

INSTRUCTORS:

LEC and LAB: Dr. Aaron McGowan (he/him/his), ammspsa@rit.edu

Office: Orange Hall ORN-1331, 475-7689

Tentative Office Hours: Carlson (CAR-76) A110/2230, TuTh 10-11am, Fr 11am-1pm

LAB: Dr. Shima Parsa (she/her/hers), spmsps@rit.edu

Office: Carlson Hall CAR-2128, 475-2534

Tentative Office Hours: Mo 10:30-11:30am, Tu 12-1pm

CLASS SCHEDULE: See SIS for details. All labs are in Carlson Hall 2226/2230 (Weeks 1-6) and A110/A220 (Weeks 7-15). Lecture is in Gleason Hall GLE-1159, Fr 10-10:50am BUT will move to Carlson labs around Week 7. See details below.

COURSE MATERIALS:

1. *Mandatory:* A laptop (one will be provided to you during lab if required) or tablet that you will use to actively edit your OneNote notebook.
2. *Recommended:* Introduction to Error Analysis, by Taylor. This is a reference that is easily found online.
3. *Recommended:* Experimental Measurements, by Barford. There is one physical copy in A110 for your reference. This is a bit harder to find as it is out of print.
4. *Optional:* One physical notebook of your choosing (graph paper suggested) for handwritten diagrams, notes, equations, etc. that you may photograph and include digitally in OneNote. Paper is optional if you are comfortable using a digital pad.

CALENDAR: Please watch myCourses Calendar for updates!

Mo-Tu	15-16 Jan	NO LABS
We	17 Jan	MoWe labs begin (Introduction and common experiment)
Th	18 Jan	TuTh labs begin (Introduction and common experiment)
Fr	19 Jan	Lecture begins
Tu	23 Jan	Last day to ADD/DROP
Mo-Fr	11-18 Mar	SPRING BREAK – NO CLASSES OR LABS
Mo	08 Apr	Lab required attendance of Total Solar Eclipse
Mo-Tu	22-23 Apr	Lab6 finish
We-Th	24-25 Apr	Final Presentations (Locations TBD)
Mo	29 Apr	All Notebooks due – NO LABS MEET
Mo	06 May	Final Slot 10:45am-1:15pm, GLE-1159

EXPERIMENTS:

You will each complete **six** experiments, as follows. See myCourses for the lab manual detailing each experiment. Each Lab grade is weighted proportionally to the number of days.

Lab 1: Weeks 1-2, six hours (3 days): Quantum Dots (QD) – All students will **complete one** ‘short’ experiment simultaneously, collecting and sharing data as a group, and applying various analysis techniques. This is our collective introduction to the concepts of error propagation, χ^2 (chi-square) minimization, interpretation of p-value, thorough notebook documentation, and model discrimination. You will not have a partner but will collaborate with the instructor and the class as a whole to complete this experiment.

Labs 2 and 3: Weeks 3-6, eight hours (4 days) each: From the ‘medium’ experiments, **complete two** of the following: Measurements using Interferometry (MI), Band Gaps (BG), SuperConductivity (SC), or Noisy Signals (NS). You will normally have a partner for both experiments.

Labs 4 and 5: Weeks 7-13, twelve hours (6 days) each: From the ‘long’ experiments, **complete two** of the following: Gamma Spectroscopy (GS), X-ray Diffraction (XD), Optical Pumping (OP), and Polarization Rotation (PR). You will normally have a partner for both experiments.

Lab 6: Weeks 14-15, four hours (2 days): You will each **wrap up one** experiment: a deeper investigation of an experiment you’ve performed (either from earlier this semester or from Modern Lab) assigned by the instructor. SEE LAB 6 BELOW. You will be expected to think more critically about the experiment (applying chi-square analysis to all fits), complete it (if not complete the first time), and possibly acquire/analyze some new experimental data. You will give your presentation on this experiment.

GRADE COMPOSITION:

Lecture and Participation	10 %
PreLab/Lab notebooks	70 %
Lab 6 ‘Final Project’ Notebook	10 %
Final presentation	10 %

LECTURE AND PARTICIPATION: 10% of final grade.

