2.3: Absorption, Scattering and Attenuation Coefficients

The decrease in radiance $-dL$ as a beam of radiance L passes through a medium of thickness ds as a result of absorption is

$$-dL = \alpha L ds \tag{2.3.1}$$

where α is the **linear absorption coefficient**. With similar equations we can define the *linear scattering coefficient* σ and the *linear attenuation (extinction) coefficient* ε. The SI units of α, σ and ε are m^{-1} and $\varepsilon = \sigma + \alpha$.

The *mass absorption coefficient*, *mass scattering coefficient* and *mass extinction coefficient* each with units $m^2\ kg^{-1}$ are defined respectively as α/ρ, σ/ρ and ε/ρ, where ρ is the density (kg m^{-3}) of the medium. Chandrasekhar uses κ for the mass extinction coefficient, which, in the theory of stellar atmospheres, is also known as the **opacity**.

The *atomic* (or *molecular*) *absorption*, *scattering* and *extinction coefficients* are respectively α/*N*, σ/*N* and ε/*N*, where *N* is the number density (atoms or molecules per unit volume), with units of m^2/atom (or molecule). Because of these units the coefficients are often referred to as **cross-sections**.