Physics 137A, Spring 2003
Course Outline

Instructor: Martin White, 561-C Campbell
GSI: Peter Shepard (pgs@socrates)

Lectures: Tu/Th 9:30-11:00am, 343 LeConte
Office Hours-MW: Th 11-12 (561 Campbell)
Office Hours-PS: M 1pm & Tu 11am (281 LeConte), Th 11-12 (Milano)
Exams: problem sets (30%), midterm (30%), final (40%)
Texts: Griffiths (Merzbacher, Sakurai, Baym)

1. Fundamentals of Quantum Mechanics
   (a) Interference and uncertainty
   (b) Linear algebra, Hilbert spaces and bra-ket notation, connection with wave mechanics
   (c) Postulates of QM, precise statement of Uncertainty Principle
   (d) Time evolution and the Schrödinger equation.
   (e) Schrödinger and Heisenberg pictures, spin precession and the non-classicality of the spin-vector
   (f) Connection with classical mechanics, Ehrenfest and virial theorems.
   (g) Path integral formulation.
2. One-dimensional problems in Wave Mechanics
   (a) Connection of bra-ket notation with Wave Mechanics, stationary states
   (b) Conservation of probability current and speading of the wavepacket
   (c) Escape proof box, bound states, symmetry of states, double well
   (d) Scattering theory in 1D, phase shift, resonances and bound states, evolution of a wave packet
   (e) Nanocircuits and the Quantum Point Contact, Landauer conductance
   (f) Harmonic oscillator, raising and lowering operators, coherent states
   (g) Example of decoherence, Schrödinger's cat
3. Interlude
   (a) Quantum computers
   (b) Quantum cryptography
4. WKB Methods
   (a) The classical limit and semi-classical methods
   (b) Matching conditions and integral quantization condition
   (c) Quantum bouncing ball and evanescent waves
   (d) Barrier penetration
   (e) WKB and the virial theorem
5. Many particles and many dimensions
   (a) Many particle systems
   (b) Systems of more than 1D
6. Hydrogen atom
   (a) Central potentials
   (b) Separation of variables
   (c) Energy eigenvalues/eigenfunctions