

## PHYS 431L Fall 2021

### Modern Physics Laboratory

**Instructor** Dr. Theodosia Gougousi

**Phone** 410 4556874

**Office** PHYS 317

**E-mail** gougousi@umbc.edu

**Office hours:** Monday, Tuesday: 9:30-10:30 am.

**Textbook:** You will not need to purchase a textbook for this class.

**The class will be taught in person with all safety measures mandated by UMBC. Attendance is mandatory in all lab sessions for the whole semester. No exceptions.**

### Safety Protocols and Compliance

*“UMBC has set clear expectations for masking while on campus that include the requirement that you must wear a face mask that covers your nose and mouth in all classrooms regardless of your vaccination status. This is to protect your health and safety as well as the health and safety of your classmates, instructor, and the university community. Anyone attending class without a mask or wearing one improperly will be asked by the instructor to put on a mask or fix their mask in the appropriate position. Any student that refuses to comply with this directive will be asked to leave the classroom immediately and failure to do so will result in the instructor requesting the assistance of the University Police. Students who refuse to wear masks may be referred to Student Conduct and Community Standards and may face disciplinary action for violations of the Code of Student Conduct, specifically, Rule 2: Behavior Which Jeopardizes the Health or Safety of Self or Others and Rule 16: Failure to Comply with the Request of a University Official. UMBC’s on-campus safety protocols, including masking requirements, are subject to change in response to the evolving situation with Covid-19.”*

## Course description (from the registrar)

Laboratory course intended for upper-level physics majors. The course will acquaint students with contemporary experimental techniques in physics, with an emphasis on open-ended inquiry, data analysis, and the development of technical writing and presentation skills.

Prerequisite: You must have completed PHYS 324 & PHYS 330L with a grade of C or higher.

## Course Overview

Since this lab is the last experimental course in the curriculum the main objective of this course is to provide an experience closer to a real-life workplace or graduate school. Unlike your previous laboratory courses, in this class, we will challenge you by asking you to design and carry out the experiments independently. All the required equipment will be at your disposal in good working order. You will be given a brief outline of the subject as well as supporting materials, but it will be your responsibility to design and assemble the experimental setup and decide on the correct data acquisition procedure. Some of the supporting material provided will be write-ups from other universities for similar experiments. There is also a plethora of information available at your fingertips. Therefore, it will be of the utmost importance that you come to the lab prepared. The instructor will be there to answer your questions and make sure that you are capable of performing the experiment safely and properly.

As in any lab course, we will place a lot of emphasis on the correct recording and handling of the experimental errors. You will have to include uncertainties for all the measured quantities and use standard error propagation techniques to find the error associated with the measurements reported in your lab report.

## Learning Objectives:

To be successful in the course by the end of the semester you should be able to.

1. Design and carry out laboratory experiments using modern techniques
2. Analyze experimental data properly
3. Prepare professional-level laboratory reports and oral presentations

## Course grade

Your final grade will be based on the pre-labs and lab reports for the four labs and the project and the final presentation. There are no exams in the course.

Your percentage score will be calculated as follows:

- Pre-labs (4): 3% each
- Initial experiment reports (4): 3% each
- Final experiment reports for 2-week labs (4): 12% each
- Project proposal: 3%
- Final project report: 15%
- Final presentation: 10%
- Lab notebooks: Up to 3% extra credit

*At the end of the semester, you must have turned in all the experiment and project reports. If you miss even a single report, you will automatically get a C or lower in the course, regardless of the scores that you got for the other reports. If you complete all reports, your percentage score will be converted to a letter grade as follows:*

score  $\geq 90$  : A

score  $\geq 80$ : B

score  $\geq 70$ : C

score  $\geq 60$ : D

score  $< 60$  : F

## Course management

I will use Blackboard to post course announcements, reading materials, lab handouts, and post grades. Please make sure that you arrive in the lab on time.

## Calendar of assignments

Just to keep everything straight there is a calendar with all assignments marked posted on Blackboard.

## Course Requirements

### Lab Notebook

You are required to document all your lab work using a conventional notebook. Practicing scientists often need to come back to their notebooks years later to recall the details of the experiments that they did; you should strive to have your notebook entries complete and clear enough to meet this standard. You must make every effort to record and describe everything that you are doing. Draw or take pictures. Even if the information is stored in a computer, it should be printed out, as a picture, graph, table, etc., and taped (pasted) into your notebook. All entries should begin with the date that the entry is made.

