

Homework 3

Prepare a 10 -15 min talk for Tuesday 19.11. 8:30 about Doppler effect:

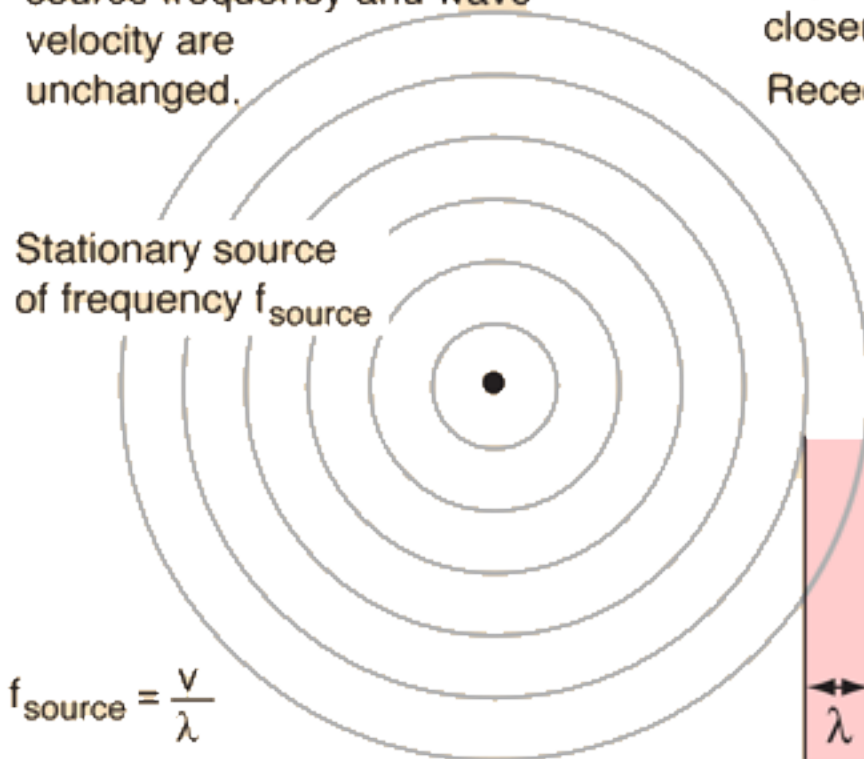
1. Frequency change for case of fixed source and moving detector
2. Frequency change for moving source and fixed detector.
3. General relation

Doppler effect

$$f' = f \frac{v \pm v_D}{v \pm v_S}$$

When the motion of detector or source is toward the other, the sign on its speed must give an upward shift in frequency. When the motion of detector or source is away from the other, the sign on its speed must give a downward shift in frequency.

Movement of the source alters the wavelength and the received frequency of sound, even though source frequency and wave velocity are unchanged.



$$f_{\text{source}} = \frac{v}{\lambda}$$

Sound velocity v

Source approaching: $f'' = \frac{v}{\lambda''} = \frac{v}{v - v_S} f_{\text{source}}$
 In period T , source moves closer by $v_S T$, so

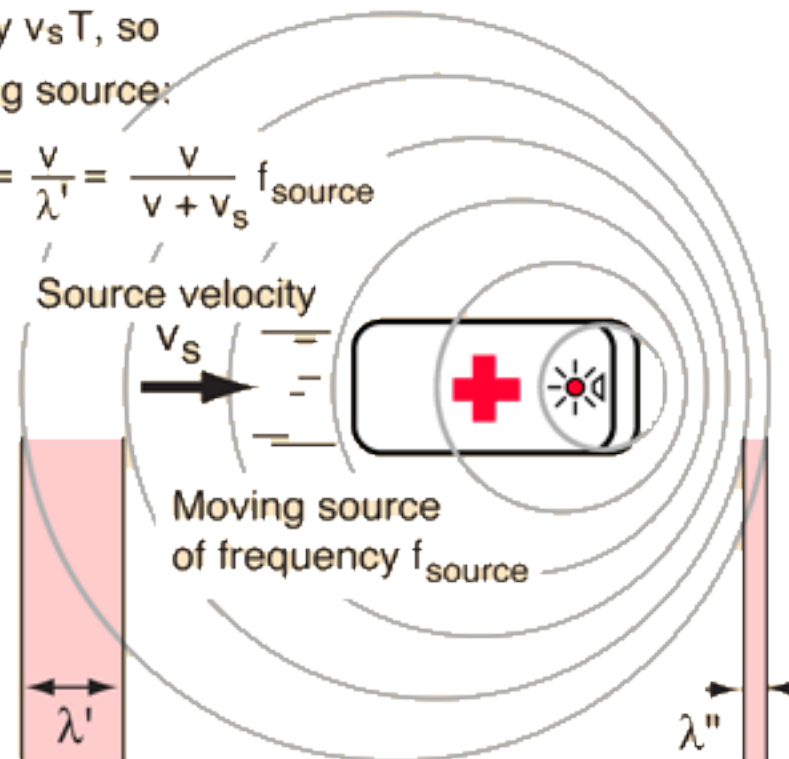
Receding source:

$$f' = \frac{v}{\lambda'} = \frac{v}{v + v_S} f_{\text{source}}$$

Source velocity



Moving source of frequency f_{source}



$$\lambda = vT$$

$$\lambda' = (v + v_S)T$$

$$\lambda'' = (v - v_S)T$$