

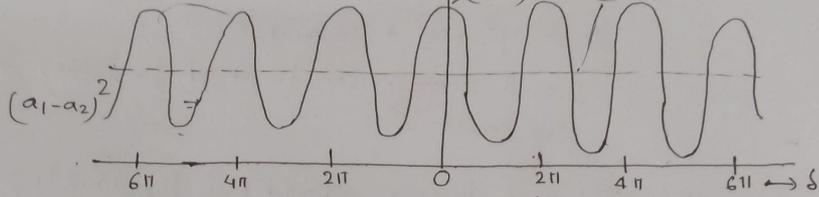
UNIT-1  
OPTICS

B.Sc. 3<sup>rd</sup> Year  
2017

TOPIC Distribution of Energy / Conditions for Interference

The resultant intensity of light at any point in the interference pattern is given by

$$I = a_1^2 + a_2^2 + 2a_1a_2 \cos \delta$$



Graph between I and  $\delta$

Periodic curve with highest and lowest points at  $(a_1+a_2)^2$  and  $(a_1-a_2)^2$  respectively which are max<sup>m</sup> and min<sup>m</sup> intensities

Average Intensity between the range  $\delta = 0$  to  $\delta = 2\pi$  is

$$\begin{aligned} \text{given, } I_{av} &= \frac{\int_0^{2\pi} I d\delta}{\int_0^{2\pi} d\delta} = \int_0^{2\pi} (a_1^2 + a_2^2 + 2a_1a_2 \cos \delta) d\delta \\ &= \left[ a_1^2 \delta + a_2^2 \delta + 2a_1a_2 \sin \delta \right]_0^{2\pi} \\ &= \frac{2\pi(a_1^2 + a_2^2)}{2\pi} \end{aligned}$$

$$\therefore I_{av} = a_1^2 + a_2^2$$

This average velocity is equal to the sum of the separate intensities

That is energy apparently disappears at min<sup>m</sup> is actually present at the max<sup>m</sup>.

Thus no violation of the law of conservation of energy in the interference phenomenon.

xxx Conditions of Interference

Intensity at points corresponding to constructive and destructive interference must be maintained max<sup>m</sup>. to zero

## Now condition for interference

- (i) The two interfering beams should be coherent that is the phase difference between them must remain constant with time.

The resultant intensity at a point.

$$I = a_1^2 + a_2^2 + 2a_1a_2\cos\delta$$

$\therefore$  I will remain constant if  $\delta$  remains constant.

- (ii) The two beams should have the same frequency  
if the light are of diff. frequencies, the phase between them will continuously vary. The resultant intensity at a point will change with time.

- (iii) If the interfering waves are polarised, they must be in the same state

- (iv) The amplitude of the interfering waves should be equal. ~~or~~

- (v) The amplitude of the interfering waves should be equal.