Quantum Mechanics
Fall Quarter 2023
Physics 115A

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Physics 317

**Lectures:** M,W,F 9:00-9:50 AM in Roessler 55

**Textbook:** Intro. to Quantum Mechanics (3rd Ed.) by Griffiths and Schroeder
Lecture notes will be available on the course website.

**Course TAs:**

| | |
|---|---|
| Ben Eustis-Guthrie | (bmguthrie@ucdavis.edu) |
| Umut Oktem | (ucoktem@ucdavis.edu) |

**Office Hours:**

| | |
|---|---|
| Problem Solving: | Monday 2:00 PM in Physics 80 (basement) |
| Eustis-Guthrie: | Wednesday 5:00-6:00 PM outside PSEL 3014 |
| Oktem: | Friday 10-11 AM in Physics 80 (basement) |
| Mulhearn: | Wed 2:30-4:00 PM in Physics 317 |

(May end at 3:30 PM if there is a faculty meeting I cannot dodge.)

**Midterm Exam:** Nov 8 during lecture, see section below.
**Final Exam:** Wed, December, 13 2023 6:00 PM in Roessler 55

**Course Description:**
Introduction to quantum mechanics. We will introduce the Schrödinger Equation and it's probabilistic interpretation. We will then hone our understanding and intuition with a series of examples: infinite potential wells, harmonic oscillators, free particles, finite potential wells, delta function potentials, scattering, and the WKB approximation. Grounded by these examples, we will formalize our understanding of quantum mechanics with Hilbert Space, Observables, and the Uncertainty Principle. We will also introduce the powerful Dirac Notation.

**Homework:**
Homework and due dates will be posted on the course website. The best way to prepare for the exams is to solve problems yourself or by actively participating within a study group. Do not post homework problems to internet forums or use solutions found online. Always do you own work and be prepared to explain it.

**Cheating:**
Cheating is in the long run counterproductive, but I can understand that it is frustrating when it seems the cheaters are getting away with it in the short term. Therefore, this class will include some countermeasures against cheating. Most homework assignments will include practice problems which are graded on effort only. Anyone cheating on these problems would be risking getting caught for no benefit to their grade. For newly written problems, we will be monitoring the cheating websites to see if they begin to appear. If they do, we may implement additional countermeasures: such as looking for tells in the online solutions, or starting weekly homework quizzes, just to mention a few. The best safeguard against cheating is the midterm and final exam. If you do all your homework yourself, you should be well prepared for those exams.

**Grades:**
Final grades will be approximately 60% Homework, 20% Midterm Exam, and 20% Final Exam. Your worst homework score will be dropped.

**Midterm:**
The Midterm is scheduled for Nov 8 during lecture. The scope of the midterm will be:

- HW1-HW5
- Griffiths Chapter 1, Chapter 2 until and including Section 2.4.
- Lecture Notes for Chapter 1, Fourier Appendix, Chapter 2 (Parts A and B).

The exam is closed note. The lecture notes will soon be updated to include chapter summaries. These chapter summaries will be attached to the Midterm exam. I am not interested in memorization, so I will provide specific equations when relevant to a problem if they are not in the summary.

**Course Schedule**:
Here is the anticipated schedule for the course. It may change as the course progresses. Attendance on Nov 22 (the day before Thanksgiving) will be worthwhile but optional. The pace will be about one section per lecture: brisk but doable. Please keep up with the reading even if the lectures fall behind.

**Lectures**:

| **Week** | **Dates** | **Topics** | **Reading** |
|---|---|---|---|
| 1 | Sep 27,29 | Wave Function, Schrondinger Equation | 1.1-1.4, P1.14 |
| | | Momentum Operator | 1.5 |
| 2 | Oct 2,4,6 | Uncertainty Principle | 1.6, P1.7 |
| | | Stationary States, Infinite Square Well | 2.1, 2.2 |
| | | Fourier Series | |
| 3 | Oct 9,11,13 | Harmonic Oscillator | 2.3 |
| | | Commutators | |
| 4 | Oct 16,18,20 | Free Particle, Momentum Space | 2.4 |
| | | Fourier Transform | |
| 5 | Oct 23,25,27 | Delta Function Potential | 2.5 |
| | | Finite Square Well | 2.6, P2.52 |
| 6 | Oct 30, Nov 1,3 | WKB Approximation | 9.1,9.2 |
| | | Hilbert Space, Observables, Operators | 3.1, 3.2, 3.3 |
| 7 | Nov 6,8 | Catch-up and Midterm Nov 8 | |
| 8 | Nov 13,15,17 | Statistical Interpretation, Uncertainty Principle | 3.4,3.5 |
| | | Dirac Notation | 3.6 |
| 9 | Nov 20,(22) | TBD | |
| 10 | Nov 27, 29, Dec 1 | TBD | |
| 11 | Dec 4,6,8 | TBD | |