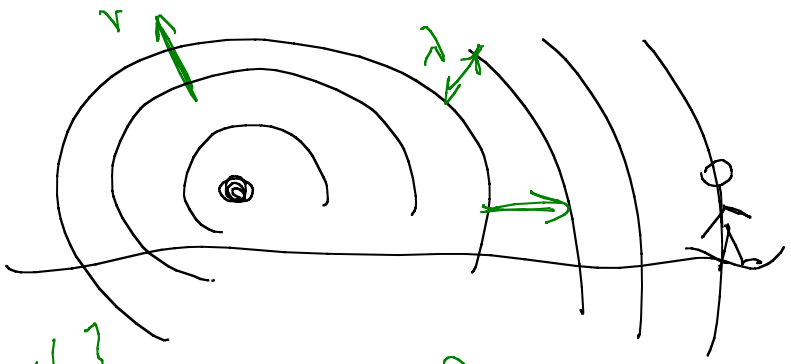
Phys 2110-3 12/8/10

Note Title 12/8/2010

Doppler Effect

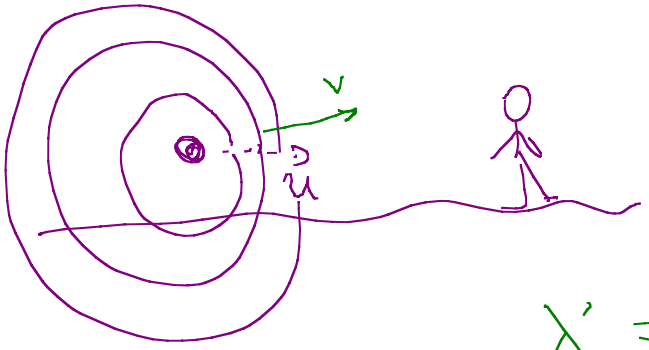


$\lambda f = v$

f = True frequency

f' = frequency observed

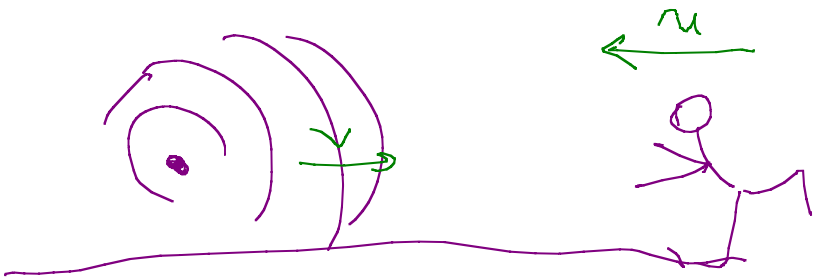
Moving source



{toward / away}

$$\lambda' = \lambda\left(1 \mp \frac{u}{v}\right)$$

$$f' = \frac{f}{\left(1 \mp \frac{u}{v}\right)}$$



Effective speed = $v+u$

$$f' = \frac{(v+u)}{\lambda} = \frac{v}{\lambda}\left(1+\frac{u}{v}\right)$$

$$= f\left(1+\frac{u}{v}\right)$$

$$f' = f\left(1 \pm \frac{u}{v}\right)$$

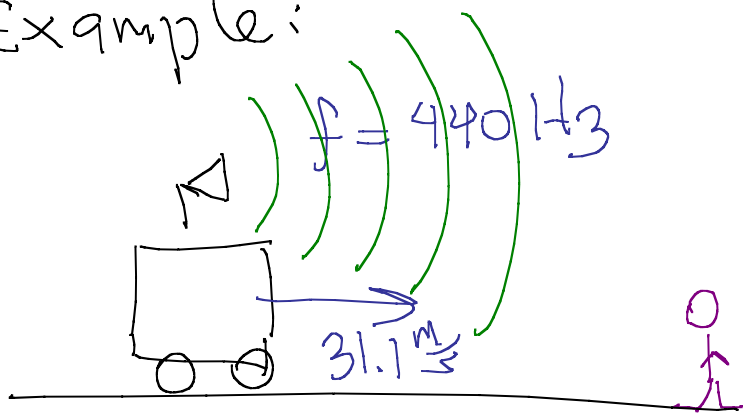
v = speed of sound

$\doteq 343 \frac{m}{s}$

Both obs & source in motion,

$$f' = f\left(\frac{1 \pm \frac{u_{obs}}{v}}{1 \mp \frac{u_{source}}{v}}\right)$$

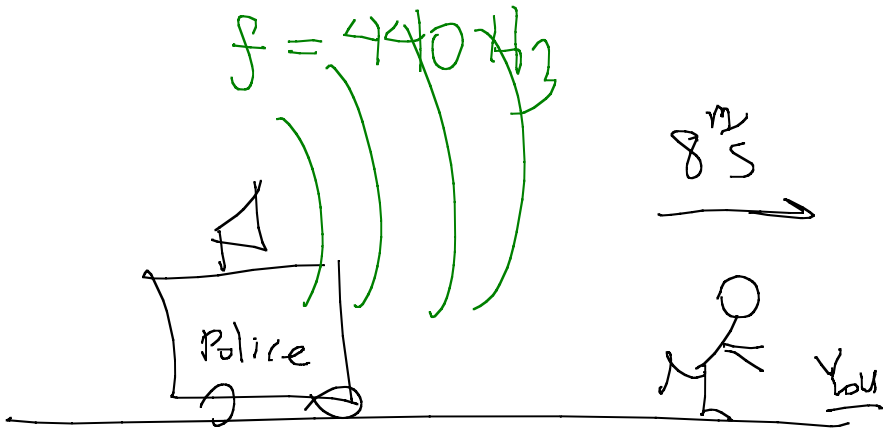
Example:



What does man hear?

$$f' = \frac{f}{1 - \frac{v}{V}} = \frac{440\ Hz}{1 - \frac{31.1}{343}}$$

$$= 484\ Hz$$



Away

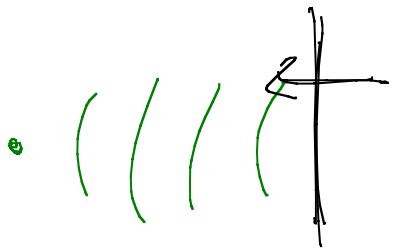
$$f' = 440\ Hz \left(1 - \frac{8.0}{343}\right)$$

$$= 429\ Hz$$

14.74 Obstetricians use ultrasound fetal heart beat. Detect 100 Hz frequency shift in sound 5.0 MHz How fast is wall moving

Wall "hears" a new freq, f' because it's in motion

Another Doppler shift, source in motion.



$\Rightarrow f''$ $\quad |f - f''| = 100\ \text{Hz}$