312(7): Calculation of the Rest Frequency without Approximation for Monochromatic Radiation

The Beer Lambert law is:

$$\frac{\Phi}{\Phi_i} = \exp\left(-\alpha l\right) \quad -(1)$$

where

$$\Phi = \frac{\hbar\left(\omega^2 - \omega_0^2\right)^2}{3c^2\pi^2\left(e^y - 1\right)} \quad -(2)$$

and

$$\Phi_1 = \frac{\hbar\left(\omega_i^2 - \omega_0^2\right)^2}{3c^2\pi^2\left(e^{y_i} - 1\right)} \quad -(3)$$

So:

$$\frac{\omega^2 - \omega_0^2}{\omega_i^2 - \omega_0^2} = \left(\frac{e^y - 1}{e^{y_i} - 1}\right)^{1/2} \exp\left(-\frac{\alpha l}{2}\right) \quad -(4)$$

$$:= A$$

So:

$$\omega_0^2 = \frac{\omega^2 - A\omega_i^2}{1 - A} \quad -(5)$$

Various spectra and theories of the power absorption coefficient α can be used to evaluate ω_0^2. Note that ω_0^2 must be a constant.