UC Berkeley
Physics 137A - Lecture 001
Quantum Mechanics, Spring 2018
Course Information

Instructor Information	Lecture Information	Office Hours
Austin Hedeman 443 Birge Hall aphysicist28@berkeley.edu	**Lecture 001** MWF, 9:00am – 10:00am 390 Hearst Mining	M, 11:00am – 12:00pm θ, 12:00pm – 1:30pm F, 4:00pm – 5:00pm 429 Birge Hall

Enrollment: This course is **Physics 137A - Lecture 001 - Quantum Mechanics.**

Course Description: Quantum Mechanics is the startling theory of the microscopic world that was forced on science near the beginning of the 20th century. This theory is of fundamental importance for physics and most modern devices rely on the strange-seeming rules of Quantum Mechanics to function properly. In this course we will develop the basic rules of how quantum systems operate. Along the way this course will cover many example systems such as the simple harmonic oscillator, the quantum version of angular momentum, and the hydrogen atom.

Course Website: https://bcourses.berkeley.edu/
The course website will be hosted through the bCourses system. If you having trouble accessing the website, please e-mail me at aphysicist28@berkeley.edu so we can get you set up!

Texts:

- Griffiths, David, *Introduction to Quantum Mechanics, 2nd Edition*. This has become a standard introductory text for Quantum Mechanics. This is a **required** text. This semester we will primarily cover Chapters 1 through 4 of this text.

On the syllabus you will find a tentative outline of topics and dates for this course. In italics listed next to most of the topics is the relevant section of Griffiths. These sections are to be read **before** coming to lecture. There will be more specific reading assignments listed in the Homework Assignments folder on bCourses.

It is important to get many different perspectives and takes on the subject, since you never know which one may 'click' for you. Different authors have different writing styles and organizations of the subject. Listed below are other Quantum Mechanics texts that you may find useful! They are on reserve at the Physics Library:

- Shankar, Ramamurti, *Principles of Quantum Mechanics*. This book is very useful for learning Dirac notation (which we will study in the second third of the course). This book is also available as an electronic resource through the Berkeley Library at http://link.springer.com/book/10.1007%2F978-1-4757-0576-8. You should be able to access it with your Berkeley affiliation. This is only a **recommended** text (but a highly recommended one, since you can get it for free through the link).
- Bransden & Joachain, *Quantum Mechanics*. This is the textbook that is preferred by some other professors in the department (notably Professor Siddiqi). This is also a very good text. The material for this class will cover up through Chapter 7 of this book.
- Liboff, *Introductory Quantum Mechanics*. This is another standard introductory text.
- Feynman, *The Feynman Lectures on Physics, Vol. 3*. Volume 3 of the Feynman Lectures covers Quantum Mechanics. Like all of Feynman's stuff it is very well written and worth looking at!

Content: This course is broken up into three parts:

- **Part I: 1D Quantum Mechanics**: We begin our journey into quantum mechanics by studying 1D systems from a *wave function* approach, which is how you may have been exposed to quantum mechanics in previous courses such as Physics 7C. We will develop some useful examples and use these examples to introduce and develop the important concepts and *interpretations* that underlie quantum mechanics. Mathematically, all we are doing in this part is introducing a new wave equation that governs how the wave function behaves (this is the same math involved in studying *any* type of wave phenomena such as sound waves, optics, or electromagnetism). All of the interesting physics comes from how we interpret the information that the wave function gives us.

- **Part II: Formalism**: In this part we develop the underlying mathematical structures that arise in quantum mechanics (linear algebra). We will come to view the object that describes the quantum system as a type of vector called a "ket," and the wave function as a "component description" of the ket. We will explore this formalism through two quantum systems, a double-well "toy model" and the simple harmonic oscillator.
- **Part III: 3D Quantum Mechanics**: In the last part we will explore three-dimensional quantum mechanical systems. The end result is that we will be able to derive the energy levels of hydrogen and create all of those neat "electron cloud" pictures that pop up all the time in chemistry textbooks! We will conclude this section with an in-depth discussion of *angular momentum* in quantum mechanics. In particular, we will explore the concept of *spin*, a new and fascinating type of angular momentum that pops up in quantum mechanics.

