

# PHYS4102 Lecture 6

## Spring 2024

Wing To

Department of Physics, Physical Sciences and Geology  
California State University Stanislaus

2024/01/14



- 1 Using LaTeX on Overleaf.com
- 2 AIP Paper Formatting
- 3 LaTeX Tips and Resources

# What's LaTeX?

Typesetting system created by Scientists for Scientific Writing and Publications.

## The Advantage of LaTeX versus WYSIWYG Word Processors

- 1 Science Community Standard: All Science paper publishers accepts LaTeX for their submissions, some does accept Word docx but they have to be in a particular format.
- 2 Easy to have a uniform format with templates. Since you're essentially writing codes that programs a computer to produce a document. The code itself can be copied over from one document to another, one machine to another and produce the same exact document. This avoids software, software version and operating system dependency on the document.
- 3 Its really designed for scientific writing. There are built-in functionality to produce equations, caption figures, create tables and generate citations.

# Overleaf



Figure 1: Overleaf.com

LaTeX before 2010 was more difficult to use because you have to install the software into your computer to "compile" the LaTeX codes to produce your document. Due to the variety of computers and operating systems, the instruction might or might not work right away.

This changes in 2010 when Overleaf and other websites similar to them came out.

You type into a box on your web browser and the code is compiled on Overleaf's server and produce the PDF for you to preview and download.

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# American Institute of Physics Paper Template

The AIP has a paper publication template on Overleaf.

To find it, click on New Project → View All → Search for AIP.



Figure 2: AIP Template

You can submit the papers you write in this class the be published by the AIP without doing any editing.

This is exactly the format they want you to submit your paper!

# Title

- ❶ This is the link to my version of the template.  
<https://www.overleaf.com/project/65c3fa4cccbc80c4bf26d05d>
- ❷ The title is the title of your paper. This should be around 10-20 words.
- ❸ Try not to use any special characters because it would be used in citation in the future.
- ❹ If you only want 1 line on your title, you can remove the slashes in the title code.
- ❺ Change the names of the Author, you're the 1st author, your partner is the 2nd author.
- ❻ Remove the affiliation unless you have 2nd school.
- ❼ Put the 1st author's email address.

# The Abstract

The abstract is the usually the first thing you have to submit to a publisher or conference. It should be the last thing and hardest part of the paper to write. It is used advertise your paper or talk. People will read the abstract and decide whether or not your work is worth their time and sometimes money.

The abstract must be SHORT. One short paragraph at most.

- 1 The measurement you are making.
- 2 The method, instrument or technique you're using to make your measurement.
- 3 The results of your measurements WITH the uncertainties.

Let's look at a few abstract.

Go to [library.csustan.edu](http://library.csustan.edu) Advanced Search, Title: Boson 125, Author: "W. To" Let's read through the abstract.

Go to [arxiv.org](http://arxiv.org) Search for "LUX reanalysis".



# Introduction

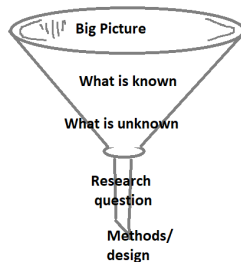


Figure 3: The funnel structure for introduction of a paper.

- Should be easy to understand by your **audience**
- Think about the funnel structure. Big Picture, Known, Unknown, Question, Method.
- Narrow down to the pertinent content AS QUICKLY AS POSSIBLE.
- Should be readable by anyone with a scientific background.

# Introduction Examples

Let's look at a few introductions:

Go to google and search "Electrodynamcis of moving bodies" Let's read through the introduction. Look for,

- Big Picture
- What is Known
- What is Unknown
- Research Question
- Method

Something less familar...

Google Pubmed PMC4709266

# Experimental Setup and Procedure

Let's look at an example of Setup.

- Go to arxiv
- Search for EOS: a demonstrator of hybrid optical
- Jump to section III: Detector Design
- Description of all "Major" components in your experiment
- A diagram is nice.
- Specifications the major components that ARE RELEVANT to the science goals.
- Citation for the datasheets (usually weblink) to all the major components.

## Experimental Setup and Procedure 2

The procedure is to document what YOU DID.

The idea is to allow someone else with the same setup to repeat your experiment and get the same results (statistically).

