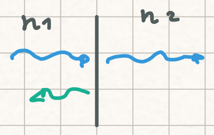
→ Ahora nos concentraremos en los campos y no solo en su dirección



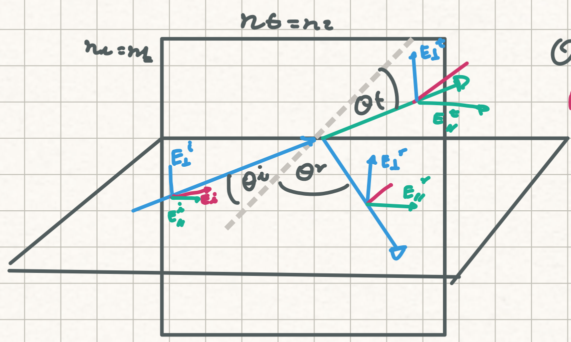
$v_1 \neq v_2$
$f_1 = f_2$

la longitud cambia λ

$v_1 = f \cdot \lambda_1$

$v_2 = f \cdot \lambda_2$

Ondas s y ondas p



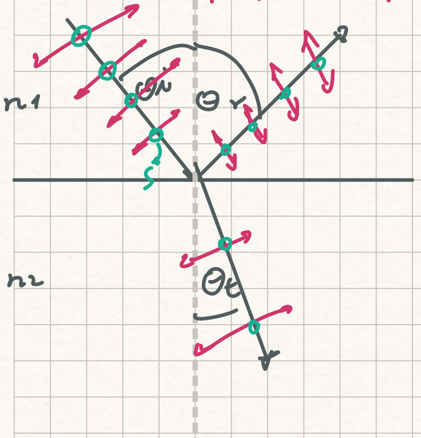
Onda P: $E_\parallel^{(i,r,t)}$
paralelo

Onda s: $E_\perp^{(i,r,t)}$
perpendicular

$$\vec{E}^{(i)} = E_\perp^{(i)}\hat{s} + E_\parallel^{(i)}\hat{p}$$

↓
viendo desde arriba

onda p (paralelo al plano de incidencia)



$$I^{(i)} = \frac{1}{2}\varepsilon v |E^{(i)}|^2 = \frac{1}{2}\varepsilon v \left(E_\perp^{(i)2} + E_\parallel^{(i)2}\right)$$
$$= I_\perp^{(i)} + I_\parallel^{(i)}$$

Coeficientes de fresnel → Se obtiene utilizando las ecuaciones de maxwell

$$E_{\parallel}^{r} = r_{\parallel} E_{\parallel}^{(i)} \Rightarrow r_{\parallel} = \frac{E_{\parallel}^{(r)}}{E_{\parallel}^{(i)}} \qquad E_{\parallel}^{t} = t_{\parallel} E_{\parallel}^{(i)} \Rightarrow t_{\parallel} = \frac{E_{\parallel}^{t}}{E_{\parallel}^{i}}$$

$$E_{\perp}^{r} = r_{\perp} E_{\perp}^{(i)} \Rightarrow r_{\perp} = \frac{E_{\perp}^{(r)}}{E_{\perp}^{(i)}} \qquad E_{\perp}^{t} = t_{\perp} E_{\perp}^{(i)} \Rightarrow t_{\perp} = \frac{E_{\perp}^{t}}{E_{\perp}^{i}}$$

$$r_{\perp} = \frac{n_1 \cos\theta_i - n_2 \cos\theta_t}{n_2 \cos\theta_i - n_2 \cos\theta_t} \qquad t_{\perp} = \frac{2n \cos\theta_i}{n_1 \cos\theta_i + n_2 \cos\theta_t}$$

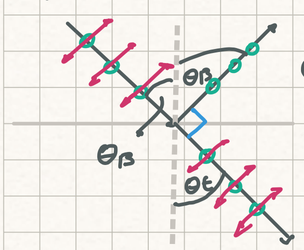
$$r_{\parallel} = \frac{n_2 \cos\theta_i - n_1 \cos\theta_t}{n_2 \cos\theta_i - n_1 \cos\theta_t} \qquad t_{\parallel} = \frac{2 n_1 \cos\theta_i}{n_2 \cos\theta_i + n_1 \cos\theta_t}$$

Dependen de

$n_1, n_2, \theta_i, \cancel{\theta_t}$

↳ $n_1 \sin\theta_i = n_2 \sin\theta_t$

Angulo de brewster



→ son complementarios

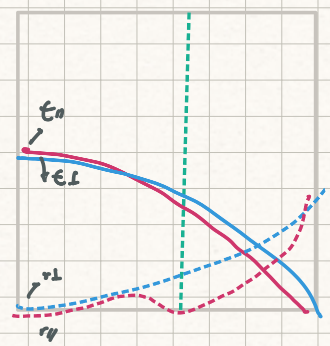
$\theta_B + \theta_t = \frac{\pi}{2}$ → desfase

