Stony Brook University
Department of Physics and Astronomy

PHY 133 Lab

How to LaTeX

An introductory guide:
Learn to write in the language of science!

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Contents

1 What is LaTeX?

LaTeX is the typesetting system of the scientific community. It allows authors to create publication-quality papers without having to worry about formatting. Adding a title page, a table of contents, perfectly formatted equations, figures, tables, lists, and references is simpler in LaTeX than a word processor like Microsoft Word. This being said, it may take you a little while to get used to the feel of LaTeX and become comfortable with using it.

You can learn more about LaTeX here: https://www.latex-project.org/.

This guide will show you everything you need to use the lab report template and create publication-quality lab reports.

2 Some general information

LaTeX formats everything using macros: you give the computer a command, and it knows what instructions to execute. For example, if you type `\textbf{Hello!}` it will print '**Hello!**'. The command `\textbf{}` prints everything within the two curly brackets in bold.

If you look at the template, you will see this nice formatting in action. You don't have to worry about the commands because they are already in the template for you, but it's always good to know how it works.

3 How can I use LaTeX on my computer?

There are many different ways to use LaTeX, but the easiest is to make an account on overleaf.com. Use your Stony Brook email address to make the account.

You don't get unlimited space, but it should be enough for a year of lab reports. If you need more space, you can download a project and save it on your computer.

To create a new project in Overleaf using the lab report template:

1. Create an Overleaf account at `overleaf.com` using your Stony Brook email address
2. Download the *lab_report_template.zip* file to your computer - you can find it on Blackboard
3. Upload the project - the ENTIRE .zip file - in Overleaf

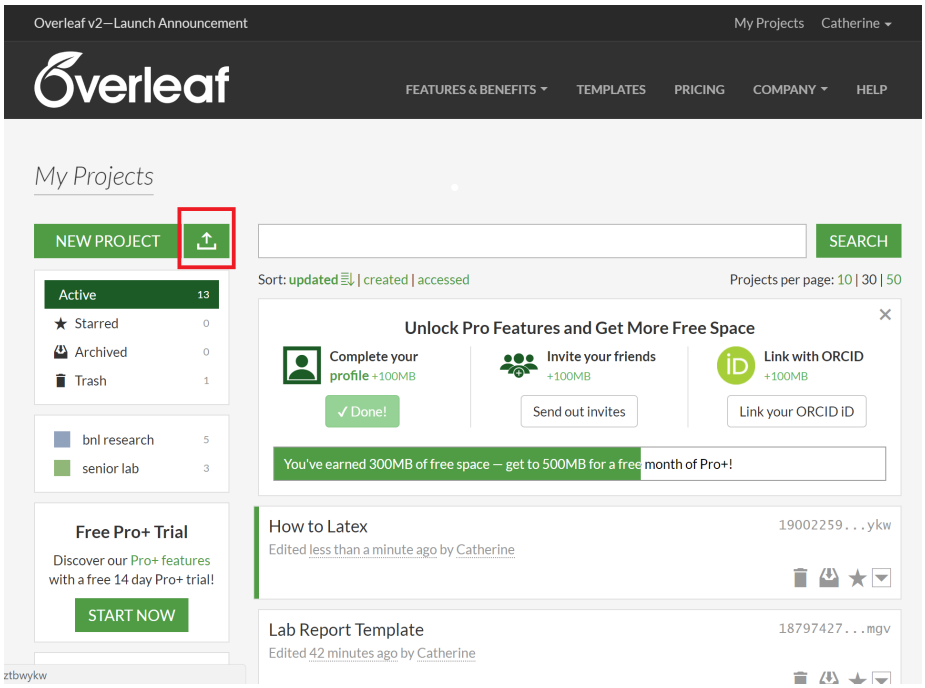

Figure 1: Click on the icon in red and upload the zip file (not in protected mode, then you can't edit it).

Now you can edit the template to have the text you want.

