$\bar{E}(\bar{r})$

$\vec{p}$

$\cdot\, \bar{r}'$

3x3

$$\bar{E}(\bar{r}) = \mathcal{G}(\bar{r}, \bar{r}', \omega) \cdot \bar{p}$$

$$\mathcal{G}(\bar{r}, \bar{r}', \omega) = \mathcal{G}^{T}(\bar{r}', \bar{r}, \omega)$$

$$\left[\nabla \times \bar{\nabla} \times - k^2 \varepsilon(\bar{r}, \omega)\right] \mathcal{G}(\bar{r}, \bar{r}', \omega) = 4\pi k^2 \delta(\bar{r} - \bar{r}')$$

$$(\bar{\nabla} \times \bar{\nabla} \times - k^2 \varepsilon)\, \bar{E} = \frac{4\pi i k}{c} j^{ext}$$

$(\to \hat{x})$

$z = z_0$

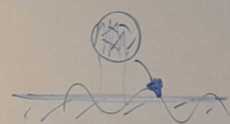
$\bar{r}_d$ $\bar{E}^{ext}$

$$\bar{j}^{ext}(\bar{r}, \omega) = -e \hat{x} \frac{v}{|v|} e^{i\omega x/v} \delta(y)\, \delta(z - z_0)$$

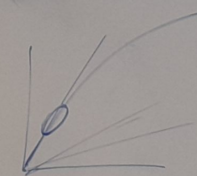
$\lesssim$ few nm

$\lesssim$ nm

$\bar{v}$



0.1 – 0.7 c

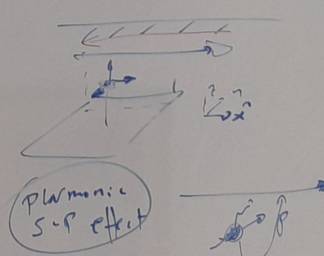


$\vec{j}^{ext}(\bar{r}, \omega)$

$$\bar{E}^{ext}(\bar{r}, \omega) = \frac{i}{\omega} \int d\bar{r}'\, \mathcal{G}(\bar{r}, \bar{r}', \omega) \cdot \bar{j}^{ext}(\bar{r}', \omega)$$

+ plasmonic s-p effect

E^{ext}



$$\bar{p} = \frac{1}{1/\alpha - \mathcal{G}} E^{ext}$$

$= \alpha^{eff}$

$\bar{E}^{ind} = $ —

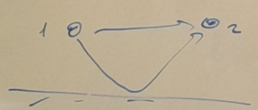
$$= \int dx'\, \mathcal{G}(\bar{r}_d, (x', 0, z_0), \omega) \cdot \left(-\frac{ie}{\omega} \hat{x} \frac{v}{|v|} e^{i\omega x'/v}\right) = \bar{E}^{ext}(\bar{r}_d, \omega) = E_x^{ext}\hat{x} + E_y^{ext}\hat{y} + E_z^{ext}\hat{z}$$

$$\Gamma_{EELS} = \Gamma''_{EELS} + \frac{1}{\pi\hbar} \mathrm{Re}\Big\{ i \Big(\alpha^{eff}_{xx} \big((E_y^{ext})^2 - (E_x^{ext})^2 \big) + \alpha^{eff}_{zz} (E_z^{ext})^2 \Big) \Big\}$$

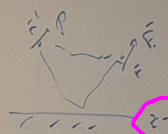
$$\Gamma^{dip}_{EELS} = \mathrm{Re} \int \left[E_x^{ind}(x) = \hat{x} \cdot \mathcal{G}((x, 0, z_0), \bar{r}_d, \omega) \cdot \vec{p} \right] \frac{e}{\pi\hbar\omega} e^{-i\omega x/v}\, dx \Big\} =$$

$$= \mathrm{Re}\Big\{ \frac{i\bar{p}}{\pi\hbar} \cdot \int dx'\, \mathcal{G}(\bar{r}_d, (x', 0, z_0), \omega) \left(\frac{-ie}{\omega} \hat{x}\right) e^{-i\omega x'/v} \Big\}$$

$$= -E_x^{ext}\hat{x} + E_y^{ext}\hat{y} + E_z^{ext}\hat{z}$$



$z, z' > 0$



$z = 0$

yo tengo el dipolo en z=0

$$\bar{P}_j = \alpha^{eff}\left(\bar{E}_j^{ext} + \sum_{j' \neq j} G_{jj'} \bar{P}_{j'}\right)$$

$$\frac{e^{ik|\bar{r}-\bar{r}'|}}{|r-r'|}$$

$$G(\bar{r},\bar{r}',\omega) = k^2 \int \frac{d^2\bar{Q}}{(2\pi)^2} \frac{2\pi i}{k_z} e^{i\bar{Q}\cdot(\bar{R}-\bar{R}')}$$

$$\cdot\left[\left(\hat{\varepsilon}_p^{\pm} \otimes \hat{\varepsilon}_p^{\pm} + \hat{\varepsilon}_s \otimes \hat{\varepsilon}_s\right) e^{ik_z|z-z'|}\right.$$

$$\left. + \left(r_p\, \hat{\varepsilon}_p^{+} \otimes \hat{\varepsilon}_p^{-} + r_s\, \hat{\varepsilon}_s \otimes \hat{\varepsilon}_s\right) e^{ik_z(z+z')}\right]$$

$\pm$ $\uparrow z > z'$, $\downarrow z < z'$

no estoy segura de los signos en mi configuracion (dipolo en zD=0)

$$\left(k^2 + \bar{\nabla}\otimes\bar{\nabla}\right) \frac{e^{ik|\bar{r}-\bar{r}'|}}{|\bar{r}-\bar{r}'|} = G_{dir}$$

$$\frac{e^{ikR}}{R^3}\left[(k^2R^2 + ikR - 1)\mathbb{I} - (k^2R^2 + 3ikR - 3)\hat{R}\otimes\hat{R}\right]$$

$$(\bar{R} = \bar{r} - \bar{r}')$$

$$k \to 0 \quad \frac{3\hat{R}\otimes\hat{R} - \mathbb{I}}{R^3}$$

$$\bar{E}^{ext}(\bar{r},\omega) = \frac{i}{\omega}\int d\bar{r}'\, G(\bar{r},\bar{r}',\omega)\cdot \bar{j}^{ext}(\bar{r}',\omega) = -\frac{e v \omega}{|v| c^2}\int dQ_y \frac{e^{i\bar{Q}\cdot\bar{R}}}{k_z}\left[e^{ik_z(z_0-z)}\left(\hat{\varepsilon}_p^{+}\frac{Q_x k_z}{kQ} + \hat{\varepsilon}_s \frac{Q_y}{Q}\right) + e^{ik_z(z_0+z)}\left(r_p \hat{\varepsilon}_p^{-}\frac{Q_x k_z}{kQ} + \hat{\varepsilon}_s \frac{Q_y}{Q}\right)\right]$$

G_{surf}

$$\bar{j}^{ext}(\bar{r}',\omega) = \frac{-e\hat{x}\, v}{|v|}\,\delta(y')\,\delta(z'-z_0)\cdot e^{i\omega x'/v}$$

$$\int dx'\, e^{i\omega x'/v - iQ_x x'}$$

z_0, z

$$Q_x = \frac{\omega}{v}, \quad z < z_0$$

$\bar{E}_{dir}^{ext}$ $\#149$ $\bar{E}_q^{(\omega)}$

$y = 0 \to E_y = 0$

no falta integrar en dphi_{k_\parallel}?
--> tabla de integrales en fundamental limis.. paper 331