$\hat{z}$, $\hat{x}$ $\quad \bar{p} = \alpha \bar{E}^{ext}$ $\quad \bar{r}=0$

$\frac{E_x^{ext}}{E_y^{ext}} \in \mathbb{R}$ $\quad \bar{r} = \dots$ $\uparrow \hat{z}$

$$\frac{1}{r} = \int \frac{d^2\bar{Q}}{(2\pi)^2}\, \frac{2\pi}{Q}\, e^{i\bar{Q}\cdot\bar{R}}\, e^{-Q|z|}$$

$$\phi^0_{dip} = \frac{\bar{p}\cdot\bar{r}}{r^3} = -\bar{p}\cdot\nabla\frac{1}{r} = \int \frac{d\bar{Q}}{(2\pi)^2}\, \frac{2\pi}{Q}\, e^{i\bar{Q}\cdot\bar{R} - Q|z|}\left[-\bar{p}\cdot(i\bar{Q} - \hat{z} Q\, \mathrm{sign}(z))\right]$$

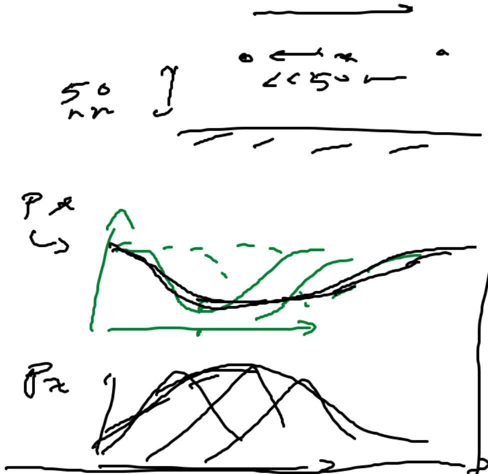
$$\phi_{dip} = \int \frac{d\bar{Q}}{2\pi}\, e^{i\bar{Q}\cdot\bar{R}}\, e^{-Q z_0}\left(-\bar{p}\cdot(i\bar{Q}+\hat{z}Q) + \bar{p}\,(i\bar{Q}+\hat{z}Q)\, r_p\right)$$

$(z<0)$

$$= \int \frac{d\bar{Q}}{(2\pi)^2}\, e^{i\bar{Q}\cdot\bar{R}}\, \phi_{dip}(\bar{Q})$$

$\leftarrow$ by dipole at $\bar{R}=0$

ε $\quad Q \quad \frac{\varepsilon-1}{\varepsilon+1}$



a

$\bar{v} \parallel \hat{x}$ $\quad \bar{r}_j = (\bar{R}_j, z_0)$ $\quad \bar{R}_j = (x_j, y_j)$

$$\phi = \int \frac{d\bar{Q}}{(2\pi)^2}\, e^{i\bar{Q}\cdot\bar{R}}\, \phi_{dip}(\bar{Q}) \sum_j e^{-i\bar{Q}\cdot\bar{R}_j + i\omega x_j/v}$$

$\bar{R}_j = \hat{x}\, a j$, $\quad j = -N, \dots, N$

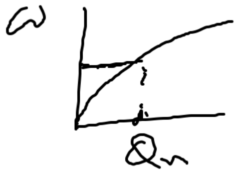
$$\rightarrow \sum_{j=-N}^{N} e^{-i(Q_x - \omega/v)aj} \xrightarrow{N\to\infty} \frac{2\pi}{a}\sum_n \delta\!\left(Q_x - \frac{\omega}{v} - \frac{2\pi n}{a}\right)$$

$$\bar{Q}_n = \left(\frac{\omega}{v} + \frac{2\pi n}{a}, Q_y\right)$$

$$\Rightarrow \phi(x,y)_{(z=-z_0)} = \int \frac{dQ_y}{2\pi a} \sum_n e^{i\bar{Q}_n\cdot\bar{R}}\, \phi_{dip}(\bar{Q}_n)$$

$$= \phi^0 + \phi^{ref}$$

$\omega = \omega_p(Q)$



$$\phi^0_{dip} = -\bar{p}\cdot\bar{\nabla}\frac{1}{r} \qquad q = \frac{\omega}{v}$$

$$\phi^0 = -\bar{p}\cdot\bar{\nabla}\int dx' \frac{1}{|\bar{r}-\bar{r}'|} e^{iqx'} \qquad \bar{r}' = (x',0,0)$$

$$" \; 2K_0\big(q\underbrace{\sqrt{z^2+y^2}}_{d}\big)\, e^{iqx} \to \log(qd)$$

$$p_x \longrightarrow q\log(qd)$$

$$p_y, p_z \longrightarrow \frac{1}{d}$$

$$q_p = \sqrt{\left(\frac{\omega_{pl}}{v} - \frac{2\pi n}{a}\right)^2 + q_y^2} \qquad q_y = 0 \longrightarrow q_p = \frac{\omega_p}{v} + \frac{2\pi n}{a}$$

2D film $\quad \omega_p = C\sqrt{q_p}$

grav–

#335 → Ag film

$$\delta(a - a_p) = \frac{\delta(a_y^2 \quad)}{\left|\frac{\partial}{\partial a_y}\right|}$$

$$a = \sqrt{a_x^2 + a_y^2}$$

n