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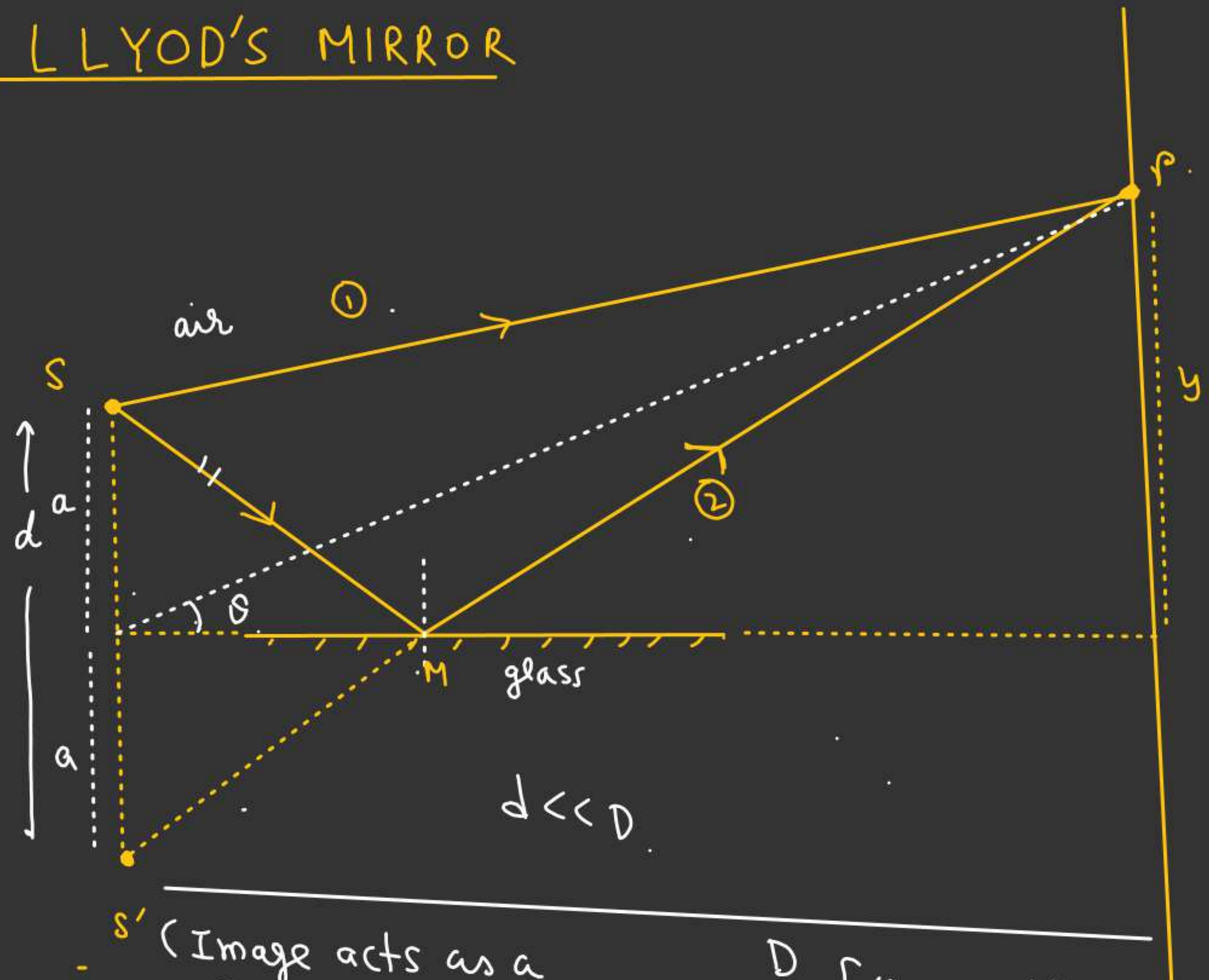
LLYOD'S MIRROR

$$d = 2a$$

$$\Delta x = \underbrace{\left(SM + MP + \frac{\lambda}{2}\right)}_{\Downarrow \text{ Ray 2}} - \underbrace{SP}_{\Downarrow \text{ Ray 1}}$$

