PHYS 711 Fall 2011
Syllabus

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The **required** text for this class is my notes, which can be purchased from the *Quick Copy* in the basement of Russell House (near where you get your ID). I also recommend as a secondary text any of the standard graduate texts like Sakurai, *Modern Quantum Mechanics*, Merzbacher, *Quantum Mechanics*, Shankar, *Principles of Quantum Mechanics*, or Messiah, *Quantum Mechanics.* You may also find it useful to refer to one of the many good undergraduate texts such as Griffiths or Park. Problems are due one week after they are assigned.

Grades are calculated as follows:

Mid Term	20%
Final Exam	20%
Homework	60%

I would like to organize an informal (voluntary) problem session for either Monday or Wednesday afternoon. During this period we can go over homework problems or problems typical of the qualifying exam.

The goal of this course is to give you a working knowledge of the theoretical and conceptual foundations of quantum mechanics.

day	subject	objectives
8/18 8/23	**Mathematical Foundations of QM** Hilbert space, operators, basis states,	Develop facility with the bra-ket notation Construct operators and states in Hilbert space.
8/25 8/30 9/1	**The Harmonic Oscillator** Ladder operators, coherent states Landau levels in 2D electron gas Shell model of the nucleus	Develop a facility with the algebra of the ladder operators. Apply algebraic methods to interesting problems
9/6 9/8 9/13 9/15	**Quantum Dynamics** Unitary time evolution, the Hamiltonian The Schrodinger equation Propagator for the TDSE, the Feynman path integral, Heisenberg and interaction pictures, time-dependent perturbation theory.	Solve the TDSE in a basis. Calculate time-dependent expectation values Calculate time-dependent operators in the Heisenberg picture . Calculate TDPT to second order and apply Fermi's Golden Rule
9/20 9/22 9/27	**Conceptual foundations of QM** Copenhagen and Universal wavefunction Two-slit, Stern-Gerlach, EPR, GHZ, Bell	Explore the consequences of the tenets of QM. Ponder the implications of the 2 slit, EPR,and GHZ experiments.
9/29 10/4 10/6	**Symmetry and Unitary Transformations** Change of basis, Translations, Rotations, Parity Time reversal symmetry	Construct change of basis by unitary transformation. Find the generators and the Lie algebra for continuous transformations. Construct antiunitary operators for time reversal.
10/11 10/13 10/18 10/20 10/25	**The Theory of Rotations** Algebra of angular momentum operators Irreducible reps of rotation group, Clebsch-Gordan Series, tensor operators, Wigner-Eckart theorem	Use the symmetry of systems under rotation to characterize its energy eigenstates. Construct cartesisan and spherical tensor operators.
10/27 11/1 11/3 11/8	**Approximation Methods** Perturbation theory, Variational Methods	Construct the perturbation series to second order. Apply the variational method to calculate ground states
11/15 11/17	**The Hydrogen Atom** Relativistic corrections	Develop a facility and familiarity with the hydrogenic eigenfunctions. Apply approximation methods to understand the details of the spectrum of the hydrogen atom. Explore the "hidden" symmetry generated by the Runge-Lenz vector.
11/22	**Thanksgiving Holiday**	
11/29 12/1	Hyperfine interaction Runge Lenz vector	