PHYS 709: Applied Quantum Mechanics

TU 2:30, CW 129

Fall 2004

Instructor:
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For questions:

If necessary, we can arrange a once-per-week review session — I have done so in the past. Otherwise, check the Message Board at http://online.ksu.edu/PHYS_709_BESRY to see if it's already been answered or to post your question. You can also email me, stop by my office, or call.

Textbook:

Principles of Quantum Mechanics, Second Edition, R. Shankar

Supplements:

Physics of Atoms, Molecules, and Nuclei, Eisberg and Resnick

The Picture Book of Quantum Mechanics, S. Brandt and H.D. Dahmen

Quantum Mechanics, Cohen-Tannoudji, Diu, and Laloë

Modern Quantum Mechanics, Sakurai

Grading:

Midterm	20%
Final	30%
Homework	50%

Course philosophy:

This course will challenge you. I expect that you will learn the most from the homework, so there will be quite a bit of it: assignments will be given roughly once per week. I encourage you to discuss the problems with your classmates, but you should write up the assignment *on your own*. Some assignments will require computer work.

Guidelines for homework:

- Discuss your homework with classmates as much as you like, but *write your homework solutions on your own!* There will be a severe grade penalty for copying.
- As a scientist in training, you need to learn to communicate scientific information in an effective, efficient manner. You should consider homework assignments as practice in this art. It is your responsibility to present your homework solutions in a readable, logical manner — not mine to decipher and interpret them. There will be a grade penalty.
- In an incorrect solution, I will reward statements in homework and on exams that show you know it is incorrect and why. I will also reward any effort above and beyond what is explicitly asked for in a problem.

Are you ready yet?

Take a look at our departmental exam in quantum mechanics. It is what our department expects someone with a B.S. in physics to know. In other words, what you should know at the end of this course! We won't be able to cover all of the material on that exam, but at the end of this course you should be well enough prepared to be able to pick up the extra topics on your own.

Students with disabilities:

If you have any condition such as a physical or learning disability that will make it difficult to carry out the work as I have outlined it or that will require academic accomodations, please notify me and contact the Disabled Students Office (Holton 202) in the first two weeks of the course.

Plagiarism:

Plagiarism and cheating are serious offenses and may be punished by failure on the exam, paper, or project; failure in the course; and/or expulsion from the University. For more information refer to the "Academic Dishonesty" policy in the *K-State Undergraduate Catalog* and the *Undergraduate Honor System Policy* on the Provost's web page at http://www.ksu.edu/honor/.

Tentative Course Outline:

I will assume that you have a working knowledge of Chaps. 1, 2, 3, 5, 7, and 13. The more important material from these chapters will be reviewed in class — especially Chap. 1 — but will not be covered completely. If you do not feel comfortable with the material in any of these chapters, then I strongly suggest that you at least read through them.

The following is the tentative list of topics that will be covered in lecture (we may not get to the whole list and there may be others added):

Chap. 1 Mathematical Introduction
Covered in the first few lectures.

Chap. 2 Review of Classical Mechanics
Sec. 2.8 — symmetries are important.

Chap. 4 The Postulates — a General Discussion
Skip density matrices. Choosing a basis is important.

Chap. 5 Simple Problems in One Dimension
Gaussian wavepackets and lots of homework; applications. 1D scattering and computer work.

Chap. 7 The Harmonic Oscillator
Algebraic solution and applications.

Chap. 9 The Heisenberg Uncertainty Relations
Review canonical pairs of observables.

Chap. 10 Systems with N Degrees of Freedom
Direct product solutions and nonseparable systems.

Chap. 11 Symmetries and Their Consequences
Relation to quantum numbers, etc.

Chap. 14 Spin
Application to two-level systems.

Chap. 15 Addition of Angular Momenta

Chap. 16 Variational and WKB Methods
Just the variational method. Applications to atomic and molecular structure. Possibly also structure of solids. Some computer work.

Chap. 17 Time-Independent Perturbation Theory
Should be mostly review; few applications.

Chap. 18 Time-Dependent Perturbation Theory
Electromagnetic transitions.