YOUNG'S DOUBLE SLIT EXPERIMENT

Determination of fringe width

Determination of wavelength of monochromatic wave.

Note:
Approximations to be used:
1. Small d
2. large D
3. small θ

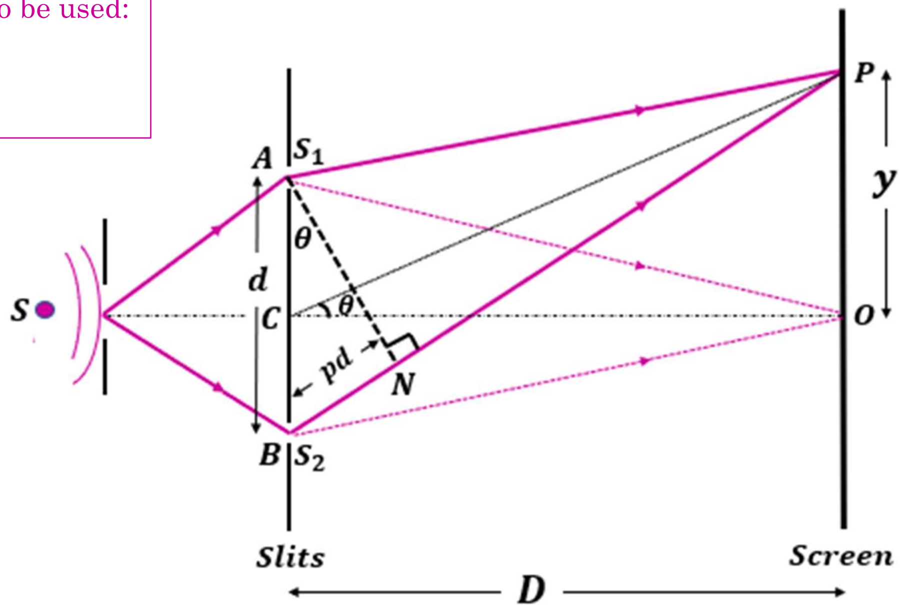

Figure: Interference due to double slit

The given figure shows the interference between two coherent light waves (from ($\boldsymbol{S_1}$ *and* $\boldsymbol{S_2}$). The two coherent sources of light are separated by distance $\boldsymbol{d}$ and $\boldsymbol{D}$ be the distance between the plane of source and the screen.

Fringe width (β): The distance between any two successive bright fringes (or distance between two successive dark fringes) is called as fringe width.

1. **Condition and Position of Central Maximum [Primary maxima]:**

   Any point on the screen will be a point of central maxima if light from S_1 *and* S_2 reaches the point in same phase or if the path difference is zero.

   Point $\boldsymbol{O}$, on the screen, is equidistant from each source. Hence, the path difference between each corresponding waves reaching to point $\boldsymbol{O}$ will be zero.

   Therefore, point $\boldsymbol{O}$ is the point of central maximum (central bright fringe).

2. **Condition and Position of secondary maxima and secondary minima:**

   In figure, point P is at distance y from the central maxima on the screen. The path difference between the rays reaching at point P is:

$$path\ difference = \boldsymbol{BN} = \boldsymbol{d\ sin\theta} \quad \text{[From } \Delta\, ABN\text{]}$$

$$for\ small\ \theta,\ \boldsymbol{path\ difference = d \times \theta \ldots \ldots \ldots} \text{ [1]}$$

Also, in triangle ΔPCO ,

$$\boldsymbol{tan\theta \approx \theta = \frac{y}{D}} \ldots \ldots \ldots \text{ [2]}$$

For small angle θ,

$sin\theta \approx \theta$

and, $tan\theta \approx \theta$