Attend lecture sessions and complete safety training and all non-lab assignments. Join the Discord server and discuss experiments with your colleagues.

PRELAB AND LABORATORY NOTEBOOK: 70% of final grade.

You are expected to work through the PreLab material for each experiment prior to the first day of that lab. You must use OneNote **during** labs. You must actively develop your notebook while you are performing each experiment. There will be a weekly check (20% of final grade) and an end-of-experiment check (50% of final grade). **This structure will distribute the load and stress of producing a single polished notebook at the end of each experiment, and reward you for being present in lab, performing the experiments, and carefully documenting what you are doing.** You are given time in the lab session to complete this work.

One of the vital skills of an experimental physicist is the ability to keep a good record of their work. Your laboratory notebook will contain a complete record of what you do **before** lab, **during** lab, and **after** the lab. It is much more than simply a collection of numbers. The notebook should contain pre-lab responses, all data recorded during lab, analysis of the data, preliminary and final plots with fits, references to helpful material, and any other information you deem useful. **Do not be afraid to write in your notebook. Consider it a diary of your work, not a polished presentation.** At the conclusion of any experiment, a written lab report should be easily extracted from the laboratory notebook, and you should be prepared to choose any experiment to write your paper from. Record relevant theory and equations, along with data, equipment drawings, and everything else! Photographic records of setup and handwritten work should be included.

Weekly Check: 20% of final grade. Graded on a 4-point scale (2 points per day):

4	Completed PreLab on time; Present in lab both days and documented work done
1-3	Deductions for one AWOL, incomplete PreLab, or failure to document work done
0	Absent without leave (AWOL) from both lab periods

End-of-Experiment Check: 50% of final grade.

LAB 6:

No experiment is ever truly finished – there are always improvements that can be made! You may choose (if your instructor approves) to revisit one experiment in greater depth or breadth. You will begin with your digital notebook from earlier and append new notebook entries at the end. You must carefully read your instructor's comments for your graded experiment and have a discussion with your instructor to ensure you have a clear plan for extending the experiment. You will apply everything that you learn this semester to clearly identify systematic error in your first attempt at the experiment, re-take any necessary data, quantitatively assess systematic uncertainties, perform all fits using χ^2 (chi-square) and p-value interpretation, and possibly test at least one new model for your data. You will be more independent for this experiment (but will have full access to your instructor for questions and discussions). We will give you suggested avenues for investigation if you get stuck when thinking of ways to extend your experiment. If you are not interested in extending an experiment, or your instructor does not approve it (equipment conflicts may arise) you will be assigned to complete a portion of one of the experiments you were not assigned to earlier in the semester.

LAB 6 Notebook: 10% of final grade.

Fully document your work over the course of the semester for this experiment.

FINAL PRESENTATION: 10% of final grade.

Share the results of your hard work with your lab mates and instructor during your final lab session. In 10 minutes, present all work completed on the experiment performed as Lab 6. This is meant to prepare you for Capstone and give you a lower-stress environment during which to present a short talk.

LATE POLICY:

Lab notebooks are due one calendar week after completion of the experiment. Because we have continuous access to your OneNote notebook, your instructor is free to start grading after the two-day grace period after the notebook is due. You are free to complete late notebooks at any point during the semester for a maximum grade of B. **This is an automatic due date extension and you do not need to request extensions on an individual basis.** Individual accommodations to adjust due dates may be made for illness and other significant life interruptions.

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 by all instructors at the end of the semester, to maintain consistency between lab sections. Typically these will be about the upper and lower 3 points within a 10 point range. The instructor will keep grades updated in the lab section of MyCourses, per RIT policy.

DISCORD:

It is important that you take advantage of our shared brain power. If you have a question about the lab, or just a physics question in general, or random life observations, please use Discord instead of email. The instructor(s) and TA/LA will be checking Discord often so if you have a question it should be answered rather quickly. **It is a requirement of this course that you join our Discord server, reflected in your participation grade.**

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. Other people have often already figured out the thing you are stuck on. **Please do not spend hours despairing alone over something that isn't working.** Give it your best effort, post a question on Discord, then go to sleep!

