

## PHYSICS 482, QUANTUM MECHANICS II

### Introductory Quantum Mechanics contd.

1. Time dependent perturbation theory (application to two-level atoms).
2. Density matrices, Bloch equation, application to two level atoms.
3. Approximation methods: Adiabatic and abrupt approximations, WKB and semi-classical methods.

### Quantum Many-body physics:

1. Variational principle, simple applications.
2. Many body wave-functions for Bosons. Applications: Elementary variational theory of Bose condensates.
3. Many body wave-functions for Fermions (Slater determinants). Applications: Variational Hartree-Fock theory of free electron gas, ferromagnetism of the electron gas, Wigner crystals and quantum phase transitions.
4. Second quantization for bosons and fermions.

### Quantum Field Theory:

1. Scalar field theory, Feynman diagrams; calculation of cross sections at tree level.
2. Dirac fermions, Yukawa theory, Feynman rules for QED (stated, not derived, with tree level applications).

**Recommended Text:** "Introduction to Quantum Field Theory" by Peskin and Schroeder (Perseus Books 1995).