

Spring 2026 Syllabus  
**PHYS 434, Advanced Quantum Mechanics**

Instructor: Dr. Todd Pittman  
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Office Hours: Tuesday 10 – 12

Lectures: MW 11:00 – 12:15  
Location: Physics 201

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

### 1. Course Introduction

PHYS 434 (Advanced Quantum Mechanics) is an elective course that builds upon knowledge learned in PHYS 424 (Introduction to Quantum Mechanics). To a first approximation, PHYS 424 covered the material in McIntyre Chapters 1 - 8 and PHYS 434 will cover the material in McIntyre Chapters 9 – 16.

### 2. Course Overview

The structure of this course is non-traditional: we'll cover McIntyre Chapters 9 – 13 in a standard Lecture & Discussion format, and then get into a series of semi-independent 1-week "Applied Modules" that are largely driven by student interest. Student Teams will do the first 3 - 4 Applied Modules. As time permits at the end of the semester, I'll lead 1 – 2 more Applied Modules.

The course will also include a hands-on experimental component that leverages some of the cutting-edge quantum research facilities in my lab. This activity will largely correlate with the material in Chapter 13 ("Identical Particles").

### 3. Homework

We will have ~ 8 - 10 HW sets throughout the semester (~4 - 5 on McIntyre Chapters 8 – 13, and ~ 4 - 5 on the Applied Modules). In addition to standard HW problems, a small number of selected problems will include a conceptual *Deep-Dive Discussion*. For these problems, an assigned student will prepare and lead an in-class discussion/questions (~5 - 10 min, on the due date) focused on the physical interpretation, assumptions, and implications of the results, rather than on the detailed calculations.

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. When computing your overall HW grade, your lowest HW set score will be dropped. More details on the HW expectations and grading will be provided in the "*PHYS 434 HW Guidelines and Grading Rubric*" document that will be handed out with the first HW assignment.

#### 4. Applied Modules

Student teams (comprised of 2 - 3 students, pending enrollment) will fully prepare and execute 1-week Applied Modules. You are essentially the “Professor” for your 1-week module. This means you’ll prepare and deliver lectures, hand out a reference material package, and prepare and grade a HW set. The Applied Modules may cover historically important QM ideas/discoveries/applications, “hot-topic” modern research efforts, or material from McIntyre Chapters 14 – 16.

Each student will also write an independent (sole author) paper on their topic (~ 3 – 5 pages, journal format). These papers will be handed out as a key component of your reference material package. Your papers and overall Applied Modules will be graded by your peers as well as Dr. Pittman.

The general format of the 1-week Applied Modules will be:

- *Monday*: ~ 30 - 40 minute lecture during 2<sup>nd</sup> half of class. Hand out reference material package and HW set.
- *Wednesday*: ~ 50 - 70 minute lecture/discussion.
- *Monday*: HW sets and peer assessments due at the beginning of class. HW review (and possible *Deep-Dive Discussions*) during 1<sup>st</sup> half of class.
- *Tuesday*: Graded HW sets due to Dr. Pittman by 4 pm. (I will review them Tuesday evening, and return them to students on Wednesday in class).

Additional Applied Module info:

- Teams, topics, and the schedule will be chosen in early/mid-February.
- Detailed grading rubrics for the written papers and the HW sets will be given when topics are assigned.
- Detailed rubrics for peer assessment of the written papers and overall Applied Modules will be given when topics are assigned.
- You will have ~6 – 8 weeks to prepare your modules.
- **All students will turn in their Applied Module package (written papers, reference materials, HW sets and solutions, outline of lectures) on the same due day in early April (TBD).** You’ll then participate in the other modules, and wait for your turn to lead your module.

## 5. Course Schedule

- *Mid-February:* Applied Module teams, topics, and schedule chosen.
- *February/March:* McIntyre Chapters 9 – 13.
- *Mid/late March:* 1 or 2 possible dedicated in-class Applied Module prep sessions.
- *Early April:* All teams turn in completed Applied Module materials.
- *Early April – Mid-May:* Applied Modules
  - Applied Module 1 (Team 1)
  - Applied Module 2 (Team 2)
  - Applied Module 3 (Team 3)
  - Applied Module 4 (Team 4 – pending enrollment)
  - Applied Module 5 (Dr. Pittman; as time permits)
  - Applied Module 6 (Dr. Pittman; as time permits)

## 6. Course Grading

HW Sets on McIntyre Chapters 9 – 13 will be graded by me. HW sets on the Applied Modules will be graded by the Student “Professors”, and reviewed by me. The overall course grade is determined by the following weightings:

- |                                          |     |
|------------------------------------------|-----|
| • Average of HW set scores               | 50% |
| • Individual paper average peer score    | 10% |
| • Individual paper Dr. Pittman score     | 20% |
| • Applied Module average peer assessment | 10% |
| • Applied Module Dr. Pittman assessment  | 10% |

## 7. Academic Integrity

As with all courses, Academic Integrity is required in PHYS 434:

*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.*

## **8. 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