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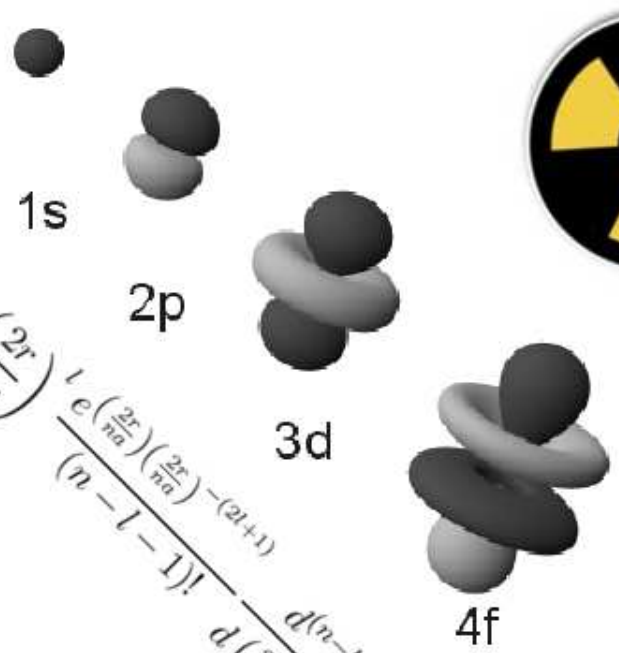

$$\psi_{nlm} =$$

$$\sqrt{\frac{(n-l-1)!}{2n(n+l)!}\left(\frac{2}{na}\right)^3}\, e^{-\frac{r}{na}} \left(\frac{2r}{na}\right)^l e^{\left(\frac{2r}{na}\right)} \frac{d^{(n-l-1)}}{d\left(\frac{2r}{na}\right)^{(n-l-1)}} \left(e^{-\left(\frac{2r}{na}\right)} \left(\frac{2r}{na}\right)^{n+l}\right) \sqrt{\frac{2n+1}{4\pi}\frac{(n-m)!}{(n+m)!}}\, e^{im\phi} \left(1-\cos(\theta)^2\right)^{\frac{|m|}{2}} \left(\frac{d}{d\cos(\theta)}\right)^{|m|} \frac{1}{2^l l!}\left(\frac{d}{d\cos(\theta)}\right)^{l} (\cos(\theta)^2-1)^l$$

Non-relativistic Schrödinger model– explains isolated simple hydrogen atom and adaptable to explain more complex configurations.

Bohr model- Gives more complete energy spectrum but too simple.

$$\frac{m_e v^2}{r} = \frac{m_e}{r}\left(\frac{n^2\hbar^2}{m_e^2 r^2}\right) = \frac{1}{4\pi\epsilon_o}\frac{e^2}{r^2} \rightarrow r = \frac{4\pi\epsilon_o n^2\hbar^2}{e^2 m_e}$$

Thompson model- Gives ~Lyman-Alpha wavelength, no others.

$$V = \frac{-e4\pi\rho}{4\pi\epsilon_0}\left(\int_0^{r'}\frac{r^2dr}{r'} + \int_{r'}^{R}\frac{r^2dr}{r}\right) = \frac{-e\rho 4\pi}{4\pi\epsilon_0}\left(\frac{-r'^2}{6} + \frac{R^2}{2}\right) \Rightarrow \omega = \sqrt{\frac{k}{m_e}} = \sqrt{\frac{e^3}{4\pi\epsilon_0 R^3 m_e}}$$

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