

Intensity and Loudness

- **Intensity** is the power per unit area.

→ $I = P / A$

→ Units: Watts/m^2

- For Sound Waves

→ $I = p_0^2 / (2 \rho v)$ (p_0 is the *pressure amplitude*)

→ Proportional to p_0^2 (note: Energy goes as A^2)

- **Loudness (Decibels)**

→ Loudness perception is logarithmic

→ Threshold for hearing $I_0 = 10^{-12} \text{ W/m}^2$

→ $\beta = (10 \text{ dB}) \log_{10} (I / I_0)$

→ $\beta_2 - \beta_1 = (10 \text{ dB}) \log_{10}(I_2/I_1)$

