Phase lag of an oscillator, scattered wave always in phase with oscillator;


180°
90°
0°
$\omega < \omega_0$ ω_0 $\omega > \omega_0$
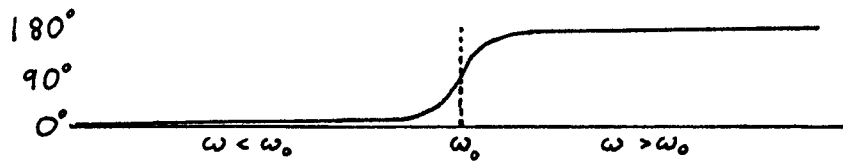
wavelength = λ
frequency = $\nu = c/\lambda$
frequency = $\omega = 2\pi\nu$
energy = $h\nu = hc/\lambda$

Refractive index "n" : a measure of the interaction of light with matter
: relates a bulk medium property to individual oscillators

$$n = 1 + \frac{Nq^2}{2\varepsilon m(\omega_0^2 - \omega^2)}$$

$$n = 1 + f\left(\frac{1}{\omega_0^2 - \omega^2}\right)$$

N = # charges / unit volume
q = charge of an electron
m = mass of electron
ε = fudge factor to get magnitude and
dimensions correct
ω = frequency of driving wave
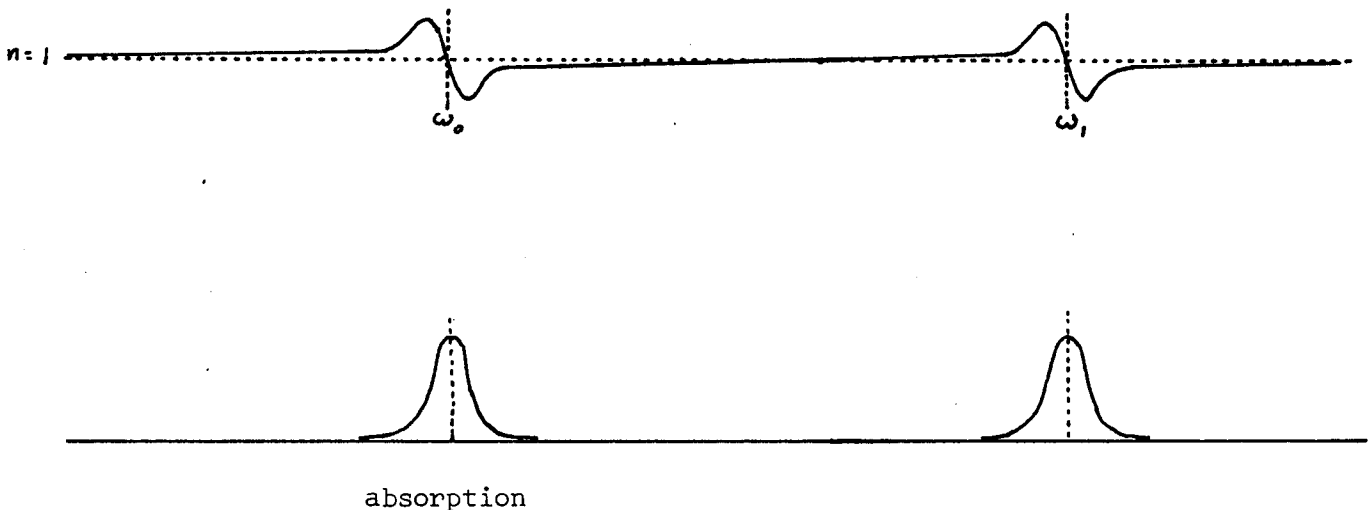ω_0 = natural frequency of oscillator

n = 1

ω_0
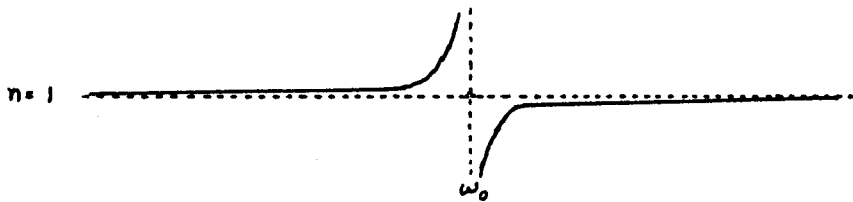
fix up equation to avoid ω_0 disaster and allow for different types of oscillators

$$n = 1 + \frac{q^2}{2\varepsilon m}\sum_k \frac{N_k}{(\omega_k^2 - \omega^2 + i\gamma_k\omega)}$$

k different types of oscillator
$i\gamma_k$ = damping factor , allows for
real but finite absorption of
energy

see: Feynman, vol 1, 31.3,31.4

n = 1

ω_0 ω_1

absorption