Math Methods (PHYS 320):18

Spring 2019

Reading: Finish reading Chapter 13, sections 1-8.

(1) (a) Separate the TISE form of Schrödinger's equation (equation 3.22 on page 631) in spherical coordinates assuming that

$$V(r) = \frac{1}{2}\mu\omega^2 r^2.$$

This is a 3D harmonic oscillator. Assume the mass is μ.

(b) Find the angular solutions - much like we just did in class.

(c) When you get to the radial equation it is convenient to define

$$R(r) = \frac{u(r)}{r},\ \rho = \alpha r = \sqrt{\frac{\mu\omega}{\hbar}}r, \text{ and } \lambda = \frac{2E}{\hbar\omega}.$$

Show that the ODE becomes

$$\frac{d^2u}{d\rho^2} - \frac{\ell(\ell+1)}{\rho^2}u - \rho^2 u = -\lambda u.$$

(d) to be continued... Please note your results so far so you an pick this up in Questions 19.