

Physics 3316 Course Information, Spring 2025

Lectures: M/W/F 9:05-9:55AM, Rock 230 by Prof. Xiaomeng Liu (xl956)

Discussion sections (from week2): Wed 1:25-2:15, Rock128, Th 3:35-4:25, Rock 231 by GTA Steven Ferrante (sef87)

Study Hall (from week2): Wed 2:15-4:15&Th 4:25-6:25, Clark 294H

Office hours (from week2): Wed 2:15-3:15 (Steven), Th 5:25-6:25 (Prof. Liu), *Clark 294H during Study Hall*. The hour after each lecture, Clark 528 (Prof. Liu).

Homework Due: Friday midnight (from week2). Grader: Zihao Qi (zq73)

Textbooks:

- *An Introduction to Quantum Physics*, by French and Taylor (FT)
- *Introduction to Quantum Mechanics*, 3rd ed., by David Griffiths
- *Lecture Notes*, by Prof. Liu

Grades:

- 35% HW (lowest 2 dropped, 20% penalty per day late, three penalty-free late days over the semester), 25% mid-term, 40% final (final grades override HW and/or mid-term when higher).
- *Bonus grade* for participation: in-class, discussion session, study hall, and Ed discussion (1% assigned by instructor + 1% assigned by GRA).
- Mid-term: in-class, March 19 or March 21 TBD.

Syllabus:

1. Historical development and experimental foundations
 - 1) 19th Century: difficulties of classical physics and birth of quantum physics
 - 2) Energy quantization of light: Blackbody radiation, photoelectric effect and Compton scattering
 - 3) Structure of atoms: Rutherford model, atomic stability, line spectra
 - 4) Wave properties of particles: Bohr's atom and De Broglie hypothesis
2. The wave function (Griffiths Chapter 1)
 - 1) Schrodinger equation
 - 2) Statistical interpretation: particle-wave duality, superposition and normalization
 - 3) Uncertainty principle
3. Solving 1D time-independent Schrodinger equation (Griffiths Chapter 2)
 - 1) Stationary states
 - 2) Square well potential
 - 3) Quantum tunneling
 - 4) Harmonic oscillator

- 5) Free particle and wave packet
4. Formal quantum theory (Griffiths Chapter 3)
 - 1) Brief review of linear algebra
 - 2) Hilbert space, Hermitian operators, and eigenfunctions
 - 3) Generalized uncertainty principle
 - 4) Dirac (bra-ket) notation
5. Spherical 3D potential (Griffiths Chapter 4)
 - 1) Schrodinger equation in spherical coordinates
 - 2) Hydrogen atom
 - 3) Angular momentum
6. Spins and quantum statistics (Griffiths Chapter 4-5)
 - 1) Identical particles
 - 2) Spin
 - 3) Bosons and Fermions: Pauli exclusion principle
7. See the world with quantum mechanics (Griffiths Chapter 4, 5, 12)
 - 1) Unravel the periodic table
 - 2) Solid materials
 - 3) Entanglement and Bell's theorem
 - 4) The Aharonov-Bohm effect
 - 5) Measurement and wavefunction collapse: quantum Zeno effect

Policies:

- **All registration issues** (add/drop, section assignments, etc.) are handled through the Physics Department office. Please contact Danyel Wiersen at physicsenrollment@cornell.edu. For swapping discussion sections, students can swap to open sections during their add/drop period using the instructions published at www.physics.cornell.edu/swap.
- Homework problems will be available on Canvas the week before their due date. The problem sets must be submitted to **Gradescope** (accessible through Canvas) on Friday Midnight sharp. For 1s-24 hour late, grade will be multiplied by 0.8, 24h1s-48h late will be multiplied by 0.6, et cetera.
- Discussion and collaboration on the problem sets are encouraged, but you must first **attempt to solve as much as you can by yourself**. Step-by-step solutions or final answers are not to be posted or copied from Ed Discussion, although conceptual questions are welcome. The study hall is for students to gather to work on problems on which they have gotten stuck or could not solve themselves. However, you must have worked on the problems independently before coming to the study hall.

- **Homework grading related questions** (late submission, re-grade request) should be directed to Zihao Qi (zq73). To ensure fairness, we will do our best to grade with uniform criteria, which will not be adjusted on an individual basis.
- For **physics questions**, ask the instructor after class, come to Study Hall or post on Ed discussion. Course staff will try to address Ed discussion questions in a day; please do not expect immediate response.
- Study halls will be run by the course teaching staff, including instructor, GTA and UTAs. Attendance is voluntary.
- Canvas will be the central repository for all course materials (problem sets, grades, general class information, etc.).
- **Academic Integrity:** Each student in this course is expected to abide by the Cornell Code of Academic Integrity. “Any work submitted by a student in this course for academic credit will be the student's own work.” This includes exams, problem sets, and other homework. We will impose the corresponding penalties for violation of this policy.
- **Please talk to the instructor when you have any issues or suggestions.** Instructor can be reached by emails for other questions (Prof. Xiaomeng Liu, xl956@cornell.edu) Please include “3316” in all emails' “Subject:”.

Homework: drop on Friday after stuff meeting, Due Friday midnight.

Staff meeting: Friday 10:30AM

Homework problems: Xiaomeng, obtain previous questions

Homework solution: Steven

Grading and deal with grading/late request: Grader

Exam: Xiaomeng, in consult with Steven

Grading of exam: all three of us

Ed: rotate between three staff