It is a good idea to plot your data as you acquire it. This way, you will immediately see where more data is required and if any apparent systematic errors could be fixed. This will slow down the data acquisition somewhat, but it will be much more efficient in the long run than having to come back and start all over again when you find out that the data was problematic or incomplete.

In real-world research, lab notebooks are the official record of the experiment performed and are the primary piece of legal evidence used to settle priority disputes, or if there is an accusation of research misconduct. It is therefore forbidden to alter lab notebook entries, including tearing pages out of the book, or even erasing entries – anything that you don't want to keep should be crossed out with a single line.

I may ask to go through your lab notebook at any time during the semester. At the end of the semester, I will review your lab notebooks. You can earn up to 3% extra credit in the course if you have maintained an exceptionally detailed and well-organized lab notebook.

### Pre-Labs

For each of the experiments, you will be required to hand in a pre-lab report. This report must include the following:

- An explanation of the purpose of the experiment
- A brief overview of the theories and principles underlying the experiment
- An outline of the planned experimental approach

The report should be no more than four pages long. You do not need to include a cover page for your pre-lab.

**Pre-labs are due by 10:00 am the day you are scheduled to begin the experiment.** Pre-lab reports must be submitted electronically to the course Blackboard site.

At the beginning of each experiment, one student will be randomly selected to briefly summarize to the class the purpose and background for the experiment that they are about to perform.

Before you perform the experiment, the instructor will discuss your pre-lab with you to make sure that there are no issues that will compromise your safety or prevent you from completing the work. You will not be allowed to carry out the lab if the instructor believes that you are not prepared to perform the experiment safely. You may be allowed to perform a make-up experiment later if you demonstrate at that point that you are prepared.

### Lab Reports

A complete laboratory report is required for every experiment and project completed. There is no specific template for the report (apart from the cover page). Rather, the report should be prepared in the format and style of a scientific paper.

There is a separate handout explaining the requirements and expectations for the reports.

The handout includes a rubric, which will serve as the basis for grading the reports. Each of the criteria will be evaluated as "Not addressed," "Novice," "Intermediate," or "Proficient," and the evaluations will serve as the basis of your score on the report. Not all of the criteria will be given equal weight, and the conversion of the evaluations to a score will be based on the instructor's judgment. There is an expectation that your report-writing skills will improve over the semester, so, later in the semester, you will have to get better evaluations to get a higher score than you do earlier in the semester.

Reports must be submitted electronically to the course Blackboard site. All submitted reports will be scanned for plagiarism using the SafeAssign application. Late reports will be accepted only in the case of a documented issue or problem.

Initial reports are due **the Monday (by 10:00 am)** after the experiment or project is complete. The instructor will provide high-level comments on Blackboard by Thursday after the reports are received. You will then have until **the following Tuesday (by 10:00 am)** to revise your report and turn in the final version.

Make-up labs will be given only in the event of a documented issue or problem. You must notify the instructor as soon as possible if you are going to miss a lab or have missed a lab because of an unexpected issue. Going out of town for a recreational trip is not a valid reason for requesting make-up.

After completing all the experiments, you will have the opportunity to re-submit a revised version for one of your lab reports, with the score for the revised report replacing the score for the initially submitted report. Redoing all or part of the experiment is allowed but not required. A week will be available before the projects are started to redo the experiment if desired or to make up any experiments that were missed (for a valid reason) earlier in the semester. Make-up labs are due on **Wednesday, November 24th (11:59 pm)**.

### SafeAssign

All reports must be submitted electronically to the course blackboard site where SafeAssign will be used to check for plagiarism. Failure to upload your lab report to Blackboard will result in a score of 0 for that lab.

### Project Proposals and project report

Before beginning the project, you will be required to hand in a project proposal. The proposal must include the following:

- A project title and list of group members
- An explanation of the goals of the project
- An explanation of why these goals are important or interesting
- A brief overview of the scientific theories and principles underlying the project
- A step-by-step outline of the planned experimental approach, including an estimate of the time required to complete each step
- A list of the laboratory equipment that will be used, and a list of any additional materials, supplies, equipment, or other resources that will be required
- A summary of any special hazards that may be encountered in the experiment and any other safety considerations

The proposal should be no more than five pages long. You do not need to include a cover page for your proposal.

