

Fall 2026 Syllabus
PHYS 312, Quantum Mechanics I

Instructor: Dr. Todd Pittman

Office: Physics 318

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Office Hours: Wednesday 1:00 – 2:30 pm.

Lectures: MWF 9:00 - 9:50

Location: Public Policy 206

Course Text: *Quantum Mechanics: A Paradigms Approach*, by David H. McIntyre

1. Course introduction

Welcome to quantum mechanics, the most fascinating subject in all of physics! As Niels Bohr famously remarked, “*Those who are not shocked when they first come across quantum theory cannot possibly have understood it.*” Get ready — this semester we’ll be exploring ideas that challenge common sense, reveal the strange beauty of the quantum world, and change the way you see nature. It’s going to be a wild ride!

This course introduces 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 and – equally importantly -- develop deep insight into what the solutions mean. **We’ll be using McIntyre as an anchor point for the entire course, with a goal of sequentially working through most parts of Chapters 1 - 6, and some aspects of Chapters 7 – 9, 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 sets throughout the semester. HW sets will generally be due one week after they are assigned (with some variation throughout the semester). When computing your overall HW grade, your lowest HW set 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 must 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 312 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 8 specific learning objectives for PHYS 312 are summarized below. By the end of this course, students should be able to:

1. **Apply the fundamental postulates of quantum mechanics** to spin-1/2 systems, using Stern–Gerlach experiments, state vectors, Dirac notation, superposition, and matrix representations.
2. **Analyze quantum measurements and observables** using operators, eigenvalues and eigenstates, projection operators, expectation values, commutators, and the uncertainty principle.
3. **Determine the time evolution of quantum states** using the Schrödinger equation and Hamiltonian, including applications to spin precession and two-state systems.
4. **Explain and analyze fundamental nonclassical features of quantum mechanics**, including entanglement, the EPR paradox, Bell inequalities, and the Schrödinger-cat paradox.
5. **Solve and interpret one-dimensional bound-state problems**, including infinite and finite square wells, using the energy eigenvalue equation, wave functions, boundary conditions, parity, and superposition.
6. **Analyze unbound quantum states and wave packets**, including free particles, momentum eigenstates, position–momentum uncertainty, scattering, and quantum tunneling.
7. **Apply quantum angular-momentum theory** to three-dimensional systems, including separation of variables in spherical coordinates, angular-momentum eigenstates, and spherical harmonics.
8. **Solve and interpret the quantum-mechanical hydrogen atom**, including its radial and angular wave functions, energy eigenvalues, quantum numbers, probability distributions, and spectrum.

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 for registration information and office procedures.

SDS email: 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 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; 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; 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.
