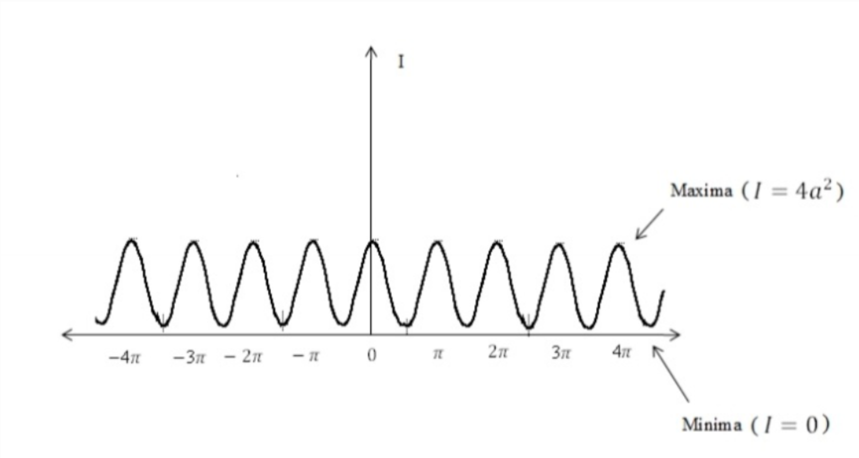
Interference

Interference is the modification in the intensity when two or more waves are superimposed. It occurs only at a point where the waves overlap. As the waves surpass the point they travel independently & unaffected.

Superposition principle → $y = y_1 \pm y_2$

$$I = R^2 = a_1^2 + a_2^2 + a_1 a_2 \cos\phi$$

* Constructive interference $= n\lambda$
 Destructive interference $= (2n \pm 1)\frac{\lambda}{2}$



Conditions for interference

1) waves must be coherent
2) Same amplitude & monochromatic
3) path difference must be there
4) path difference must only vary with the position & not with time.

Division of amplitude → Newtons ring
→ Michelson's interference

avg wavelength of visible light is 5500 Å

$$\boxed{PD = 2\mu t \cos r \pm \frac{\lambda}{2}}$$

Optical path = $\mu \times$ geometrical path.

Constructive interference

$$= 2\mu t \cos r \pm \frac{\lambda}{2}$$

$$= 2n \frac{\lambda}{2}$$

Destructive interference $= 2\mu t \cos r \pm \frac{\lambda}{2}$

$$= (2n \pm 1) \frac{\lambda}{2}$$

* Fizau's fringes: The fringes which are parallel to the edge of the film, equidistant & in the horizontal plane

(r constant t varies)

* Haidinger's fringes: The fringes occur in circular symmetry if observed from the top & will appear concentric circular (r is variable t is constant))
PD is constant.

$$\mu = \frac{\sin i}{\sin r} \Bigg\} \text{ Snell's law}$$

$$\boxed{\beta w = \frac{\lambda}{2\mu \tan\alpha} \qquad d = x\tan\alpha}$$

$$PD = 2\mu t\cos(r+\alpha) \pm \frac{\lambda}{2}$$

$$D_n^2 = \frac{4Rn\lambda}{\mu} \qquad D_n \propto \sqrt{2n}$$

$$D_n = \sqrt{\frac{4Rn\lambda}{\mu}} = \sqrt{\frac{2R\lambda}{\mu}}\sqrt{2n}$$

Bright fringes $D_m = \sqrt{\frac{2R\lambda}{\mu}} \sqrt{2m \pm 1}$

Radius of curvature $R = \frac{\mu \left(D_m^2 - D_n^2 \right)}{4(m-n)\lambda}$

$$\mu = \frac{D_n^2}{D_m^2} = \frac{D_m^2 - D_n^2}{D_m^2 - D_n^2}$$

$$t_{ARC} = \lambda / 4\mu$$