Phys541: Applications of Quantum Mechanics
Spring 2024
Instructor: Alejandro Garcia

Physics 541 Syllabus

We will cover basic concepts that are important for applications of quantum mechanics and examine some examples in detail. In particular, the structure of the hydrogen atom and simple molecules, solids and quantum statistics, the Zeeman effect, electromagnetic transitions, laser cooling of atoms and quantum computing. During the last two weeks of classes students will make presentations on research projects that they will work on during the 2nd half of the quarter.

Physics 541 Schedule

Class#	Topic	Text Reading*
01	Introduction and Review (H Atom)	Chp 4
02	Harmonic oscillator, Two particle Systems	2.3, 5.1
03	Beyond H: Rydberg, Alkali, and 2-electron atoms	5.2
04	Solids, Quantum Statistical Mechanics	5.3, 5.4
05	Time-independent perturbation theory	6.1, 6.2
06	Fine and hyperfine structure, Zeeman effect.	6.3, 6.4, 6.5
07	Variational principle, Helium ground state	7.1, 7.2
08	Hydrogen molecule ion, molecules	7.3
09	Quantum tunneling	8.1, 8.2, 8.3
10	Two-level systems, Rabi problem	9.1
11	Emission and absorption of EM radiation	9.2, 9.3
12	Laser cooling, Ultracold Atoms and Applications	Notes
13	Scattering and Scattering Resonances	11 and notes
14	Quantum computing	Notes
15	In-class presentations I	
16	In-class presentations II	
17	In-class presentations III	
18	In-class presentations IV	
19	Review	
20	In-class final exam	

*From Griffiths, except for "notes", which will be distributed.