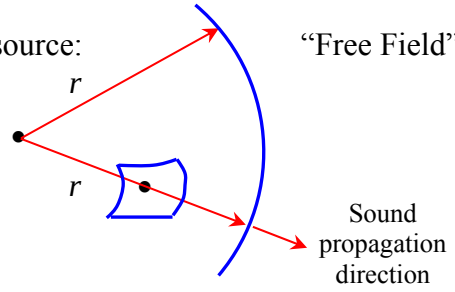
Auditorium & Room Acoustics

Sounds out in the open, distance $r \gg \lambda$ away from sound source: "Free Field"

Sound Intensity $\boxed{I(r) = Power/4\pi r^2}$ sound source:



Intensity, I in $Watts/m^2$ (since *SI* units of Power are *Watts*)

Sound intensity $I(r)$ decreases as $1/r^2$, spreads out radially in all directions from sound source

* Sound Intensity Level, $L_I(r) = 10\log_{10}(I(r)/I_o)$ decreases by 6 *dB* for every doubling of r.
* Ground (grass, weeds, bushes, *etc*.) absorbs sound…
  - sound level $L_I(r)$ falls off faster than $1/r^2$ ($L_I(r)$ falls off more steeply than 6 *dB*)
* Put a reflecting surface behind musicians for focusing sound to audience…

* Confined sound in an enclosure (*e.g*. a room):
  - Get sound reflections off of all walls (just like light bouncing off of mirrors)
  - Angle of incidence = Angle of reflection
  - Law of reflection (light and/or sound) arises from energy/momentum conservation at wall/mirror!)

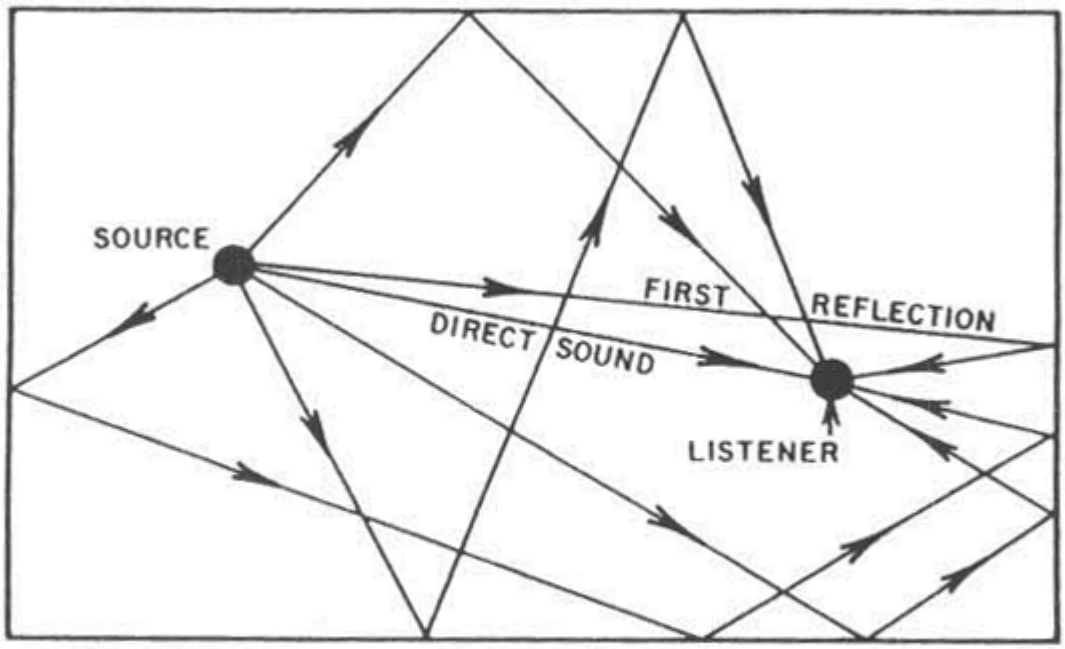


FIG. 1. Multiple reflections from the walls of a room of a single impulse produced by a sound source.