Course Syllabus Fall 2023
Experiments in Modern Physics - PHYS315
(alpha release subject to change)

Instructors

Dr. Aaron McGowan
he/him

Email: ammspsa@rit.edu

OfficeHours:
Mon 10-1 in Carlson 2230/2226/
A110/A220
Fri 10-11 in Orange 1331

Dr. Michael Pierce
he/him

Email: mspsps@rit.edu

OfficeHours:
TBD

Teaching Assistants

Ollie Yakimow (they/them)

Nathan Klein (they/them)

Electronic communication policy
We will check email/Discord when available during work hours (9-5) and will attempt to respond to your question within 24 hours during the week. Any emails sent over the weekend may not be responded to until Monday.

Discord

If you have a question about the lab, or just a physics question in general, please use the Discord channel before email. If you have a general question just use the channels, but you are also welcome to DM the instructors or TAs as needed. We will be checking it so hopefully if you have a question it will be answered rather quickly. It is a requirement of this course that you join the Discord server, and will be reflected in your participation grade.

Further, your fellow students are a better resource for answering questions than you could ever imagine. When used correctly, you can all help each other when you get stuck with the data analysis for the experiments. The thing you are stuck on other people have probably already figured out! It's also an invaluable resource for sharing Python and LaTeX tips and tricks.

Class Meeting Times

Lecture
Gosnell 1174 Friday 9:00 – 9:50 am

Lab
All labs are in Carlson 2230/2226.

L1:	McGowan	Monday	2:00 pm – 4:50 pm	&	Friday 12:00 pm – 12:50 pm
L5:	McGowan	Tuesday	11:00 am – 1:50 pm	&	Friday 1:00 pm – 1:50 pm
L2:	Pierce	Wednesday	2:00 pm – 4:50 pm	&	Friday 2:00 pm – 2:50 pm
L4:	McGowan	Thursday	11:00 am – 1:50 pm	&	Friday 4:00 pm – 4:50 pm
L3:	McGowan	Thursday	2:00 pm – 4:50 pm	&	Friday 3:00 pm – 3:50 pm

Final Project

Presentation given on one of the lab experiments, to be given during the last scheduled lab time.

Lab reports due dates

TBD

Grading

Your final semester grade will be computed from:

65%	Digital lab notebooks (of which 15% is pre-lab and check-in tasks)
5%	Lab report first draft
10%	Lab report second draft
10%	Lecture/Participation
10%	Final Project

Note: Please observe that 65% of your grade comes from the lab notebooks! This is very unique for a physics class. The notebooks are the core of the course and everything else exists in order to reinforce good notebook practice.

Grading scale:

100-90: A-type
89-80: B-type
79-70: C-type
69-60: D
59-00: F

These cutoffs indicate what is needed to earn one of the letter grades within each type. Finer-grained divisions in the A, B, and C ranges will only be determined after a careful analysis at the end of the semester, but typically will be the upper and lower 3 points within a 10 point range.

The instructor will attempt to keep grades updated in MyCourses the best of their ability.

Required Materials

- Access to a computer – This class requires the use of the Python programming language in order to analyze the data from the lab, and will use the Microsoft OneNote software for your digital lab notebooks. Both of these software are free (Python is open source and OneNote is part of your student Microsoft 365 account). A phone will not suffice, and we have laptops in the lab if you do not have one for lab.
- Lab notebook – We will be using digital notebooks this semester, but you will still need a physical notebook to write down data and make sketches. A bound composition book is fine (gridded is preferable to lined). Loose leaf paper is not acceptable.
- Textbook (digital) – *Introduction to Error Analysis* by Taylor. This is available online.

Course Description

In this course, students perform experiments representative of the foundation of modern quantum physics. These include investigations of wave particle duality, and the earliest of quantum mechanical models as well as measurements of fundamental constants. Experiments typically include electron diffraction, the photoelectric effect, optical diffraction and interference, atomic spectroscopy, charge-to-mass ratio of an electron, and thermal radiation. This class teaches basic instrumentation techniques as well as data reduction and analysis. Students are expected to keep a laboratory notebook and present results from one experiment in a journal-style paper.

A physics course without exams

Yes that's right. This being an experimental physics course, the emphasis is very different than what you find in your theory courses. We are tasked with teaching you experimental

techniques, laboratory notebook skills, technical writing, data analysis, and more. The vast majority of jobs in physics involve these skills, and the majority of employed physicists are experimental physicists. This course is your first real foray into that world.

I believe that as long as you put in the proper effort all of you have the ability to not only pass this course but to be highly successful. The data analysis is deep enough that hopefully even the theorists of you out there find something to enjoy about this course. Also hopefully you will agree with me by the end of the term that experiments are cool and fun, and should not be feared (yes, even when they "break").

Expectations for lab work

Because this is a laboratory class, working well with your group is of the utmost importance. Groups will be pre-assigned after the first week of class, with some consideration given to your preference. The lab groups will rotate, as learning to work with people you may not be familiar with is an incredibly important laboratory (and life) skill.

Please be respectful to your teammate, solicit input from them, and do not talk over them. And please participate! Even if you know the answers the best way to learn something is to explain it to someone else. If there is an issue with your group please see your lab instructor and they will take actions to remedy the issue.

You are expected to be in the lab for the entire lab period. If you are finished taking data please use that time to start and finish the analysis. You have your partner and the instructor at your disposal - use them.

You will be taught to use Python to analyze the data from your labs. Using Python is not required, and if you have a language you prefer by all means use it. However depending on the choice of software, your instructors and the TA may not be able to help you if you get stuck.