$[SM = S'M]$



$$\Delta x = \left(\underline{S'M + MP} + \frac{\lambda}{2} - SP\right)$$

$$\Delta x = (S'P - SP) + \frac{\lambda}{2}$$

$$\boxed{\Delta x = \left(\frac{dy}{D} + \frac{\lambda}{2}\right)}$$

(Image acts as a Source for reflected light)

$$\left[\begin{aligned} S'P - SP &= d\sin\theta \\ &\simeq d\tan\theta \\ &\simeq \frac{dy}{D} \end{aligned}\right.$$

Condition for Maxima.

$$\frac{dy}{D} + \frac{\lambda}{2} = n\lambda.$$

$$\frac{dy}{D} = (2n-1)\frac{\lambda}{2}$$

$$y = (2n-1)\frac{D\lambda}{2d}$$

$n = 1, 2, 3, 4 \ldots$

$n = 1 \Rightarrow$ Central Maxima
$n = 2 \Rightarrow$ 1^{st} Maxima

$$y_1 = \frac{D\lambda}{2d}$$
$$y_2 = \frac{3D\lambda}{2d}$$

$$\boxed{W = \frac{D\lambda}{d}}$$

Condition for minima

$$\frac{dy}{D} + \frac{\lambda}{2} = (2n+1)\frac{\lambda}{2}.$$

$$\frac{dy}{D} = n\lambda$$

$$\boxed{y = \frac{nD\lambda}{d}}$$

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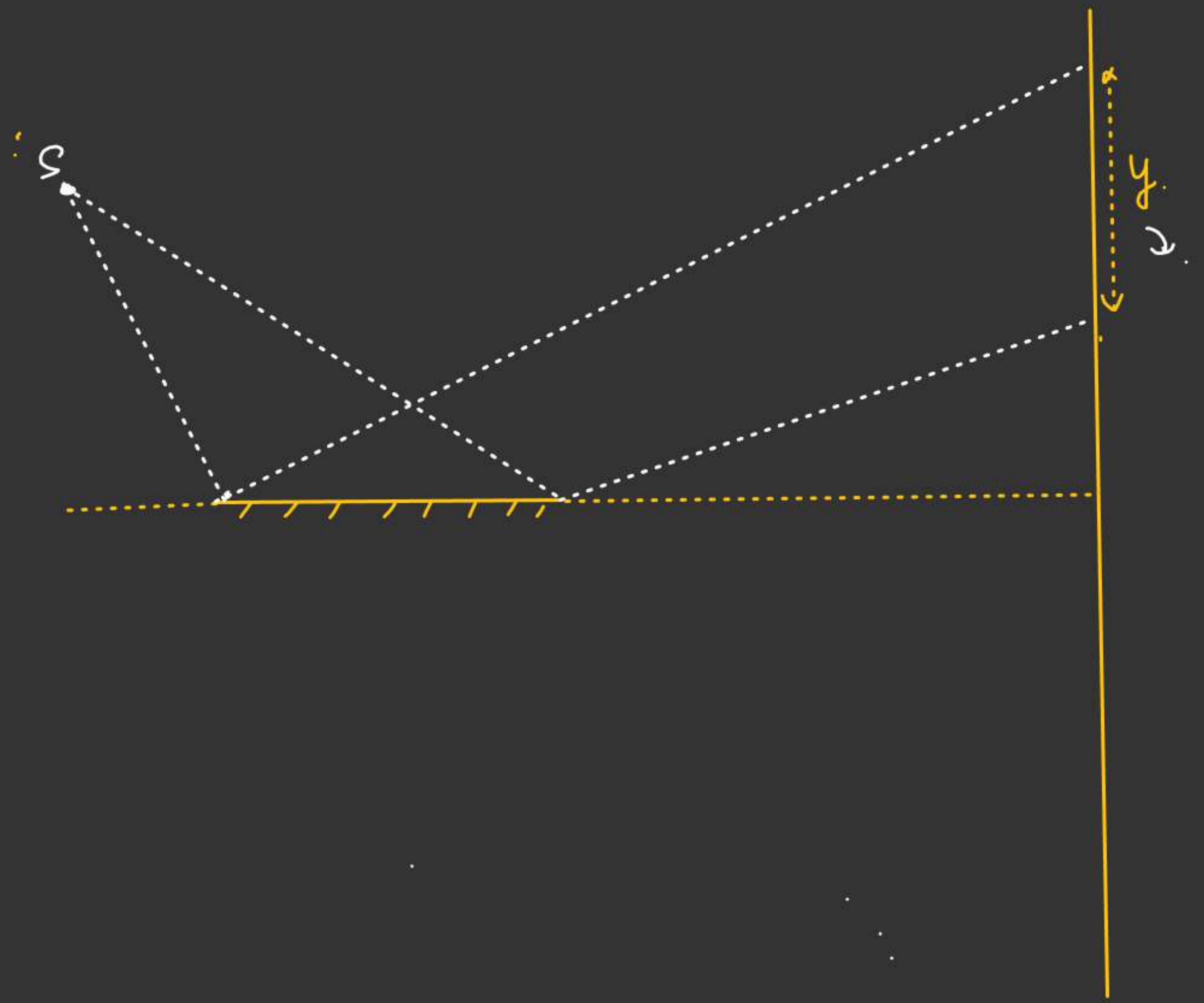
$y = $ [length on the Screen where interference Pattern Visible.



