

3/7/03 start

PS4 # 10 comments

"Find most likely points"

- Strictly, find maxima in Ψ^2

$$\Rightarrow \text{solve } \frac{\partial}{\partial r}(R^2) = 0 \quad \text{and} \quad \frac{\partial}{\partial \theta}(\Psi^2) = 0$$

(no ϕ dependence)

- In practice, find extrema in Ψ (will get same answers)

$$\Rightarrow \text{solve } \frac{\partial R}{\partial r} = 0 \quad \text{and} \quad \frac{\partial \Psi}{\partial \theta} = 0$$

for $2p_z$, $Y_{10} = \sqrt{\frac{3}{4\pi}} \cos\theta$

$$\frac{\partial Y_{10}}{\partial \theta} = -\sqrt{\frac{3}{4\pi}} \sin\theta = 0$$

\Downarrow

$$\theta = 0 \text{ or } \pi$$

locations of extrema of Y_{10}

$$(Y(0) = \sqrt{\frac{3}{4\pi}}, \quad Y(\pi) = -\sqrt{\frac{3}{4\pi}})$$

$$\Rightarrow Y_{10}^2 = \frac{3}{4\pi} \cos^2\theta$$

$$\frac{\partial}{\partial \theta} Y_{10}^2 = \frac{3}{2\pi} \cos\theta (-\sin\theta) = 0$$

\Downarrow

$$\theta = \frac{\pi}{2}$$

location of minimum in Y_{10}^2

$$(Y^2(\frac{\pi}{2}) = 0)$$

\Downarrow

$$\theta = 0 \text{ or } \pi$$

locations of maxima in Y_{10}^2

$$(Y^2(0) = Y^2(\pi) = \frac{3}{4\pi})$$

Same answers!