The principal of operation of *LIDAR* and/or Doppler *RADAR* can also be used in an acoustical application, if the probe beam is used to illuminate *e.g*. a small, light-weight aluminized mylar mirror mounted on the cone of a loudspeaker. Then the frequency of the probe beam is Doppler-shifted by the motion of the vibrating cone of the loudspeaker. When recombined with the reference beam, optical beats occurs, and if the ***envelope*** of the overall resultant/total/combined light intensity is detected e.g. using a photodiode, then electrically amplifying the signal output from the photodiode, and output to ***another*** (*i.e*. 2nd) loudspeaker, the sound output from the ***original*** loudspeaker can be heard in the ***second*** loudspeaker!

The Doppler Effect – Frequency Shifts Due To Motional Effects:

Waves and Wave Propagation 45

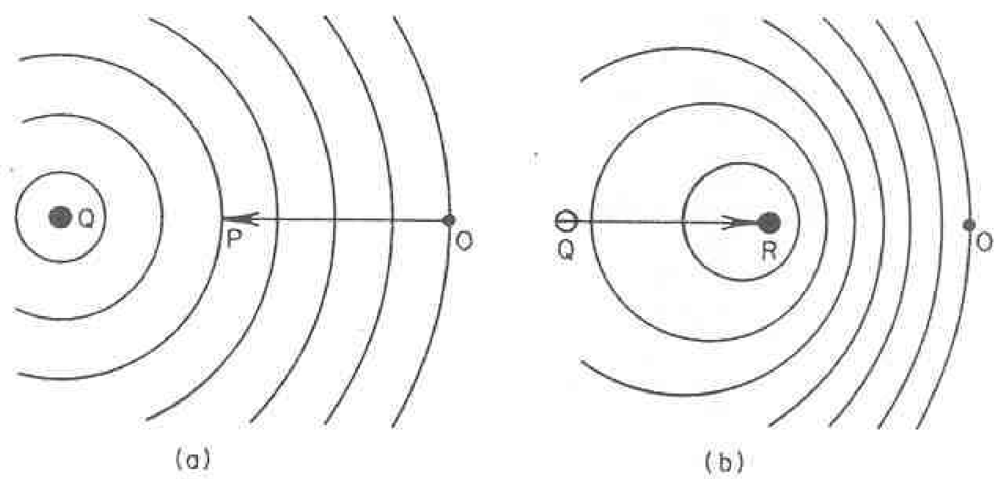

FIG. 14. Doppler effect. (a) Observer moving toward the sound source. (b) Source moving toward the observer.

Simplest Case: Relative Motion of Sound Source and Observer in *1-Dimension*:

Let us first define:

a.) Ground speed = speed of an object *relative* to ground (ground is assumed stationary).
b.) Moving sound source has ground speed, U_{source}.
c.) Moving observer has ground speed, $U_{observer}$.
d.) Speed of propagation of sound in medium (e.g. air) has ground speed, V_{medium}.
e.) Sound source emits sound with frequency, f_{source} *in sound source reference frame*.
f.) Moving observer hears/perceives frequency, $f_{observer} \neq f_{source}$ *in his/her reference frame*!