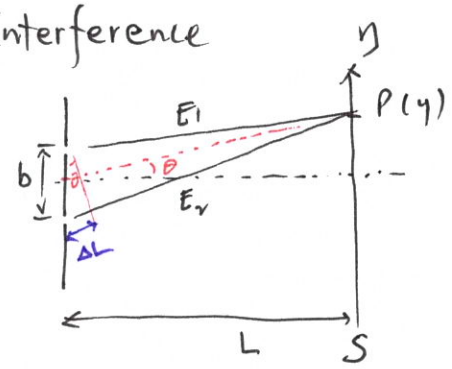
Interference



$\Delta L = b\sin\theta$, $L \gg b$, $\theta \ll 1$

$\sim b\tan\theta$

$\sim \frac{by}{L}$

- $E_1 = E_0 e^{i(kr_1 - \omega t + \varphi_1)}$

  $E_2 = E_0 e^{i(kr_2 - \omega t + \varphi_2)}$, $\varphi_1 = \varphi_2$ due to coherence from the same source.

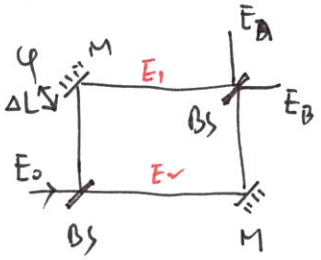
At P, $E = E_1 + E_2 = E_0(e^{ikr_1} + e^{ikr_2})$

$I = EE^* = I_0(e^{ikr_1} + e^{ikr_2})(e^{-ikr_1} + e^{-ikr_2})$

$= I_0(1 + 1 + e^{ik(r_1 - r_2)} + e^{-ik(r_1 - r_2)})$

$= 2I_0(1 + \cos k\delta r)$, $\delta r = r_1 - r_2 = \Delta L$

$= 2I_0\left(1 + \cos\frac{2\pi by}{\lambda L}\right)$.



$E_1 = \frac{E_0}{\sqrt{2}} e^{i\varphi_1}$

$E_2 = \frac{E_0}{\sqrt{2}} e^{i\varphi_2}$

$\varphi = \varphi_1 - \varphi_2$

$\begin{pmatrix} E_A \\ E_B \end{pmatrix} = (BS)(\varphi)(BS)\begin{pmatrix} E_0 \\ 0 \end{pmatrix}$, $(BS) = \frac{1}{\sqrt{2}}\begin{pmatrix} 1 & i \\ i & 1 \end{pmatrix}$

$= \frac{1}{2}\begin{pmatrix} 1 - e^{i\varphi} & i(1 + e^{i\varphi}) \\ i(1 + e^{i\varphi}) & -1 + e^{i\varphi} \end{pmatrix}\begin{pmatrix} E_0 \\ 0 \end{pmatrix}$. $(\varphi) = \begin{pmatrix} 1 & 0 \\ 0 & e^{i\varphi} \end{pmatrix}$

$I_A = E_A E_A^* = \frac{I_0}{4}(1 - e^{i\varphi})(1 - e^{-i\varphi})$

$= \frac{I_0}{4}(1 + 1 - e^{i\varphi} - e^{-i\varphi})$

$= \frac{I_0}{2}(1 - \cos\varphi)$. $\varphi = k\Delta L$

$I_B = E_B E_B^* = \frac{I_0}{2}(1 + \cos\varphi)$.