Relation Between Sound Intensity, *I* and Radiated Acoustic Power, *P*

Sound intensity $I \equiv$ acoustic power P radiated from sound source *per unit area* A.

Sound *e.g.* from a "point" sound source is radiated over the surface area of (an imaginary) sphere of radius R centered on the sound source. The sound intensity I at a radial distance $r = R$ from the sound source is thus:

$$I(r=R) = P/A_{Sphere} = P/4\pi R^2$$ (SI units: $Watts/m^2$)

Sound energy is conserved, and propagates radially outward in all directions from the point sound source.

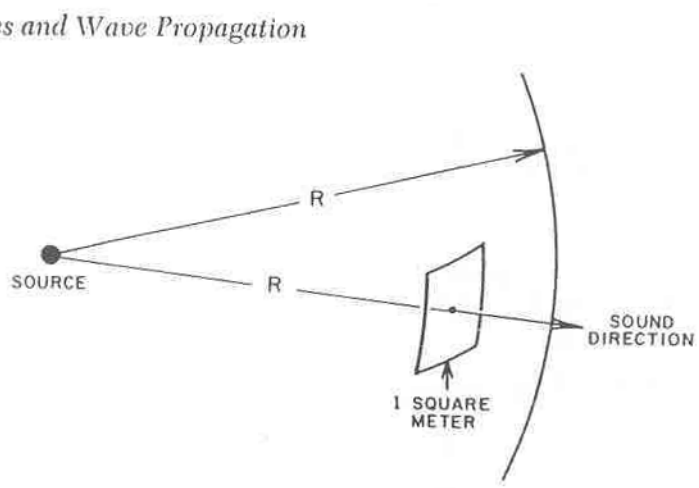

FIG. 21. Sound intensity at a distance from a small source.

Sound Absorption:

Sound energy can also be *absorbed* in propagating through a medium, and/or upon *reflection* from a surface.

The transmitted and/or reflected sound intensity is in general less than incident sound intensity:

$$I_{Incident} = I_{Transmitted} + I_{Reflected} + I_{Absorbed}$$ (from conservation of energy)

Define: $a \equiv$ sound absorption coefficient $\equiv I_{Absorbed}/I_{Incident}$

$$0 \le a \le 1$$

$a = 0$: no sound absorbed
$a = 1$: sound completely absorbed

The amount of sound absorption in a given material depends on the detailed nature of the material and also the frequency, *i.e.* in general the absorption coefficient $a = a(f)$.
We will discuss this further in subsequent lecture(s), *e.g.* on auditorium/room acoustics.