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PHSX 461.01: Quantum Mechanics I

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PHSX 461: Quantum Mechanics I

Fall 2018

PROFESSOR:	Dr. Alex Bulmahn
OFFICE:	226 CHCB (inside of room 225)
EMAIL:	alexander.bulmahn@umontana.edu
LECTURE:	MWF 11:00-11:50 pm, Charles H. Clapp Building 231
OFFICE HOURS:	T 11-1, W 1-3, R 11-12, and by appointment
TEXTBOOK:	<i>Introduction to Quantum Mechanics, 2nd Edition</i> David J. Griffiths
PREREQUISITE:	PHSX 343
COREQUISITE:	M311

Overview

This course will present an introduction to quantum mechanics. The emphasis of this first semester will be on formalism and learning the “language”. We will be studying the Schrodinger equation and its solutions in one, two, and three dimensions. We will also be studying specific systems such as the harmonic oscillator and the hydrogen atom and develop an understanding of the quantum mechanical treatment of spin. While quantum mechanics is beautiful in its elegance and extraordinarily precise in its predictions, it is very difficult to interpret. Throughout the semester, we will consider some of the philosophical and conceptual issues inherent in quantum mechanics. This is an intensive course, so do not be discouraged if you find yourself having difficulty. The big payoff will come next semester when we focus more on applications to physical systems.

Learning Objectives

Upon completion of this course you should have gained an understanding of:

- the central concepts and principles of quantum mechanics.
- the Schrodinger equation and how to solve it for simple systems.
- how to use the solutions to compute probabilities, expectation values, uncertainties, and time evolution.
- the formalism and language of quantum mechanics and how it relates to linear algebra.
- the quantum mechanical treatment of angular momentum and spin.

Grading

Your grade for the course will be based on weekly homework assignments, two in-class midterm exams, and a final exam. **Homework is due at the end of the day on the due date and late homework will be penalized 10% per day late (not including weekends and holidays). Homework more than a week late will not be accepted. Make up exams will only be given in extreme circumstances.** The grading for the course will be broken down as follows:

Homework:	30%
Midterm Exams:	20% each (40% total)
Final Exam:	30%

This course can only be taken with the traditional grading option. The letter grades in this course will be based on a curve, giving you the grade that you earn. The curve will be determined by the performance of the class as a whole, but I do not have a set number of A's, B's, etc. predetermined. *Note: the last day to add or drop the course via Cyberbear is September 17th. The last day to drop the course without the Dean's signature is October 29th.*

Couse Guidelines and Policies

Student Conduct Code

The Student Conduct Code at the University of Montana embodies and promotes honesty, integrity, accountability, rights, and responsibilities associated with constructive citizenship in our academic community. This Code describes expected standards of behavior for all students, including academic conduct and general conduct, and it outlines students' rights, responsibilities, and the campus processes for adjudicating alleged violations. [Full student conduct code.](http://www.umt.edu/student-affairs/dean-of-students/default.php) (<http://www.umt.edu/student-affairs/dean-of-students/default.php>)

Disability Modifications

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and [Disability Services for Students](https://www.umt.edu/dss/default.php). (<https://www.umt.edu/dss/default.php>) If you think you may have a disability adversely affecting your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or call 406-243-2243. I will work with you and Disability Services to provide an appropriate modification.

Tentative Schedule

Week	Dates	Topic	Reading and Notes
1	8/27—31	Course Introduction, the Wave Function	1.1—1.4
2	9/3—7	Momentum, the Uncertainty Principle	1.5—1.6
3	9/10—14	Time Independent Schrodinger Equation, the Infinite Square Well	2.1—2.2
4	9/17—21	The Harmonic Oscillator	2.3
5	9/24—28	The Free Particle	2.4
6	10/1—5	Dirac Delta Function, the Finite Square Well	2.5—2.6
7	10/8—12	Finish and Review Quantum in 1-D	Midterm Exam #1
8	10/15—19	Formalism: Hilbert Space and Observables	3.1—3.2
9	10/22—26	The Eigenvalue Approach	3.3—3.4
10	10/29—11/2	Matrix Manipulation, the Uncertainty Principle	Appendix A, 3.5—3.6
11	11/5—9	Quantum Mechanics in Three Dimensions	4.1
12	11/12—16	Angular Momentum	4.3
13	11/19—23	Turkey Week	Midterm Exam #2
14	11/26—30	The Hydrogen Atom	4.2
15	12/3—7	Spin	4.4
16	12/10—14	Finals Week Final Exam 8:00-10:00 am, Friday 12/14	Exam in 231 CHCB