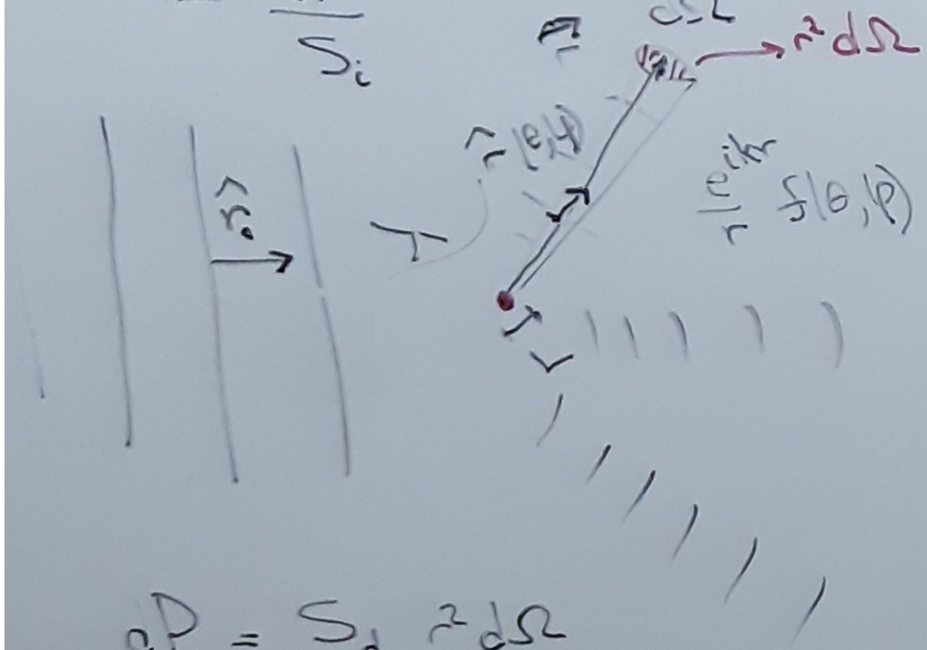
Pot. dispersa x 1 difusor localizado

Todo tiene dep. temp $\sim e^{-i\omega t}$

$$d\sigma = \frac{dP}{S_i}$$



Potencia $\longleftrightarrow$ secc. eficaz

$$\frac{d\sigma}{d\Omega}, \quad \sigma = \int \frac{d\sigma}{d\Omega}\, d\Omega$$

Potencia disp. debida a pol. $\vec{\epsilon}$ de los campos dispersos

(del C.E. !!)

$$\boxed{\frac{d\sigma}{d\Omega}(\hat{r}, \vec{\epsilon}; \hat{r}_0, \vec{\epsilon}_0) = r^2 \frac{|\vec{\epsilon}^{\,*} \cdot \vec{E}_d|^2}{|\vec{\epsilon}_0^{\,*} \cdot \vec{E}_i|^2}}$$

$$dP = S_d\, r^2 d\Omega$$

$$S_d = \underbrace{\langle \vec{S} \cdot \hat{r} \rangle}_{\text{prom. temp.}}$$

$$\boxed{\frac{d\sigma}{d\Omega} = \frac{S_d}{S_i} r^2}$$

$$r \overset{\text{campos rad}}{\gg} \lambda \gg L$$

$\hookrightarrow$ desarrollo multip. $\frac{L}{r}$

$$\frac{\omega}{c} = k, \quad \lambda = \frac{2\pi}{k}$$

$(|\vec{r} - \vec{r}'|$, $k|\vec{r} - \vec{r}'|$

r, $|\vec{r}'| \le L$

$$\boxed{\frac{d\sigma}{d\Omega} = \frac{k^4}{(4\pi\epsilon_0 E_0)^2}\left|\vec{\epsilon}^{\,*}\cdot\vec{p} + \hat{r}\times\vec{\epsilon}^{\,*}\cdot\frac{\vec{m}}{c}\right|^2}$$

Esfera pequeña dieléctrica

$\rightarrow L \ll \lambda$

radio $\underline{a}$, $\mu_r = \mu/\mu_0 \approx 1$

$\epsilon_r(\omega) = \epsilon(\omega)/\epsilon_0$ isotrópico, uniforme

monocrom.

