Degeneracy :-

The probability of finding particle anywhere is

$$\bar{\psi}_n(z,\bar{z})\,\psi_n(z,\bar{z}) = |N|^2\, z^n e^{-\frac{m\omega}{\hbar} z\bar{z}}\, \bar{z}^n e^{-\frac{m\omega}{\hbar} z\bar{z}}$$

$$= |N|^2 \cdot r^{2n} e^{-\frac{m\omega}{2\hbar} r^2}$$

Rotationally invariant.

$$dP = \int d\theta\, \bar{\psi}_n(r)\psi_n(r) = 2\pi r\, |\psi_n|^2\, dr$$

$$\Rightarrow \frac{dP}{P(r)} \sim 2\pi|N|^2 r^{2n+1} e^{-\frac{m\omega}{2\hbar} r^2}$$

$$\frac{dP}{dr} \sim 2\pi |N|^2 \left[(2n+1) r^{2n} e^{-\frac{m\omega}{2\hbar} r^2} + r^{2n+1}\left(-\frac{m\omega}{2\hbar}\right)\cdot 2r\, e^{-\frac{m\omega}{2\hbar} r^2}\right] = 0$$

$$\Rightarrow P_{max}\ \text{at}\ r_* = (2n+1) r_*^{2n} - \frac{m\omega}{\hbar} r_*^{2n}\cdot r_*^2 = 0$$

$$\Rightarrow r_*^2 = \frac{\hbar}{m\omega}(2n+1)$$

$$\Rightarrow r_{max}^2 = \frac{\hbar mc}{meB}(2n+1) = \frac{\hbar c}{eB}\left(n+\frac{1}{2}\right)$$

Require

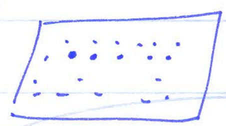
$$n_{max}\frac{\hbar c}{eB} = R^2$$

$$n = \frac{R^2 e B}{\hbar c}$$

$$= \pi R^2 B \,\frac{e}{hc}$$

$$= \Phi \,\frac{e}{hc}$$

Number of allowed states is proportional to flux. $\frac{hc}{e}$ is the unit flux.



An issue :-

$$\vec{A} = -B_0 y \,\hat{i}$$

$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ -B_0 y & 0 & 0 \end{vmatrix} \qquad \hat{k}$$

$$H_x = \frac{1}{2m}\Big(-i\hbar\frac{\partial}{\partial x} - i\hbar\frac{\partial}{\partial y} - B_0 y$$