PHY 408 Quantum Mechanics II

Pre-requisites

You should know classical mechanics at the PHY235 level as well as quantum mechanics at the PHY407 or PHY238 level. It is best to know linear algebra at the PHY404 level; if not you should take that course concurrently.

Syllabus

•Review of Linear Vector Spaces; Operators

•Review of the axioms of quantum mechanics; the algebra of Observables; Hilbert space of states. Heisenberg and Schrodinger equations.

•Review of classical mechanics; classical observables; Poisson algebra.

•Semi-Classical Methods; WKB method for bound states; Tunneling; Instantons; Symbol calculus; Higher orders in the semi-classical expansion.

•Observables and Operators; Eigenvalue Problems.

•Angular Momentum: Representations; Addition of Angular Momentum; Spin; Spin-Orbit coupling

•Time Independent Perturbation Theory: Anharmonic

Oscillator; Helium atom; Degenerate Pertrurbation Theory.

•Time Dependent Perturbation Theory: Impulse approximation; Adiabatic approximation;Periodic perturbation; beta decay.

•Variational Principle: Helium; Virial theorem; anharmonic oscillator.

•Scattering Theory: differential cross section; partial wave expansion; Hard Sphere; Rutherford Scattering.

•Hartree-Fock approximation: density matrix; Slater determinant.

•Thomas-Fermi approximation: atomic structure function for large Z .