4 How to use the lab template

When you first upload your Overleaf project, you'll see something like this:

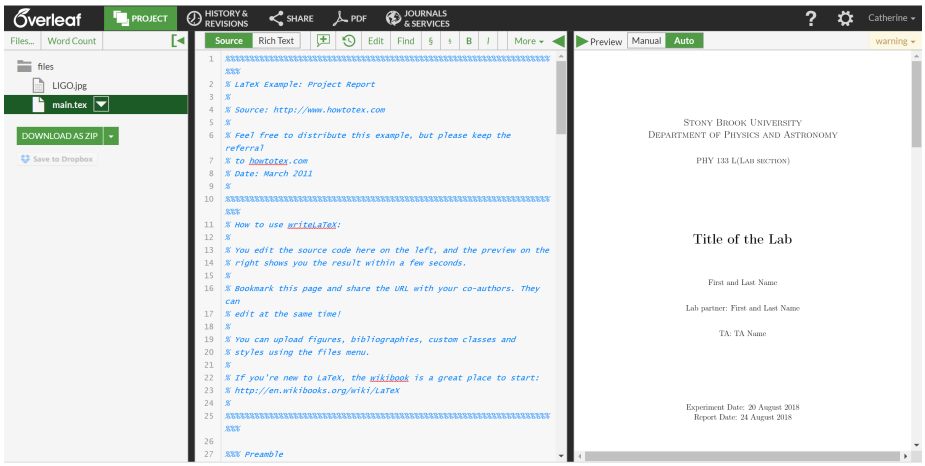

Figure 2: The Overleaf editing environment

The section all the way on the left is the **Project** section. It lists all of the files that are part of the project: images, .tex files, etc. How to upload a file is discussed in Images. To open and close the **Project** section, click the Project icon (highlighted in green next to the Overleaf logo).

The middle section is the source code. It is where you will type in all the commands, text, equations, images, and tables that you want LaTeX to format.

The section on the right is the formatted pdf of your document. It automatically updates as you type! It will also tell you if there is an error in the source code, meaning that you typed something that the computer doesn't understand. Sometimes, this is because the document is rendered faster than you can type and finish something. Other times, it is because you forgot a bracket or incorrectly used a command. If you can't find the solution by googling, please ask your TA.

5 Title page

The title page of the lab report is created by the commands shown in Figure 3. The comments in blue tell you what you need to change in the red boxes to make the template your own.

```
%%% Begin document
\begin{document}

\begin{titlepage}
    \centering
    {\scshape\LARGE Stony Brook University \\ Department of Physics and Astronomy \par}
    \vspace{1cm}
    {\scshape\Large PHY 133 L99\par} %Replace this with your lab section number
    \vfill
    {\Huge\bfseries Title of the Lab\par} %Replace this with the lab title
    \vspace{2cm}
    {\Large First and Last Name\par} %Replace this with your name
    \vspace{1cm}
    {\Large Lab partner: First and Last Name\par} %Replace this with your lab partner's name
    \vspace{1cm}
    {\Large TA: TA Name\par} %Replace this with your TA's name
    \vfill
    {\Large Experiment Date: 20 August 2018\par} %Also replace these dates!
    {\Large Report Date: 24 August 2018\par}
\end{titlepage}
```

Figure 3: What to edit in the title page section. Change the text in the red boxes to what you need it to be.

6 Sections

The sections of the lab report are:

- Introduction
- Procedure
- Data Sheet
- Data Analysis and Results
- Discussion and Conclusion
- References

The lab report template has information about what to put in each section. If you need more specific instructions or have questions, please don't worry - just

ask your TA and they'll be happy to help!

You should delete the text of each section in the template and replace it with your own.

7 Labels

LaTeX will keep track of all of your Figure and Table and Equation numbers for you! Just add `\label{label_name}` when you define such a thing as shown in the examples below, and LaTeX will keep track of the numbering.

The convention for label naming is to use 'fig:figure_name' for naming Figures, 'tab:table_name' for Tables, and 'eq:equation_name' for Equations.

To refer to a Figure, Table, or Equation, simply type `\ref{label_name}` where you want the number to go.

8 Equations

8.1 How to type an equation

Equations are quite possibly the nicest thing about LaTeX. They let you format fractions and exponents without having to worry about physically inserting and placing all the symbols yourself. LaTeX knows how to print all kinds of characters in different languages - especially helpful in physics, which often uses greek characters. Some of the common commands are:

These commands can be combined to make more complicated equations. Some examples are in the lab report template.