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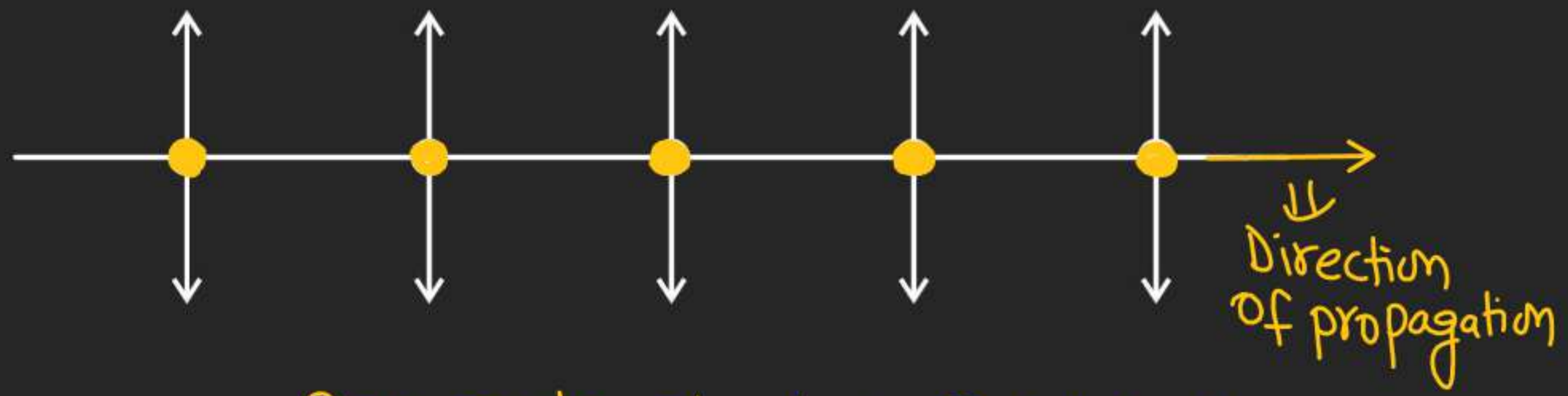
POLARIZATION

In an ordinary or unpolarized ray of light the vibrations of electric field vector are symmetrically distributed in all the directions but perpendicular to the direction of propagation of the light such ray of light is called unpolarized light.

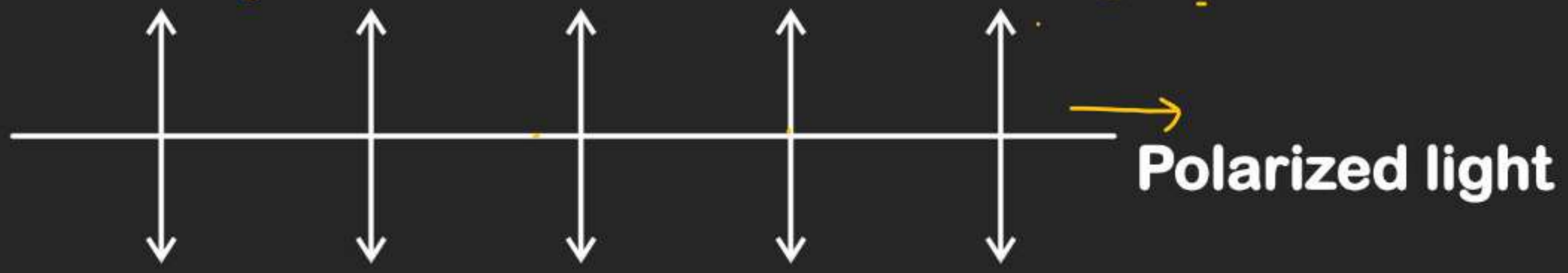


• → Represents electric field vector perpendicular to the plane.

