Lecture 24 Highlights

A black body radiation spectrum has an energy density (energy per unit volume per unit frequency) given by Planck's formula:

$$\rho(\omega) = \frac{\hbar}{\pi^2 c^3} \frac{\omega^3}{e^{\hbar\omega/k_B T} - 1}, \qquad (1)$$

where ω is the angular frequency of the radiation, k_B is Boltzmann's constant, and T is temperature of the blackbody radiator. On pages 352→354 of Griffiths there is a calculation of the rate of absorption of this type of radiation by a two-level atom (states a and b) assuming random polarization of the light:

$$R_{a\to b} = \frac{\pi e^2 \rho(\omega_{ab})}{3\varepsilon_0 \hbar^2} \left(|x_{ab}|^2 + |y_{ab}|^2 + |z_{ab}|^2 \right) \equiv \rho(\omega_{ab}) M_{ab},$$

where $E_b - E_a = \hbar\omega_{ab}$, and the term in parentheses contains the three Cartesian matrix elements between states a and b.