$\Rightarrow \cos\theta_t = \sin\theta_B$

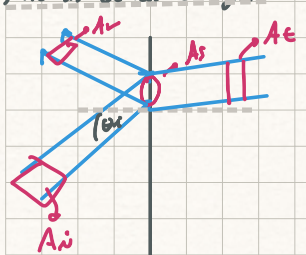
$r_{\parallel}(\theta_B) = 0 \Rightarrow n_2 \cos\theta_B - n_1 \cos\theta_t = 0$

$n_2 \cos\theta_B = n_1 \sin\theta_B$

$$\boxed{\tan\theta_B = \frac{n_2}{n_1}}$$



Análisis de las energías



I_o: intensidad del haz incidente

I_i: intensidad incidente sobre la superficie

I_r: intensidad reflejada desde la superficie

I_t: intensidad transmitida desde la superficie

D = i, t, r

$I_D = \langle |\vec{S} \cdot \hat{n}| \rangle$ → normal al plano

↳ vector de poyting

$A_i = A_s \cdot \cos\theta_i$

$$\boxed{I_i^{\perp,\parallel} = I_o \cdot \cos\theta_i = \frac{1}{2} \varepsilon_1 v_1 |E_{0,\perp,\parallel}^{i}|^2 \cos\theta_i}$$

$$\boxed{I_t^{\perp,\parallel} = \frac{1}{2} \varepsilon_2 v_2 |E_{0,\perp,\parallel}^{(t)}|^2 \cos\theta_t} \qquad \boxed{I_r^{\perp,\parallel} = \frac{1}{2} \varepsilon_1 v_1 |E_{0,\perp,\parallel}^{r}|^2 \cos\theta_r}$$

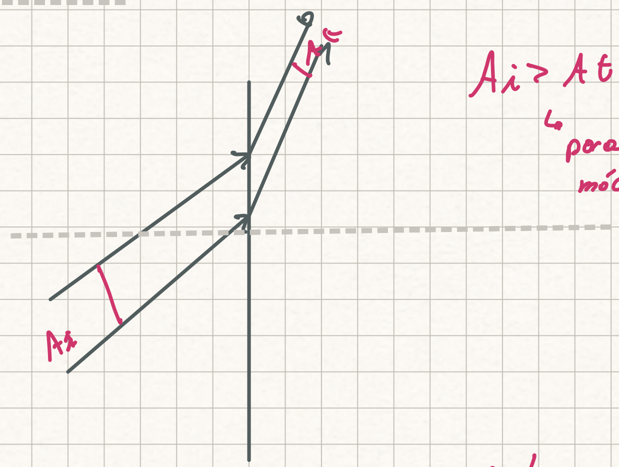
$$R_{\parallel} = \frac{I_{\parallel}^{r}}{I_{\parallel}^{i}} \qquad T_{\parallel} = \frac{I_{\parallel}^{t}}{I_{\parallel}^{i}}$$

$$R_{\perp} = \frac{I_{\perp}^{r}}{I_{\perp}^{i}} \qquad T_{\perp} = \frac{I_{\perp}^{t}}{I_{\perp}^{i}}$$

coeficientes de reflexión — coeficientes de transmisión

$$\rightarrow R_{\parallel} = \frac{\frac{1}{2}\varepsilon_1 v_1 |E_{\parallel}^{r}|^2 \cos\theta_r}{\frac{1}{2}\varepsilon_1 v_1 |E_{\parallel}^{i}|^2 \cos\theta_i} = \left|\frac{E_{\parallel}^{(t)}}{E_{\parallel}^{(i)}}\right|^2 = r_{\parallel}^2$$

$$\rightarrow T_{\parallel} = \frac{\frac{1}{2}\varepsilon_2 v_2 |E_{\parallel}^{t}|^2 \cos\theta_t}{\frac{1}{2}\varepsilon_1 v_1 |E_{\parallel}^{i}|^2 \cos\theta_i} = |t_{\parallel}|^2 \cdot \frac{\varepsilon_2 n_1 \cos\theta_t}{\varepsilon_1 n_1 \cos\theta_i}$$



$A_i > A_t$

↳ para conservar la energía el módulo debe ser mayor

Por la conservación de la energía: $\underbrace{R_{\parallel} + T_{\parallel} = 1}_{\text{sup perfecta}}$

$$R_{\perp} + T_{\perp} = 1$$