

Quantum Mechanics I
Course Information for Fall 2001 Semester
August 30, 2001

Course Number: PHYS6510 (also PHYS4510)
Course Name: Quantum Mechanics I
Meeting Times: Monday and Thursday 8:30-9:50am
Classroom: Low (CII) 3045

Instructor:	Jim Napolitano	Grader:	Yury Varshavsky
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Office Hours:	By appointment	Hours:	Thursday 10am-12noon

This course covers Quantum Mechanics at a level appropriate to graduate study in Physics. Suitable prerequisites are Quantum Mechanics or Quantum Physics at an undergraduate level, as well as familiarity with calculus, linear algebra, and differential equations.

The main textbook for the course is *Quantum Mechanics, Third Edition*, by Merzbacher. (Wiley, 1998.) This text is available in the RPI bookstore. However, the first part of the course will instead follow *Modern Quantum Mechanics*, by Sakurai. (Addison Wesley, 1985.) This book is not in the bookstore, and it is not required, but you can easily purchase a copy online or elsewhere. Alternatively, as this book has been used in the past in our department, you can likely find a copy to borrow from one of your graduate student colleagues. Another book to which I will refer from time to time, is *Principles of Quantum Mechanics, Second Edition*, by Shankar (Plenum, 1994.) The book *Introductory Quantum Mechanics, Third Edition*, by Liboff (Addison Wesley, 1998) is a good undergraduate text that makes a good reference for the prerequisite material.

Your course grade will be based on seven problem sets throughout the term. You are strongly encouraged to collaborate with other students on working these problem sets **except for the midterm and final sets** on which you must work independently. Due dates and times for all problem sets will be strictly enforced. The midterm and final problem sets will account for about half the total course grade.

The reverse side of this page outlines the class schedule we will follow. It will be helpful if you can read the material in the text before coming to class. (We will try hard to stick close to this schedule, but it may be subject to change.) Next semester in PHYS6520 Quantum Mechanics II, we will cover much of the rest of Merzbacher, certainly Chapters 17, 18, and 19; probably Chapters 20 and 21; possibly Chapter 22; but probably not Chapters 23 and 24. We will also spend some time discussing Quantum Computing and Quantum Information.

Week	Date	Topic	Textbook	Date	Topic	Textbook
1	27Aug	Introduction; Dirac Notation	Sakurai 1.1,1.2 (Merzbacher 9.4)	30 Aug	Bras, Kets, and Measurements	Sakurai 1.3,1.4 (Merzbacher Chap 10)
2	3 Sep	No classes		6 Sep	Observables and Uncertainties	Sakurai 1.4 (Merzbacher Chap 10)
3	10 Sep	Unitary Transformations	Sakurai 1.5,1.6 (Merzbacher 9.5, 9.6)	13 Sep	Wave functions	Sakurai 1.6,1.7 (Merzbacher Chap 2)
4	17 Sep	Time evolution	Sakurai 2.1 (Merzbacher Chap 14)	20 Sep	Pictures	Sakurai 2.2 (Merzbacher Chap 14)
5	24 Sep	The Simple Harmonic Oscillator	Sakurai 2.3 (Merzbacher 10.6)	27 Sep	Schrödinger's Equation	Sakurai 2.4 (Merzbacher Chap 3)
6	1 Oct	Gauge Transformations	Merzbacher 4.6,4.7 (Sakurai 2.6)	4 Oct	The WKB Approximation	Merzbacher 7.1, 7.2 (with Chapter 6)
7	9 Oct (Tues)	Applications of the WKB Method	Merzbacher 7.3-7.5	11 Oct	The Variational Method; Rayleigh-Ritz Function	Merzbacher 8.1, 8.2, and 8.4
8	15 Oct	The Double Oscillator	Merzbacher 8.5 (with Chapter 5)	18 Oct	Molecular and Periodic Systems	Merzbacher 8.6, 8.7
9	22 Oct	Rotations; Angular Momentum	Merzbacher 11.1,11.2	25 Oct	Orbital Angular Momentum	Merzbacher 11.3-11.5
10	29 Oct	Spherically Symmetric Potentials	Merzbacher 12.1-12.3	1 Nov	One-Electron Atoms	Merzbacher 12.4-12.6
11	5 Nov	Scattering and Green's Functions	Merzbacher 13.1-13.3	8 Nov	Born Approximation; Partial waves	Merzbacher 13.4, 13.5
12	12 Nov	Resonances and Coulomb Scattering	Merzbacher 13.6-13.8	15 Nov	Representations and Propagators	Merzbacher 15.1,15.2 (Sakurai 2.5)
13	19 Nov	Feynman Path Integrals	Merzbacher 15.3 (Sakurai 2.5)	22 Nov	No Classes	
14	26 Nov	The Density Matrix	Merzbacher 15.5	29 Nov	Spin revisited; Rotations	Merzbacher 16.1-16.3
15	3 Dec	Spin Dynamics	Merzbacher 16.4-16.6	6 Dec	Scattering and the Stern-Gerlach Experiment	Merzbacher 16.7, 16.8