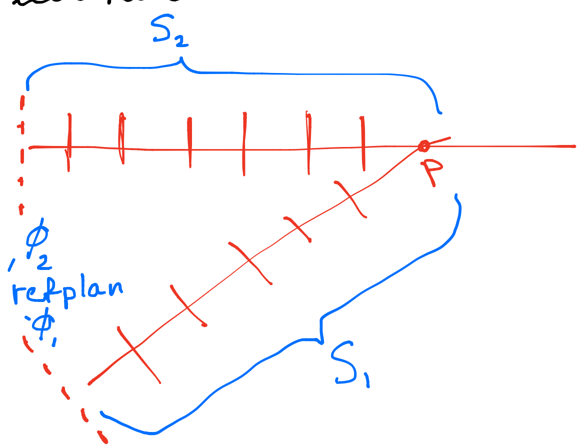
Interferens



$$\bar{E}_1 = \bar{E}_{01}\cos(ks_1 - \omega t + \phi_1)$$
$$\bar{E}_2 = \bar{E}_{02}\cos(ks_2 - \omega t + \phi_2)$$

Superpositionsprincipen

$$\bar{E}_p = \bar{E}_1 + \bar{E}_2$$

medelvärde

Intensitet: $I = \varepsilon_0 c \langle \bar{E}\cdot\bar{E} \rangle$

$$\Rightarrow I_p = \varepsilon_0 c \langle \bar{E}_p \cdot \bar{E}_p \rangle = \varepsilon_0 c \langle (\bar{E}_1 + \bar{E}_2)(\bar{E}_1 + \bar{E}_2) \rangle$$
$$= \varepsilon_0 c \langle \underbrace{\bar{E}_1\cdot\bar{E}_1}_{I_1} + \underbrace{\bar{E}_2\cdot\bar{E}_2}_{I_2} + \underbrace{2\bar{E}_1\cdot\bar{E}_2}_{\text{Interferens}} \rangle$$

$I_p = I_1 + I_2 + I_{12}$ – vågegenskap

$I_{12} = 2\varepsilon_0 c \langle \bar{E}_1 \cdot \bar{E}_2 \rangle$ blir 0 om $\bar{E}_1 \perp \bar{E}_2$

men om $\bar{E}_1 \parallel \bar{E}_2$

$$\bar{E}_1\cdot\bar{E}_2 = \bar{E}_{01}\cdot\bar{E}_{02}\cos(ks_1 - \omega t + \phi_1)\cdot\cos(ks_2 - \omega t + \phi_2)$$

$\alpha = ks_1 + \phi_1$ var den början

$\beta = ks_2 + \phi_2$

$$\Rightarrow 2\bar{E}_1\cdot\bar{E}_2 = 2\bar{E}_{01}\cdot\bar{E}_{02}\cos(\alpha - \omega t)\cos(\beta - \omega t)$$

Samla alla t

trick $\quad 2\cos A\cos B = \cos(A+B) + \cos(B-A)$

$$\Rightarrow 2\langle \bar{E}_1 \cdot \bar{E}_2 \rangle = \bar{E}_{01}\bar{E}_{02}\left[\underbrace{\langle \cos(\alpha+\beta-2\omega t)\rangle}_{\text{medel}=0} + \langle \cos(\beta-\alpha)\rangle\right]$$

$$= \bar{E}_{01}\bar{E}_{02}\langle \cos(\beta-\alpha)\rangle = \bar{E}_{01}\bar{E}_{02}\langle \cos\delta \rangle \text{ om } \delta = \beta - \alpha = k(s_2 - s_1) + \phi_2 - \phi_1$$

$$\boxed{I_{12} = \varepsilon_0 c \bar{E}_{01}\bar{E}_{02}\langle \cos\delta \rangle}$$

$$I_1 = \varepsilon_0 c \langle \bar{E}_1 \cdot \bar{E}_1 \rangle = \varepsilon_0 c \bar{E}_{01}^2 \underbrace{\langle \cos^2(\alpha - \omega t)\rangle}_{\frac{1}{2}} = \frac{1}{2}\varepsilon_0 c \bar{E}_{01}$$

$$I_2 = \frac{1}{2}\varepsilon_0 c \bar{E}_{02}$$

om $\bar{E}_1 \parallel \bar{E}_2$

$$\Rightarrow I_{12} = 2\sqrt{I_1 I_2}\langle \cos(\delta)\rangle$$

$$\boxed{\Rightarrow I_p = I_1 + I_2 + 2\sqrt{I_1 I_2}\langle \cos(\delta)\rangle}$$

