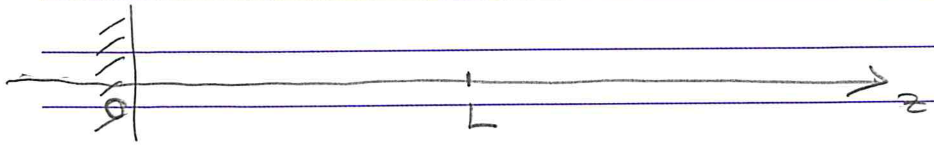


$$m\ddot{x} = F(t) + qE(L,t) - m\omega_0^2 x - m\gamma_{nr}\dot{x}$$

$$\partial_z E\Big|_{L^-}^{L^+} = -\frac{4\pi i\omega}{c^2} J \quad ; \quad J = q\dot{x}$$

$$-\omega^2 x = F + qE(L) - m\omega_0^2 x + im\omega\gamma_{nr} x$$

$$x = \frac{F+qE(L)}{m(\omega_0^2-\omega^2-i\gamma_{nr}\omega)}$$

$$E(0<z<L) = E_L e^{-i\frac{\omega}{c}x} + E_R e^{i\frac{\omega}{c}x}$$

$$E(z=0) = 0 \implies E_L + E_R = 0.$$

$$E(z) = 2i\sin\left(\frac{\omega}{c}x\right) E_R$$

$$E(z>L) = E_{rad} e^{i\frac{\omega}{c}z}$$

$$\frac{i\omega}{c} E_{rad} e^{i\frac{\omega}{c}L} - 2i\frac{\omega}{c}\cos\frac{\omega L}{c} E_R = -\frac{4\pi\omega^2}{c^2} q x$$

$$E(z=L^-) = E(z=L^+) \implies E_{rad} e^{i\frac{\omega}{c}L} = E_R \cdot 2i\sin\left(\frac{\omega}{c}L\right)$$

$$E_R = E_{rad}\frac{e^{i\frac{\omega}{c}L}}{e^{i\frac{\omega}{c}L} - e^{-i\frac{\omega}{c}L}}$$

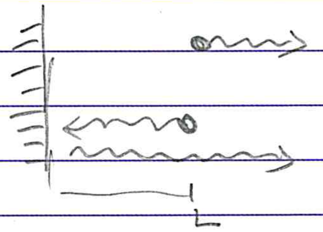
$$\frac{i\omega}{c} E_{rad}\, e^{i\frac{\omega}{c}L}\left[1-\frac{e^{i\frac{\omega}{c}L}+e^{-i\frac{\omega}{c}L}}{e^{i\frac{\omega}{c}L}-e^{-i\frac{\omega}{c}L}}\right] = -\frac{4\pi\omega^2}{c^2}\, q x$$

$$\parallel$$

$$i\frac{\omega}{c}E_{rad}\left[\frac{\cancel{e^+}-e^- - \cancel{e^+} - e^-}{e^+-e^-}\right]e^+$$

$$E_{rad} = \frac{4\pi i\omega}{c}\, q x\, \frac{e^{i\frac{\omega}{c}L}-e^{-i\frac{\omega}{c}L}}{-2} = +\frac{2\pi i\omega}{c}\, q x \left(e^{-i\frac{\omega}{c}L} - e^{+i}\right.$$

oscillating function of distance →



$$m\left(\omega_0^2-\omega^2-i\gamma_{mr}\omega\right)x := F + \frac{2\pi i\omega}{c}\, q^2\left(1-e^{2i\frac{\omega}{c}L}\right)$$

$$x\left[m\left(\omega_0^2-\omega^2-i\gamma_{mr}\omega - i\,\frac{2\pi\omega}{c}\,\frac{q^2}{m}\left(1-e^{2i\frac{\omega}{c}L}\right)\right)\right] = F$$

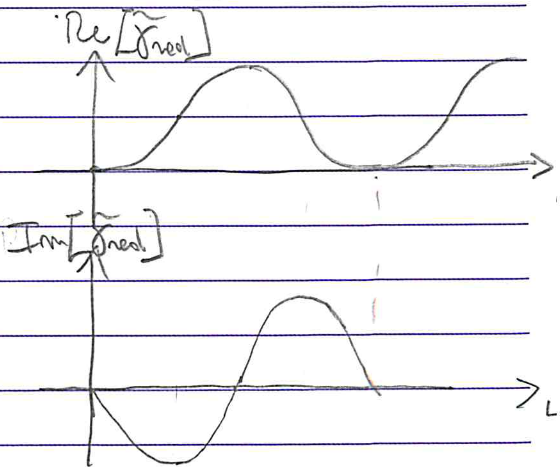
$$\tilde{\gamma}_{rad} = \frac{2\pi q^2}{mc}\left(1-e^{2i\frac{\omega}{c}L}\right)$$

$$\mathrm{Re}\left[\tilde{\gamma}_{rad}\right] = \frac{2\pi q^2}{mc}\left(1-\cos\frac{2\omega}{c}L\right)$$

radiative decay oscillates

$$\mathrm{Im}\left[\tilde{\gamma}_{rad}\right] = -\frac{2\pi q^2}{mc}\sin\left(\frac{2\omega L}{c}\right)$$

sort of Lamb-shift



$$E_{red} = \frac{2\pi i\omega}{c} \cdot \frac{qF}{m} \frac{e^{-i\frac{\omega}{c}L}\left(1 - e^{2i\frac{\omega}{c}L}\right)}{\omega_0^2 - \omega^2 - i\gamma_{mr}\omega - i\frac{2\pi q^2}{mc}\left(1 - e^{2i\frac{\omega}{c}L}\right)}$$

Note: same oscillating factor in numerator and resonance

$$|E_{red}|^2 = \left(\frac{2\pi q\omega}{c}\right)^2 |x|^2 \left(1 + 1 - e^{-2i\frac{\omega}{c}L} - e^{2i\frac{\omega}{c}L}\right) =$$

$$= \left(\frac{2\pi q\omega}{c}\right)^2 |x|^2 \cdot 2 \underbrace{\left(1 - \cos\frac{2\omega L}{c}\right)}_{\text{same dependence as } Re[\tilde{\gamma}_{red}]}$$

Equation of motion for emitter:

in Fourier $\underbrace{-m\omega^2 x}_{m\frac{d^2}{dt^2}x} = -m\omega_0^2 x - (-i\omega)\gamma_{mr} x +$

$$- \left(-i\omega \cdot \frac{2\pi q^2}{mc} Re\left[1 - e^{2i\frac{\omega}{c}L}\right]\right) +$$

$$- \left(-2\omega \frac{\pi q^2}{mc} Im\left[1 - e^{2i\frac{\omega}{c}L}\right]\right)$$

$\rightarrow \omega \approx \omega_0$

$$\Rightarrow m\ddot{x} = -m\left(\omega_0 - \frac{\pi q^2}{mc}\sin\left(\frac{2\omega}{c}L\right)\right)^2 x - \left(\gamma_{mr} + Re[\tilde{\gamma}_{red}]\right)\dot{x}$$

valid over bandwidth $<< c/L$ around ω_0.

$\Rightarrow \tilde{\gamma}_{red} << c/L \longrightarrow$ field @ steady state at all times after reflect