↑ → Arrow represent electric field vector along the plane.

POLARIZATION

- **Polarization of light:-** It is the phenomenon due to which the vibration of light are restricted in a particular plane is called polarization of light.
- **Plane of Vibration:-** The plane within which the Vibrations of the polarized light are confined is known as plane of vibration.
- **Plane of polarization:-** It is the plane at right angle to the plane of vibration and passing through the direction of propagation of light.
- **Plane polarized light:-** It may be defined as the light, in which the vibration of the light (vibration of electric field vector) are restricted to a particular plane.



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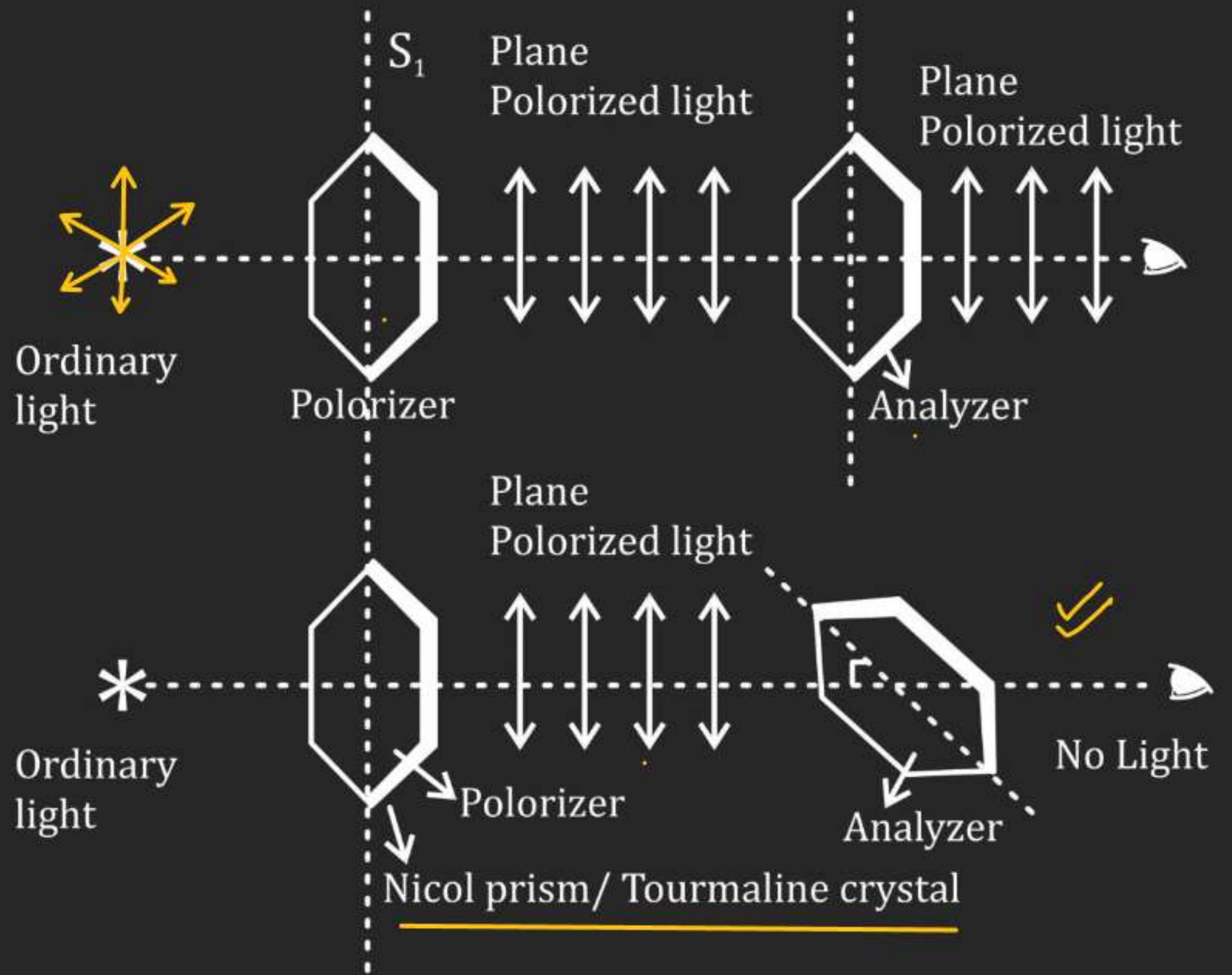
Polarization is the characteristic of Transverse waves only.



