Tips on Scientific Writing

PHYS 480 – Fall 2018

Setup for the Abstract / Proposal

- Choose a good (and catchy) title!
  - Must succinctly describe the work you've done
  - Consult your advisor when in doubt.

- Choose your person and stick with it
  - First person: "In this thesis, I will consider…"
  - Third person: "This thesis will consider…"

- Follow the general prescription:
  - **Introduction**: what are you doing?
  - **Methodology:** How will you do it?
  - **Goals:** what do you expect to find / how will it be different from what's already done?
  - **Significance:** Why is it important?
  - **References:** On which giants' shoulders did you stand?

- Do. Or do not. There is no try!
  - Never say "I will try to do X", "Hopefully this result will show", *etc…*
  - "I WILL do X", "The result WILL show"

Structure of the Thesis

- **Chapter 1: Introduction**
  - This is where you give a broad introduction to the area of physics that you are studying. For example, if you are studying superconductors, briefly describe the history of the field, the broader applications, and end off with how you will add your own contribution! (*i.e.* "This thesis will examine …")

- **Chapter 2: Background for *your* specific project**
  - After establishing the bigger picture in Chapter 1, you will now focus on what you will be doing. You can expand on the background at bit to put your work in context, and you can start explaining your approach and how it is different.

- **Chapter 3: "The Meat/Tofu"**
  - This is where you present your work: data analysis, plots, code structure, etc…. If the chapter gets overly long, you can split it in two at an appropriate point.

- **Chapter 4: Conclusions and Future Directions**
  - Wrap it up. Re-emphasis the significance of your work and its relation to what has been done previously. Also, give some thoughts on where you would take the project next, if you had another year to work on it.

Bibliography Format

- Journal paper:
  - Author name(s), *Journal name* **VOLUME # ,** pages (year) [arXiv: 12345.6789 [category]].
- arXiv paper (not published):
  - Author name(s), “Article title”, arXiv:12345.6789 [category].
- Book:
  - Author name(s), *Book Title*, Publisher (Year).
- Article from a book:
  - Author name(s), “Article title”, *in: Book Name*, Publisher (Year).
- Website:
  - Name of website, URL, (accessed on DATE).

    [1] The LIGO Scientific Collaboration, https://www.ligo.org/ (accessed on 17 Sep 2018)

Citation Format

- When citing in the text, cite the reference by number from the reference list:

  "The theory of general relativity was originally formulated by Einstein [12]."

- All references are placed at the end of the thesis, in the order of appearance.

[12] A. Einstein and M. Grossman, *Zeitschrift für Mathematik und Physik*, **62**, 225–244, 245–261 (1913).

- When citing multiple papers:

  "The interested reader is referred to [23-29] for further information".

More Citation Format

NEVER quote a passage from another paper, even if you cite it! Say it in your own words.

WRONG!

In his recent paper, Mureika said:

"Solutions to Einstein's equations in (1 + 1) dimensions have been considered for decades, initially as a pedagogical curiosity, and later as probes of quantum gravity effects." [2]

RIGHT!

In a recent paper [2], the authors note that (1+1)-dimensional solutions to Einstein's equations have a wide range of applications, from being artifacts of a full quantum gravity theory, to providing a deeper pedagogical insight into gravitation.

DOs

- Your thesis is a living, evolving document. *Feed it every day!*
  - Everything you do related to it (abstract, proposal, bibliography, *etc…*) will make up part of the final product.
  - You should be constantly adding to it.
  - Don't wait until you've done everything to start writing (you will be hosed)

- Cite ***ALL*** sources for material that is not your original idea!

- After you read it, *write it down in your own words*.
  - Helps you to understand it.
  - Hones your scientific language.
  - Don't cut-n-paste thinking "I'll change it later!", because (a) you will forget, and (b) you will be hosed because you plagiarized.

- Seek frequent feedback from your advisor. Don't disappear until March and hope to get their undivided attention.

DO NOTs

- Do not repeat ideas or words in subsequent sentences.
  "In this thesis I will research X. The researching of X will be done by looking at [methods]…"
  "In this thesis, I will research X by [methods]…"

- Do not use colloquial language.
  "I will find out what happens", "I will look to see the result"
  "I show that…", "It is shown that.."

- Do not use overly complicated sentences (or invent words!)
  - "I am currently assessing X and reaching the determinating facts of what happens when I look into Y …"
  - "I will consider the effects of X on Y…:"

- Do not say "(famous) scientists did X" (or physicists, mathematicians, *etc…*). YOU are one of those now!
  - "Scientists did experiments and said that dark matter is made of space puppies."
  - "It has recently been suggested that space puppies are a possible candidate for dark matter."

- Do not include personal reflections ("I didn't know this before, but now I do."). That's the point of the research!
  - "My results were new to me!"

Tips for Improvement

- Be succinct! Say it in as little space as possible.
  "The methods that I will go through to figure this out is to analyze…"
  "I will analyze …"

- Avoid prefacing your actions.
  - "The purpose of this project…", "The point will be to…"
  - "This project will show…"

- Don't write a "recipe". Skip to the main point.
  - "First I will get the equation for the force from a book. Next I will type it in the computer and use the computer to solve it. After that I will plot F vs t on the computer. From that, I will look to see how F depends on t."
  - "I will study the time-dependence of the force…"

- Do not invent words or use overly complicated language.
  - "I digitially produced and analyzed a file which represents the average progression of the experimental data points of the experiment."
  - "A statistical analysis of the data suggests…"

- The thesaurus is your friend!

A Tale of Two Abstracts

Before:

Me and my friend Addison are doing a project on planting seeds in different kinds of soils to see which ones grow and which ones don't. The soils that grows the tallest plants will be the best kind of soil for that kind of plant. It will probably help us to provide more food out of plants and help supermarkets like Tjs and Ralph's. I will also see how extra dimensions will help the plants grow.

A Tale of Two Abstracts

After:

Impact of Soil Content Variance on Plant Growth in (d+1)-Dimensions

G. Mureika and A. Lastname

Understanding the relation between a soil's mineral content and plant development is becoming increasingly important in today's global market. This thesis will investigate the propensity for accelerated crop growth in the following media: dry sand, water, moist paper towels, and potting mix. Identifying soils that produce the largest agricultural yield in the least amount of time will have far reaching implications for addressing food shortages in developing countries. The impact of large extra spatial dimensions on plant growth will also be investigated, in order to evaluate the likelihood of such flora production at future high energy colliders.

For Next Week…

- Completed abstract and proposal due!

- Prepare a 1-2 page Powerpoint presentation detailing your thesis and the usual points:
  - **Introduction**: what are you doing?
  - **Methodology:** How will you do it?
  - **Goals:** what do you expect to find / how will it be different from what's already done?
  - **Significance:** Why is it important?
  - **References:** Fit in as many of your 5 (or more) refs you found