

PHYSICS 851
Quantum Mechanics I
Fall 2001
Professor *Vladimir Zelevinsky*

Lectures: Monday, Wednesday, Friday 10:20 - 11:10, Room 317 PA

Office hours: Tuesday 1:00 - 3:00 or by appointment, Room 202 Cyclotron;
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Textbook: *E. Merzbacher*, Quantum Mechanics, third edition

Grading: Homework 30% (assigned every week on Wednesday), Quizzes 10%,
Midterm exam 20% (end of October), Final exam 40%.

Tentative program:

1. Foundations of quantum mechanics. [Chapter 1]
2. Wave function, superposition principle. Coordinate and momentum representation. Uncertainty relation. Motion and spreading of the wave packet. [Chapters 2,3]
3. Schrödinger equation. Operators and expectation values. Continuity equation. Ehrenfest theorems. [Chapters 3,4]
4. One-dimensional motion. Discrete and continuous spectrum. Scattering and tunneling. Periodic potential. Harmonic oscillator. [Chapters 5,6]
5. Semiclassical approximation. Idea of path integrals. Quantization rules. Barrier penetration. [Chapter 7]
6. Three-dimensional motion. Reduction of a two-body problem. Central field. Three-dimensional harmonic oscillator. Spherical functions. Radial equation. Hydrogen atom (discrete spectrum). [Chapters 11,12]
7. Hilbert space and operators. Completeness and orthogonality. Dirac notations. Commutators and measurability. Heisenberg representation, operator equations of motion. Sum rules. Symmetry and conservation laws. Linear momentum as generator of spatial displacements. [Chapters 9,14,15]
8. Operator methods. Ladder relations. Harmonic oscillator, creation and annihilation operators. Coherent and squeezed states. [Chapter 10]
9. Angular momentum as generator of rotations. Algebra and irreducible representations. Notion of group theory. Spin 1/2. Parity. [Chapters 11,16,17]