Command	Formatted Printout
`\frac{a}{b}`	$\frac{a}{b}$
`a_{b}`	a_b
`a^{b}`	a^b
`\pi`	π
`\sigma`	σ
`\pm`	$\pm$

Table 1: Common commands used to format equations.

If you need to look up the command for a symbol, this website lets you draw the symbol, and it will tell you what command to use:
http://detexify.kirelabs.org/classify.html.

8.2 How to insert an equation

LaTeX needs to know that an equation is being written in order to format it properly. To do this, we use special symbols to tell LaTeX that we are using an **equation environment**. To create an in-line equation like this: $x = a^b + c$, type the equation between dollar signs. To create a numbered equation like this:

$$x = a^b + c \tag{1}$$

you will need to use a slightly more complicated:

```
\begin{equation}
x = a^b+c
\label{eq:example}
\end{equation}
```

9 Images

You will need to insert an image of your lab setup, lab notebook, and graphs. To do this, copy and paste the lines (shown in Figure 4 below) in the lab template that produces the image of the LIGO detector. Replace the text in red boxes with your own text - the comments in blue should help you.

```
\section*{Procedure}
Describe the equipment you used in the lab. Include a picture of the setup here (if you are using \LaTeX, upload your
image and include it). An example is shown in Figure \ref{fig:graph}.

%Upload your own file and insert a picture here!
    \begin{figure}[h!]
        \center{\includegraphics[width=\textwidth]{LIGO.jpg}} %Change the file name!
        \caption{A cool picture of the LIGO detector, where gravitational waves were detected for the first time,
from: https://www.ligo.caltech.edu/news/ligo20170927} %Also change the caption!
        \label{fig:graph} %Change the label so you can reference the figure.
    \end{figure}

```

Figure 4: The Overleaf editing environment

The three things you will have to change are the filename, the caption, and the figure reference name.

First, you will need to upload your image. Do this by clicking Project → Files... → Upload from... Computer. Then choose the file to upload. It will be in the project section of Overleaf.

The caption tells the reader what they are looking at. The rule of thumb is, the reader should be able to tell what the figure is showing without having to read the lab report at all.

You can add a label (in this case, the label name is fig:graph) so you can reference the Figure later.

10 Tables

A good way to present your data is in tables. Making tables in LaTeX is a bit complicated, so for now just use this LaTeX table generator: https://www.tablesgenerator.com/. There are options to copy and paste table data, import a .csv file (you can save excel spreadsheets as this format), or insert the numbers by hand. Then you can just copy and paste the code generated right into your .tex file!

The commands that created the table in the lab report template is shown below in Figure 5.

```
Table \ref{tab:data} is an example table with some made-up student data!

\begin{table}[h!]
\begin{tabular}{|c|c|c|} % c for centered, l for left-justified, etc.
\hline %Put a horizontal line
Student Number & Measured Value of Velocity (m/s) & Error (m/s) \\
\hline
1              & 10.3                             & 0.2         \\
2              & 9.7                              & 0.4         \\
3              & 10.2                             & 0.1         \\
4              & 9.8                              & 0.3         \\
\hline
\end{tabular}
\caption{Table with made-up student data of measured velocity and error.}
\label{tab:data}
\end{table}
```

Figure 5: A basic table in LaTeX made using the online table generator.

There are some options that you can use to make your table look nicer. You can add a horizontal line to separate cells using the `\hline` command as shown in the green box. The red box tells how to format the table. 'c' tells LaTeX to center the text in each cell of the table. Instead, you can use 'l' to left-justify the text or 'r' to right-justify it. The vertical lines between the 'c' s tell LaTeX to

put a vertical lines between the columns on the table.

11 Saving Your Lab Report

Overleaf automatically saves your work! To save your lab report as a pdf, which you will need to do in order to hand it in and print it, click the PDF icon on the top, near the project button. This will save your lab report to the Downloads folder of your computer.

12 History and Revisions

A nice feature of Overleaf is that you can revert back to and compare to previous versions of your lab report. Save a version by clicking on the **History and Revisions** button, and add a descriptive label to the current version of the project. This way, if you mess up terribly, your previous work can be recovered.