HEALTH AND SAFETY:

Please respect each person's choice to mask or not to mask. If your partner requests that you mask during lab, please consider doing so as many personal life situations factor into this decision (child or elder care at home, lowered immune system due to medical treatment, etc.). We require that you follow RIT's current guidelines for masking and COVID isolation. Accommodations will be made throughout the semester for illness-related and other excused absences. In general, if you are sick (fever, coughing, sneezing, vomiting, or otherwise not controlling your own fluids and aerosol particles very well) please stay home and we will all thank you for that. If you are mildly sick but feel well enough to come to class and aren't spewing too many fluids then please wear a mask for the common good.

You may bring food and/or beverage but it must be kept and consumed in the hallway, atrium, or outdoors, NOT IN LAB. I encourage regular short breaks and you may grab some fresh air outdoors whenever you feel it is necessary. I often monitor radon levels in the lab rooms and they are very low, indicating rapid turnover of the air and large outdoor air flow into these spaces. Rooms will be cleaned following RIT guidelines. Please follow all of RIT's guidelines, and use common sense.

We all need to be adaptable to changing circumstances. We do have a back-up plan for remote learning in case things change. If you cannot make it to lab for health reasons, you will be asked to Zoom with your partner (if you are well enough to do so) as they complete the in-person part of the lab. If both partners are sick on a given day, talk to your lab instructor for how to proceed. If for any reason you feel uncomfortable in lab speak your instructor ASAP and we will figure out a solution.

Disability Services:

RIT is committed to providing reasonable accommodations to students with disabilities. If you need accommodations such as special seating, testing modifications, and note taking services, please contact the Disability Services Office.

<https://www.rit.edu/studentaffairs/disabilityservices/> 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.

Academic Integrity:

I view cheating and plagiarism as serious offenses, and any instances will be reported to the appropriate disciplinary channels. You should check the results of your analysis with your classmates and to discuss your approach to each experiment, but your lab notebook must represent your own work for a grade. I expect you to conduct yourself in a professional manner. Please refer to the RIT Academic Integrity Policy:

<https://www.rit.edu/twc/academicintegrity/>

RIT Statement on Harassment and Discrimination:

RIT is committed to providing a safe learning environment, free of harassment and discrimination as articulated in our university policies located at <https://www.rit.edu/academicaffairs/policiesmanual/> . RIT's policies require faculty to

share information about incidents of gender-based discrimination and harassment with RIT's Title IX coordinator or deputy coordinators, regardless whether the incidents are stated to them in person or shared by students as part of their coursework. See <https://www.rit.edu/fa/compliance/content/title-ix> If you have a concern related to gender-based discrimination and/or harassment and prefer to have a confidential discussion, assistance is available from one of RIT's confidential resources on campus (listed below).

1. The Center for Women & Gender: Campus Center Room 1760; 585-475-7464; CARES (**available 24 hours/7 days a week**) Call or text 585-295-3533.
2. RIT Student Health Center – August Health Center/1st floor; 585-475-2255.
3. RIT Counseling Center - August Health Center /2nd floor - 2100; 585-475-2261.
4. The Ombuds Office – Student Auxiliary Union/Room 1114; 585-475-7200 or 585-475-2876.
5. The Center for Religious Life – Schmitt Interfaith Center/Rm1400; 585-475-2137.
6. NTID Counseling & Academic Advising Services – 2nd Floor Lynden B. Johnson; 585-475-6468 (v), 585-286-4070 (vp).

RIT Attendance Policy

“Absences, for whatever reason, do not relieve students of their responsibility for fulfilling normal requirements in any course. In particular, it is the student's responsibility to make individual arrangements in advance of missing class due to personal obligations such as religious holidays, job interviews, athletic contests, etc., in order that he or she may meet his or her obligations without penalty for missing class." (*RIT Governance Policy D4.0, Section I.B*) Therefore, if a student needs to miss class, there are mutual responsibilities for students and faculty: It is the student's responsibility to notify the faculty member **in advance of the planned absence**. With advance notice of the planned absence, it is the faculty member's responsibility to ensure that the student can fulfill all class assignments and expectations without penalty or bias.”

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.