

(1) Find the mean and most probable radius of the 2s orbital in hydrogenic atom.

(2) Show that the linear combination of Y_1^1 and Y_1^{-1} is equal to

$$p_x = \frac{1}{\sqrt{2}}(Y_1^1 + Y_1^{-1}) = \left(\frac{3}{4\pi}\right)^{\frac{1}{2}} \sin \theta \cos \phi$$

And

$$p_y = \frac{1}{\sqrt{2}}(Y_1^1 - Y_1^{-1}) = \left(\frac{3}{4\pi}\right)^{\frac{1}{2}} \sin \theta \sin \phi$$

Plot these functions on a polar graph papers at $\phi =$ (a) 0, (b) 30 (c) 60 and (d) 90 degrees. What is your observation?

(3)