Onda plana que incide es esf. diel. : $\vec{p} \neq 0$, $\vec{m} = 0$

$$\vec{p} = 4\pi\epsilon_0 \frac{\epsilon_r - 1}{\epsilon_r + 2} a^3 \vec{E}_{inc}$$

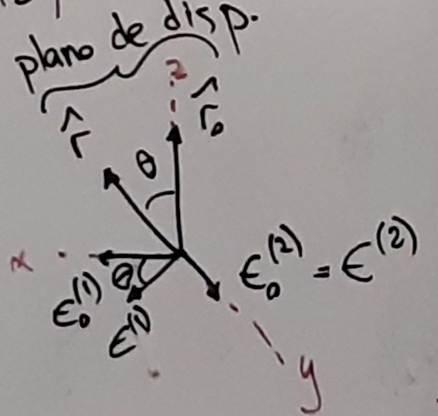
volumen $\qquad E_0 \vec{\epsilon}_0 e^{\cdots}$

$$\frac{d\sigma}{d\Omega} = \frac{k^4}{(\cancel{4\pi\epsilon_0 E_0})^2}\left|\vec{\epsilon}^{\,*}\cdot\vec{\epsilon}_0 \cancel{E_0}\ \cancel{4\pi\epsilon_0}\ \frac{\epsilon_r - 1}{\epsilon_r + 2} a^3\right|^2 = k^4 a^6 \left|\frac{\epsilon_r - 1}{\epsilon_r + 2}\right|^2 |\vec{\epsilon}^{\,*}\cdot\vec{\epsilon}_0|^2$$

Situación de interés : rad. incidente $\underbrace{\text{no polarizada}}_{NP}$!

$$\boxed{\frac{d\sigma^{NP}}{d\Omega} = \frac{1}{2}\left(\left.\frac{d\sigma}{d\Omega}\right|_{\epsilon_0^{(1)}} + \left.\frac{d\sigma}{d\Omega}\right|_{\epsilon_0^{(2)}}\right)}$$

Sistema coord/polariz.



$\epsilon^{(1)}, \epsilon^{(2)}$: lineales (sin *)

$\epsilon^{(1)}$: $\parallel$ plano disp. $\quad \vec{\epsilon}^{(1)} \cdot \vec{\epsilon}_0^{(1)} = \cos\theta$, $\quad \vec{\epsilon}^{(1)} \cdot \vec{\epsilon}_0^{(2)} = 0$

$\epsilon^{(2)}$: $\perp$ plano disp. $\quad \epsilon^{(2)} \cdot \epsilon_0^{(1)} = 0$, $\quad \epsilon^{(2)} \cdot \epsilon_0^{(2)} = 1$

$$\left.\frac{d\sigma^{NP}}{d\Omega}\right|_{\parallel} = \frac{1}{2} k^4 a^6 \left|\frac{\epsilon_r - 1}{\epsilon_r + 2}\right|^2 \left(\cos^2\theta + 0^2\right)$$

$$\left.\frac{d\sigma^{NP}}{d\Omega}\right|_{\perp} = \frac{1}{2} k^4 a^6 \left|\frac{\epsilon_r - 1}{\epsilon_r + 2}\right|^2 \left(0^2 + 1^2\right)$$

$$\boxed{\Pi = \frac{d\sigma_\perp - d\sigma_\parallel}{d\sigma_\perp + d\sigma_\parallel}}$$

