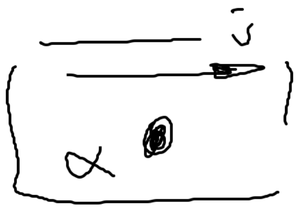
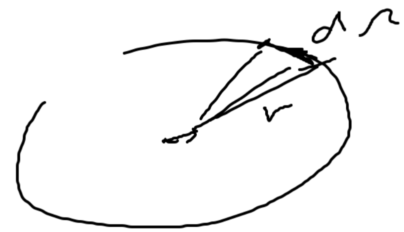


$$\bar{p}(\omega) = \alpha(\omega)\, \bar{E}^{ext}(\bar{b},\omega)$$

$$\text{lossless } \alpha = \frac{i3}{2k^3}$$



$$\bar{E}(\bar{r},\omega) = k^2(\bar{p} - \hat{r}\,\bar{p}\cdot\hat{r})\frac{e^{ikr}}{r}$$

$$\int dt\, r^2 \int d\Omega \frac{c}{4\pi} |\bar{E}(\bar{r},t)|^2 =$$

$$= r^2 \int d\Omega \frac{c}{4\pi} \int dt \left(\int \frac{d\omega}{2\pi} e^{-i\omega t} \bar{E}(\bar{r},\omega)\right)\left(\int \frac{d\omega'}{2\pi} e^{i\omega' t} \bar{E}^*(\bar{r},\omega')\right)$$

$$2\pi\,\delta(\omega-\omega')$$

$$= r^2 \int d\Omega \frac{c}{4\pi} \int \frac{d\omega}{2\pi} |\bar{E}(\bar{r},\omega)|^2$$

$$= \frac{c\,k^4}{4\pi}\frac{\cancel{2}}{\cancel{2}\pi}\int_0^\infty d\omega\, |\bar{p}|^2 \int d\Omega\,(1-\cos^2\theta) = \int_0^\infty \hbar\omega\, d\omega\, \Gamma^{cl}(\omega)$$

$$4\pi - \frac{4\pi}{3} = \frac{8\pi}{3}$$

$$\Rightarrow \Gamma^{cl}(\omega) = \frac{ck^4}{\hbar\omega\, 4\pi^2}\frac{8\pi}{3}|\alpha|^2 |E^{ext}(\omega)|^2 = \frac{2k^3}{\pi\hbar\, 3}|\alpha|^2|E^{ext}(\omega)|^2$$

$$\mathrm{Im}\{G^{vac}\} = \frac{2k^3}{3} \longrightarrow \quad = \frac{2}{\hbar}|p|^2\, \mathrm{Im}\{G^{vac}\}\frac{1}{2\pi} =$$

$$\mathrm{Im}\{\alpha\} = |\alpha|^2 \frac{2k^3}{3} = \frac{3}{2k^3}$$

$$= \frac{2}{\hbar}\left(\frac{1}{2k^3/3}\right)^2\left(\frac{2k^3}{3}\right)|E^{ext}(\omega)|^2\frac{1}{2\pi}$$

\#149 eq. 34

$$\Gamma^{EELS} = \frac{1}{\hbar\pi}\left(\frac{2e\omega}{v^2\gamma}\right)^2\left(K_1^2 + K_0^2/\gamma^2\right)\frac{1}{(2k^3/3)} \overset{?}{=} \frac{1}{\hbar\pi}\frac{1}{(2k^3/3)}|E^{ext}(\omega)|^2$$

eq. 4