During the week before you begin your project, you will meet with the instructor to go over your proposal, make any changes that may be needed, and plan out your work over the next two weeks. Proposals are due **Wednesday, November 3<sup>rd</sup> (11:59 pm)**. Proposals must be submitted electronically to the course Blackboard site. Project reports are due on **Dec 7<sup>th</sup> (11:59 pm)**. Presentation slides (PowerPoint) are due on **Dec 9<sup>th</sup> (10:00 am)**.

During a project, it often becomes clear that changes to the plan are necessary. This is fine if you discuss any major changes with the instructor.

### Oral Presentation

At the end of the semester, each student in the course will give a fifteen-minute presentation on the project that they have completed. The presentation will follow the format of a typical research talk given by a scientist at a national conference. There is a separate handout with the guidelines and grading rubric for the presentations. Slides for the presentations must be uploaded to the Blackboard page by the end of the day before the presentations.

## Incompletes

Please read carefully the catalog statement on acceptable grounds for an incomplete. The only grounds for obtaining an incomplete in this course is failure to complete the project and final

presentation due to illness. Since, according to the catalog, you must be doing "qualitatively satisfactory" work to qualify for an incomplete, you must have at least completed the four laboratory reports, with a grade of C or better up to the time you took sick. If you are given an "Incomplete", it can be removed by completing the missed assignments (lab and presentation) in the following semester's PHYS 431L course.

Note: Do not register for PHYS431L again; just make arrangements with the instructor to attend the appropriate sessions.

## **Academic Integrity**

By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty, and they are wrong. Academic misconduct could result in disciplinary action that may include, but is not limited to, suspension or dismissal. To read the full Student Academic Conduct Policy, consult the UMBC Student Handbook, the Faculty Handbook, or the UMBC Policies section of the UMBC Director.

## **UMBC Policies and Resources for Students during COVID-19**

### **UMBC's Vision Statement**

Our UMBC community redefines excellence in higher education through an inclusive culture that connects innovative teaching and learning, research across disciplines, and civic engagement. We will advance knowledge, economic prosperity, and social justice by welcoming and inspiring inquisitive minds from all backgrounds.

### **Student Safety**

In response to the COVID-19 pandemic, it is understood that some students who are enrolled in classes that have an in-person component may have or develop COVID-19 related health concerns coming to campus to attend those classes this semester. No student shall be compelled to attend class or attend an assessment if they have COVID-19 related health concerns. However, for students enrolled in courses having a physical presence component who anticipate not being able to attend the in-person class sessions due to COVID-19 related health concerns, it is advisable to provide notice to the course instructor at the beginning of the term so that alternate arrangements can be made. Students enrolled in courses with an in-person

component who develop COVID-19 related health concerns during the semester should immediately contact the course instructor to discuss alternative instructional arrangements.

## **COVID-19: Safety Expectations and Guidelines**

Students enrolled in this course are expected to adhere to all UMBC policies, rules, and regulations, including COVID-19 emergency health and safety rules, policies, guidelines, and signage enacted for the UMBC community. For students attending in-person classes, signage, policies, rules, and/or guidelines may include but are not limited to specific requirements for face coverings, physical distancing, and sanitization, in addition to efforts to reduce density efforts that involve reductions in seating and room capacity. Please be aware that UMBC's COVID-19 emergency health and safety rules, regulations, policies, guidelines, and/or signage are subject to change as our public health crisis evolves. Any violation will be subject to disciplinary action and may include but not limited to immediate dismissal from the classroom, removal from the classroom and/or campus, a requirement to work remotely, and/or sanctions and conditions enumerated in the [UMBC Code of Student Conduct](#) that may entail suspension or expulsion from UMBC.

## **Enrollment Dates and Deadlines**

Students must be familiar with the academic policies and enrollment dates and deadlines as published in the [Undergraduate Catalog](#) and the [Academic Calendar](#). They are also responsible for managing their course enrollment(s) accordingly.

## **Accessibility and Disability Accommodations, Guidance and Resources**

Accommodations for students with disabilities are provided for all students with a qualified disability under the Americans with Disabilities Act (ADA & ADAAA) and Section 504 of the Rehabilitation Act who request and are eligible for accommodations. The Office of Student Disability Services (SDS) is the UMBC department designated to coordinate accommodations that would create equal access for students when barriers to participation exist in University courses, programs, or activities.

If you have a documented disability and need to request academic accommodations in your courses, please refer to the SDS website at [sds.umbc.edu](https://sds.umbc.edu) for registration information and office procedures.



SDS email: [disAbility@umbc.edu](mailto:disAbility@umbc.edu)  
SDS phone: (410) 455-2459

If you will be using SDS approved accommodations in this class, please contact me (instructor) to discuss implementation of the accommodations. During remote instruction requirements due to COVID, communication and flexibility will be essential for success.