tensor de polarizacion $\Pi(\theta)$

$\Pi = 0 : \perp = \parallel$

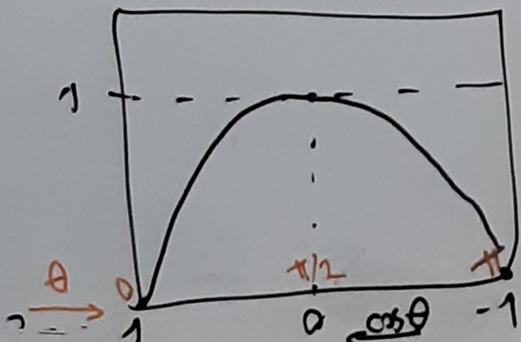
$\Pi = 1 : \parallel = 0$

$\Pi = -1 \quad \perp = 0$

$$\boxed{\left.\frac{d\sigma^{NP}}{d\Omega}\right|_{NP} = \left.\frac{d\sigma^{NP}}{d\Omega}\right|_{\epsilon^{(1)}} + \left.\frac{d\sigma^{NP}}{d\Omega}\right|_{\epsilon^{(2)}}}$$

(promedio en pol. iniciales
suma en pol. finales)

$$\boxed{\left.\frac{d\sigma^{NP}}{d\Omega}\right|_{NP} = \frac{k^4 a^6}{2} \left|\frac{\epsilon_r - 1}{\epsilon_r + 2}\right|^2 \left(1 + \cos^2\theta\right)}$$



$$\boxed{\Pi(\theta) = \left(\frac{\operatorname{sen}^2\theta}{1 + \cos^2\theta}\right)}$$

Esfera cond. perfecta

radio $\underline{a}$, $\begin{cases} \vec{p} = 4\pi\epsilon_0 a^3 \vec{E}_i \\ \vec{m} = -2\pi a^3 \vec{H}_i \end{cases}$ $\qquad \vec{p} \perp \vec{m}$

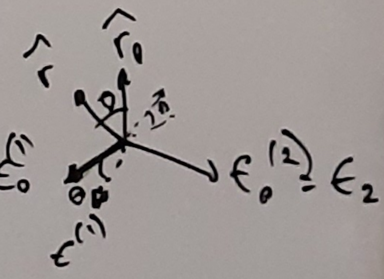
$$\frac{d\sigma}{d\Omega} = \frac{k^4}{(4\pi\epsilon_0 E_0)^2} \left| \vec{\epsilon}^* \cdot \vec{p} + \hat{r} \times \vec{\epsilon}^* \cdot \frac{\vec{m}}{c} \right|^2 = \frac{k^4 a^6 \cancel{(4\pi\epsilon_0)^2 E_0^2}}{\cancel{(4\pi\epsilon_0 E_0)^2}} \left| \vec{\epsilon}^* \cdot \vec{\epsilon}_0 + \hat{r} \times \vec{\epsilon}^* \cdot \left(-\frac{\hat{r}_0 \times \vec{\epsilon}_0}{2\epsilon_0 Z_0 c} \right) \right|^2$$

$$\begin{cases} \vec{E}_i = \vec{\epsilon}_0 E_0 e^{ik\hat{n}_0\cdot\vec{r}} \\ \vec{H}_i = \dfrac{\hat{r}_0 \times \vec{E}_i}{Z_0} = \dfrac{E_0}{Z_0} e^{ik\hat{n}_0\cdot\vec{r}}\, \hat{r}_0 \times \vec{\epsilon}_0 \end{cases} \qquad \epsilon_0 Z_0 c = \epsilon_0 \sqrt{\frac{\mu_0}{\epsilon_0}} \frac{1}{\sqrt{\mu_0\epsilon_0}} = 1$$

$$\frac{d\sigma}{d\Omega} = k^4 a^6 \left| \vec{\epsilon}^* \cdot \vec{\epsilon}_0 - \frac{1}{2} \hat{r} \times \vec{\epsilon}^* \cdot \hat{r}_0 \times \vec{\epsilon}_0 \right|^2$$