When the axis of the two crystal are parallel intensity of emergent light is Maximum & When the axis of two crystals become at right angels to each other intensity is Minimum.

POLARIZATION

Polarization by Reflection

When Unpolarized light is reflected from a plane boundary between two transparent media such as air and glass, or air and water, the reflected light is partially polarized. The degree of polarization depends on the angle of incidence:

The degree of polarization increases as the angle of incidence increases: At a particular value of angle of incidence, the reflected beam become completely polarized.

The angle of incidence is called the polarizing angle for that Medium.

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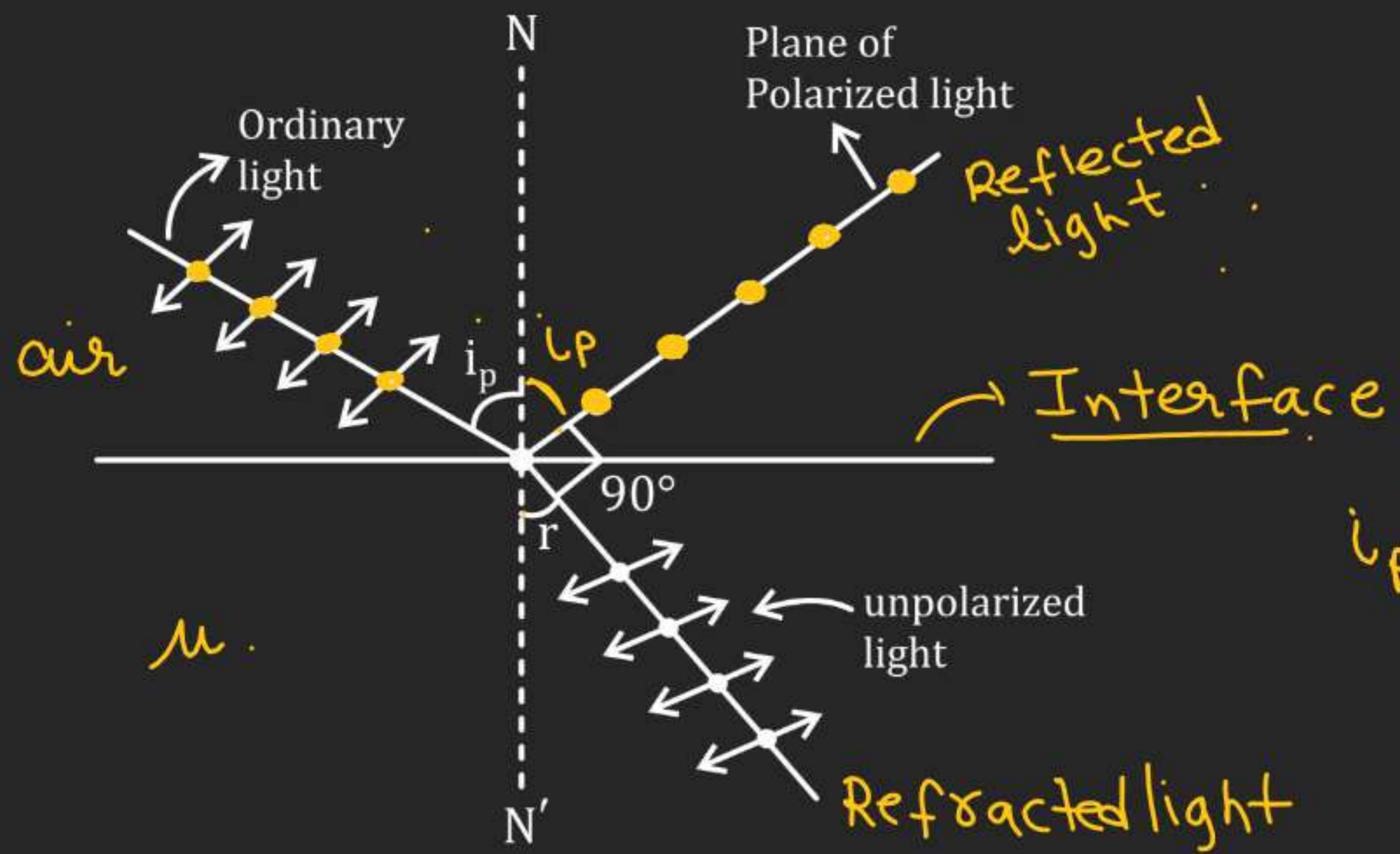
POLARIZATION



