PHYS-UA-123
Quantum Mechanics I
FALL 2019

Lectures:	Tue., Thu.	11:00 AM - 12:15 PM	Rm. 1045
Recitations:	Tue.	3:30 - 4:45 PM	Rm. 1067
	Tue.	4:55 - 6:10 PM	Rm. 1025

http://cosmo.nyu.edu/~jr4089/QuantumSyllabus.pdf

Instructor: Prof. Joshua Ruderman
Contact: prof.josh.ruderman@gmail.com, 212-998-7717
Office Hours: Wed. 3:30 - 5:30 PM and by appointment, Rm. 907

TA: Panagiotis Charalambous
Contact: pc2560@nyu.edu
Office Hours: Thu. 2:00 - 4:00 PM and by appointment, Rm. 1043

Start of Semester Meeting

Students are recommended to meet Prof. Ruderman one-on-one during the first two weeks of the semester, in his office, 726 Broadway 907. We will discuss course expectations, student backgrounds, *etc.* Please email Prof. Ruderman at prof.josh.ruderman@gmail.com to arrange a meeting.

Course Description

Quantum mechanics is the probabilistic description of nature that applies to the smallest length scales, such as atoms and subatomic particles. Quantum mechanics is consistent with all experimental tests (so far), and we now understand classical deterministic physics to be an approximation to an underlying quantum world.

We will develop quantum mechanics, beginning with simple 2-state spin systems, which are examples of *qubits*, and building up towards continuous systems. Topics to be covered include quantum states, matrix mechanics, operators, uncertainty relations, the Schrödinger equation, wave mechanics, the harmonic oscillator, the hydrogen atom, and entanglement.

Prerequisites

- Mathematical Physics (PHYS-UA-106)
- Classical and Quantum Waves (PHYS-UA-105)

Required Textbook

John S. Townsend, *A Modern Approach to Quantum Mechanics* (2nd Edition), 2012.

Other References

- D. J. Griffiths, *Introduction to Quantum Mechanics*
  (traditional approach of wave mechanics before matrix mechanics)
- J. J. Sakurai, *Modern Quantum Mechanics*
  (harder than Townsend)

Problem Sets

Problem sets will be assigned each Tuesday and must be turned in to the TA by 3:00 PM Friday, the following week.

Problem set solutions must include a clear description of what is being done using *words*. Equations only, without explanatory words, will not receive full credit. Students are encouraged to first attempt homework problems on their own since this is the best way to learn the material. If stuck, students can discuss problems with the instructor, TA, and other students. Students are required to turn in their own, independent, write-ups, which should be in their own words.

Exams

Students will be provided an *equation sheet*, with important formulas, during exams.

Midterm

The midterm will occur during class and is tentatively scheduled for Tuesday October 17. The date will be confirmed later.

Final

The final exam is scheduled for December 17, 10:00 - 11:50 AM.

Grading

Problem Sets (dropping lowest score)	30%
Midterm	30%
Final	40%

The mapping of numerical scores to letter grades will be determined later (note: if we curve, we will only curve up).

Tentative Schedule

The following schedule is tentative and subject to change.

Week	Class Dates	Topics	Townsend Chapter(s)
week 1	9/3, 9/5	intro, Stern-Gerlach	1
week 2	9/10, 9/12	Stern-Gerlach / matrix mechanics	1,2
week 3	9/17, 9/19	matrix mechanics	2
week 4	9/24, 9/26	angular momentum	3
week 5	10/1, 10/3	angular momentum / time evolution	3,4
week 6	10/8, 10/10	time evolution	4
week 7 fall break	Thu 10/17 10/15-Legislative Day	midterm	
week 8	10/22, 10/24	wave mechanics	6
week 9	10/29, 10/31	wave mechanics	6
week 10	11/5, 11/7	harmonic oscillator	7
week 11	11/12, 11/14	harmonic oscillator / 2-body problem	7,9
week 12	11/19, 11/21	2-body problem	9
week 13 Thanksgiving	Tue 11/26	hydrogen atom	10
week 14	12/3, 12/5	hydrogen atom / entanglement	10,5
week 15	12/10, 12/12	entanglement	5
week 16 final	Tue 12/17 10:00 - 11:50 AM	final exam	