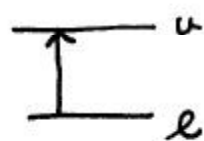


Integrated Absorption Coefficients

$$I(\nu) = I_0(\nu) e^{-K_\nu l}$$

$$\text{Absorbed Intensity (erg/cm}^2\text{ s)} = \int [I_0(\nu) - I(\nu)] d\nu \cong I_0 \int (1 - e^{-K_\nu l}) d\nu$$

assuming constant intensity

$$\text{For weak absorption } K_\nu l \ll 1: 1 - e^{-K_\nu l} \cong K_\nu l$$

$$\text{Absorbed Intensity} \cong I_0 l \int K_\nu d\nu$$

$$\text{Now, from theory: } \frac{dn_e}{dt} = - \underbrace{B_{u \leftarrow l} p(\nu_{ul}) n_e}_{\text{molecules cm}^{-3} \text{ s}^{-1}}$$

$$\text{Absorbed energy cm}^{-3} \text{ s}^{-1} = B_{u \leftarrow l} p(\nu_{ul}) n_e h \nu_{ul}$$

$$\text{Absorbed energy in a cell of length } l \text{ cm}^{-2} \text{ s}^{-1} = B_{u \leftarrow l} p(\nu_{ul}) n_e h \nu_{ul} l$$

$$\therefore \underbrace{I_0 l \int K_\nu d\nu}_{\text{expt.}} = \underbrace{B_{u \leftarrow l} p(\nu_{ul}) n_e h \nu_{ul} l}_{\text{theory}}$$

$$B_{u \leftarrow l} = \frac{2\pi}{3h^2} |\mu_{ul}|^2 \quad I_0 = c p(\nu_{ul})$$

$$\Rightarrow \int K_\nu d\nu = \frac{8\pi^3 \nu_{ul} n_e |\mu_{ul}|^2}{3hc}$$