Discussion Sections:

Section 101:	Monday	2:00pm - 3:00pm	2 LeConte	GSI: [redacted]
Section 102:	Wednesday	4:00pm - 5:00pm	2 LeConte	GSI: [redacted]

Sections will be devoted to working through examples. You are highly encouraged to attend! There will be no discussion sections during the first week of lecture.

Office Hours:

My office hours are listed at the top of this document and will be held in 429 Birge Hall. The GSIs will also hold office hours and their schedule will be posted on the course site. These office hours may change based on student availability. I am also available by appointment.

Homework Assignments:

There will be weekly problem sets posted on bCourses at least one week prior to the due date of the assignment. You are encouraged to work together on these assignments, but each student must submit their own work. Problem sets will typically be due **Fridays at 6pm** (though the dates may move around slightly during exam season so you don't get too slammed with work). You must submit your homework in the designated box in the second floor breezeway between Birge and LeConte Halls.

Late homework will be accepted with a *penalty*. If you turn the homework in by **2pm** one business day after the due date you will receive a **25% penalty** on the work turned in. If you turn the homework in by **2pm** two business days after the due date you will receive a **50% penalty** on the work turned in. Solutions to the homework will appear on bCourses at this time and late homework will **not** be accepted after that.

Problem sets will constitute 40% of your overall grade. At the end of the semester your lowest homework score will be dropped.

In each problem you do over the semester it is important to not only *show* your work, but also to *explain the steps you are taking*. As with any physics problem set, the answers are not typically as important as knowing *how* to get the answers. Think of these as opportunities to show off what you know. If you can explain what you are doing and why you are doing it, you are well on your way to understanding what is going on!

You are encouraged to work with your peers on these problem sets. Discussing problems, explaining your thought processes to other people, and hearing how others approach the problems are excellent ways of expanding your understanding of the material. That being said, students must turn in their *own* work.

Exams:

There will be three exams for this class - two midterm exams and a final exam. Since it is impractical to have in-class exams where we only have 50 minutes, the exams will be held in the evening. I am requesting rooms for 6:00pm on either **Monday, February 26th** and on **Monday, April 9th**. I will post the rooms once the room reservations are confirmed. If any of these dates conflicts with your schedule, please contact me ASAP, but *no later than Friday, January 26th*. Each of the exams will be worth 18% of your final grade. Watch this space and bCourses for updates. The final exam will be held on **Monday, May 7th from 7:00pm - 10:00pm** and will be worth 24% of your final grade.

Midterm 1 will cover *Part I: 1D Quantum Mechanics* and Midterm 2 will cover *Part II: Formalism*. The Final Exam will emphasize *Part III: 3D Quantum Mechanics*, but will be a comprehensive exam.

Piazza: Piazza is a service that lets students ask questions (either publicly or anonymously) that the instructor, GSI, or other students can then answer. This is great for asking questions about the homework. You can sign up to our Piazza page by going to http://piazza.com/berkeley/spring2018/phys137alec001.

Grades: The grade breakdown will be as follows:

Homework Assignments	40 %
Midterm 1 (2/26)	18 %
Midterm 2 (4/9)	18 %
Final Exam (5/7)	24 %

Disabled Students' Program: http://www.dsp.berkeley.edu/

All students who have special needs can receive appropriate accommodations. The DSP office must determine or verify these accommodations before they can be offered. Students who are requesting academic accommodations are responsible for contacting the DSP Coordinator *immediately*. Please contact the instructor when a request for accommodation has been filed.

Student Code of Conduct: http://sa.berkeley.edu/code-of-conduct

The instructor and students are expected to behave with the utmost of integrity, responsibility, and civility towards all members of the classroom as well as Extension staff. Additionally, all members of the Extension community are expected to comply with all laws, University policies, and campus regulations, conducting themselves in ways that support a thriving learning environment. For more information, see the linked document. Violation of the code of conduct can result in disciplinary steps as outlined in the code.

Administrative Issues: Please do not hesitate to e-mail me at aphysicist28@berkeley.com with any questions, feedback, or administrative issues!

Changes and Updates: Any changes, corrections, modifications, amendments, or updates to these policies will be announced in lecture and posted on the course website.

If you are in trouble for whatever reason, please let me know! I'll try to help!

◊