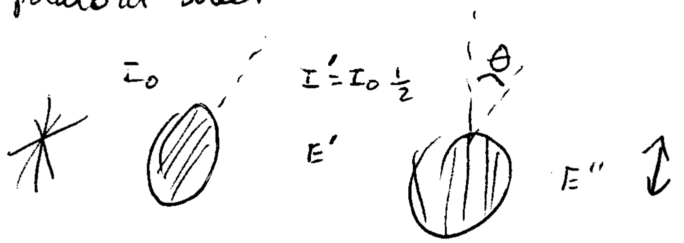
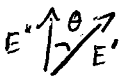
Suppose the light having passed thru the 1st polaroid film – Now passes thru a second film which ~~us~~ has a TRANSmission axis that makes an angle of θ w/ that of the 1st polaroid sheet





$E'' = E' \cos\theta \quad \therefore \quad I'' = I' \cos^2\theta = I_0 \frac{1}{2} \cos^2\theta$

$I \sim E^2$

What is the magnitude of $|\vec{E}|$, $|\vec{B}|$ ~~on~~ in light incident on Earth from the sun.

DIST Earth - Sun = 149×10^6 km

TOTAL power output from Sun = 3.9×10^{26} watts

Intensity of light at Earth = $\frac{\text{Power}}{m^2}$

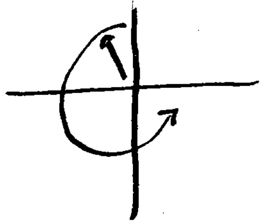
$$I = \frac{3.9 \times 10^{26} \text{ watts}}{4\pi (149 \times 10^9 \text{ m})^2} \approx 1360 \text{ W/m}^2$$

> surface area of sphere w/ R_{earth}

$$I = \frac{1}{2} \frac{E_0 B_0}{\mu_0 c} = \frac{1}{2} \frac{E_0^2}{\mu_0}$$ → Solve for E_0

$B_0 = \frac{E_0}{c}$

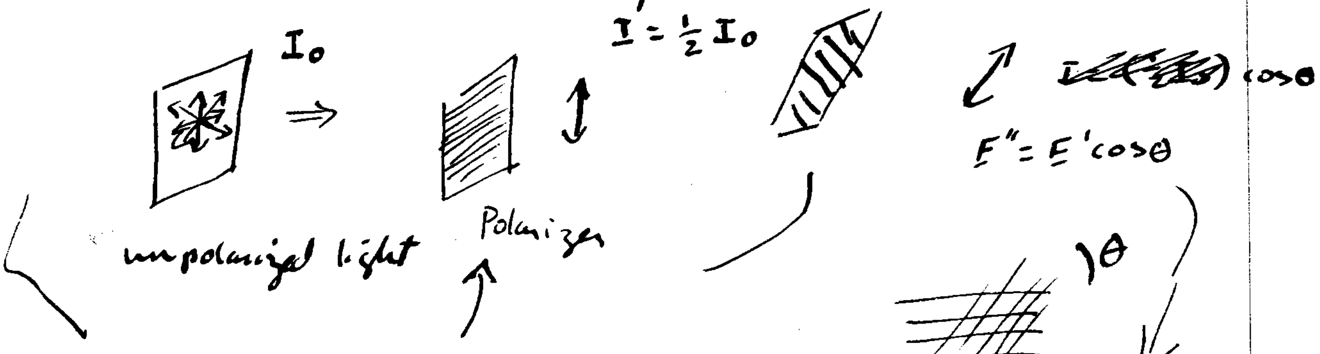
if $\varepsilon = -\pi/2$ you'll see left circular polarization



if $E_{0x} \neq E_{0y}$ can get elliptical Polarization

Natural light is unpolarized

No coherence / correlation between emission of light from diff atoms



Many ways to polarize light

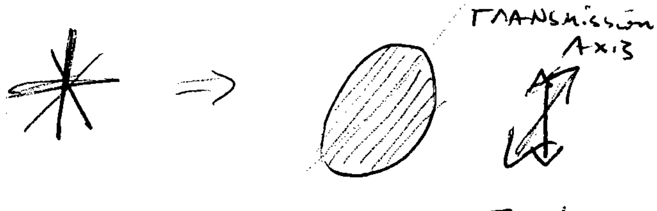
- Polaroid sheets
- dichroic crystals
- reflection

