Senior Laboratory

PHYS 493L, Fall 2025

Lab Time: Tuesdays & Thursdays, 8am-10:50am

Lab Location: PAIS 1417

Lectures and Group Meetings: (most) Tuesdays,

10am-10:50am in PAIS 1405

Instructor: Tara Drake

Email: drakete@unm.edu

Offices: PAIS 2234 and CHTM 118B

Teaching Assistant: Rukhshana Parvin

Email: rparvin@unm.edu

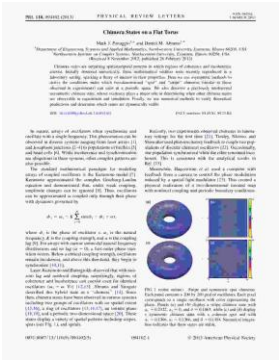
Manuscripts/Lab Reports

Each student produces a **separate** journal-style, manuscript based on their experiment.

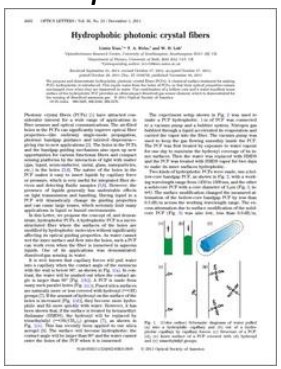
Should follow the style of a scientific journal.

- See Optics Letters or Physical Review Letters
- LaTeX template will be provided.

Phys. Rev. Lett.



Opt. Lett.



Next lab report is due **Thursday**, Sept 18, **before class**. Please submit **by email**.

Figures

IMO, the make-or-break of a paper.

---

1. All axes have labels and units.
2. Figure caption
   - Separated from main text (standard journal format)
   - Enough detail that the main concept is clear without reference to text. A reader should be able to answer, “what measurement is this showing?”
3. Figures have numbers (Fig. 1, Fig. 2) and at least one referral in text.
   - If there is Fig. 1a and Fig 1b, both appear in text separately.
4. Text in figure (labels, etc.) is big enough to read (similar in size to text).
5. If figure is taken from somewhere, “Reproduced from []” must be in caption. (Please do not copy setup diagrams from lab guides—instead make your own.)

Figures

IMO, the make-or-break of a paper.

---

1. **All axes have labels and units.**
2. Figure caption
   - Separated from main text (standard journal format)
   - Enough detail that the main concept is clear without reference to text. A reader should be able to answer, “what measurement is this showing?”
3. Figures have numbers (Fig. 1, Fig. 2) and at least one referral in text.
   - If there is Fig. 1a and Fig 1b, both appear in text separately.
4. **Text in figure (labels, etc.) is big enough to read (similar in size to text).**
5. If figure is taken from somewhere, “Reproduced from []” must be in caption. (Please do not copy setup diagrams from lab guides—instead make your own.)

Abstract

How reader decides if your paper is worth their time!

The abstract contains a summary of your manuscript:

- It is short (~250 words).

1. Briefly state the motivation and give context for the work (~ one-two sentences)
2. Problem statement/statement of work (~one sentence)
3. Statement of methodology and results (with errors)
4. Relevance of results to your field, other disciplines, or the general public (depending on the journal's audience)

(This is the "long version" of an abstract.)

- Completely encapsulates your paper

Abstract

Other abstracts you will see:

Variation 1

1. Problem statement/statement of work (~one sentence)
2. Statement of methodology and results (with errors)
3. Relevance of results to your field, other disciplines, or general public (depending on the journal's audience)

Variation 2

1. Briefly state the motivation and give context for the work (~ one-two sentences)
2. Problem statement/statement of work (~one sentence)
3. Statement of methodology and results (with errors)

But we practice the long version because:

- It is easily reduced to the other forms.
- It works great for talk/conference abstracts (i.e. independent of a paper).

Manuscripts

Main sections (see guide in class website for specific details)

- **Abstract**
- **Introduction**: motivation, background and summary of experiment
- **Methods**: description of experimental methods and **calibrations**
- **Data**: present the data, use plots or/and tables
- **Results and data analysis**: describe how the data analysis was done and present your results with uncertainty and error analysis
- **Discussion**
- **Conclusion**
- **References:** Pick a consistent format. If you don't know one, use this:

  A. Author, B. Coauthor, C. Lastauthor, "Title," *Journal using standard abbreviation such as Nat. Phys.* **Volume,** first page–last page (year published).
- **Appendix if necessary**

Writing in LaTeX

Your lab reports should be written using LaTeX typesetting language.

