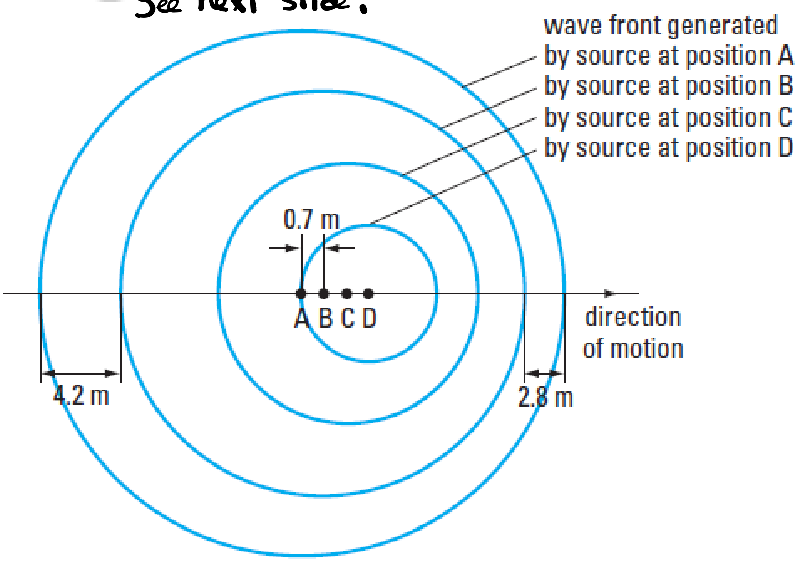
L07 - Doppler Effect

Agenda:

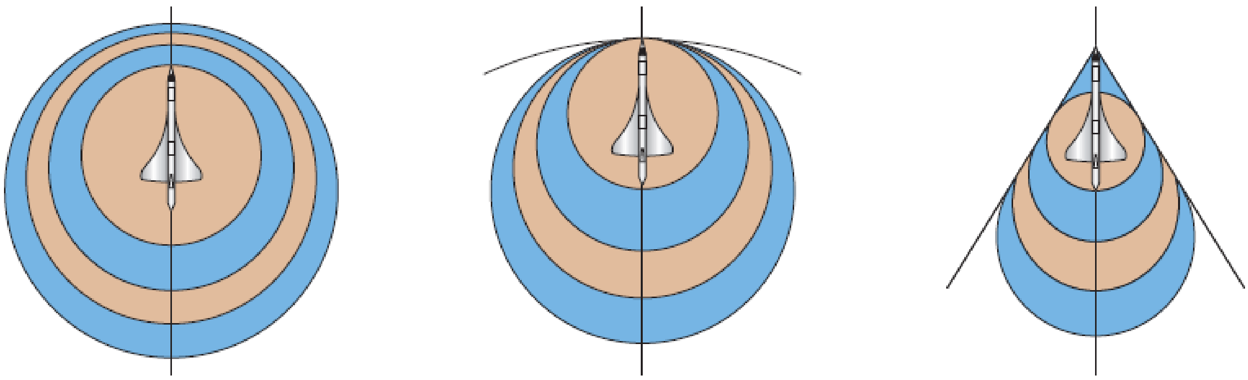
- Attendance
- Formative Quiz - Double-Slit Diffraction
- Doppler Effect
  - Simulation
  - Red Shift
  - Equation

http://astro.unl.edu/classaction/animations/light/dopplershift.html

See next slide.



Doppler Effect and Sonic Booms

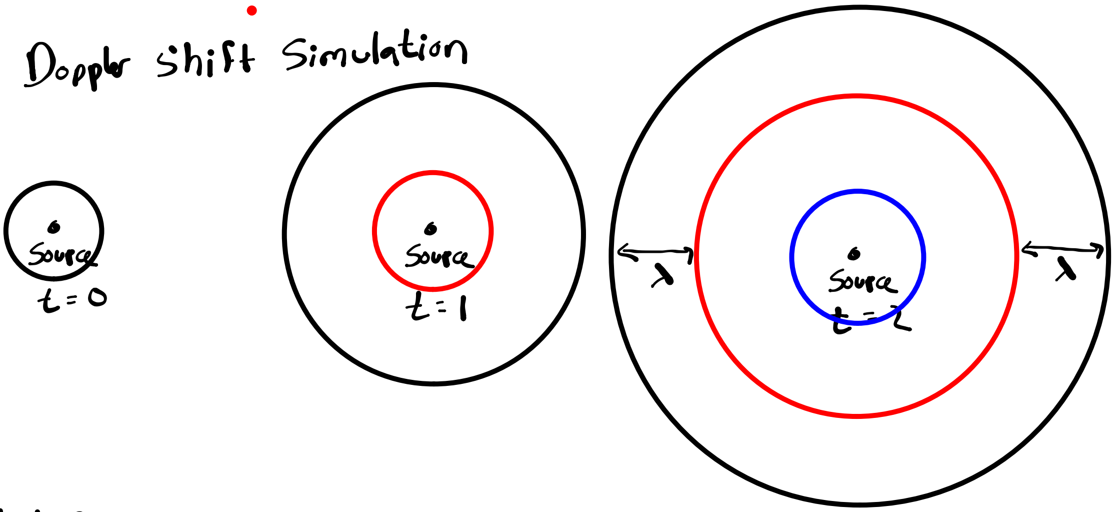


(a) Slower than speed of sound: Pressure waves move out around plane.

(b) At speed of sound: Pressure waves at nose form a shock wave.

(c) At supersonic speed: Shock waves form a cone, resulting in a sonic boom.

Doppler shift Simulation



What if source is moving right?

Doppler Effect and Red Shift

Doppler Effect Equation

$$f = \left(\frac{v}{v \pm v_s}\right) f_s$$

+ if the object is moving away
- if the object is moving towards

f - frequency that you hear
f_s - frequency being produced by the source
v - speed of the wave
v_s - speed of the ~~object creating the wave~~ Source

Doppler Effect Practice

A train is travelling at a speed of 30.0 m/s. Its whistle generates a sound wave with a frequency of 224 Hz. You are standing beside the tracks as the train passes you with its whistle blowing. What change in frequency do you detect for the pitch of the whistle as the train passes, if the speed of sound in air is 330 m/s?

$v_s = 30\,m/s$
$f_s = 224\,Hz$
$v = 330\,m/s$

Approaching (-)

$f = \left(\frac{v}{v - v_s}\right) f_s$

$f = \left(\frac{330}{330 - 30}\right) 224$

$f = 246.4\,Hz$

Larger freq.
Higher pitch.

Leaving (+)

$f = \left(\frac{v}{v + v_s}\right) f_s$

$f = \left(\frac{330}{330 + 30}\right) 224$

$f = 205.\bar{3}\,Hz$

Smaller freq.
Lower pitch.

$\Delta f = 41.0\bar{6}\,Hz$

.