**Please note:** Shady Grove campus (USG) student accommodation needs are arranged through the UMBC main campus SDS office.

## Hate, Bias, Discrimination and Harassment

UMBC values safety, cultural and ethnic diversity, social responsibility, lifelong learning, equity, and civic engagement.

Consistent with these principles, [UMBC Policy](#) prohibits discrimination and harassment in its educational programs and activities or with respect to employment terms and conditions based on race, creed, color, religion, sex, gender, pregnancy, ancestry, age, gender identity or expression, national origin, veterans status, marital status, sexual orientation, physical or mental disability, or genetic information.

Students (and faculty and staff) who experience discrimination, harassment, hate or bias or who have such matters reported to them should use the [online reporting form](#) to report discrimination, hate or bias incidents; reporting may be *anonymous*.

## Religious Observances

UMBC [Policy](#) provides that students should not be penalized because of observances of their religious beliefs, students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. It is the responsibility of the student to inform the instructor of any intended absences for religious observances in advance, and as early as possible. For questions or guidance or to request an accommodation, please contact the [Office of Equity and Inclusion](#) at [oei@umbc.edu](mailto:oei@umbc.edu).

# Sexual Assault, Sexual Harassment, and Gender Based Violence and Discrimination

UMBC's [Policy on Sexual Misconduct, Sexual Harassment and Gender Discrimination](#) and Federal Title IX law prohibit discrimination and harassment on the basis of sex in University programs and activities. Any student who is impacted by sexual harassment, sexual assault, domestic violence, dating violence, stalking, sexual exploitation, gender discrimination, pregnancy discrimination, gender-based harassment or retaliation should contact the University's Title IX Coordinator to make a report and/or access support and resources:

Mikhel A. Kushner, Title IX Coordinator (she/her/hers)  
410-455-1250 (direct line), [kushner@umbc.edu](mailto:kushner@umbc.edu)

*You can access support and resources even if you do not want to take any further action. You will not be forced to file a formal complaint or police report. Please be aware that the University may take action on its own if essential to protect the safety of the community.*

If you are interested in or thinking about making a report, please see the [Online Reporting Form](#). Please note that, while University options to respond may be limited, there is an anonymous reporting option via the online form and every effort will be made to address concerns reported anonymously.

## **Notice that Faculty are Responsible Employees with Mandatory Reporting Obligations:**

All faculty members are considered *Responsible Employees*, per [UMBC's Policy on Sexual Misconduct, Sexual Harassment, and Gender Discrimination](#). Faculty are therefore required to report possible violations of the [Policy](#) to the Title IX Coordinator, even if a student discloses something they experienced before attending UMBC.

While faculty members want you to be able to share information related to your life experiences through discussion and written work, students should understand that faculty are required to report Sexual Misconduct to the Title IX Coordinator so that the University can inform students of their [rights, resources and support](#).

If you need to speak with someone in confidence, who does not have an obligation to report to the Title IX Coordinator, UMBC has a number of [Confidential Resources](#) available to support you:

- The [Counseling Center](#): 410-455-2742 / After-Hours 410-455-3230
- [University Health Services](#): 410-455-2542
- Pastoral Counseling via [Interfaith Center](#): 410-455-3657; [interfaith@umbc.edu](mailto:interfaith@umbc.edu)

Other Resources:

- [Women's Center](#) (for students of all genders): 410-455-2714; womenscenter@umbc.edu.
- [Shady Grove Student Resources](#), [Maryland Resources](#), [National Resources](#).

Child Abuse and Neglect:

Please note that Maryland law and [UMBC policy](#) require that I report all disclosures or suspicions of child abuse or neglect to the Department of Social Services and/or the police.

## Pregnancy

UMBC's [Policy on Sexual Misconduct, Sexual Harassment, and Gender Discrimination](#) expressly prohibits all forms of Discrimination and Harassment based on sex, including pregnancy. [Resources for pregnant students](#) are available through the University's Office of Equity and Inclusion. Pregnant and parenting students are encouraged to contact the Title IX Coordinator to discuss plans and assure ongoing access to their academic program with respect to a leave of absence or return following leave related to pregnancy, delivery, or the early months of parenting.

In addition, students who are pregnant may be entitled to accommodations under the ADA through the [Student Disability Service Office](#), and/or under Title IX through the [Office of Equity and Inclusion](#).