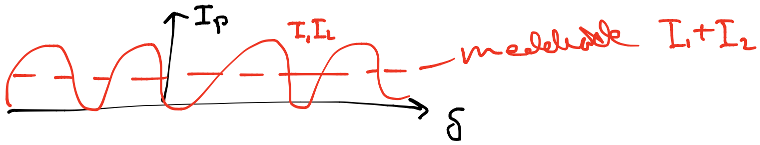
$$\langle \cos\delta \rangle = 1 \quad I_{max} = I_1 + I_2 + 2\sqrt{I_1 I_2}, \quad \delta = 2m\pi$$

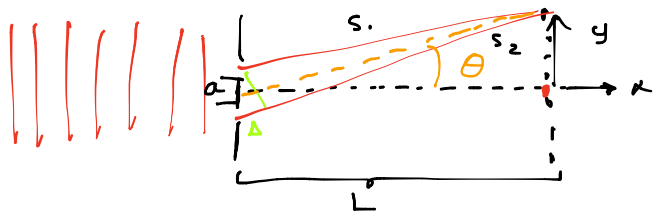
$$\langle \cos\delta \rangle = -1 \quad I_{min} = I_1 + I_2 - 2\sqrt{I_1 I_2} \quad \delta = (2m+1)\pi$$

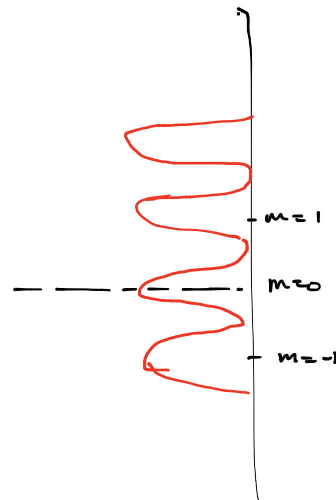
samma Intensitet $I_1 = I_2 = I_0$

$$I_{max} = I_0 + I_0 + 2I_0 = \underline{4I_0}$$

$$I_{min} = I_0 + I_0 - 2I_0 = 0$$







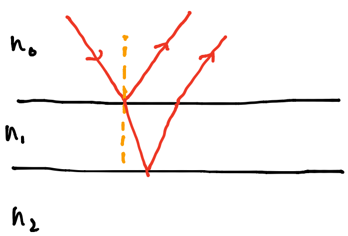
$L >> a \Rightarrow s_2 - s_1 = \Delta = m\lambda \simeq a \sin\theta$

↑ Ljust

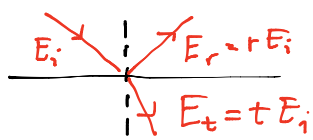
Mörkt då $\Delta = (m+\frac{1}{2})\lambda \simeq a\sin\theta$

Omvandling våglängd → fas $\delta = k(s_2 - s_1) = \frac{2\pi}{\lambda}\Delta$

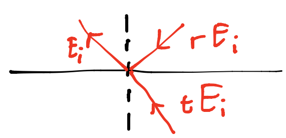
Interferens i tunna skikt

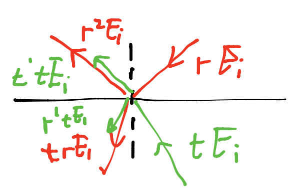


Stokes relationer



$r = \frac{1-n}{1+n}$ $\quad r = \frac{E_r}{E_i}, \quad t = \frac{E_t}{E_i}$

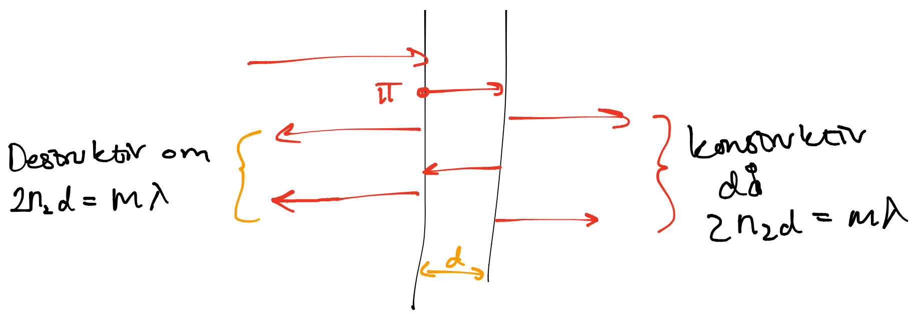




$\Rightarrow E_i = (r^2 + t't)E_i$

$0 = (r't + tr)E_i$

$r = -r'$ ⇐ Fasskift π


π
Destruktiv om
2n₂d = mλ
d
Konstruktiv
då
2n₂d = mλ