

# Syllabus for Physics 212B

Fall 2012, Physics Department, UCSD

INSTRUCTOR: Congjun Wu (5430 MH) Email: wucj@physics.ucsd.edu

Time/Place: 12:30 - 1:50am, TUTH, MHA 2623.

Office hour: Wed: 1:00 pm - 2:00pm

TA: Wang Yang Email: wyang19ninety@gmail.com

TA office number MH5206 office hour: Friday

Books:

1. Baym *Lectures on Quantum Mechanics*, Westview Press, 1990
2. Sakurai *Modern Quantum Mechanics*, Publisher: Addison Wesley; Rev Sub edition (September 10, 1993).
3. L. D. Landau & E. M. Lifshitz, *Quantum Mechanics: Non-relativistic Theory*, Vol 3 of Landau's theoretical physics course, Butterworth-Heinemann; 3 edition (January 1, 1981).
4. L. I. Schiff, *Quantum Mechanics*, McGraw-Hill Companies; 3 edition (June 1968)

Grade:

We will decide the policy during the first class. Basically it will depend on your homework, midterm and the final project. Homework 30%, Midterm 30%, and final exam 40%.

Homework Assignments:

Homework will be assigned every one or two weeks. The TA will teach discussions, and grade homeworks.

## Class Schedule

1. Symmetry
  - Lect 1: D-matrix and Schwinger-bosons
  - Lect 2: Spherical tensor and Wigner-Eckert theorem
  - Lect 3: Symmetries and conservation laws
  - Lect 4: Discrete symmetries: parity, time reversal, Kramer degeneracy
2. Approximation methods
  - Lect 5 : Non-degenerate Perturbative theory
  - Lect 6 : Degenerate perturbative theory
  - Lect 7 : Quantum transition, Fermi golden rule, spontaneous emission
  - Lect 8 : Semi-classical approximation WKB
3. Path integral
  - Lect 9 : Path integral for quantum mechanics.
  - Lect 10: Path integral for quantum spins.
4. Scattering theory
  - Lect 11 Description of scattering problem
  - Lect 12 Partial Waves: phase shifts
  - Lect 13 Low energy scattering, bound states, resonance
  - Lect 14 The Born Approximation and Optical Theorem
5. Berry phases
  - Lect 15. Berry phases;
  - Lect 16. Parallel transport
6. Second quantization
  - Lect 17 : Bose statistics and Fermi statistics
  - Lect 18 : Second quantization of identical Bose and Fermi systems
  - Lect 19 : Application of the second quantization