Lab Notebook – Observing Log Guidelines
ASTR 2401 Observational Astronomy
Texas Tech University

Lab reports are to be written in permanent ink your lab notebooks, but feel free to paste-in printed pages into the notebook. Accordingly, **please be as neat and legible as possible; I can't grade what I can't read!** Record your name and the course information on the cover. Each lab report will then be completed within this notebook. Lab notebooks need to be permanently bound, include a table of contents, and the pages need to be pre-numbered. A composition-style notebook is ideal.

 For each lab, the corresponding report should include the following (*clearly labeled*) sections:

1. Title and Information:
- Title of the lab with a corresponding entry in the table of contents at the front of the notebook. New labs should start on a left page. Organization and neatness count, it's ok to leave blank spaces/pages where needed
- Name & Date
- Names of your lab partners
- All writing in the lab notebook must be in ink. Correct mistakes by drawing a SINGLE line through the error, and neatly write the correction nearby

2. Purpose and Background:
As you begin your lab (or, preferably, before you begin it) you should ask yourself a couple questions:
- What is the purpose of this lab, or, what am I trying to determine?
- What do I already know about this subject?

In this section describe what the goal(s) of the lab is/are and why the lab is important to astronomy, and give a concise description of the astronomical ideas and physical theories relevant to the experiment. *Use your own ideas and words; do not just rewrite the assignment*. The assignment may state the goal of the lab is to teach you about some astronomy concept, but that's not necessarily the goal or purpose of the specific experiment you are performing!

3. Procedure and data collection:
3.1 Personal in-lab notes
As you perform experiments, make *detailed* notes in your lab notebook about what you are doing and why. These notes are primarily for your own reference. I will not grade the content of this section, but merely check that it exists. These notes do not have to be neat (but should be legible); they should before your own use. Your lab notebook will serve as a useful tool in the future if it's annotated.

3.2 Lab Report write-up of procedure and data collection

For this section in your lab report you should rewrite these notes in a clear, organized manner, as I will be grading these for content. It's important to specify when you deviate from the guidelines. All observations and measurements should be reported in a clear fashion with all details necessary for understanding the data (units, uncertainties, etc.). I should be able to repeat the lab/experiment in the same manner you performed it from this section. For observing labs, I expect an annotated log of all exposures taken, including calibration frames to be included in this section.

4. Data Analysis:
Quantitatively present your results. (If you have taken any measurements.) When applicable, present all data in tables and/or graphs. When plotting data, choose an appropriate display and *make sure to label everything* (title, axes labels, legend if appropriate, and a description either with the plot or in the text of your report) and present everything *clearly*. Feel free to use plotting software of your choice. This also where you can tape in your sketches and images. If you turn in your images/computer data on flash drive or a web archive, the location and filenames should also be listed here. Note: This section may not apply to all labs and may be omitted if it is not relevant, if in doubt - ask.

5. Results Discussion and Questions:
Now, qualitatively present your results. In this section, put your results into words (especially if you do not have numerical data). Please *clearly* answer all assigned questions from the lab, as your answers to these questions will factor into your lab grade! Show any calculations you make.

6. Error Analysis
When applicable include in the discussion a section describing possible errors. While it is instructive to describe what you may have done wrong, use scientific reasoning to think of error associated with the experiment itself. "Human Error" by itself is not an appropriate description of error. If you have done something wrong, make a note of what and how that could be avoided next time, and estimate the magnitude of the error associated with your mistakes. Try to think in terms of the lab equipment and environment. If appropriate, use the data analysis skills learned in class to quantify error. Note: This section may not apply to all labs and may be omitted if it is not relevant, if in doubt - ask.

7. Conclusion:
This section should sum up the experiment and synthesize the data. Some questions that may be helpful in writing your conclusion:
- Did you reach the goal of the experiment?
- Do your results make sense? For example, if you are trying to determine the speed of light and come up with 5 meters per hour, then you can suspect a mistake somewhere, and try to identify/discuss that here.
- How do your results compare to what you might expect? (Think about what's already known on the subject, you should have written about this in your "Background" section.)
- Are there any trends or patterns in your data? If so, you should discuss them here!

• What future work could be done to revise your results or make them better? Or, what could be changed in the experiment you performed to make it more accurate?

Discuss the results that you obtained from a more critical standpoint. Did they make sense? Did they help illustrate an astronomical theory? If not, what went wrong? What could be better? If they do make sense, what meaning do your results have? Finally, write a couple of sentences that state the conclusion you can derive from your results.

8. Data Access

With your lab notebook you should turn in all your raw and processed data/images, either on a flash drive or a easily access online file storage site (Dropbox, Box, Google drive, etc.). Just like your notebook, the filenames and directory structure should clear and easy to navigate.

A few more notes...
You may find a graphing program (like Microsoft Excel, Google Documents, MATLAB, Matplotlib, or Wolfram Alpha) to be useful for inserting plots and tables into your lab reports. Feel free to print them out and tape them into your lab reports as needed.

Please strive to be both *clear* and *concise* in your work. Include as much information as is necessary and nothing more. There is no required length for the sections of the report, so use your best judgment in determining how much you should write.

Lab Notebook – Observing Log Grading Rubric

Section	3 Points	2 Points	1 point	0 Points
Title and Information, Neatness. Organization	Neat and well organized, entry in table of contents, title, name, date, and names of lab partner	Few minor mistakes, one or two instances of sloppiness	Some items missing, most or all items hard to read, chaotic or confusing organization, corrections not clear. Sections not clearly labeled	Many items missing, completely illegible entries, no listing in table of contents, no lab partner name[1]

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[1] Failure to identify/acknowledge lab partners is a breach of academic honestly.

Section	3 Points	2 Points	1 point	0 Points
Purpose and Background	Clear and concise writing. Student can articulate the background material on purpose well	Generally readable, and demonstrates understanding, but lacks detail, or is too long/wordy, few writing errors	Incomplete, hard to read, lacking detail, numerous spelling/grammar/citation mistakes, student does not demonstrate understanding of the lab material	Missing
Procedure and Data Collection	Procedures and notes are complete and free of errors, log is well annotated.	Data reproducible from notebook alone, despite minor mistakes, log is complete but missing some annotation	No notes taken during lab, log incomplete, procedures incomplete, reproducing the lab/data from notes impossible	Missing
Data Analysis[2]	Graphs/images clearly labeled and captioned, results are neatly laid out and clear	Graphs/images complete, but lack complete and clear descriptions or contain multiple errors	Graphs/images missing or uncaptioned, axes not labeled. Data archive/locations of files missing	Missing
Results and Discussion	Clear and concise writing. Lab questions are complete and correct	Generally readable, and demonstrates understanding, some lab questions omitted or wrong	Incomplete, hard to read, lacking detail, numerous spelling/grammar mistakes, many lab questions missed	Missing
Error Analysis[2]	Clear discussion of multiple error sources	Some thought given to at least one source of error	Citing "Human error" without detailed discussion of a specific incident	Missing

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[2] May not be required on all labs.

Section	3 Points	2 Points	1 point	0 Points
Conclusion	Conclusion matches the data and analysis in the rest of the report, clear and well written	Conclusion is consistent with evidence from lab, but is vague or incomplete	Conclusion is unfounded, or does not agree with the evidence presented in lab report	Missing
Data Access	Data is accessible and easy to navigate with clear/useful filenames	Data is accessible, but hard to access/navigate	Files missing, incomplete	Missing