Compton Effect

↳ CE

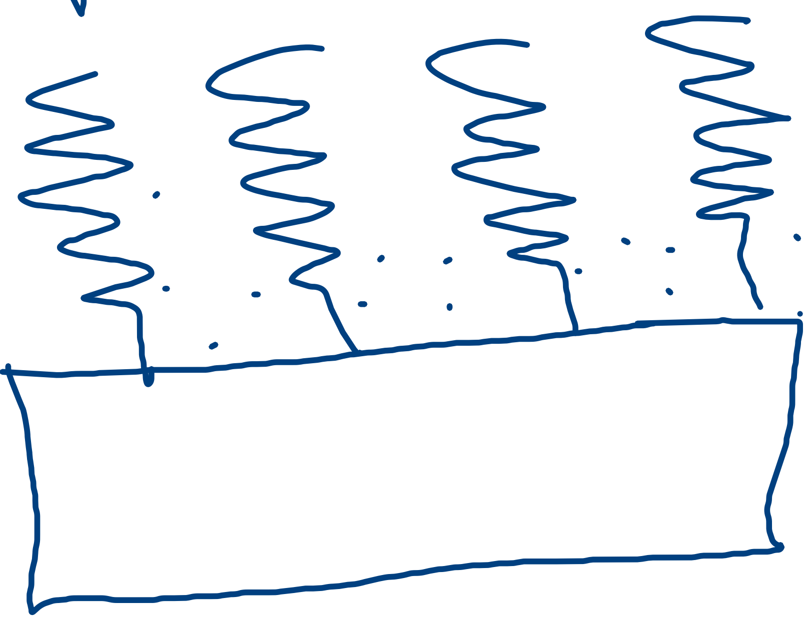
Photon → Particle → P.E.E, C.E

Photon → Wave — YDE

PEE

CE

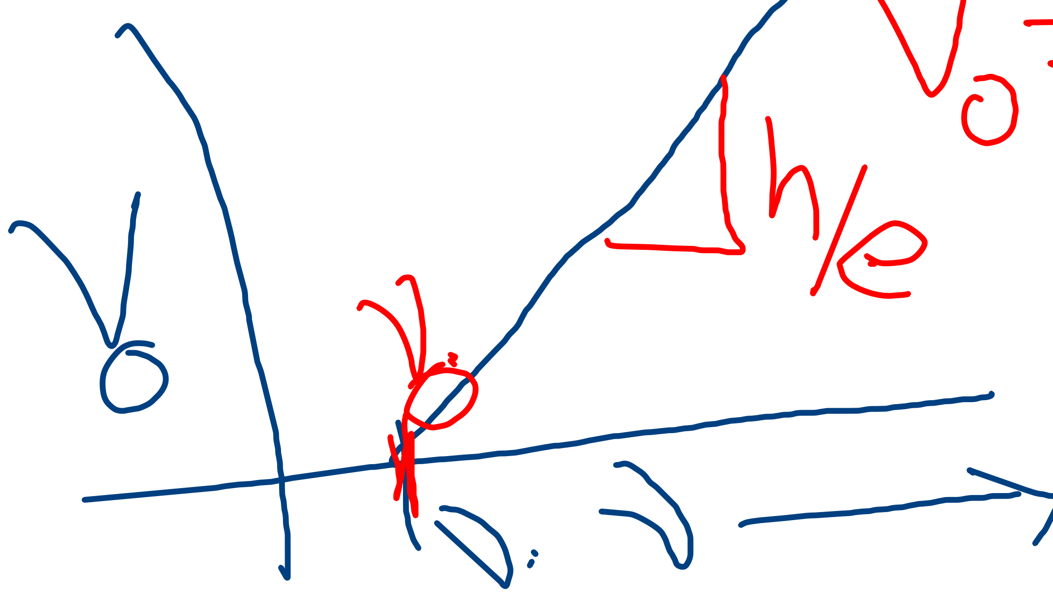
$h\nu = h\nu_0 + \frac{1}{2}mv_m^2$



$I \propto I$

$\phi_0 = h\nu_0$

$V_0 = \frac{h}{e}(\nu - \nu_0)$



$\lambda \uparrow \quad E \downarrow \quad E = \frac{hc}{\lambda}$

$E = h\nu$

$E = h\nu$

$\lambda = 6000\text{Å}$

$$\Delta\lambda = \lambda' - \lambda = \frac{h}{m_0 c}(1 - \cos\theta) \quad \text{Å}$$

$\lambda = 6000\text{Å}$

$\theta = 0 \Rightarrow \Delta\lambda = 0 \qquad \lambda' = \lambda$

$\theta = 45 \Rightarrow \Delta\lambda = 0.0071\text{Å} \qquad \lambda' = 6000.0071\text{Å}$

