$$\text{power}\ \ \mathrm{P} = \frac{\text{energy}}{\text{time}}$$

$$= \frac{\mathrm{J}}{\mathrm{s}}$$

$$\text{flux}\ \ \mathrm{F} = \frac{\text{energy}}{\text{area time}}$$

$$= \frac{\mathrm{J}}{\mathrm{m}^2\,\mathrm{s}}$$

$$\text{flux density}\ S_\nu = \frac{\text{energy}}{\text{area time frequency}}$$

$$= \frac{\mathrm{J}}{\mathrm{m}^2\,\mathrm{s}\,\mathrm{Hz}}$$

$$1\ \text{Jansky} = 10^{-26}\ \frac{\mathrm{J}}{\mathrm{m}^2\,\mathrm{s}\,\mathrm{Hz}}$$

$$\text{Intensity}\ I_\nu = \frac{\text{energy}}{\text{area time frequency solid}\cdot\text{angle}}$$

$$= \frac{\mathrm{J}}{\mathrm{m}^2\,\mathrm{s}\,\mathrm{Hz}\,\mathrm{sr}}$$

$$\text{solid angle}\ \Omega = \pi\theta^2 \qquad \mathrm{sr}$$

$$\text{measured power P} = \int I_\nu\ d\Omega\ d\nu\ dA$$

$$L_{\mathrm{Hz}} \sim 33\ \frac{\mathrm{J}}{\mathrm{s\ Hz}}$$

$$I_\nu = \frac{L_{\mathrm{Hz}}}{4\pi r^2\ \Omega}$$

$$\text{flux density}\ \ \mathrm{F}_\nu = X\nu^2$$

$$\text{flux density}\ \ \mathrm{F}_\nu = \left(\frac{2kT}{c^2}\right)\nu^2$$

$$\text{intensity}\ \ \mathrm{I}_\nu = \left(\frac{2kT}{c^2}\right)\nu^2 \qquad ?$$

$$T = \left(\frac{c^2}{2k\nu^2}\right) I_\nu \qquad \text{if a blackbody}$$

$$\mathrm{I}_\nu = \frac{P}{A\ \Delta\nu\ \Omega}$$

$$\text{brightness temperature } \mathrm{T_B} \equiv \left(\frac{c^2}{2k\nu^2}\right) I_\nu$$

$$\text{beam width } \theta_b \sim \frac{\lambda}{D}$$

$$\text{beam solid angle } \Omega_b \sim \pi\left(\frac{\theta_b}{2}\right)^2 \sim \frac{\pi}{4}\left(\frac{\lambda}{D}\right)^2$$

$$\Omega_b \sim \frac{\pi}{4}\left(\frac{\lambda}{D}\right)^2 \sim \frac{\pi\, c^2}{4\, D^2\, \nu^2}$$

$$\text{diluted } I_\nu^* = \frac{P}{A\ \Delta\nu\ \Omega_b} = I_\nu \left(\frac{\Omega_{\rm source}}{\Omega_b}\right)$$

$$\text{diluted } \mathrm{T_B^*} = \left(\frac{c^2}{2k\nu^2}\right) I_\nu^* = \mathrm{T_B}\left(\frac{\Omega_{\rm source}}{\Omega_b}\right)$$

$$\text{usually} \qquad \mathrm{T_B^*} < \mathrm{T_B}$$

$$\text{antenna temperature } \mathrm{T_a'} = \mathrm{T_B}\left(\frac{\Omega_{\rm source}}{\Omega_b}\right)$$