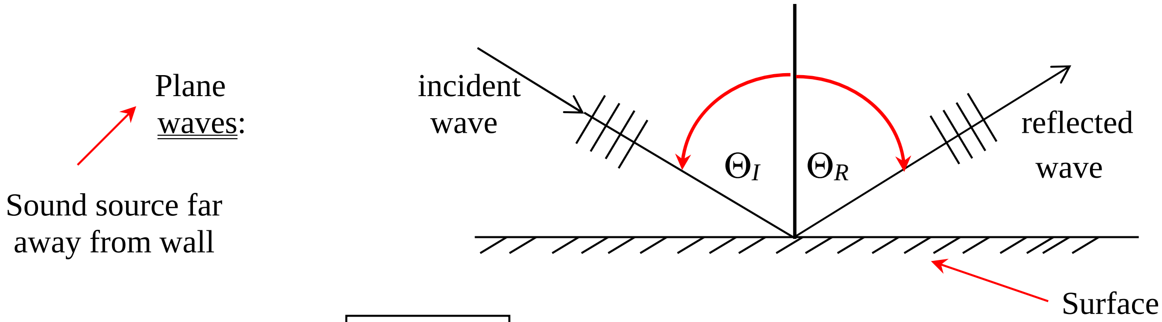
Lecture Notes III (Continued – Part 2)

Reflection of Sound Waves: — Sound waves bounce (*i.e.* reflect) off of walls – just like light waves (*i.e.* *EM* waves) bouncing off of/reflecting from a mirror:



The Law of Reflection: $\boxed{\Theta_I = \Theta_R}$ Angle of Incidence = Angle of Reflection.

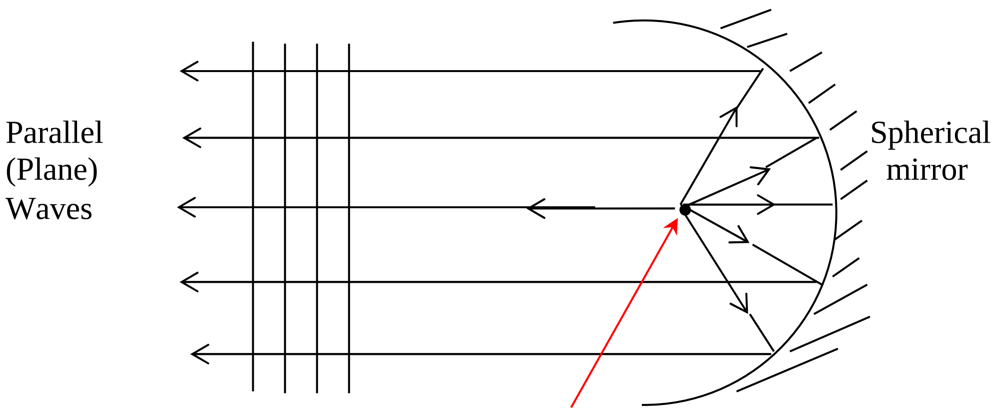
The law of reflection for sound waves is same as that for light waves, *e.g.* light reflecting off of a mirror and/or a refracting interface. The law of reflection (in either case) physically arises from (microscopic) conservation of energy and momentum at the interface/reflecting mirror!

Sound Waves Can Be Focused Just Like Light!!!

In one dimension, define the sound source location, S_{source}. Define the receiver/observer location, $S_{observer}$. The focal length of a (*concave*) spherical mirror, $f = +R/2$, where R = radius of curvature of spherical mirror.{For a *convex* spherical mirror, $f = -R/2$}. All distances are measured with respect to the *apex* of the mirror.

Then: $$\boxed{\frac{1}{S_{source}} + \frac{1}{S_{observer}} = \frac{1}{f} = \frac{2}{R}}$$ "Acoustic Mirror Equation"

Thus, if the sound source is located at the focal point of spherical mirror, $S_{source} = f = R/2$, then the sound emerges from the acoustic mirror as parallel rays (*i.e.* as plane waves) – just as in the optics case (see figure below)! The observer's location is at $S_{observer} = \infty$.



Sound source located at focal point of mirror, $f = +R/2$.