Spring 2017 Syllabus
PHYS 424, Quantum Mechanics

Instructor: Dr. Todd Pittman
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Office Hours: Wed. 1 – 3 pm.

Lectures: MWF 11:00-11:50
Location: Sondheim 114
HW Grader: Michael Wolfe

Course Text: *Introduction to Quantum Mechanics* (2nd edition), by David J. Griffiths

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. 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!

Course Schedule (*tentative*)

Date	Topic	Griffiths Chapter
	Failure of classical mechanics; Quantum states, wave functions, and qubits; Postulates of QM	NA
	The wave function	1
	Time independent Schrodinger eq.	2
~ early March	**EXAM 1**	
	Formalism of QM	3
	QM in 3 dimensions	4
Mar. 20-24	**Spring Break**	
~ early April	**EXAM 2**	
	Identical particles	5
	Entanglement; quantum computing	12
~ early May	**EXAM 3**	
	Time-independent perturbation theory	6
~ late May	**FINAL EXAM**	

Course Grading

Homework	20%
Exam 1	20%
Exam 2	20%
Exam 3	20%
Final Exam	20%

Homework

We'll have roughly 8-10 HW assignments throughout the semester. Understanding the homework problems is a key part of your learning QM, and significant portions of the exams will be along the lines of the homework problems. Homework will be turned in at the beginning of the class in which it is due. I cannot accept late homework, since we will discuss solutions in class.

Each graded homework problem will be scored as follows:

3 points:	Clear explanation with nice derivations and correct results; quality plots and figures when applicable.
2 points:	Clear explanation with reasonable derivations but incorrect/missing results.
1 point:	Correct results but poor explanation/derivation; Good effort, but incorrect/missing results.
0 points:	Incoherent ramblings; sloppy and un-readable; no effort.

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.

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.

Academic Integrity

As with all courses, Academic Integrity is required in PHYS 424:

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.