$$\left.\frac{d\sigma^{NP}}{d\Omega}\right|_{\parallel} : \quad \begin{aligned} &\vec{\epsilon}_1^* \cdot \vec{\epsilon}_0^{(1)} = \cos\theta \quad && \hat{r} \times \vec{\epsilon}_1^* \cdot \hat{r}_0 \times \vec{\epsilon}_0^{(1)} = \epsilon_0^{(2)} \cdot \epsilon_0^{(2)} = 1 \\ &\vec{\epsilon}_1^* \cdot \vec{\epsilon}_0^{(2)} = 0 && \underbrace{\hat{r} \times \vec{\epsilon}_1^*}_{\epsilon_0^{(2)}} \cdot \underbrace{\hat{r}_0 \times \vec{\epsilon}_0^{(2)}}_{\perp \epsilon_0^{(2)}} = 0 \end{aligned}$$

$$\left.\frac{d\sigma^{NP}}{d\Omega}\right|_{\perp} : \quad \begin{aligned} &\vec{\epsilon}_2^* \cdot \vec{\epsilon}_0^{(1)} = 0 \quad && \hat{r} \times \vec{\epsilon}_2^* \cdot \hat{r}_0 \times \epsilon_0^{(1)} = 0 \\ &\vec{\epsilon}_2^* \cdot \vec{\epsilon}_0^{(2)} = 1 && \hat{r} \times \vec{\epsilon}_2^* \cdot \underbrace{\hat{r}_0 \times \epsilon_0^{(2)}}_{-\epsilon_0^{(1)}} = \cos\theta \end{aligned}$$



$$\left.\frac{d\sigma^{NP}}{d\Omega}\right|_{\parallel} = \frac{1}{2}\left(\left.\frac{d\sigma}{d\Omega}\right|_{\epsilon_0^{(1)},\epsilon_1} + \left.\frac{d\sigma}{d\Omega}\right|_{\epsilon_0^{(2)},\epsilon_1}\right) = \frac{k^4a^6}{2}\left\{\left|\cos\theta - \frac{1}{2}\right|^2 + |0-0|^2\right\}$$

$$\boxed{\left.\frac{d\sigma^{NP}}{d\Omega}\right|_{\parallel} = \frac{k^4a^6}{2}\left(\cos\theta - \frac{1}{2}\right)^2}$$

$$\left.\frac{d\sigma^{NP}}{d\Omega}\right|_{\underset{\epsilon_2}{\perp}} = \frac{k^4a^6}{2}\left(\left|0 - \cancel{\tfrac{1}{2}}\;0\right|^2 + \left|1 - \frac{1}{2}\cos\theta\right|^2\right)$$

$$\boxed{\left.\frac{d\sigma^{NP}}{d\Omega}\right|_{\perp} = \frac{k^4a^6}{2}\left(\frac{\cos\theta}{2} - 1\right)^2}$$

$$\left.\frac{d\sigma^{NP}}{d\Omega}\right|_{NP} = \left.\frac{d\sigma^{NP}}{d\Omega}\right|_{\parallel} + \left.\frac{d\sigma^{NP}}{d\Omega}\right|_{\perp}$$

$$\left.\frac{d\sigma^{NP}}{d\Omega}\right|_{NP} = \frac{k^4a^6}{2}\left(\frac{5}{4}\cos^2\theta - 2\cos\theta + \frac{5}{4}\right)$$

$$\boxed{\left.\frac{d\sigma^{NP}}{d\Omega}\right|_{NP} = k^4a^6\left(\frac{5}{8}(\cos^2\theta+1) - \underbrace{\cos\theta}_{\text{interf. } \vec{p},\,\vec{m}}\right)}$$

$$\boxed{\Pi(\theta) = \frac{3\,\mathrm{sen}^2\theta}{5(\cos^2\theta+1) - 8\cos\theta}}$$