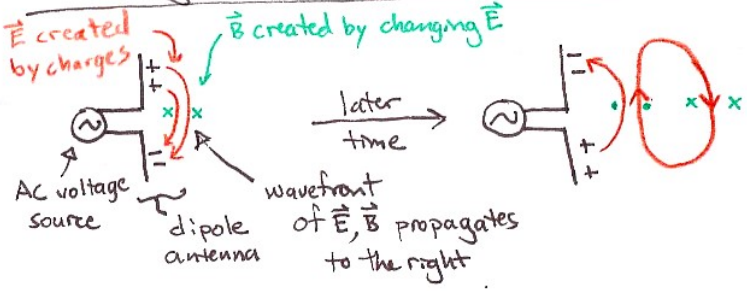
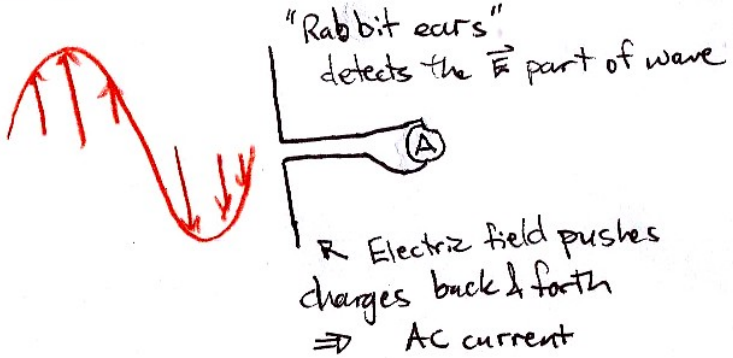
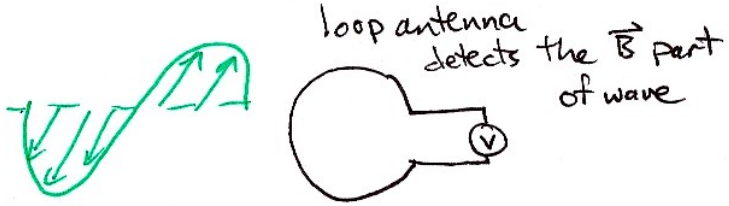
Producing electromagnetic waves



Detecting electromagnetic waves





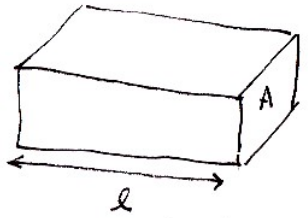
Changing Φ_B through loop

→ AC emf

Electromagnetic Wave Intensity & the Poynting vector

We've seen that there is energy density (energy / volume) associated with $\vec{E}$ & $\vec{B}$: $u_B = \frac{1}{2\mu_0} B^2$ $u_E = \frac{\varepsilon_0}{2} E^2$

⇒ There is energy contained in a volume that's filled with plane waves:



This energy would be deposited into an absorbing target in a time $\frac{l}{c} = \Delta t$ ⇒ Power $\propto \frac{Al}{l/c} \propto A$

⇒ To characterize the energy transmitted by a plane wave, we use

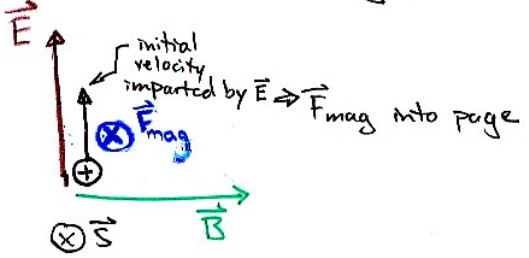
$$\text{Intensity} \equiv \frac{\text{Power}}{\text{Area}}$$

Book → $\vec{S} = \frac{\vec{E} \times \vec{B}}{\mu_0}$ "Poynting vector"

has magnitude = intensity
direction = direction of propagation

Radiation pressure

Consider the effect of an em wave (going into the page) on a ⊕ charge:



Similar arguments for a ⊖ charge also give a force into the page.

Poynting → resulting "radiation pressure" $\equiv \frac{\vec{F}}{\text{Area}}$

is given by $\text{Pressure} = \frac{\vec{S}}{c}$