Welcome to Introductory Quantum Mechanics & Spectroscopy!

Quantum mechanics is the theory that explains the properties of all matter. We begin with the historical origins of quantum mechanics, and then proceed to the postulates and their physical significance. We treat simple model problems that elucidate quantization of bound particles, and tunneling through a barrier. The quantum mechanical basis for microwave and infrared spectroscopies – arising from molecular rotation and vibration - will be uncovered. The underlying electronic structure of atoms and molecules will also be investigated.

Course Content:

A. The Schrödinger Equation
- origins of quantum mechanics in classical mechanics and wave optics
- the time independent Schrödinger equation
- the time dependent Schrödinger equation
- operators, commutators, spin, Heisenberg uncertainty principle
- postulates of quantum mechanics
- particle in the box
- tunneling

B. Nuclear Motion in Molecules
- harmonic oscillator
- rigid rotor & angular momentum
- perturbation theory
- introduction to spectroscopy; selection rules
- rotational & vibrational spectroscopy

C. Electronic Structure
- hydrogen atom
- many-electron atoms; angular momentum coupling
- Hartree-Fock theory
- electron spectroscopic methods
- diatomics
- Hückel theory
Textbook:


Textbook (optional):


Assessment:

Five A2L quizzes (best 4 of 5)  
due Sep. 27, Oct. 18, Nov. 1, 22 and Dec. 7  
20%

Two Group Assignments  
due Oct. 7 and Dec. 2  
10%

Tutorial participation (best 10 out of 12)  
5%

Midterm (Nov. 4, 7-9 pm)  
25%

Final exam (3 hours)  
40%