

Intensitetsfordelingen i tospalteeksperimentet (LHL 30.3)

Elektrisk felt i P fra

Bølge fra spalte i : $E_i = E_0 \sin(kr_i - \omega t)$; $i=1,2$

Totalt felt i P : $E = E_1 + E_2 = E_0 \{ \sin(kr_1 - \omega t) + \sin(kr_2 - \omega t) \}$

$$\sin \alpha + \sin \beta = 2 \cos\left(\frac{\alpha - \beta}{2}\right) \sin\left(\frac{\alpha + \beta}{2}\right)$$

$$\Rightarrow E = 2E_0 \cos\left(\frac{k(r_2 - r_1)}{2}\right) \sin\left(\frac{k(r_2 + r_1)}{2} - \omega t\right)$$

Merk: E_0 varier med
sehender for sylindrebølge,
men varier samme E_0 i P
fra begge spalter

$$I = c \epsilon_0 \langle E^2 \rangle = c \epsilon_0 \cdot 4E_0^2 \cos^2\left(\frac{kd \sin \theta}{2}\right) \underbrace{\langle \sin^2\left(\frac{k(r_2 + r_1)}{2} - \omega t\right) \rangle}_{1/2}$$

$$= 2c \epsilon_0 E_0^2 \cos^2\left(\frac{kd \sin \theta}{2}\right)$$

Hvis en spalte: $I_0 = c \epsilon_0 E_0^2 \langle \sin^2(kr - \omega t) \rangle = \frac{1}{2} c \epsilon_0 E_0^2$

$$\Rightarrow \boxed{I(\theta) = 4I_0 \cos^2\left(\frac{kd \sin \theta}{2}\right)}$$

$\sin \theta \approx \tan \theta = y/L$ for små vinkler (dvs $y \ll L$)

$$k = 2\pi/\lambda$$

$$\Rightarrow \boxed{I(y) = 4I_0 \cos^2\left(\frac{\pi d y}{\lambda L}\right)}$$

