APHY 439/506/PHYS 439 : Basic Quantum Mechanics (Fall 2012)

Location and time: 17 Hillhouse Ave. (HLH17) room 03, Tuesday/Thursday 1:00pm-2:15pm
Web page: See APHY 439 at classesv2.yale.edu
Prerequisites: PHYS 181b or 201b and PHYS 301a, or equivalents (or permission of instructor)
Instructor: Sohrab Ismail-Beigi, sohrab.ismail-beigi@yale.edu, 432-2107, Becton 307
Teaching Assistant: Kevin Chou, kevin.chou@yale.edu, Becton 429 (or check in lab Becton 418)
Office hours: Kevin, Becton 508: Tuesdays 8pm-10pm
Sohrab, Becton 307: Wednesdays 6pm-7pm by email appointment, 8pm-9pm walk-in
Weekly Review Sessions: Kevin, Becton 508: Tuesdays 8pm-10pm
Textbook: *Introduction to Quantum Mechanics (2nd edition)*,
by David J. Griffiths, Publisher: Benjamin Cummings, ISBN 0131118927

Pre-lecture reading quizzes: count for 10% of the course grade. These pen and paper quizzes take place during the first 5 minutes of the lecture time so show up on time. They are based on the reading assigned for that day's lecture and will test *elementary* aspects of your understanding of the reading and not exercises in difficult problem solving under high speed. There will be quizzes for almost all lectures, so assume there will be quiz unless told otherwise. All these quiz scores will be sorted (separately for each student) and this portion of the grade will only be based on the top half to the sorted scores, i.e. half of the quiz scores are dropped. The point of these quizzes is to ensure that you will do the reading prior to coming to lecture, as this makes for improved comprehension, better retention, and more useful questions in lecture. The objective is not to stress you out but just to have you come prepared to lecture by reading the text and thinking a bit about it. To date, I have found no other way to ensure students read the text before class (but would happy to hear of another equally effective method!) The first quiz will be on Tuesday September 11^{th} 2012.

Weekly problem sets: count for 35% of the course grade and are due on Thursdays at the start of lecture. Homework handed in by the end of the next lecture is graded out of a maximum of 50%; there is no credit for homework handed in thereafter. Solutions will be posted on classesv2 within a week. Problem sets are a *crucial* part of the course and learning process. To receive full credit, you must show the logic and steps and not simply produce the final answer out of thin air.

Exams: One midterm worth 25% of the course grade will take place on the evening of Wednesday Oct. 10^{th}. The final exam, scheduled for Friday Dec. 14^{th} at 9am (Group 26), is cumulative and worth 30% of the course grade.

The only **acceptable excuses** for missed exams or late homework are written dean's excuses and permission of the instructor.

Outline: We will cover the material of Chapters 1-5 of the textbook. Time permitting, we will cover parts of Chapters 6, 7, and 9.

The emphasis is on *solving* a variety of quantum mechanics problems and building intuition.

The main topics are:

- Schrödinger equation, wave function and its probabilistic interpretation, uncertainity
- Time-independent problems in 1D (square well, harmonic oscillator, free particle, etc.)
- Formalism (Hilbert space, operators and eigenvalues, uncertainty, Dirac notation)
- 3D problems (spherical coordinates, Hydrogen atom, angular momentum, spin)

- Identical particles (meaning and implications)
- Perturbation theory I (time-independent)
- Perturbation theory II (time-dependent)
- Variational principle
- "Philosophical" issues

This is a great deal of material. The pace of the course will be **rapid** and will require a good deal of effort on your part. In return, you will gain a solid basic understanding of quantum mechanics and its implications.

Griffith's textbook is a good one with reasonable style and presentation of subjects, but there are many good introductory quantum mechanics textbooks each with its own style to fit a particular way of thinking and learning. I encourage you to look in the library and find something that works best for you. For example, here is a book with a *very* different style that I found useful in my undergraduate days:

Primer of Quantum Mechanics, by Marvin Chester (Courier Dover, 2003) ISBN 0486428788.