

double-slit

Constructive
max
(bright)

destructive
min
(dark)

for small angles ie $\theta \ll 1$ rad.
 $\sin \theta \approx \tan \theta \approx \theta$
 fringes near center.

$$n\lambda = d \sin \theta \approx d \tan \theta$$

$\frac{y}{L}$

$$n\lambda \approx \frac{dy}{L}$$

$$y \approx \frac{n\lambda L}{d}$$

lateral deflection

$$(n + \frac{1}{2})\lambda = d \sin \theta \approx \frac{y}{L}$$

$$y = (n + \frac{1}{2}) \frac{\lambda L}{d}$$

Bright fringe lateral deflection $\Delta y \leftarrow$ distance between fringes!!

n^{th} order $y_n = \frac{n\lambda L}{d}$

$(n+1)^{\text{th}}$ order $y_{n+1} = \frac{(n+1)\lambda L}{d}$

$y_{n+1} - y_n = \frac{(n+1)\lambda L}{d} - \frac{n\lambda L}{d} = \frac{\lambda L}{d}$

$$\Delta y = \frac{\lambda L}{d}$$

n^{th} order dark fringe $y_n = (n + \frac{1}{2}) \frac{\lambda L}{d}$

$(n+1)^{\text{th}}$ order $y_{n+1} = (n+1 + \frac{1}{2}) \frac{\lambda L}{d}$

$$y_{n+1} - y_n = (n+1 + \frac{1}{2}) \frac{\lambda L}{d} - (n + \frac{1}{2}) \frac{\lambda L}{d}$$

$$\Delta y = \frac{\lambda L}{d}$$