$\theta = 90 \Rightarrow \Delta\lambda = 0.0242\text{Å} \qquad \lambda' = 6000.0242\text{Å}$

$\theta = 135 \Rightarrow \Delta\lambda = 0.0414\text{Å} \qquad \lambda' = 6000.0414\text{Å}$

$\theta = 180 \Rightarrow \Delta\lambda = 0.0484\text{Å} \qquad \lambda' = 6000.0484\text{Å}$

$\theta = 90$

$\lambda' = 6000.0242$

$\theta = 180$

$\frac{h}{m_0 c}$

ΔE

$\theta = 90^\circ$

e^-

$\boxed{\Delta\lambda = 0.0242\,A}$

H

$\Delta\lambda = 10^{-30}\,A$

$0.00013\,A$

$\frac{h}{mv}$

C 150 m/s

$\Delta\lambda =$

1 m = 1709 m

v = 20 km/hr

$= 10^{-30}\,A$

you

m =

$\Delta\lambda =$

BB m = 650 gm

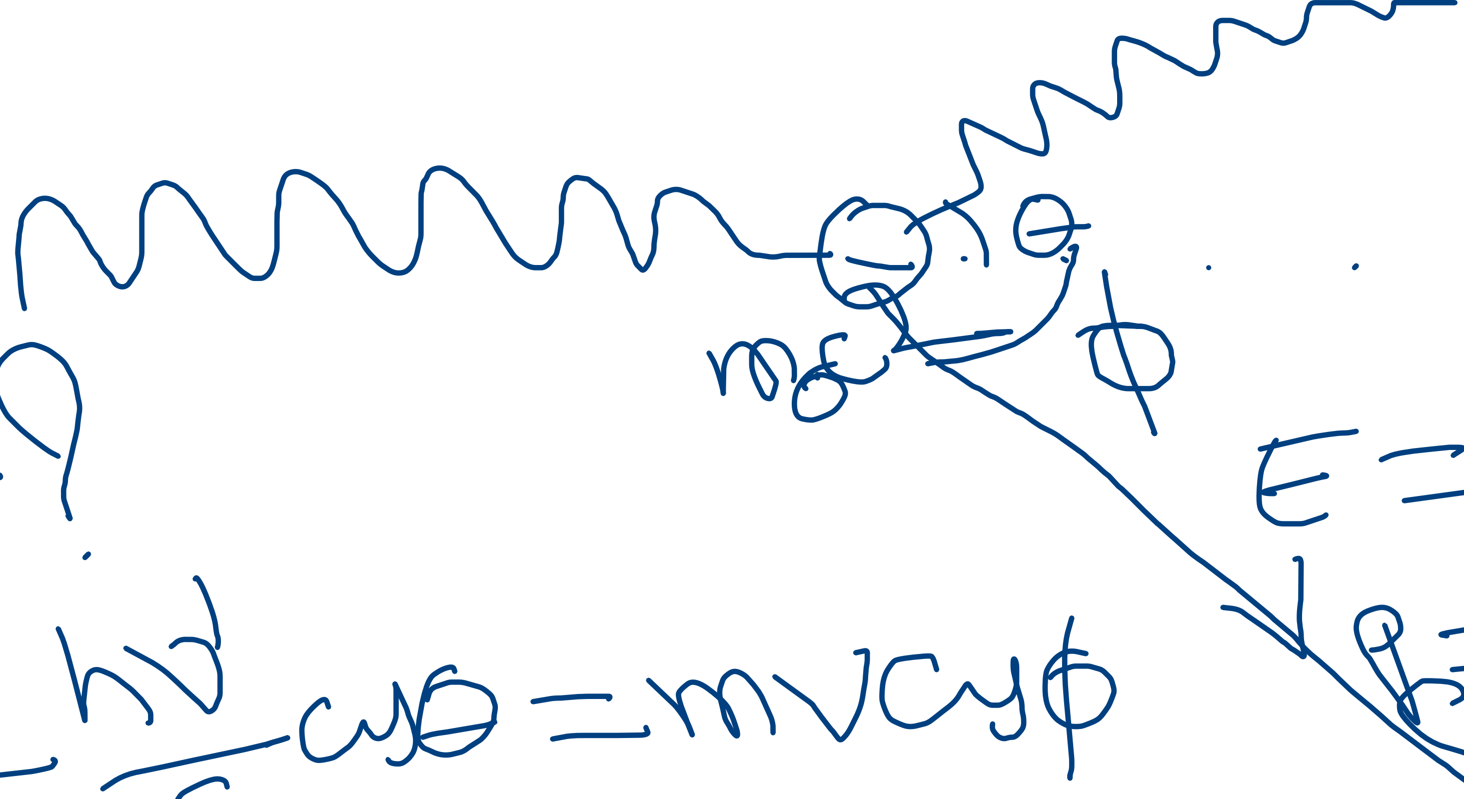
$\Delta\lambda =$

