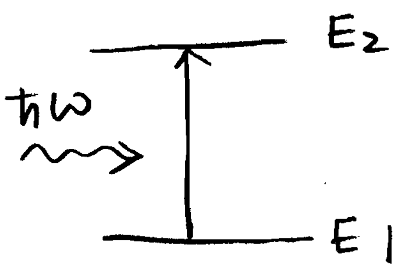
Discrete 2-level system in <u>non-monochromatic</u> electromagnetic field



polarization

$$R_{12} = \frac{1}{V}\sum_{k}\frac{2\pi}{\hbar}|H'_{12}|^2\cdot\delta(E_2 - E_1 - \hbar\omega_k)\cdot 2\,n_{ph} \qquad \left(\frac{1}{s\cdot cm^3}\right)$$

Photon wave vector

$$n_{ph} = \frac{1}{e^{\hbar\omega_k/k_BT} - 1}$$

number of photons per state (Bose-Einstein statistics)

Density of states for <u>photons</u>.

$$e^{i\vec{k}\cdot\vec{r}}$$

Periodic boundary cond.

$$\begin{cases} k_x = \frac{2\pi}{L}\cdot l \\ k_y = \frac{2\pi}{L}\cdot m \\ k_z = \frac{2\pi}{L}\cdot n \end{cases}$$

$$\omega_k = \frac{kc}{n_r}$$

n_r: refractive index.

Number of states with photon energy E_{21}
per unit volume, per energy interval $\left(\frac{1}{cm^3 \cdot eV}\right)$

$$N(E_{21}) = \frac{2}{\cancel{V}} \cdot \int \frac{4\pi k^2 dk}{\left(\frac{2\pi}{\cancel{L}}\right)^3} \cdot \delta(E_2 - E_1 - \hbar\omega_k)$$

$$\hbar\omega_k = \frac{\hbar k c}{n_r} = E_{21}$$

$$k = \frac{n_r}{\hbar c} \cdot E_{21}$$

$$dk = \frac{n_r}{\hbar c} \cdot dE_k$$

$$N(E_{21}) = \frac{8\pi}{(2\pi)^3} \cdot \left(\frac{n_r}{\hbar c}\right)^2 E_{21}^2 \cdot \left(\frac{n_r}{\hbar c}\right) = \frac{8\pi n_r^3 \cdot E_{21}^2}{h^3 c^3}$$