Interference
Chapter 35

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Chapter 35
Interference and coherent sources

- Reminder of the form of E&M Waves

\[ E(x,t) = E_0 \mathbf{j} \sin(kx - \omega t + \phi) , \text{ with} \]
\[ k = \frac{2\pi}{\lambda} \quad \text{and} \quad \omega = 2\pi f \]
Interference and coherent sources

(a)

(b) Constructive interference at point $b$: path difference = a whole number of wavelengths

(c) Destructive interference at point $c$: path difference = a half-integral number of wavelengths
Constructive and Destructive Interference

- **Constructive**
  
  \[ r_2 - r_1 = m \lambda \quad (m = +/- \text{ integer values}) \]

- **Destructive**
  
  \[ r_2 - r_1 = (m + \frac{1}{2}) \lambda \quad (m = +/- \text{ integer values}) \]
2 – Source Interference

(a) Monochromatic light

(b) Slits $S_1$ and $S_2$ are horizontal and seen from the side in cross section

(c) Same as (b), but with screen very far from slits ($R$ much greater than $d$)

Bright regions: interference is constructive, intensity is maximum

Dark regions: interference is destructive, intensity is minimum
Intensity in Interference

\[ I = S_{\text{ave}} = \frac{E_p^2}{2 \mu_0 c} \]

\[ = \frac{1}{2} \varepsilon_0 c E_p^2 \]
2 – Source Interference

Intensity maxima occur where $\phi$ is an integral multiple of $2\pi$ and $d \sin \theta$ is an integral multiple of $\lambda$.