

Single Slit Diffraction

$$a \sin \theta_0 = 0 \quad (\text{Central maximum})$$
$$a \sin \theta_m = (m + \frac{1}{2})\lambda \quad m = 1, 2, 3, \dots (\text{maximum})$$
$$a \sin \theta_m = m\lambda \quad m = 1, 2, 3, \dots (\text{minimum})$$

Diffraction grating

Grating constant $d = \frac{1}{N} = a + b$

$$d \sin \theta_m = m\lambda \quad m = 0, 1, 2, 3, \dots (\text{maximum})$$
$$d \sin \theta_m = (m + \frac{1}{2})\lambda \quad m = 1, 2, 3, \dots (\text{minimum})$$

$$\sin \theta_m = \frac{m\lambda}{d} \leq 1$$
$$m \leq \frac{d}{\lambda}$$

Diffraction of light

Light Waves

Inteference of light

Polarization of light

Polarizer or Poloriod is a transparent plastic sheet on which particles are deposited in a series of parallel lines. Natural crystals such as tourmaline, calcite and quartz are used as polariser

Only transverse waves can be polarised

Conditions

Coherent sources

Sources close to each other

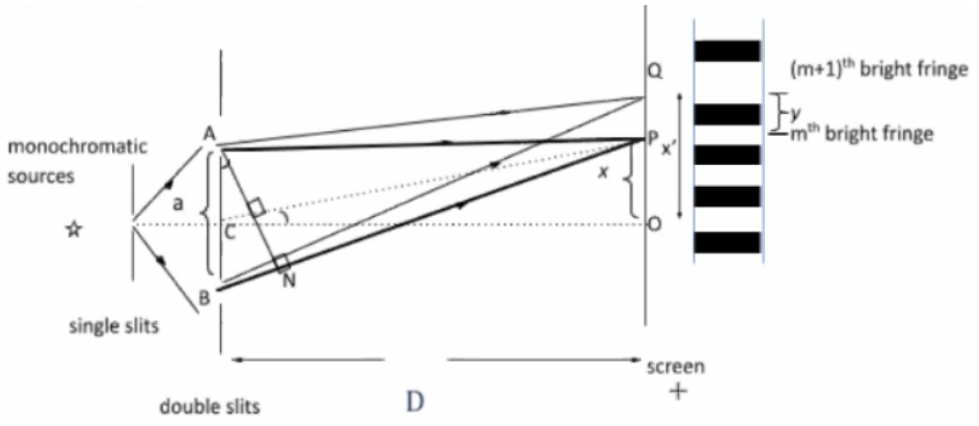
Amplitude of source same/almost same

Constructive and destructive inteference

Constructive:
$$o.p.d. = m\lambda \quad m = 0, 1, 2, 3, \dots$$
$$\phi = 2m\pi \quad m = 0, 1, 2, 3, \dots$$

Destructive:
$$o.p.d. = (m \pm \frac{1}{2})\lambda \quad m = 0, 1, 2, 3, \dots$$
$$\phi = (2m + 1)\pi \quad m = 0, 1, 2, 3, \dots$$

Young's double-slit interference

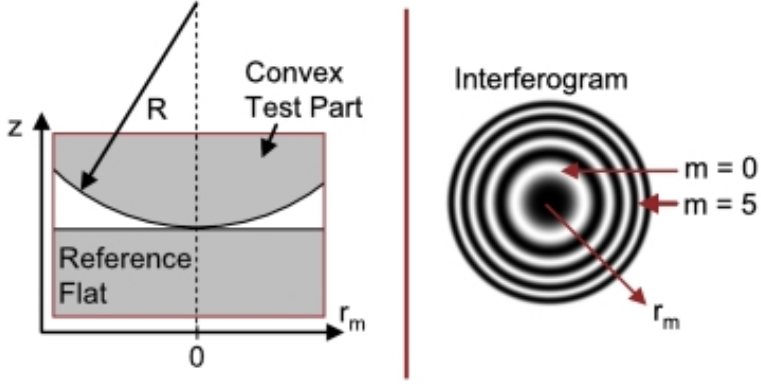


Bright fringes:
$$a \sin \theta_m = m\lambda \quad m = 0, 1, 2, 3, \dots$$

Dark fringes:
$$a \sin \theta_m = (m \pm \frac{1}{2})\lambda \quad m = 0, 1, 2, 3, \dots$$

$$\theta \approx 0$$
$$\sin \theta_m \approx \tan \theta_m$$
$$\tan \theta_m = \frac{x}{D}$$
$$y = \frac{D\lambda}{a}$$

Newton's Rings



$$\frac{r^2}{R} = (m \pm \frac{1}{2})\lambda \quad m = 0, 1, 2, 3, \dots \quad (\text{bright})$$
$$\frac{r^2}{R} = m\lambda \quad m = 0, 1, 2, 3, \dots \quad (\text{dark})$$

Thin wedge film interference

Phase change when reflected at an optically denser medium

Case 1:
 $(n_2 > n_1 \text{ and } n_2 > n_3) \text{ or } (n_2 < n_1 \text{ and } n_2 < n_3)$
$$2n_2t = (m + \frac{1}{2})\lambda \quad m = 0, 1, 2, 3, \dots \quad (\text{bright})$$
$$2n_2t = m\lambda \quad m = 0, 1, 2, 3, \dots \quad (\text{dark})$$

Case 2:
 $(n_1 < n_2 < n_3) \text{ or } (n_1 > n_2 > n_3)$
$$2n_2t = m\lambda \quad m = 0, 1, 2, 3, \dots \quad (\text{bright})$$
$$2n_2t = (m + \frac{1}{2})\lambda \quad m = 0, 1, 2, 3, \dots \quad (\text{dark})$$