PHYS4702 Intro to Atomic, Nuclear, & Particle Physics Fall 2015

This is a terminal course in undergraduate quantum mechanics. We will review the mathematics and underlying formalism, and then apply it to understand quantum phenomena in atomic and subatomic systems.

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Office Hours: Tuesday 2-4pm *or by appointment*

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Office Hours: Wednesday 2-4pm

WEB PAGE: http://phys.cst.temple.edu/~napolj/PHYS4702/

LECTURES: Tue, Thu Wachman 408 9:30-10:50

TEXTBOOK: Eisberg & Resnick, *Quantum Physics, Second Ed,* Wiley (1985)

The enrollment in this class is not large, so I did not order the textbook for the bookstore. You can easily find good, used copies online (or a new copy from the publisher or Amazon) at a much reduced price. You might try to find other copies online as well.

I will also distribute notes on oscillations, waves, electromagnetism, and special relativity, that will serve as reference material for the beginning and some other parts of the course.

GRADING POLICY

Grades will be determined from the homework assignments (25% altogether), the two midterm exams (25% each), and the final exam (25%). The cutoffs for course grades A, B, C, and D are 90%, 80%, 70%, and 60% respectively. I expect to make some use of "grade modifiers", that is $\pm$ after the grade. I may make other adjustments to the overall grading scheme if there are special circumstances.

Homework is due *at the start of class on Thursday* as indicated on the class schedule. The actual homework assignments (typically three problems due each week) are posted on the course web page.

The midterms and final exam are all open book/open notes. You are welcome to bring and consult whatever resources you like to an exam, except another human. Please do not make the mistake of thinking this means that you do not need to prepare for the test!

ACADEMIC INTEGRITY STATEMENT

I want you all to collaborate with each other on homework as much as possible, and to come for help during office hours, help sessions, or at any mutually convenient time. However, it is very important for me to trust that you are handing in your own work. (Just the same, it is important that you trust me to organize and teach a quality course for you.) There are formal guidelines on all this, but to put it simply,. . .

Don't copy someone else's homework, and don't cheat on exams. If I suspect you of either, I will ask for an explanation. If your explanation is unsatisfactory, you will be given a grade of zero and reported to the Dean's office. If this happens more than once, you will be given an F for the course.

GENERAL COURSE INFORMATION

The prerequisites for this course include calculus through differential equations and partial differentiation, as well as upper level material in mathematical physics, classical mechanics, electromagnetism, and, perhaps most importantly, an introduction to quantum mechanics. Some of you have different levels of preparation than others, though, and I will take this into account in the class material and homework.

You'll see from the course outline that we will start with a review of the physics and mathematics of classical waves, and then move into the Schrödinger Equation. After reviewing the solutions of some basic problems in wave mechanics, we'll talk about the operator formalism in quantum mechanics and use this to introduce the notion of "spin" angular momentum. This will complete the foundation on which we'll build the rest of the course.

Applications will be to atomic, nuclear, and particle physics. The textbook is rather dated, so when it comes (especially) to nuclear and particle physics, I will give you updated material in class. However, the book does a very good job of supplying background for understanding the concepts, sometimes in the appendices. I've tried to point out the places where you can find this material, in the course outline.

You should be aware that, especially in particle physics, the framework for understanding nature is *Quantum Field Theory*, as opposed to the single-particle quantum mechanics that you've seen so far. This is because quantum field theory deals with many-particle systems, including those in which particles can be created or destroyed. We won't use this formalism in this course, but at times I will point out to you areas in which it is critical for our understanding of physical systems. (If you want to read ahead, learn about the *Lamb Shift* in atomic hydrogen, or neutrino reactions on protons.)

It is very important that you ask questions, either in or out of class, of me or Danielle, or anyone else. This is not easy stuff, but it is fascinating and well worth the effort you'll put in to following it. Please get in touch with me any time if you'd like to get help or a further understanding.