

Astronomy 401 Fall 2013 Guidelines for the Introduction

The assignment this week is:

Completion of the Introduction (approximately 5 pages), presenting background and justification for the paper. Both substantive and grammatical improvements will be undertaken in consultation with the instructor during the following two weeks while the student is beginning subsequent sections of the paper.

Some additional guidelines are in order.

The Introduction of a paper serves several purposes. Perhaps the most important goal is to convince the reader that the topic is important and interesting, and that this paper in particular is worth reading. In making this case, other objectives must also be met: the problem at hand has to be placed in the larger context of astrophysics, some basic data and theory are needed to frame the issues and controversies you will discuss in detail, and the basic structure of your discussion needs to be outlined.

The details of how you negotiate all of these aspects will depend on many things: the nature of your problem (is it more theory-driven, observation-driven?), the detail in current possible solutions (are they sketchy or detailed), and your own judgment as to how the material most logically fits together. This means that reasonable people can disagree about the best way to organize the discussion, i.e., there is no one right way. With that in mind, you will still want to strive to make your paper, and your Introduction, flow in a smooth, organized, and logical way.

In particular, you will want to consider including the following in you Intro-bearing in mind these are guidelines and not a one-size-fits-all set of rules:

1. **Structure: Hourglass.** In organizing a paper (or a talk), I find it helpful to picture the structure as an “hourglass” which begins with broad, general ideas and goals. The discussion then narrows to focus on specific data, theory, and analysis which develops the ideas further in a concrete way. Finally, the focus broadens again to place the new and detailed results back into a larger framework and evaluate what we have learned and where we will go from here. In light of this structure, the Introduction is meant to be broad-reaching, presenting the context and motivation for what you are doing, and then leading into the more specific analysis at the heart of the paper.

2. **Give context.** Give an idea of how your specific problem fits into the big picture of astrophysics. The more connections you can make with current ideas and trends, the more readers you will draw in. Recall that your intended audience consists of astrophysicists with an ASTR 406 background or slightly higher. Thus, you want to pitch to this level. Opening your paper with “Since the dawn of time, mankind has contemplated the Universe” is a bit grandiose and overly general, while opening with “Current Monte Carlo big bang nucleosynthesis calculations underestimate the uncertainties in $A = 7$ yields, particularly at the high eta values

avored by WMAP, due to the omission of potentially large systematic errors in absolute measurements of ${}^7\text{Be}$ cross sections” is far too narrow and technical for an opening! You will want to avoid either extreme, and use the Introduction to lead the reader from a general background to the more specific analysis you will be making.

3. **Historical highlights?** The Introduction is usually the best place to give any historical account, if you will even have any. If this is needed at all, it most naturally comes in tracing the history of your problem up to the present. Oftentimes, subjects of current interest have been long-debated, or were already hinted at in the past, before becoming a hot topic today. A brief mention (one or maybe two paragraphs) of early work such as this can serve to develop your ideas by showing how the problem has come into focus. This also can serve to show that the problem has a “pedigree” and has been of interest for some time. However, you need not feel that you have to give a full history, and you may not need to mention any history at all—the only reason to do so is to help frame and introduce your discussion, and/or to give credit to any researchers you have come to admire for pushing the problem forward.
4. **How technical?** You will need to mention some data and some theory in your Introduction. But the more technical discussion of both will appear later in the heart of the paper. Thus, your introductory discussion should be less technical. The idea is to give the reader an idea of where things stand, using language that is as accessible as possible (while still being specific enough to be meaningful). The reader will (we hope) want to find out the details in the body of the paper. So try to avoid redundantly giving all the detailed results before you are going to give them again later. This means that as a rule of thumb, equations and figures typically do not appear in the Introduction, but are saved until later, though exceptions can and do occur. Striking the right level certainly takes some practice, and the best way to learn is by doing it and getting feedback. Also, while you are reading review papers, notice how the introduction is worded and organized, and how it is different from the more detailed discussion that follows.
5. **End with an outline.** Finally, an Introduction usually ends with an outline of the rest of the paper. In practice, this is often done mechanically, as in “we present data in section 2, theory in section 3, analysis in section 4, and discussion and section 5.” This doesn’t really do much for the reader, who can flip through and see the section titles as easily as read them listed here. I find it more helpful when the outline is given as a narrative which helps the reader see how the sections will work together, as in “In section 2 we present the theory of big bang nucleosynthesis and its main result, the prediction of primordial light element abundances. In section 3 we will review the data which test this theory, namely light-element abundances and the procedures used to infer their primordial values. In section 4 we compare the data and theory and find a qualified agreement, and in section 5 we discuss the implications of our results and connections with other measures of cosmic

baryons.”

6. *References and Bibliography.* Please do include these, and please use the style of the Astrophysical Journal (ApJ), info about which can be found at the ApJ “Instructions for Authors” website, linked on the course webpage. Note that any ApJ articles you are using will naturally be in this style, so you can find examples there too.

I realize that this is a lot to think about, but if you can develop good habits now, they will pay off in the coming weeks. And that’s the point of this course, to help you really engage with all of these issues and try to address them over a semester. And it’s not like this goes away—as a working scientist you have to write all the time, for a whole range of audiences, and continue to grapple with how best to do this.

Please let me know if you have any questions. And finally, don’t let all of these suggestions paralyze you—do the best you can, and we will discuss how best to revise. That’s how everyone does it in the real world anyway!

Due date: The Introduction is due Monday Sept. 30. Please try to upload to Compass, but if that doesn’t go smoothly, go ahead and email your file. Again, it’s much better to get something turned in than to give me something perfect but late.