

Fall 2024 Syllabus  
**PHYS 424, Quantum Mechanics**

Instructor: Dr. Todd Pittman

Office: Physics 318

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Office Hours: Wed. 1:30 – 3:00 pm.

Lectures: MWF 9:00 - 9:50

Location: Physics 201

Course Text: *Introduction to Quantum Mechanics* (3<sup>rd</sup> edition), by David J. Griffiths

## 1. Course introduction

Welcome to Quantum mechanics, the coolest subject in all of physics! We're in for a wild ride this semester. As Griffiths states in the preface of our text, "*.....quantum mechanics is not something that flows smoothly and naturally from earlier theories. On the contrary, it represents an abrupt and revolutionary departure from classical ideas, calling forth a wholly new and radically counterintuitive way of thinking about the world.*"

This course aims to provide an introduction to the *basic ideas* and the *actual mechanics* of quantum mechanics. Through lectures, discussions, and homework problems, I'd like to help you learn how to use quantum mechanics to solve a variety of interesting problems, as well develop some insight into what the solutions really mean. **We'll be using Griffiths as an anchor point for the entire course, with a goal of sequentially working through Chapters 1 - 5, 12, and then 6 by early December.** The objective is to build a solid foundation and provide motivation for further study and research in this area.

Quantum mechanics is more important today than ever. Recent advances in technology and laboratory techniques are allowing researchers unprecedented control over the tiny and delicate systems that obey the laws of quantum mechanics, rather than classical physics. This is particularly important in the new field of quantum information processing, which is my own area of research. There are many advances and discoveries to be made....join in!

## 2. Course Grading

- Homework 20%
- Exam 1 (Late Sept.) 20%
- Exam 2 (Late Oct.) 20%
- Exam 3 (Late Nov,) 20%
- Final Exam (mid-Dec.) 20%

### 3. Homework

We'll have roughly 10 HW assignments throughout the semester. HW will generally be assigned on Fridays, and due the following Friday (with some variation throughout the semester). When computing your overall HW grade, your lowest HW score will be dropped.

Understanding the HW problems is a key part of your learning QM, and significant portions of the Exams will be along the lines of the HW problems. Homework will be turned in at the beginning of the class in which it is due. I cannot accept late HW since it is not fair to your classmates, and we will often discuss solutions in class.

More details on the HW expectations and grading will be provided in the "*PHYS 424 HW Guidelines and Grading Rubric*" document that will be handed out with the first HW assignment.

### 4. Exams

Exams 1, 2, and 3 will be standard 50-minute closed-book in-class exams. The Final Exam will also be a closed-book in-class exam; it will be a longer comprehensive exam covering material from the entire course.

### 5. Academic Integrity

As with all courses, Academic Integrity is required in PHYS 407:

*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 Directory.*

## 6. Learning outcomes assessment

There are a number of educational objectives for physics students at UMBC. The 6 specific learning objectives for PHYS 424 are summarized below. By the end of this course, students should be able to:

1. Explain the breakdown of classical mechanics and the development of quantum mechanics.
2. Utilize the concept of the wavefunction (and quantum states and qubits) to describe quantum systems, with emphasis on using the statistical interpretation and predicting the outcomes of measurements.
3. Solve the Schrodinger equation for various 1D potentials.
4. Work with Dirac notation and the formalism of QM including the concepts of Hilbert space, operators, commutators, eigenfunctions and eigenvalues, and the uncertainty principle.
5. Perform 3D calculations in Quantum Mechanics, using the example of the Hydrogen atom, with emphasis on the concepts of angular momentum and spin.
6. Analyze systems of identical particles and the concepts of fermion and boson statistics.

These objectives will be assessed by my observations of your participation in class discussions, as well as your performance on homework and written exams.

## 7. Additional UMBC Policies, Procedures, and Resources

### **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 creates 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](tel:410-455-2459)

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

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

[UMBC Policy](#) in addition to federal and state law (to include Title IX) prohibits discrimination and harassment on the basis of sex, sexual orientation, and gender identity 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 related retaliation should contact the University's Title IX Coordinator to make a report and/or access support and resources. The Title IX Coordinator can be reached at [titleixcoordinator@umbc.edu](mailto:titleixcoordinator@umbc.edu) or 410-455-1717.

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 making a report, please use the [Online Reporting/Referral Form](#). Please note that, if you report anonymously, the University's ability to respond will be limited.

### **Notice that Faculty and Teaching Assistants are Responsible Employees with Mandatory Reporting Obligations**

All faculty members and teaching assistants are considered Responsible Employees, per UMBC's [Policy on Sexual Misconduct, Sexual Harassment, and Gender Discrimination](#). Faculty and teaching assistants therefore required to report all known information regarding alleged conduct that may be a violation of the Policy to the Title IX Coordinator, even if a student discloses an experience that occurred before attending UMBC and/or an incident that only involves people not affiliated with UMBC. Reports are

required regardless of the amount of detail provided and even in instances where support has already been offered or received.

While faculty members want to encourage you to share information related to your life experiences through discussion and written work, students should understand that faculty are required to report past and present sexual harassment, sexual assault, domestic and dating violence, stalking, and gender discrimination that is shared with them to the Title IX Coordinator so that the University can inform students of their [rights, resources, and support](#). While you are encouraged to do so, you are not obligated to respond to outreach conducted as a result of a report to the Title IX Coordinator.

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:

[Retriever Integrated Health](#) (Main Campus): 410-455-2472; Monday – Friday 8:30 a.m. – 5 p.m.; For After-Hours Support, Call 988.

[Center for Counseling and Well-Being](#) (Shady Grove Campus): 301-738-6273; Monday-Thursday 10:00a.m. – 7:00 p.m. and Friday 10:00 a.m. – 2:00 p.m. (virtual) [Online Appointment Request Form](#)

Pastoral Counseling via [The Gathering Space for Spiritual Well-Being](#): 410-455-6795; [i3b@umbc.edu](mailto:i3b@umbc.edu); Monday – Friday 8:00 a.m. – 10:00 p.m.

#### **Other Resources**

[Women’s Center](#) (open to students of all genders): 410-455-2714; [womenscenter@umbc.edu](mailto:womenscenter@umbc.edu); Monday – Thursday 9:30 a.m. – 5:00 p.m. and Friday 10:00 a.m. – 4 p.m.

[Shady Grove Student Resources](#), [Maryland Resources](#), [National Resources](#).

#### **Child Abuse and Neglect**

Please note that Maryland law and [UMBC policy](#) require that faculty report all disclosures or suspicions of child abuse or neglect to the Department of Social Services and/or the police even if the person who experienced the abuse or neglect is now over 18.

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