Pre-labs and check-ins

Review the pre-lab and complete anything that you can complete prior to the start of your three-hour lab period. Some of these are purely theoretical, some are entirely calibration and experimental setup, and most contain some combination of the two. The first hour of lab is the time to collect any data required in the pre-lab. As should be apparent by their name, pre-labs are expected to be done before the main lab day. The instructors will "check off" that you have completed the pre-lab during the main day for that lab. Your pre-lab completion will be graded on the following scale:
2 (substantially complete, every part is attempted fully)
1 (partially attempted/completed)
0 (no significant effort)

The two-week long experiments have what is called a "check-in" where you are expected to have completed some of the analysis from week 1. These will be graded during the pre-lab check the following week.

Lab Notebooks

The core of this course are the lab notebooks (see: grade distribution). Thus a large amount of time will be spent on discussing and going over these "books". It is hard to succinctly say what goes into a good notebook, but the underlying theme is **the more details the better**. For more on this please see the supplemental PDFs in myCourses.

Lab notebooks are due **one week** after completion of the experiment on Fridays. Because they have continuous access to your OneNote notebook for the course, your instructor is free to start grading immediately after class. Late notebooks (completed up until the final day of classes) will be penalized **one letter grade** from their overall score,. The toughest part of this course is not falling behind, so this policy is not meant to penalize, but to discourage procrastination. If you have a DSO accommodation relevant to this policy, please contact your lab instructor.

If you are unhappy with your notebook when it is graded, you can revisit and make additions to the notebook to be regraded. This must be done in a new 'page' in OneNote (do not change existing work) and you must inform us of its completion. As this is considered a late notebook the same letter grade penalty applies.

Traditionally we used physical paper notebooks for you to report the work on each lab. COVID gave us an opportunity to switch to digital notebooks, and we will be using them going forward. All the same work and information will be contained within them as with a paper notebook, but now you don't have to worry about printing out plots or trying to read my handwriting after they are graded. Please note though that these should still read like NOTEBOOKS. Turning in a bunch of code and plots is missing the point.

Additionally lab notebooks are an individual effort We expect you to have similar results as your lab partner, but your notebooks should not look exactly the same. If I can't tell the difference between your and your partner's notebooks, that's a problem.

Lab Reports

In addition to teaching you experimental techniques and analysis, this course is also expected to introduce you to technical writing. The lab reports are an individual effort. Do them on your own! There is no room for plagiarism and any academic integrity violations will be handled accordingly.

The lab report grades are based on the quality of the physics and the quality of the presentation; that is, clarity (including grammar and spelling) and completeness. You will be

taught the LaTeX typesetting system to format your report, and given a template. You will be assigned one experiment to write up, after consultation with your lab instructor (as some are better for this than others).

The paper will consist of two drafts in order to help teach you the art of paper writing. We will also have assignments where you write individual sections of papers for practice.

LA/TA Assistance

Your Learning or Teaching Assistants have already taken these classes and thus knows what it takes to succeed. They will help with data analysis, instrumentation, lab report write ups, and anything else about upper level physics courses. They are here to help you.

Participation

While the core of this course is the lab section, the lecture is still an important part of this class. We will discuss error analysis and propagation, data analysis techniques, good notebook practices, an introduction to LaTeX, scientific writing, and more. Some of these lectures will be interactive, where you will be asked to do the work (not me!). It will be difficult to earn an 'A' in this course without coming to lecture. Participation points are awarded by coming to and participating in lecture, and by joining the Discord server.

COVID-19

We will be following RIT's current guidance on masking and COVID related absences. Masks are no longer required in class, but you may wear one if you would like. Since this is a lab course absences are a much bigger deal than in a traditional lab course. If you have to miss class please communicate with your instructor and lab partner ASAP so we can come up with a plan. These can range from participating via Zoom, coming in outside of lab time to take your own data, or coming up with a solution that is fair to and agreed to by your lab partner.

RIT Honor Code and Academic Integrity Policy

The Department of Physics and Astronomy strives to meet the ethical standards set by RIT, and expects all students to do the same. These policies can be read in full by following the links below.

RIT Honor Code: https://www.rit.edu/academicaffairs/policiesmanual/p030

RIT Academic Integrity Policy: https://www.rit.edu/academicaffairs/policiesmanual/d080

Statement on Reasonable Accommodations

RIT is committed to providing reasonable accommodations to students with disabilities. If you would like to request accommodations such as special seating or testing modifications due to a disability, please contact the Disability Services Office. It is located in the Student Alumni Union, Room 1150; the Web site is www.rit.edu/dso. After you receive accommodation approval, it is imperative that you see me during office hours so that we can work out whatever arrangement is necessary.

Statement on Title IX

Title IX violations are taken very seriously at RIT. RIT is committed to investigate complaints of sexual discrimination, sexual harassment, sexual assault and other sexual misconduct to ensure that appropriate action is taken to stop the behavior, prevent its recurrence, and remedy its effects. Please view the Title IX Rights and Resources at RIT; you can find additional syllabus language that you can modify as need on its Syllabus Language subpage.

Diversity, Inclusion, and Respect

RIT has put forth Policy P05.0 Diversity Statement for all community members. RIT through its policies and practices is responsible for building an inclusive environment where membership in the community allows for faculty, staff and students to reach their fullest potential, both professionally and personally. RIT is committed to the development, administration and interpretation of policies and procedures in a way that is consistent with our commitment to diversity and is in compliance with federal, state and local laws. RIT's policies and procedures are administered in a way that supports fair treatment for all faculty, staff, students, and the RIT community at large.