There are many LaTeX editors. Overleaf is probably the simplest if you are starting out:

- Open overleaf.com
  - Create an account if you do not have one.
- Upload the files from “PRL template v2.zip”
- This document should help with formatting equations, tables, figures, etc.

To do:

Create an overleaf account and upload the PRL template and other LaTeX doc.

Use the template to create a document for manuscript 1.

Common error #1: formatting equations

1. An equation is a sentence or part of a sentence. As such, you should have the text around it read something like:

   …the optical frequency, ν, is given by

   $$\nu = c / \lambda ,$$

   where c is …

2. All variables used in any equation must be defined in the text. (It can be earlier for a previous equation, if the variables are the same.)

Common error #1: formatting equations

1. An equation is a sentence or part of a sentence. As such, you should have the text around it read something like:

   …the optical frequency, ν, is given by

   $$\nu = c / \lambda ,$$

   where c is ….

2. All variables used in any equation must be defined in the text. (It can be earlier for a previous equation, if the variables are the same.)

Common error #2: format for figure captions

(Grab a published paper from those provided.)

Common error #2: format for figure captions

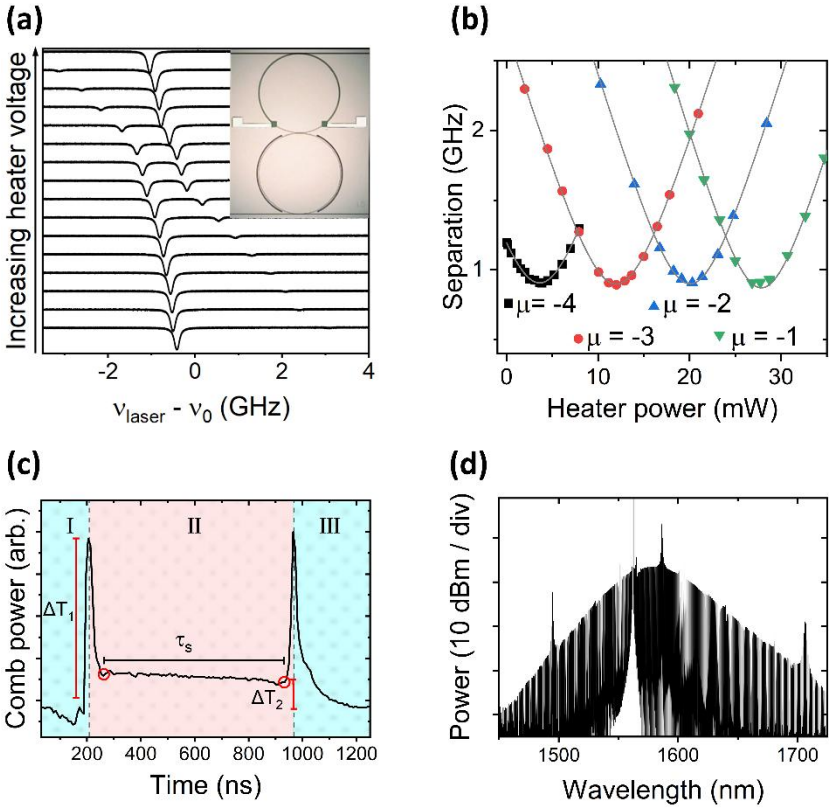


Figure #. Title. (a) Title. Complete sentences. (b) Title. Complete sentences. (c) Title. Complete sentences. (d) Title. Complete sentences.

