PHY6410: Quantum mechanics II – Applications, Fall 2011

Instructor: Sergei A. Voloshin, 345 Physics Bldg., ph:313-577-1630; fax:313-577-0711; e-mail: voloshin@wayne.edu
Office hours: 10 - 11 am MW, and by appointment.
Texts: "Introduction to Quantum Mechanics". 2nd ed., by D.J. Griffith,
"Quantum Mechanics", by D.G. Swanson
Grading: 20% homework, 40% two midterm exams, 40% final exam
Homework: assigned weekly and collected next week.
Final exam: December 15, 1:25 - 3:50 p.m., Rm 177.

Course outline

1. **Review.** Wave function, operators, Schrödinger equation. Quantum oscillator, Spin, Addition of angular momentum.
2. **Time-independent perturbation theory.** Non-degenerate, first and second order. Degenerate perturbation theory.
3. **Hydrogen atom.** Fine structure, Zeeman effect, hyperfine structure. Stark effect. The Van der Waals interaction between atoms.
4. **Quasi-classical (WKB) approximation.** Quasi-classical wave function. Bohr quantization rule. Tunneling.
5. **Helium and Multielectron atoms.**
6. **Radiation.** Time dependent perturbation theory. Emission and absorption of radiation, spontaneous emission. Dipole transitions and selection rules. Laser, magnetic resonance imaging. Sudden and adiabatic approximations.
7. **Solids and band structure.** Periodic potential and energy bands. Bloch function. Effective mass.
8. **Scattering.** Total and differential cross section. Scattering amplitude. Born approximation.
9. **Nuclear and particle physics.** Deuteron wave function. Isospin. Kaon regeneration. Neutrino oscillations.