

Senior Lab Assignments 3 and 4

General:

To write a scientific paper is to tell a story. The most difficult part about it is to decide what story to tell. The actual experiment and measurements are very complicated, and a lot of stuff is seen and done which would not become part of a paper, any more than you would put every detail of your daily existence into an autobiography. You need to distill from your measurements a good story.

A good scientific story is focused on a particular, narrow topic. It is addressed to a specific audience, in this case your peers in this class.

Here is the job of each part of a paper.

1. Title: To describe the topic of the paper, and to get the appropriate audience interested.
2. Abstract: To describe the main results of the paper.
3. Figures and captions: To communicate the experimental and theoretical results of the paper. Also, schematic figures can be used to describe experimental apparatus.
4. Text
 - a. Introduction. To introduce the general topic and put the paper in the context of the literature.
 - b. Experimental methods. To describe your apparatus and experimental procedure so that a general reader can understand how your experimental results were obtained, and so that a reader in your field could reproduce your measurements.
 - c. Experimental data. To present your experimental data. Make sure to include relevant conditions under which your experiment was performed (for example, how long had the laser been turned on?)
 - d. Analysis. To compare your data with some theoretical model. This would explain the theoretical model you are using, and describe how you computed any curve fits.
 - e. Discussion. To discuss your results and analysis, and also to talk about any discrepancies between theory and experiment.
 - f. Conclusion. The last thing the reader will read. Discuss the significance of the work.
5. References: To acknowledge related work. If a theoretical result is derived elsewhere, you do not need to derive it yourself, but can simply refer to the appropriate source. In a short paper, it is especially important to make use of references to fill in details you don't have space for.

I like to write papers in the following way. I begin with an idea for an investigation. Then, I do the investigation, collect the data, analyze it. After this is done, I look

carefully at the data, and decide what story I want to tell. First, I get the figures together, so that I see what data I really have, what the theoretical fits look like, and so on. This helps to define the story. At this stage, the figures can be rough, but it is important to look at them carefully to see what is really there—which is usually different than what you imagined would be there. Then I put together an outline, title and abstract, along with figure captions.

Assignment 3: Title, abstract, outline, rough figures and captions.

The purpose of each part has been described above. The outline should be rather detailed at this point—ideally, it would consist of the topic sentence from each of the paragraphs in the paper. These topic sentences would be included under the various sections of the paper (Introduction, Experimental Methods, etc. . .)

Assignment 4: Paper completing what you did in assignment 3.

Ideally, this is a matter of filling in the outline. As I write, I usually find that the outline actually is not exactly how I want to organize the paper, and I will change it—but the outline was still very useful.

In writing the paper, the ideas should be exposed in a linear fashion, so that the reader is guided through step by step and does not need to backtrack. The units of organization here are the paragraph and the sentence. Each paragraph should have a clear focus, and describe one thing—for instance, the layout of an optics set-up, or the procedure you used to collimate a laser beam. Do not mix things that should be in separate paragraphs in the same one.

Each sentence should be short and to the point. Each sentence needs to do a job. That job should be small, and should be done only once (avoid repetition). If possible, try to use parallel sentence structure, to help the reader read quickly (the scientific literature is vast, and it is important to write things that can be read and understood quickly).

Other details:

Try to minimize the use of "we". It distracts the reader from the topic at hand.

When describing how something changes as a parameter is varied, describe it as a function of increasing parameter unless you have a good reason not to. For example, "As the spectrometer was scanned from 3000 to 5000 Angstroms, several spectral lines were measured."

The format for the paper is the same as that in Physical Review Letters. The guidelines for a Physical Review Letter can be found at <http://prl.aps.org/info/infoL.html>. There is a **Template** available for download here. Using this, you will automatically put your paper in the right format. There is also a **length limit**. With your paper, you must turn in a

length estimate, to show that the paper does not exceed the limit. The [form](#) for estimating the length of a paper is also available for download.