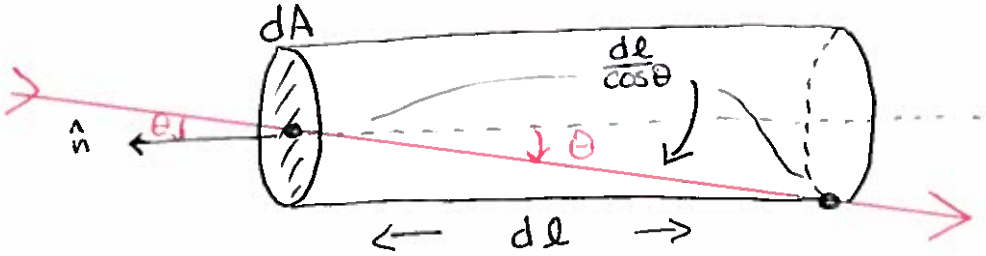
Energy Density

$$du_\nu = \frac{dE_\nu}{dV}$$ ← differential Volume

$erg \cdot cm^{-3}\,(Hz^{-1})$ ↑ if ν subscript

How is energy density related to I_ν?

Imagine a light ray passing through dA at an angle θ. In a time dt, it traces out a length of $\frac{dl}{\cos\theta}$



$$dV = dA\,dl$$

$$c\,dt = \text{length of light ray in } dV = \frac{dl}{\cos\theta}$$

$$du_\nu = \frac{I_\nu \cos\theta\, dA\, d\Omega\, dt}{dA\, dl} = I_\nu \cos\theta\, d\Omega \frac{dt}{dl}$$

$$\frac{dt}{dl} = \frac{1}{c \cdot \cos\theta}$$

$$du_\nu = \frac{I_\nu \cos\theta\, d\Omega}{c \cdot \cos\theta}$$

$$u_\nu = \frac{1}{c}\int I_\nu\, d\Omega \qquad erg \cdot cm^{-3} \cdot Hz^{-1}$$

$s \cdot cm^{-1}$ $erg \cdot s^{-1} \cdot cm^{-2} \cdot ster^{-1} \cdot Hz^{-1} \times ster$