Harvard University
Physics 143a: QUANTUM MECHANICS

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Office hours: This week Friday 10 am - 12 am, later TBA

Course Meetings: TTh, 10:00 - 11:30 in Jefferson 256
Homework: Weekly problem sets, 20% of grade.
You are encouraged to discuss problem sets. However, you must write your solutions individually.
Midterm 35% of grade
Exam 45% of grade

Topics

Introduction to nonrelativistic quantum mechanics: uncertainty relations; Schrodinger equation; one-dimensional problems including particle in a box, tunneling, and harmonic oscillator; angular momentum, hydrogen atom, spin, Pauli principle; perturbation theory; identical particles.

Primary textbook

David J. Griffiths *Introduction to Quantum Mechanics***, Prentiss-Hall (1995)**.

Additional references

C. Cohen-Tannoudji, B. Diu, F. Laloe, *Quantum Mechanics*, Wiley-Interscience publications (1977).

J.-L. Basdevant and J. Dalibard, *Quantum mechanics*, Springer (2002).

L. D. Landau and L. M. Lifshitz, *Quantum Mechanics: Non-Relativistic Theory* Elsevier Science (2003).

B. Reed, *Quantum Mechanics*, Jones and Bartlett Publishers (2008).

J. Hakim, *The Story of Science*, Smithsonian Books (2007).

Tentative outline of lectures

1. The Schroedinger equation. The statistical interpretation of wavefunctions. Reveiw of probability theory.
2. Momentum and angular momentum.
3. The uncertainty principle.
4. Time independent Schroedinger equation. Simple potentials in one dimension: infinite square well, harmonic oscillator.
5. Operator solution of the harmonic oscillator problem.
6. Free particles and wavepackets.
7. Dirac delta function potential. One dimensional scattering problem.
8. The finite square well. Double square well.
9. Principles and formalism of Quantum Mechanics. Hilbert space. Operators. Eigenstates and eigenfunctions. Physical observables. Dirac notations.
10. Quantum mechanics in three dimensions. Schroedinger equation for spherically symmetric potentials.
11. Angular momentum. Raising and lowering operators. Eigenstates
12. Hydrogen atom.
13. Spin.
14. Electrons in magnetic field. Atomic clocks.
15. Addition of angular momenta.
16. Magnetic resonance.
17. Entangled states. The EPR paradox. Bell's inequality.
18. Quantum cryptography.
19. Time independent perturbation theory. Non-degenerate case.
20. Time independent perturbation theory. Degenerate case. Periodic potentials. Solids.
21. Fine structure of monovalent atoms.
22. Variational calculations.
23. Identical particles. First and second order coherence.
24. Magnetic exchange interactions.