and R. J. Williams, "Learning representations by back-propragation errors.," *Nature*, vol. 323, pp. 533,536, 1986.

[2] A. Bermudez, M. Bruderer, and M. B. Plenio, "Controlling and measuring quantum transport of heat in trapped-ion crystals," *Phys. Rev. Lett.*, vol. 111, p. 04091, 2013.