Quantum Physics I

Overview

An introduction to quantum physics principles and the Schrodinger equation. Solutions to the time independent Schrodinger equation in one, two and three dimensions, including one electron atoms.

Quantum physics forms the basis for understanding the properties of matter including fundamental particles, nuclei, atoms, molecules, liquids and solids, and plasmas.

Understanding quantum physics is central to the development of technologies including computing, solar cells, lighting, information transfer and processing, nuclear energy, astrophysics.

Topics:

- Compelling Experiments
- Math
  - Superposition of waves, Complex numbers, Distribution functions
- Quantum state functions
  - Properties of wavefunctions
  - Free particle solutions to The Schrodinger Equation
  - Space and momentum functions
  - Probability current
  - Wavepackets and Expectation values
  - Operators
- The Time Independent Schrodinger Equation: 1-D cases
  - Particle in a box
    - Eigenvalues and Eigenfunctions
    - Superposition
  - Finite square well
  - Delta function
  - Simple Harmonic Oscillator
  - Double square well
  - Computational Approaches
  - Travelling waves and the step potential
  - Barrier tunneling
- TISE: Three dimensional cases
  - Square well
  - Central field and the Coulomb potential
  - Angular momentum, magnetic moment, and spin

Course Structure

- To the extent possible, this course will be conducted in person.
  - I will attempt to broadcast lectures in Webex for students who cannot attend in person.
- Weekly quizzes will usually be given on Tuesdays and will be related to work that was due in the previous week.
- Homework is a significant part of this course. It will be posted in LMS and Gradescope and submitted through Gradescope. It is usually due on Thursdays.

Grading Rubric (check the syllabus)

GRADE SOURCE	% of Final Grade
Homework (n~10) **(usually due Fridays)**	~40%
Quizzes and Class Activities **(Quizzes are usually Tuesdays)**	~30%
Midterm Exam	~15%
Final Exam	~15%

Exams and quizzes will be timed. (30 min for quizzes, 2 hours for midterm, and 3 hours for the final). The midterm and quizzes will be held during class hours unless you have made an arrangement due to conflict, accommodations, or time zone shift.

- Nominal cutoff for A, B, C, and D are given in the syllabus.
- The instructor reserves the right to be humane, consistent, and fair.

Resources and Sites

LMS, Box, webex,Gradescope

Thing	Details for Thing
Textbooks	Townsend, Quantum Physics
Class notes and announcements	Class folder in **LMS**
Supplementary materials (including chapters, articles, programs)	Resource folder in LMS
Class recordings	**BOX** (needs registration)
Homework questions Help/tutoring Advising/Personal	Persans' Monday Office Hours 1-3 TBA - Discord or **Webex** Fridays - ppersans1.youcanbook.me
Quizzes, Activities, and Exams	Class and Exam folders in LMS
Homework and Activity submission	**Gradescope**