$$\boxed{\lambda' - \lambda = \Delta\lambda = \frac{h}{m_0 c}(1 - \cos\theta)}$$

$$\lambda_k = \frac{h}{m_0 c} = \frac{6.625 \times 10^{-34}\ \text{J s}}{9.1 \times 10^{-31}\ \text{kg} \times 3 \times 10^{8}\ \text{m/s}} = 0.024 \text{Å}$$

$$m_0 c = \frac{h}{\lambda_k} \Rightarrow \text{mult} \to c$$

$$\boxed{m_0 c^2 = \frac{hc}{\lambda_k} = h\nu_k}$$



$\phi = \rho$

$\lambda' - \lambda = \frac{h}{m_0 c}(1 - \cos\theta)$

$E = mc^2$

$p = mv = \frac{m_0 v}{\sqrt{1 - \frac{v^2}{c^2}}}$

$(2) \Rightarrow \frac{h\nu}{c} - \frac{h\nu'}{c}\cos\theta = mv\cos\phi$

$(5) \Rightarrow \frac{h\nu'}{c}\sin\theta = mv\sin\phi$

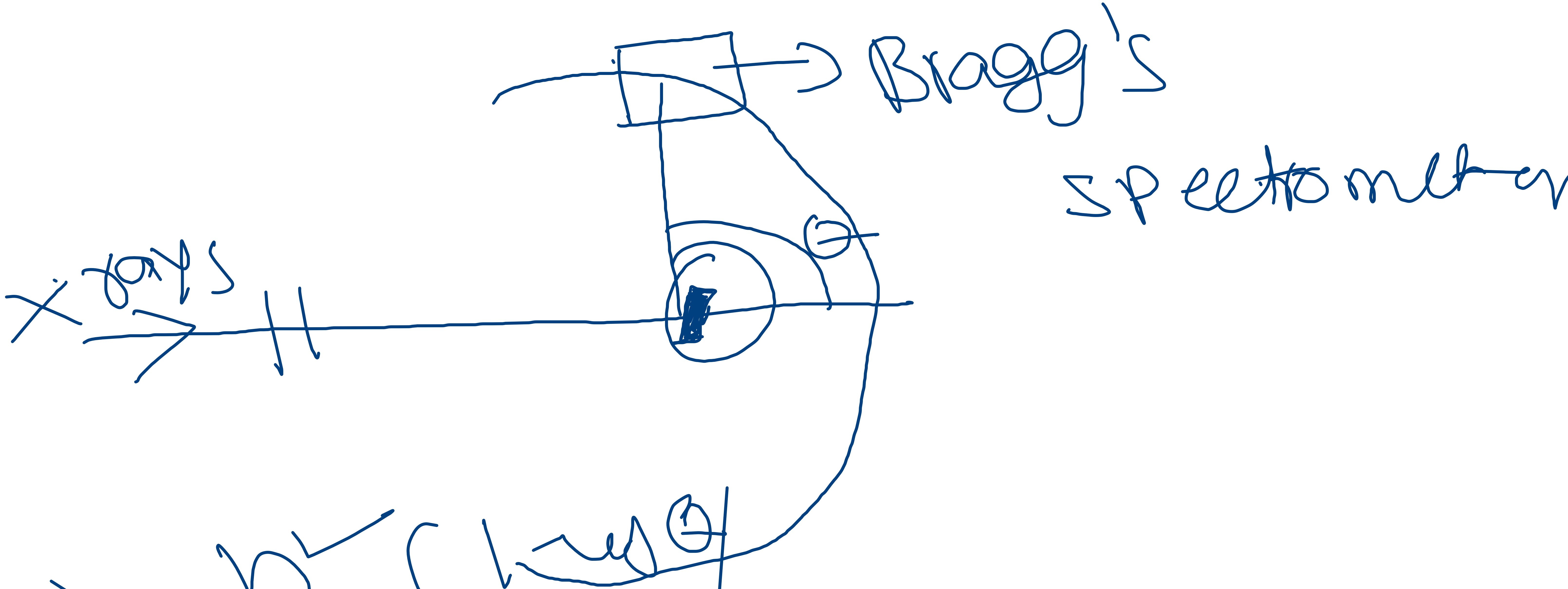
$(2) \Rightarrow p - p'\cos\theta = p_e\cos\phi \quad (6)$