$i_p + 90 + r = 180°$

$i_p + r = 90°$

$r = (90 - i_p)$

BREWSTER'S LAW

When a ray of light is incident at polarizing angle, the reflected ray at right angle to the refracted ray

$$\boxed{i_p = \tan^{-1}(\mu)}$$

$i = i_p \qquad r = (90 - i_p)$

$$\mu = \frac{\sin i_p}{\sin(90 - i_p)} = \frac{\sin i_p}{\cos i_p} \Rightarrow (\mu = \tan i_p)$$

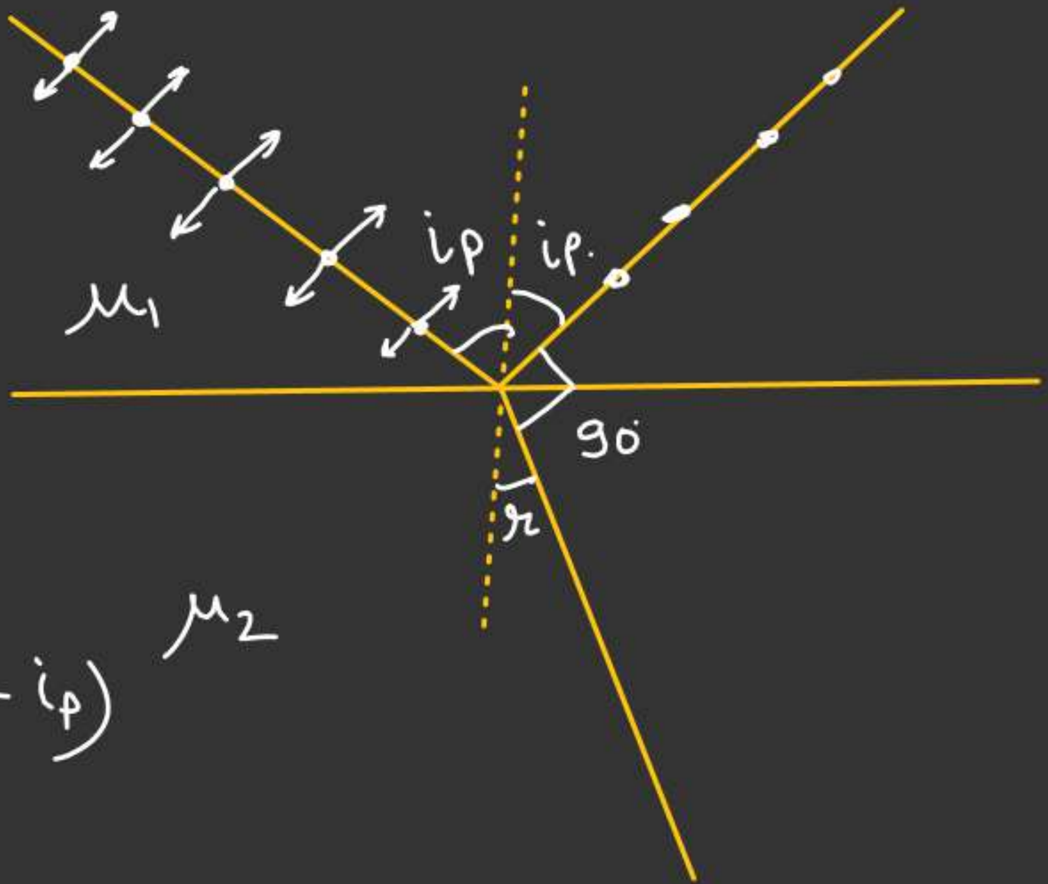
By Snell's Law

$1 \cdot \sin i_p = \mu \sin r$

$\sin i_p = \mu \sin(90 - i_p)$

$\tan i_p = \mu$

$$r = 90 - i_p$$



$$\mu_1 \sin i_p = \mu_2 \sin r$$

$$\sin i_p = \left(\frac{\mu_2}{\mu_1}\right) \sin r$$

$$\sin i_p = {}_1\mu_2 \cdot \sin(90 - i_p)$$

$$\tan i_p = \left(\frac{\mu_2}{\mu_1}\right)$$

$$i_p = \tan^{-1}\left(\frac{\mu_2}{\mu_1}\right)$$

✓

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POLARIZATION

BREWSTER'S LAW

When light is incident at polarizing angle at the Interface of refracting media, the refractive index of the Medium is equal to to~~o~~ the tangent of the polarizing angle"

