Home work 2

1) Solve the ground state of Hydrogen atom using a decaying exponential as a trial wave function and an exponential with a quadratic decay term in the radial co-ordinates. Find which one gives the closest to the actual energy levels

2) Consider a Halved Harmonic Oscillator i,e an infinite wall at zero. Find a suitable trial wave function and solve for the ground state energy using variational method. Solve the same problem using WKB method

3) Read about the Laughlin trial wave function for fractional quantum Hall effect.

4) Solve the Helium atom ground state energy by a suitable trial wave function.

5) Find the connection between Hamilton-Jacobi equation and WKB (Cf Schiff Quantum Mechanics or Park Classical Dynamics and its Quantum analogs)

6) A Ball bounces on a hard floor. Assuming the floor to be an infinite barrier and a linear potential due to gravity find a suitable trial wavefunction to solve it using variational method. Solve the same problem using WKB method.

7) We showed the concept of unit cells of Phase space in multiples of Planck's constant h while discussing the Bohr-Sommerfeld-Wilson quantization rule . In systems with large number of particles as well as states one defines a density of states using such a lattice as a continuum analog for counting quantum numbers . Read about density of states in any stat mech book.

8) Use the WKB theory for alpha decay. Show how decay rate can be verified with experimental data.