

Writing a Physics Thesis: Some Advice from Prof. Jones

So you are going to write a physics thesis? Good for you. An important part of science is conveying your discoveries to others and writing a thesis is an opportunity to sharpen those communication skills. This document is intended to help you begin a conversation with your advisor about the writing process. Any suggestions or advice here are to be interpreted in light of the one fundamental rule that governs all aspects of the thesis process:

In the end, what your advisor says is what matters. (Rule 1)

New results in science are typically communicated in journal articles. Journals, especially the more prestigious ones, often place length limits on articles. For example articles in *Physical Review Letters* are strictly limited to 4 journal pages (\approx 10 pages in normal manuscript form). Your thesis is not subject to such stringent limits, but as a scientist you will often need to present your ideas in an efficient and compact manner. A National Science Foundation proposal –outlining your ideas for 3 years of research - is typically limited to 15 pages. In scientific writing it is important to get to the point quickly. Now is the time to start practicing that skill. In writing your thesis you should strive to present your results clearly, but in an efficient and compact way. Think “short story” rather than “novel.”

It is natural to worry, as you sit down to begin writing your thesis, that you will never be able to write enough to produce a respectable thesis. Rarely is that actually a problem. More typically the problem is trying to say too much and not having sufficient time to properly edit and refine the presentation. Your main concern should be in identifying the important ideas and results that absolutely must be included for a reader to make sense of what you have done. Start with that; you can always add more material later. You have a very limited time to produce your written thesis and, as with any other kind of writing, editing and revision is an important part of the process. *You need to allow time for editing and revision.*

In an effort to encourage good scientific writing, the Physics Department has a requirement that you include in your thesis an executive summary of your work. In a space of 2 to 4 pages (keeping in mind Rule 1), you should explain to the educated reader the question you have pursued, the methods you have used to answer that question, and the status of your answer. In this context “educated reader” means a physics professor other than your advisor. You might well want to include a figure or two (which might also appear later in the document). This summary is the portion of the written thesis that is read by the entire department and thus plays a central role in the impression your work makes on the department. In addition, we sometimes recommend theses for consideration by outside prize committees who typically ask for just such a summary.

Most likely (see Rule 1) you will want to follow the executive summary with a more expanded introduction to the particular area of physics you have worked on. Your target audience here might be a student a year behind you. Your goal is to provide the reader, in a few pages, with the background to understand your project. Your advisor may identify specific topics that you should cover. Absent specific instructions, the general rule is to say what needs to be said but no more. Remember: you need to leave time for editing and revision.

One of the functions of the written thesis is as a record for “the next student” or your advisor, i.e. someone directly involved in the research who will want details that are not necessary to present to the general reader. You are encouraged to use appendices to record any such information. Examples might be computer codes, detailed operating instructions, details of supporting calculations, multiple figures showing data taken under slightly different conditions and the like. Segregating such material into appendices lets you present a complete record for your advisor (and the next student) and still make a compelling presentation to the general reader.

Figures play an important role in scientific writing. They are a powerful tool for efficiently and effectively conveying information. When I write a journal article I usually put the figures together first and then structure the text around them. That approach may or may not work for your particular topic, but you should give careful consideration to the figures and their placement relative to the text. The old saying that “a picture is worth a thousand words” applies here. If you think about the figures before you write, you might very well avoid writing and then deleting a thousand superfluous words!

When a scientific article is submitted to a journal, the editor normally sends the article to an outside referee for review. The referee is asked to comment on the style and content of the article. These comments go back to the authors who are expected to make revisions in their manuscript to address the referee’s concerns (or explain why they object to the referee’s objections!). The goal of the process is to produce a better final article. In the same spirit, your advisor will arrange for one of the other physics professors to give your thesis a careful reading. This “second reader” will provide comments, which you are expected to address (subject to Rule 1). For this process to be effective, it is essential that you give the second reader a complete version of the manuscript, one that has already been edited by you and your advisor. If the second reader is getting your rough draft, you’ve squandered the opportunity to get useful outside feedback on your work.

So how long should a thesis be? There is no hard and fast answer and it depends a lot on the nature of your particular project (see also: Rule 1). My advice is to start with the idea that the main body (excluding appendices) should be about 40 pages. You will probably end up going a little longer than this, and that’s OK; the point is to start low enough that you feel compelled to be efficient

and focused right from the start. Your goal is to produce a well-written, well-edited document. Volume often works against quality. Get to the point quickly, and then stop.