Snell's Law is due to B.C. of Maxwell eqns

Region I

$$\tilde{E}_1 = \tilde{E}_{0,I} + \tilde{E}_{0,R}$$

Region II

$$\tilde{E}_2 = \tilde{E}_{0,T}$$

from (iii) $\quad \vec{E}_1^{\parallel} = \vec{E}_2^{\parallel} \longrightarrow \tilde{E}_{0,I} + \tilde{E}_{0,R} = \tilde{E}_{0,T}$

$$\tilde{E}_{0,I}\, e^{i(k_I z - \omega_I t)} + \tilde{E}_{0,R}\, e^{i(k_R z - \omega_R t)} = \tilde{E}_{0,T}\, e^{i(k_T z - \omega_T t)}$$

wave vector holds info. that it propagates to $(-\hat{z})$ direction

holds @ $z = 0$

$$\omega_I = \omega_R = \omega_T$$

from (iv)

$$\frac{1}{\mu_1}\tilde{B}_1^{\parallel} = \frac{1}{\mu_2}\tilde{B}_2^{\parallel}$$

$$\frac{1}{\mu_1}\left[\frac{1}{v_1}\tilde{E}_{0,I} - \frac{1}{v_1}\tilde{E}_{0,R}\right] = \frac{1}{\mu_2}\frac{1}{v_2}\tilde{E}_{0,T}$$

$$\tilde{E}_{0,I} - \tilde{E}_{0,R} = \left(\frac{\mu_1 v_1}{\mu_2 v_2}\right)\tilde{E}_{0,T}$$

$$= \underbrace{\boxed{\left(\frac{\mu_1 n_2}{\mu_2 n_1}\right)}}_{\equiv \beta}\tilde{E}_{0,T}$$

$n \equiv \frac{c}{v}$

$$\tilde{E}_{0,R} = \left(\frac{1-\beta}{1+\beta}\right)\tilde{E}_{0,I}$$

$$\tilde{E}_{0,T} = \left(\frac{2}{1+\beta}\right)\tilde{E}_{0,I}$$

if $\mu_1 = \mu_2 \longrightarrow \beta \simeq \frac{v_1}{v_2} = \frac{n_2}{n_1}$

$$\longrightarrow \tilde{E}_{0,R} = \frac{n_1 - n_2}{n_1 + n_2}\tilde{E}_{0,I} \quad \& \quad \tilde{E}_{0,T} = \frac{2n_1}{n_1 + n_2}\tilde{E}_{0,I}$$

energy?

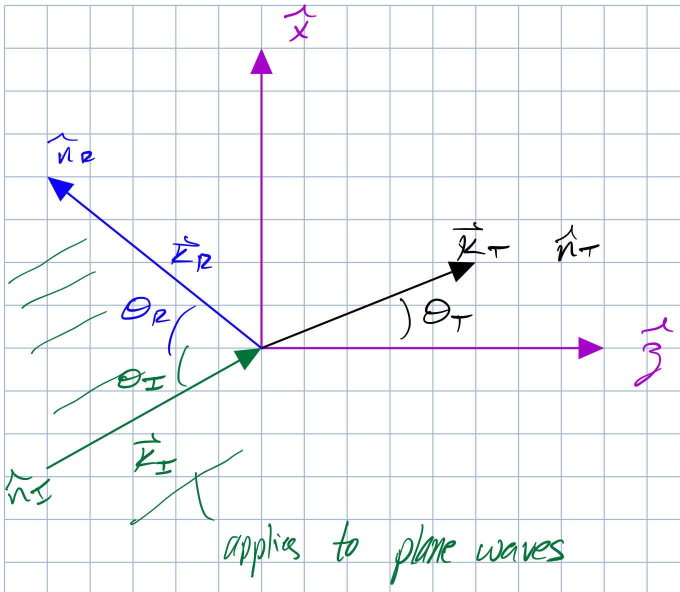
$$I = \langle \tilde{S} \rangle = \frac{1}{2}\epsilon v |\tilde{E}_0|^2 \longrightarrow R \equiv \frac{I_R}{I_I} = \left(\frac{|\tilde{E}_{0,R}|}{|\tilde{E}_{0,I}|}\right)^2$$

$$T \equiv \frac{I_T}{I_I} = \left(\frac{\epsilon_2 v_2}{\epsilon_1 v_1}\right)\left(\frac{|\tilde{E}_{0,T}|}{|\tilde{E}_{0,I}|}\right)^2$$

$$= \left(\frac{n_2}{n_1}\right)\left(\frac{|\tilde{E}_{0,T}|}{|\tilde{E}_{0,I}|}\right)^2$$

$$\frac{\tilde{E}_{0,R}}{\tilde{E}_{0,I}} = \frac{n_1 - n_2}{n_1 + n_2} \qquad \frac{\tilde{E}_{0,T}}{\tilde{E}_{0,I}} = \frac{2n_1}{n_1 + n_2}$$

$$\longrightarrow T + R = 1$$



$\hat{x}$
$\hat{n}_R$
$\vec{k}_R$
θ_R
$\vec{k}_T$
$\hat{n}_T$
θ_T
$\hat{z}$
θ_I
$\vec{k}_I$
$\hat{n}_I$
applies to plane waves