PHYSICS 852
Quantum Mechanics II
Spring 2004
Professor *Vladimir Zelevinsky*

Lectures: Monday, Wednesday, Friday 10:20 - 11:10, Room 1420 BPS
Office hours: Tuesday 1:00 - 3:00 or by appointment, Room 202 Cyclotron; Phone 333-6331; e-mail ZELEVINSKY@nscl.msu.edu
Textbook: *Albert Messiah*, Quantum Mechanics, volumes 1,2
Grading: Homework 30% (assigned every week on Wednesday), Quizzes 10%, Midterm exam 20% , Final Subject exam 40%.

Tentative program:

1. Angular momentum. Generators of rotation. Eigenvalues and matrix elements of angular momentum operators. Orbital momentum, spherical functions and Legendre polynomials. Spin, properties of spin 1/2. Parity and time reversal invariance [Chapters 9,13,15]

2. Motion in a central field. Separation of variables, radial equation. Potential well. Isotropic harmonic oscillator. Hydrogen atom. [Chapters 9,11,12]

3. Scattering problem. Cross section and scattering amplitude. Born approximation. Phase shift analysis. Low-energy and high-energy scattering. Resonances. [Chapters 10,19]

4. Angular momentum coupling. Clebsch-Gordan series. Tensor operators, Wigner-Eckart theorem. [Chapter 13]

5. Stationary perturbations. Fine and hyperfine structure of atomic levels. Atom in electrostatic and magnetostatic fields. [Chapters 16,18]

6. Identical particles, Bose- and Fermi-statistics. Atomic and nuclear configurations. Statistical (Thomas-Fermi) model. [Chapters 14,18]

7. Time-dependent perturbations. Sudden and adiabatic cases. Magnetic resonance. [Chapters 17,18]

8. Quantization of electromagnetic field. Interaction of light with matter. Radiation and absorption of light. Lamb shift. [Chapters 20,21]

9. Molecules. Periodic potential. Band structure of solids. [Chapter 18]

10. Relativistic uncertainty relations. Klein-Gordon equation. Dirac equation. Non-relativistic reduction. [Chapter 20]