$\therefore$

$I'' = I' \cos^2\theta$

Do this in problem form

Suppose unpolarized light (intensity I_0) passes thru a Polaroid film. What is the intensity?



on Average ½ the ~~E vectors~~ the incident light has an E vector along the TRANSMISSION AXIS

$I = \frac{1}{2} I_0$

More Properties of light – Geometrical optics

recall

$$c = \frac{1}{\sqrt{\epsilon_0 \mu_0}}$$

recall E, B are now different

Do same derivation ... but in materials find

$$c = \frac{1}{\sqrt{\epsilon \mu}}$$

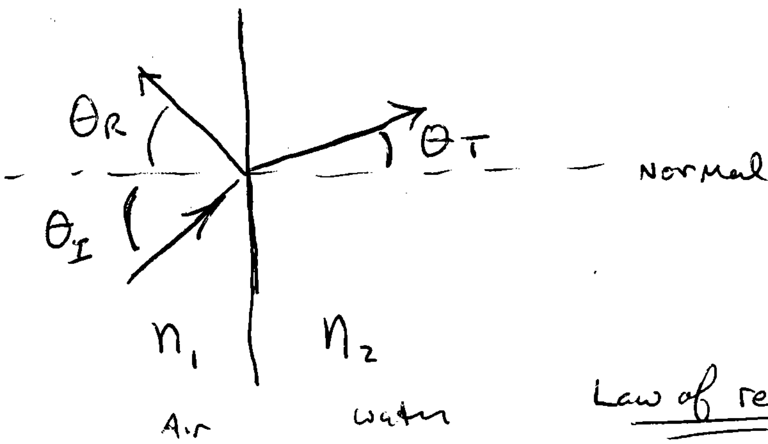
No longer c
But $v < c$

$$n = \frac{c}{v} \geq 1 \equiv \text{index of refraction}$$

⇒ light moves slower in a medium than in vacuum

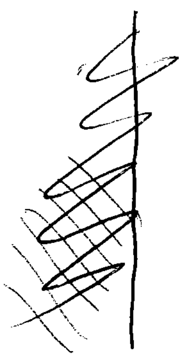
different media can have different n's

⇒ leads to interesting effects



Law of reflection:

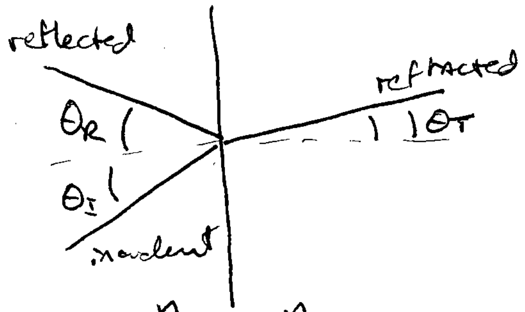
$$\theta_I = \theta_R$$



Law of refraction (Snell's law)

$$n_1 \sin\theta_I = n_2 \sin\theta_T$$

Geometrical Optics cont'd



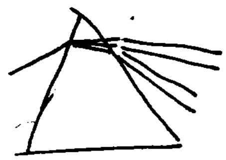
$\theta_I = \theta_R$ Law of Reflection

$n_1 \sin\theta_I = n_2 \sin\theta_T$

$n_1 = c/V_1$ $\quad$ $n_2 = c/V_2$

Dispersion: variation of n w/ ν or λ

<u>demo</u>

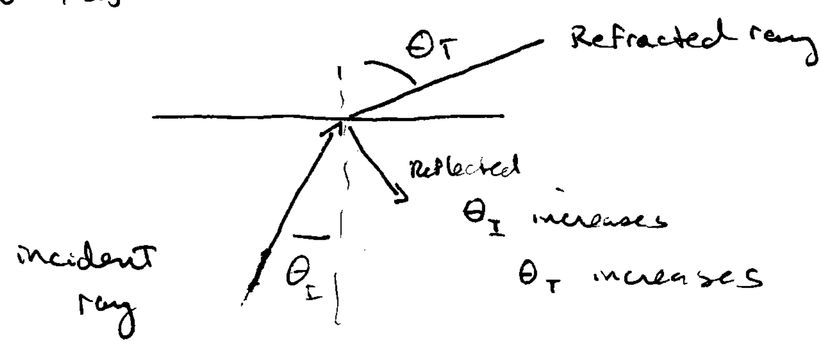


Prism

Low n to high n
Air → glass
Bend Toward Normal

High n to low n " away from normal

draw this



θ_I increases

θ_T increases