Physics 321-01: Introduction to Quantum Mechanics

Fall 2009 | Department of Physics, Loyola Marymount University

Instructor: J. R. Mureika
Class meetings: MW 13:00 – 14:15, Seaver 109
Office (hours): Seaver 102A (Mon 14:30-15:30; Tue 11:00-12:00; Wed 15:00-16:00)
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Outline: This course will introduce you to the weird world of Quantum Mechanics, from the initial failures of classical theory that led to the paradigm-shifting formulation, to practical applications in atomic and nuclear physics. Why is it that this theory -- which is completely counter-intuitive from a physical standpoint -- works so well? Lectures will involve a general mix of theory, worked problems and applications using both your head and computer software. Major topics include:

- The failure of classical mechanics and foundations of quantum theory
- Operators and physical observables
- Dirac notation, Hilbert spaces and state vectors
- The postulates of quantum mechanics
- Solutions to the one-dimensional Schrödinger equation
- Free particle, particle in a well, tunneling, scattering/reflection/transmission
- The quantum harmonic oscillator
- Three-dimensional quantum mechanics

This course serves as a pre-requisite for PHYS 322, 411, 451, 461.

Learning Outcomes: By the end of this course, you will:

- Understand the fundamental differences between classical and quantum mechanics, and how classical mechanics can be recovered from quantum theory
- Know the role of the wavefunction and its physical implications
- Be able to derive the Schrödinger Equation from first principles
- Be proficient with Dirac notation
- Be able to solve the Schrödinger Equation in various (1-D) scenarios, including free particle, infinite well, and step function potentials.
- Understand the difference between classical and quantum harmonic oscillators, and how the latter leads to a quantum formulation of thermodynamical processes.

Math background: It is assumed that you have prior knowledge of differential and integral calculus (MATH 131, 132, 133), as well as some differential equations experience (MATH 245). Linear algebra is also a must (MATH 250).

Textbook: *Introduction to Quantum Mechanics,* David J. Griffiths, ISBN: 0-13-111892-7
Other material will be distributed in handout form and/or as downloadable documents.

Grading scheme:

Assignments	8 @ 5%	40%
Midterm exam (take-home)	1 @ 30%	30%
Final exam (take-home)	1 @ 30%	30%
Total Grade:		100%

A	95-100%	C+	76-79%
A-	90-94%	C	73-75%
B+	86-89%	C-	70-72%
B	83-85%	D	60-69%
B-	80-82%	F	0-59%

Assignments: There will be eight (8) assignments distributed at regular intervals. In addition to usual problem solving, we will also be focusing on numerical and symbolic solution techniques using Maple. Late assignments will be penalized 20% per day late, up to 2 days (at which time the grade is reduced to 0).

Take-home midterm: You will be issued a midterm take-home exam on **Wednesday 15 October,** due **24 hours after pickup**. Tests will be penalized **10% per hour** they are late, up to a maximum of four hours (beyond which the exam grade is an F).

Final Exam: The final will also be a take-home exam, available during finals week in **December**. Details will be forthcoming. *Late exams will not be accepted for credit!*

Attendance: Class attendance is strongly encouraged in order for you to master the material. Three unexcused absences will result in a full letter grade reduction, as will each subsequent unexcused absence. A maximum of six unexcused absences will result in ***failure of the course***. *Students infected with the H1N1 (Swine Flu) virus are advised to contact me ASAP upon diagnosis. A doctor's note is not required in the event you contract this illness. Provisions will be made to make up for missed work.*

Class conduct advisory: The use of cellular phones, PDAs, MP3 players and other electronic equipment is not allowed during class time. Cell phones must be set to vibrate before entering the classroom and must be kept inside a backpack, purse or pocket. Bluetooth earpieces must be removed and music players must be put away before entering the classroom. Emergency communications are exempted.

Statement of Academic Honesty: Academic dishonesty will be treated as an extremely serious matter, with serious consequences that can range from receiving no credit for assignments/tests to expulsion. It is never permissible to turn in any work that has been copied from another student or copied from a source without properly acknowledging the source. It is your responsibility to make sure that your work meets the standard of academic honesty set forth in the "LMU Honor Code and Process" in the Undergraduate Bulletin 2008-2010 pages 61 – 64.

THIS SYLLABUS AND ITS CONTENTS ARE SUBJECT TO REVISION; STUDENTS ARE RESPONSIBLE FOR ANY CHANGES OR MODIFICATIONS ANNOUNCED IN CLASS.