$p'\sin\theta = p_e\sin\phi \quad (7)$

$\frac{h\nu}{c} = p \qquad \frac{h\nu'}{c} = p'$

$mv = p_e$

$(3) \Rightarrow$



$$\lambda' - \lambda = \frac{h}{m_0 c}(1 - \cos\theta)$$

$$(6) \Rightarrow P - P'\cos\theta = P_e \cos\phi$$

$$(7) \Rightarrow P'\sin\theta = P_e \sin\phi$$

$$\frac{(7)}{(6)} \Rightarrow \tan\phi = \frac{P'\sin\theta}{P - P'\cos\theta} \times \frac{c}{c}$$

$$\tan\phi = \frac{P'c\sin\theta}{Pc - P'c\cos\theta} = \frac{E'\sin\theta}{E - E'\cos\theta}$$

$$\boxed{\phi = \tan^{-1}\left[\frac{E'\sin\theta}{E - E'\cos\theta}\right]}$$

Conclusion PE, E & CE

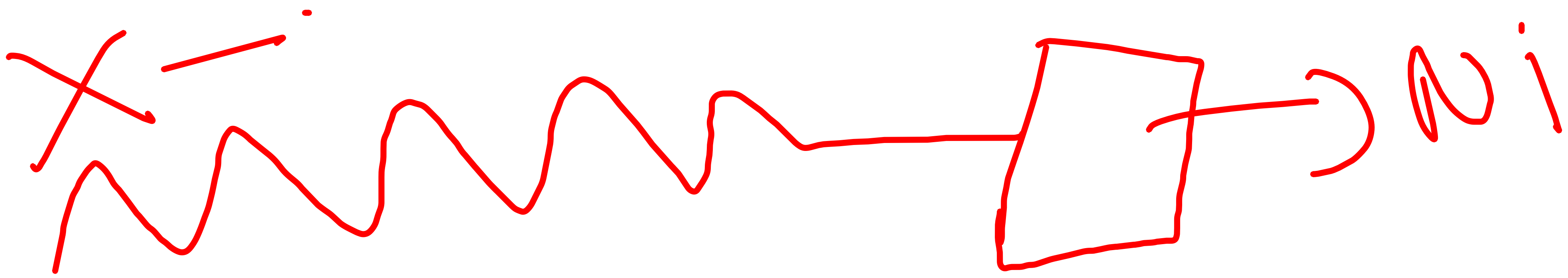
X-rays of 0.5 Å — 8° → 90°

$\lambda' = 0.524$ Å

$$\Delta\lambda = \lambda' - \lambda = \frac{h}{mc}(1-\cos\theta)$$

2) 0.198 Å → 60° $\lambda' = ?$

0.210 Å



Matter wave

└→ de-Broglie

Photon < Particle, wave

(e⁻, Protons, neu

Matter wave (or) de-Broglie

e⁻ < Particle → $\frac{e}{m}$; wave ← G.P, P.G

$\lambda = ?$

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

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

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

$$E = h\nu \qquad E = mc^2$$

$$h\nu = mc^2 \quad \text{--- } (1)$$

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

$$p = mc \quad \text{--- } (2)$$

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

$$\frac{(1)}{(2)} = \frac{h\nu}{p} = \frac{\cancel{m}c^{\cancel{2}}}{\cancel{m}\cancel{c}} = c$$

$$\frac{h\nu}{p} = c \Rightarrow \frac{h\nu}{c} = p = \frac{h}{\lambda}$$

1. de-Broglie wavelength λ in terms of KE.

$$KE = \frac{1}{2}mv^2 \times \frac{m}{m}$$

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

$$E = \frac{m^2v^2}{2m} = \frac{p^2}{2m}$$

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

$$\boxed{p = \sqrt{2mE}}$$

$$\boxed{\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mE}}}$$

2. de-Broglie w.l. in terms of A T

$$\lambda = \frac{h}{\sqrt{2mE}} \Rightarrow E = \frac{3}{2}kT$$

$$\boxed{\lambda = \frac{h}{\sqrt{2m\frac{3}{2}kT}} = \frac{h}{\sqrt{3mkT}}}$$

3. de. B λ in terms of PD

$$\lambda = \frac{h}{\sqrt{2mE}} = \frac{h}{\sqrt{2mqV}}$$

$\lambda_{100V} =$

$\lambda_{1000V} =$

$V = 0$

$V = 100$

$V = 100V$

$V = 1000V$

$\lambda =$

$\lambda =$

$\lambda =$

$\lambda =$