

# Quantum Mechanics II

Zhiyuan College

Shanghai Jiao Tong University

## Syllabus for Spring Semester 2015

**Professor: Yang Sun**

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**Class hours:** Mondays 8-9:40 am (Odd-number weeks 1-16), Lower Yard, Room 402  
Wednesdays 8-9:40 am (all weeks 1-16) Lower Yard, Room 402

**Office hours:** Wednesdays 1:30-3 pm, Physics Building #1003

**Textbook:** David J. Griffiths, *Introduction to Quantum Mechanics*. Prentice-Hall, 2005.

**Reference books:**

- R. Shankar, *Principles of Quantum Mechanics*, Plenum, 1994.
- A. Messiah, *Quantum Mechanics*, North-Holland, 1961.
- R.P. Feynman, R. B. Leighton and M. Sands, *The Feynman Lectures on Physics*, California Institute of Technology, 1966, VIII.

**Exams, homework, grading:**

Homework problems will be assigned each Wednesday, except for the Wednesdays preceding exams. Each is due in class the following Wednesday; A late handing-in will be accepted only in cases of illness or emergency. Your work on the homework assignments will contribute 25% to your final grade.

There will be a mid-term exam and a final exam. Both exams will be two-hour written exam. The mid-term exam will contribute 30% and the final will contribute 45% to your final grade. The dates for exams will be announced later.

**Collaboration and references:**

You can collaborate or seek textbook help in working on homework problems, but the final write-up must be entirely your own. You cannot copy word for word or

equation for equation from solutions. It is absolutely prohibited that you copy homework solutions from others. When you obtain outside help you must acknowledge it. (E.g. "By integrating Griffiths equation [8.5] I find that..." or even "In working these problems I benefited from discussions with Zhang xx and Wang xx.") Such an acknowledgement will never lower your grade; it is required as a simple matter of intellectual fairness.

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## **Syllabus:**

### **1. Review of some topics in part I**

Angular momentum; Spin; Two identical particles; The Pauli Principle (0.5 week)

### **2. Identical particles**

Atoms; Solids; Introduction to Quantum Statistical Mechanics (1.5 week)

### **3. Time-independent perturbation theory**

Nondegenerate perturbation theory; Degenerate perturbation theory; The Fine Structure of Hydrogen; The Zeeman Effect; Hyperfine Splitting (2.5 weeks)

### **4. The variational principle**

Theory; Applications (1 week)

### **5. The WKB approximation**

The "classical" region; Tunneling; The connection formulas;  $\alpha$ -decay of nuclei (2.5 weeks)

### **6. Time-dependent perturbation theory**

Two-level systems; Emission and absorption of radiation; Spontaneous emission (3 weeks)

### **7. The adiabatic approximation**

The adiabatic theorem; The Aharonov-Bohm Effect; Berry's phase (2.5 weeks)

### **8. Scattering**

Partial wave analysis; Phase shifts; The Born approximation (2.5 week)