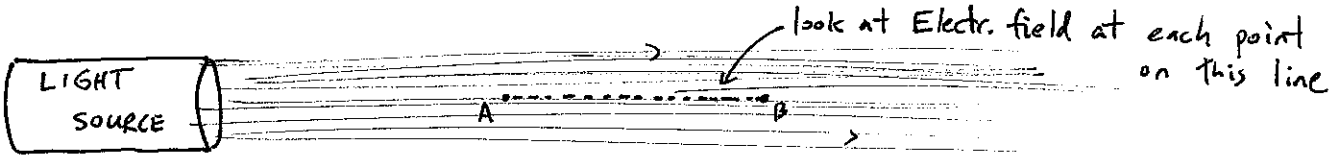
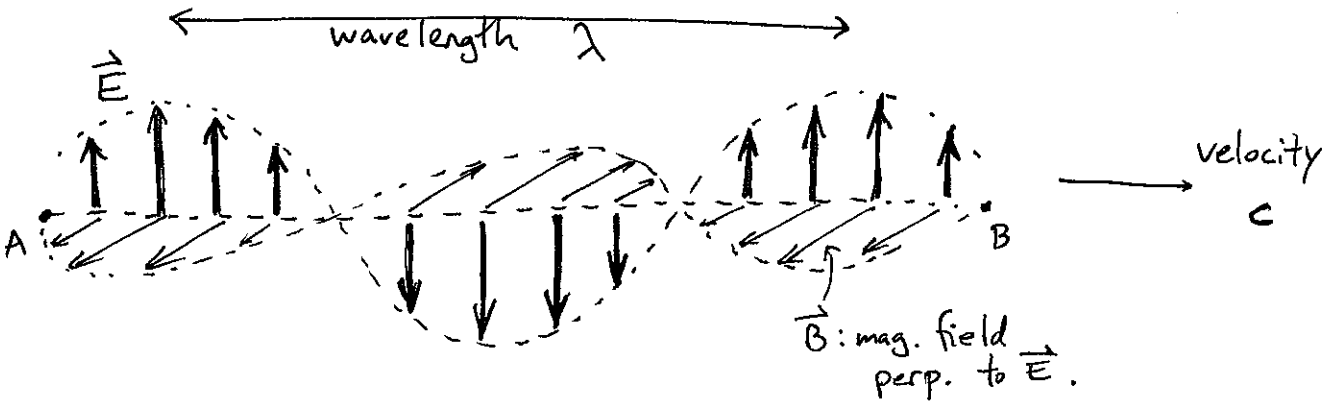
Reading: 39.1, 39.2 (QUIZ MONDAY)

PART II: QUANTUM MECHANICS

Review: the electromagnetic description of light.





CLICKER

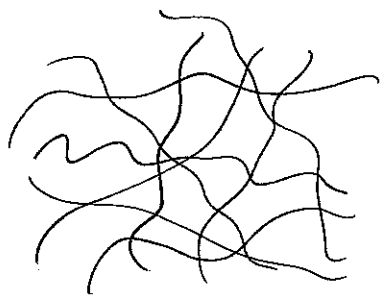
At fixed location: $\vec{E}$ oscillates with frequency $f = \frac{c}{\lambda}$

Explicitly:

$$\vec{E} = \vec{E}_0 \cos\left(2\pi\left(\frac{x}{\lambda} - f \cdot t\right) + \phi\right)$$

- Monochromatic plane wave in $\hat{x}$ direction
- $\vec{E}$, $\vec{B}$, $\hat{x}$ all perpendicular

No restriction on:
- amplitude $|E_0|$
- direction
- wavelength λ
- polarization $\hat{E}_0$



real light: superposition of waves with different properties.

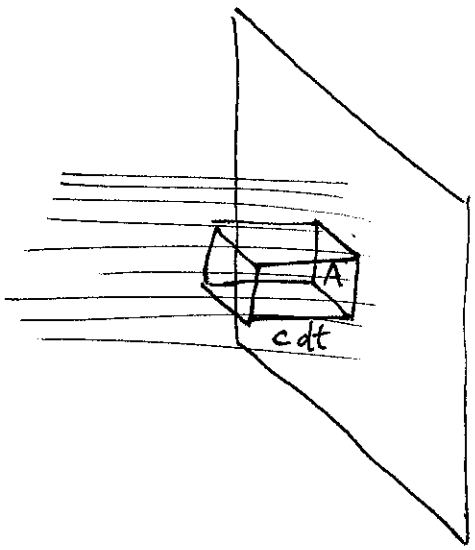
Light waves carry energy & momentum

Energy density $e = \frac{\text{energy}}{\text{volume}} \propto |\vec{E}_0|^2$

Momentum density $p = \frac{\text{momentum}}{\text{volume}} = \frac{e}{c}$ $\quad e = pc$

CLICKER

INTENSITY: measure of energy/unit time/unit area



In time dt: light in box hits surface

$$\text{energy} = e \times (A \times c\,dt)^{\text{volume}}$$

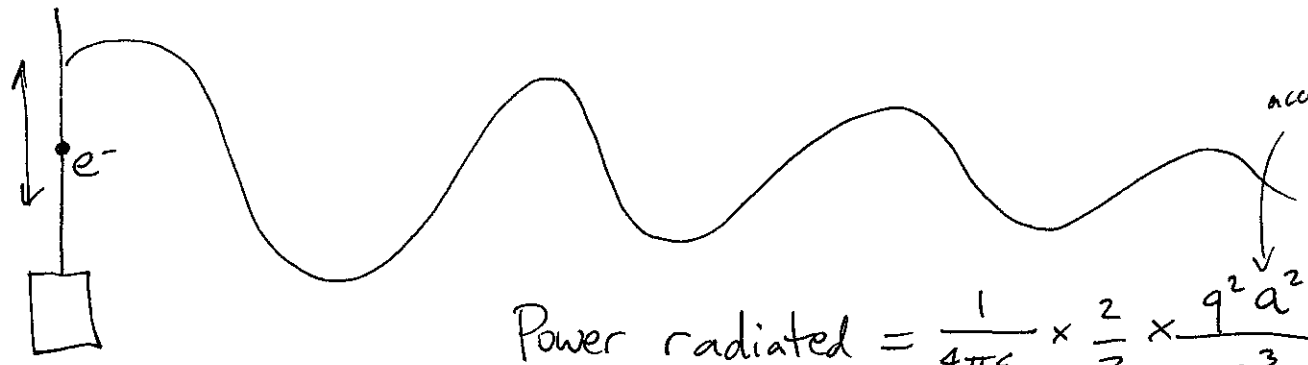
$$\text{intensity} = e \cdot c \propto |E_0|^2$$

$$\text{Intensity} \propto \text{Amplitude}^2$$

TOTAL POWER = INTENSITY x area of beam.

Light/EM radiation produced by accelerating charges

e.g. antenna



$$\text{Power radiated} = \frac{1}{4\pi\varepsilon_0} \times \frac{2}{3} \times \frac{q^2 a^2}{c^3}$$