PHYS 7610: Quantum Theory I
Syllabus

Objectives: Introduce the physical basis of quantum mechanics, the Schrodinger equation, the quantum mechanics of one-particle systems and the stationary state problem.

Instructor: Prof. Diana Vaman
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Grader: Vinh Hoang, vvh9ux@virginia.edu

Class Hours: MWF 11:00-11:50; Rm 218

Office Hours: M 1-2pm, W 1-3pm, Rm 308

Textbook: Shankar, Principles of Quantum Mechanics
Other supplemental texts I will refer to:
Merzbacher, Quantum Mechanics
Messiah, Quantum Mechanics
Sakurai, Modern Quantum Mechanics
Landau and Lifshitz, Quantum Mechanics (non-relativistic theory)
Cohen Tannoudji et al., Quantum Mechanics (vol I)
Schiff, Quantum Mechanics
Le Bellac, Quantum Physics
Weinberg, Lectures in Quantum Mechanics

Grading: Homework assignments 30%
Midterm exam 30%
Final exam 40%

Exam Dates: Midterm exam: TBD, 11:00-11:50 (during regular class hour), Rm 218
Final exam: Friday, December 12, 9:00am-12:00pm, Rm 218

Homework: Homework assignments will be posted regularly on collab; you are encouraged to discuss the assigned problems with your classmates, but you must write the solutions independently. Identical homeworks are unacceptable. The assignments are due at the beginning of the class on the announced date. Late homeworks will receive epsilon credit (with epsilon a small number, and rapidly diminishing with time).

Attendance Attendance is not taken, but you are responsible for the material presented, turning your homework in time, knowing any administrative announcements made such as changes to the syllabus, or changes to the scheduling of homeworks and exams.

Course outline (subject to change):

-physical basis for QM
-wave functions, Schrodinger eqn
-postulates of QM, Hermitean operators, Dirac notation
-stationary solution of the Schrodinger eqn
-operator spectra
-the harmonic oscillator
-tunneling, square well bound states, scattering from a square well
-commutation relations and their significance, Heisenberg's uncertainty relations
-angular momentum

-3-dimensional spherical potentials, Coulomb potential
-some features of atomic physics
-charged particles, gauge invariance, Aharonov-Bohm effect
-spin, Stern Gerlach, magnetic moment, spin dynamics in a magnetic field
-addition of angular momenta
-symmetries and conservation laws
-rotation group,
-discrete symmetries parity and time reversal
-propagators
-Feynman path integral formulation of QM
-Bell's inequality, entanglement
-ensembles, the density matrix, information loss, decoherence, quantum teleportation
-periodic potentials, Bloch's theorem