Common error #2: format for figure captions

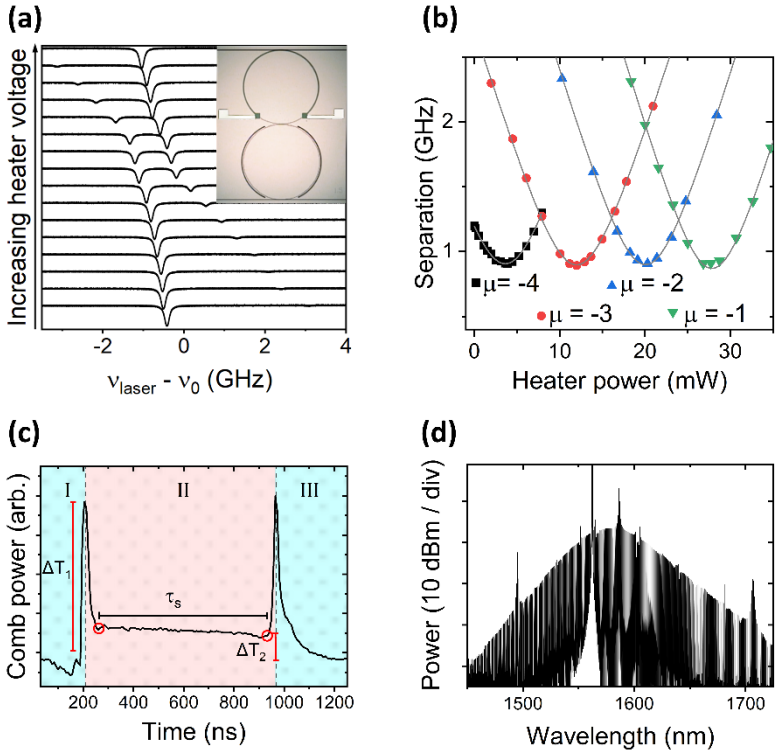


Figure 3. Coupled resonator details. (a) Avoided mode crossing of two modes in the main and auxiliary resonators, as seen in pump laser transmission. The inset is a micrograph of the coupled Si_3N_4 microring resonators. The main resonator is the bottom ring, and the top ring is equipped with a resistive heater. (b) Measured separation of four main-auxiliary mode pairs nearest to and red of the pumped mode as a function of power dissipated in the heater. (c) A short-lived soliton generated using fast laser sweeping. The soliton lifetime (τ_s) is shown. (d) Spectrum of a long-lived soliton, achieved with optimization of laser sweep parameters.

Common error #3: the final paragraph of the introduction section

Grab a published paper from those provided.

Let’s go around the room and each read this paragraph.

Common error #3: the final paragraph of the introduction section

Format/formula for the statement of work paragraph found in the intro section of a paper:

[In this work, we /Here, we demonstrate / In this paper, I / etc.]

+

STATEMENT OF WORK (a full summary in one sentence).

+

Sentence describing details in part 1.

+

Sentence describing details in part 2. (continue as needed)

+

Sentence explaining methodology ("Using Fourier analysis, we find the fringe rate of our interferometer and use this to calibrate…")

+

Sometimes a victory sentence!

Common error #3: the final paragraph of the introduction section

Format/formula for the statement of work paragraph found in the intro section of a paper:

[In this work, we /Here, we demonstrate / In this paper, I / etc.]

Note that researchers don't usually say, *In this "experiment"*. Why?

+

STATEMENT OF WORK (a full summary in one sentence).

+

Sentence describing details in part 1.

+

Sentence describing details in part 2. (continue as needed)

+

Sentence explaining methodology ("Using Fourier analysis, we find the fringe rate of our interferometer and use this to calibrate…")

+

Sometimes a victory sentence!

Common error #4: Formatting around units, numbers, etc.

1. Put a space between the number and the units.

   10.5 cm

   ~~10.5cm~~

2. Units are not italics.

   14 µm

   ~~14 *µm*~~

   ~~14 *µm*~~

3. Leading zeroes are always included (if there's a decimal and the number is < 1):

   0.7 degrees

   ~~.7 degrees~~

   0.7 ± 0.1 degrees

   ~~0.7 ± .1 degrees~~

Common error #5: Verb Tense

Use the present, active tense for most/all of the paper.

"In this work, I demonstrate a technique for…"

Not

"In this work, I will demonstrate…"

Nor

"In this work, I have demonstrated…"

The one exception I will overlook is the past tense in the conclusion section. (This is more common to see in the literature.)

To do:

Create an overleaf account and upload the PRL template and other LaTeX doc.

Use the template to create a document for manuscript 1.

Examples of Abstracts…

Abstract

How reader decides if your paper is worth their time!

The abstract contains a summary of your manuscript:

- It is short (~250 words).

1. Briefly state the motivation and give context for the work (~ one-two sentences)
2. Problem statement/statement of work (~one sentence)
3. Statement of methodology and results (with errors)
4. Relevance of results to your field, other disciplines, or general public (depending on the journal's audience)

- Completely encapsulates your paper