$$(\tan i_p = \mu)$$

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POLARIZATION

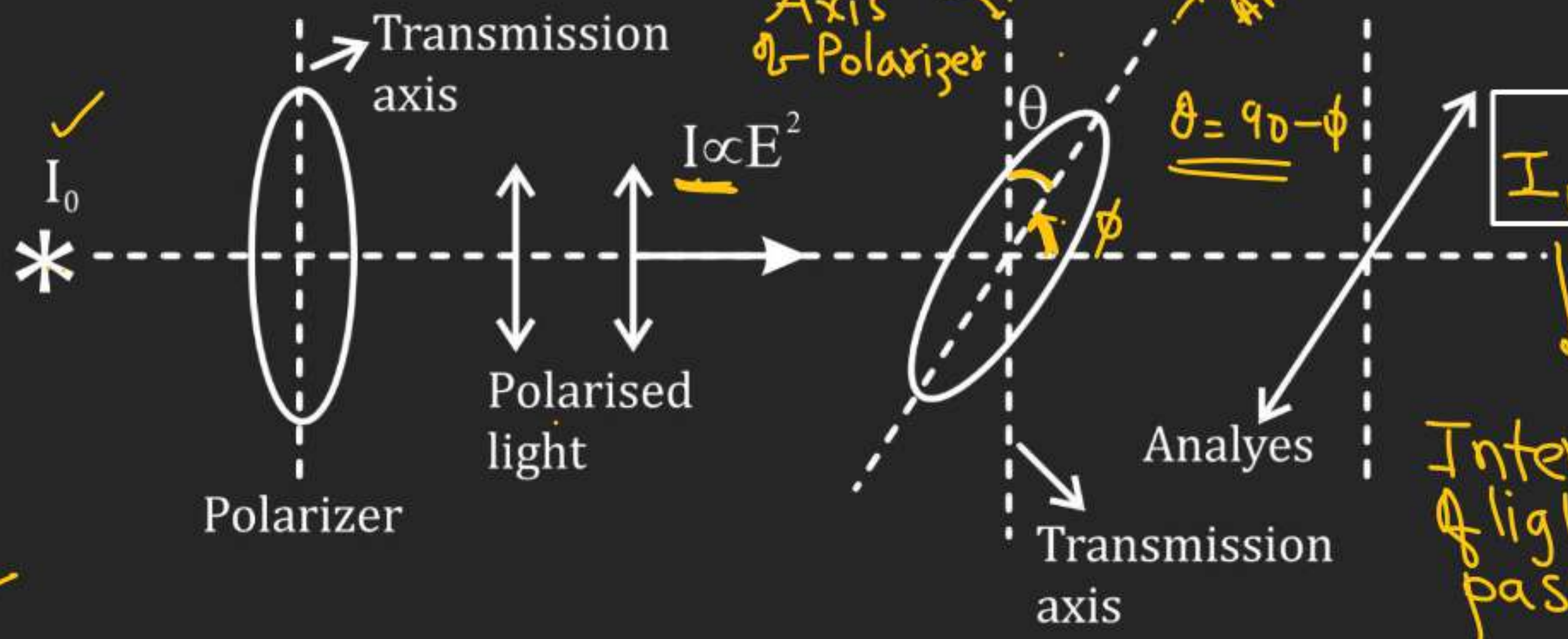
MALUS'S LAW

Note :- If I_0 be the intensity of ordinary light then after passing through polarizer, Intensity become $\frac{I_0}{2}$.

The dependence of intensity of transmitted light on the angle between the analyzer and the polarizer was investigated by Malus.

According to Malus, When a completely plane polarized Light beam is incident on an Analyzer the intensity of light varies as the square of the cosine of the angle b/w the plane of transmission of the analyzer and the polarizer.

θ = Angle b/w Axis of Polarizer & Analyzer axis.



$\boxed{I_\theta = I \cos^2\theta}$

I_θ → Intensity of light after passing through analyzer.

I → Intensity of light after passing through polarizer.

$$\boxed{I_\theta = I\cos^2\theta}$$

I → Intensity of polarized wave incident on the analyzer.