

**The syllabus of the Course 624**  
**Quantum Mechanics 2**  
**Spring 2009.**

*Instructor V.L. Pokrovsky.*

1. Elementary scattering theory. Phase shifts and scattering. Low and high-energy scattering. General scattering theory. Lippmann-Schwinger formalism. Higher Born approximations. Resonance scattering.
2. Spin.  $SO(3)$  group and its irreducible representations. Spin-orbit coupling. Spin in magnetic field.
3. Addition of angular momenta.
4. Discrete symmetries: P, CP, CPT time reversal invariance. Kramers degeneration.
5. Many-body quantum mechanics. Second quantization. Spin and statistics. Bose-Einstein condensation.
6. Atoms and molecules. Nuclei.
7. Propagators and path integrals.
8. Quantum interference phenomena: gravitational interference, Aharonov-Bohm effect, Aharonov-Casher effect.
9. Adiabatic approximation. Berry's phase. Landau-Zener theory.

Principal textbook: E. Merzbacher, Quantum Mechanics, 3-d edition, Wiley & sons. Additional recommended textbooks are: Landau and Lifshitz, Quantum Mechanics, Pergamon or Addison-Wesley; Sakurai, Modern Quantum Mechanics, 2-nd edition, Addison-Wesley. Some lecture notes are placed on personal Pokrovsky website, which can be reached through Physics website, Faculty, Pokrovsky.

12 homework assignments will be delivered each Tuesday. They are due Thursday next week. 2 exams are planned: midterm in March before the spring break, the final exam in May. The grades will be equally distributed between the homework assignments and 2 exams. The grade A requires the score more or equal to 90%, the grade B will be given for the score between 80 and 90%, the grade C for between 60 and 80%.

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