- Go to arxiv
- Search for Calibration reconstruction analysis LUX dark matter
- Jump to section III: DATA ACQUISITION AND REDUCTION section A & B
- Start from how you connect and turn on the equipment.
- Work through how you collected the data.
- Process diagrams are nice here. Easy templates on Powerpoint/Google Sheets
- Go up to the point where the data is saved / written down.
- Upload your data to a publically accessible site. [github.com](https://github.com) for small files.

# Analysis

- Go to arxiv, Search for Calibration reconstruction analysis LUX dark matter
- Jump to section C. The LUX data processing framework
- Start with a description of the raw data. What's does each row and column represent? the units?
- Describe how you processed the data, making cuts, converting units, throwing out junk data.
- Show exactly how you turn your data into a plot, result, parameters you found. See Example in Module 1.
- Make your plots, figures, tables with Title, Labels, Units, Captions.
- Someone is suppose to be able to repeat exactly what you did to the data.

## Analysis 2

This is there will be a lot of equations. The equation must flow WITH your paragraph.

Newton's second laws, Eq. 1, governs the dynamics of objects in classical physics. The left hand side is the vectorial sum of all forces,  $\Sigma \vec{F}$ , while the right hand side is the acceleration,  $\vec{a}$ , on an object with mass,  $m$ .

$$\Sigma \vec{F} = m \vec{a} \tag{1}$$

However, Newton's law breaks down at relativistic speed and at the atomic scale where Quantum Mechanics must be taken into account.

- State the results your obtained WITH the uncertainties.
- Include the permanent link to the github analysis code at the end.

## Visual Editor

Click to Visual Editor instead of Code Editor on the top of the middle box.

Open Excel or Google Sheet. Copy the rows and columns you want in your paper. Paste it into the Visual Editor.

Semester	Course 1	Course 2	Course 3	Course 4	Course 5
F24	Modern	Math			Elec
S25			EM	QM	Elec
F25	Modern	Math	A&D	CM	Elec
S26			Exp	Therm	Elec
F26	Modern	Math	EM	QM	Elec
S27			A&D	CM	Elec
F27	Modern	Math	Exp	Therm	Elec
S28			EM	QM	Elec
F28	Modern	Math	A&D	CM	Elec
S29			Exp	Therm	Elec
Total	5	5	9	9	10
38 courses required over 5 years					

# Conclusion

The conclusion is a discussion of your result. This discussion typically includes:

- Restate your results with uncertainties with a description of the scientific significance of the result.
- Is your result reasonable and within uncertainties of the expected?
- Is there accepted or theoretical values you can compare to?
- Is there anything you would do differently if you were to repeat this experiment?
- Discussion on the systematic and/or statistical uncertainties in your experiment.
- What are the applications or future experiment that can be used with your results?



# Citation

Citations and References is how scientist build on each other's work. Typically a journal article is about 4-5 pages long. You cannot give a review of all Particle Physics AND write your experiment, data analysis and results on a short article! Experiments even breaks up large results into sub-papers so one can be cited to each other. Example from LUX:

- Weakly Interacting Massive Particle search result
- Exp. Setup, Calibration, Simulation, Reconstruction, Trigger ...
- As well as the original dark matter idea from Fritz Zwicky in 1937.

To add a citation, go into the .bib file.

Edit the information for the article, book, website you are citing.

Use slash-cite{einstein} to make the citation.

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③ **LaTeX** Tips and Resources

# How to $\text{\LaTeX}$

- Don't Panic!!!!!! Be Patience!!!!!! Read the doc or help page carefully BEFORE typing in the codes yourself.
- LaTeX error messages is cryptic but becomes understandable with PRACTICE. More you learn the easier it gets!
- Make small changes and recompile OFTEN!
- Overleaf's own documentation, <https://www.overleaf.com/learn>
- Latex Primer from Colorado.edu,  
[https://www.colorado.edu/aps/sites/default/files/attached-files/latex\\_primer.pdf](https://www.colorado.edu/aps/sites/default/files/attached-files/latex_primer.pdf)
- Physics Forums, <https://www.physicsforums.com/help/latexhelp/>
- search for "How do I do -blah- in LaTeX?"
- Useful sites are Stackoverflow, StackExchange, if you can't find something on the stack, sometimes reddit has some discussion.
- If you have time, Dr. Bazett's LaTeX channel.  
<https://youtu.be/Jp0lPi2-DOA?si=F8-r3ZarL9L61P0C>