Cpt 9 Wave properties of Particle

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Wave properties of particle

e^- is a particle bt. can behave as wave

Wave – Particle Duality ← 2 properties which are wave property & particle property

↳ continuous energy ← something u can see

: phenomenon where under certain conditions there is wave, under other condition, there is particle, 2 properties cant exist simultaneously

: both properties for diffter condition

de Broglie wavelength

$\lambda = \frac{h}{p}$ → show wave-particle duality characteristic.

→ property of particle (only particle has mass)

property of wave

$\lambda = \frac{h}{mv}$

This formula can be used in any object (include electron, photon, light)

Energy of photon → only for light

$E = hf$ → Planck's quantum theory.

$= \frac{hc}{\lambda}$

Photon hv. energy

↓

light particle

K.E. of electron → only for e^-

$E = \frac{1}{2}mv^2$ (K.E.)

$K = \frac{1}{2}mv^2$ $(p = mv)$ $= \frac{p^2}{2m}$

$K = \frac{p^2}{2m}$ (K.E.)

$p = \sqrt{2mK}$ $\left(\lambda = \frac{h}{p}\right)$

$\lambda = \frac{h}{\sqrt{2mK}}$ $\begin{pmatrix} \Delta U = \Delta K \\ q\Delta V = K \\ eV = K \end{pmatrix}$

$\lambda = \frac{h}{\sqrt{2meV}}$

e^- hv. KE.

Electron Diffraction

Davisson – Germer Experiment

↳ try to prove that e^- also show wave property & e^- exhibit diffraction pattern.

Accelerating chamber

Cathode　anode

accelerated

F_e

$KE = U$

$U = K$

$eV = \frac{1}{2}mv^2$

According to de Broglie

$\lambda \downarrow = \frac{h}{mv \uparrow}$ ← velocity

$v \uparrow, \lambda \downarrow$

$\lambda \downarrow = \frac{h}{\sqrt{2meV}} \uparrow$ ← voltage.

$d\sin\theta \downarrow = n\lambda \downarrow$

Less diffraction

Rings (Diffraction Pattern) become narrower

Sharper image Higher resolution