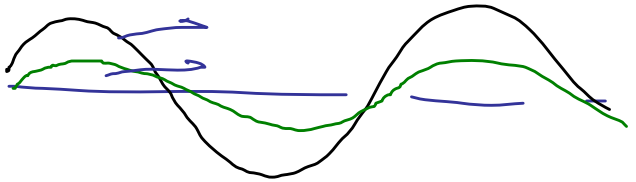
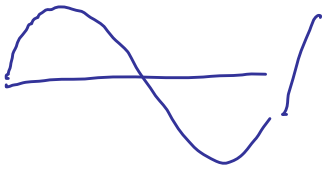
Phys 2110-4 4/26/13

Note Title 4/26/2013

Superposition

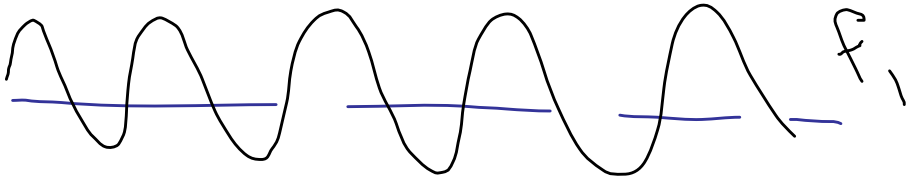


=

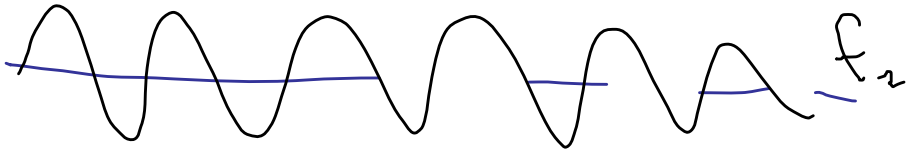


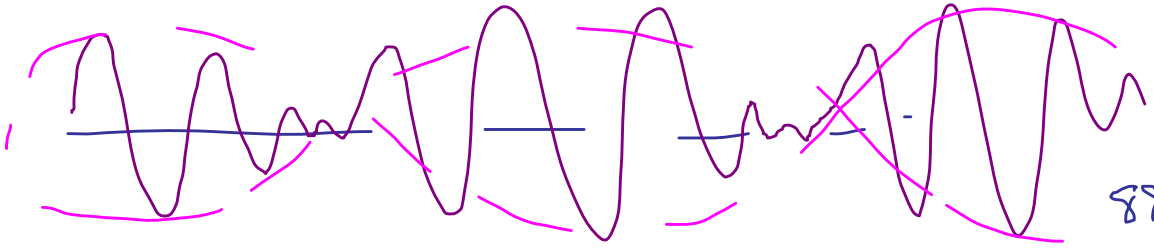
Constructive interference

Beats



+





Orig sound

pulses (beats)

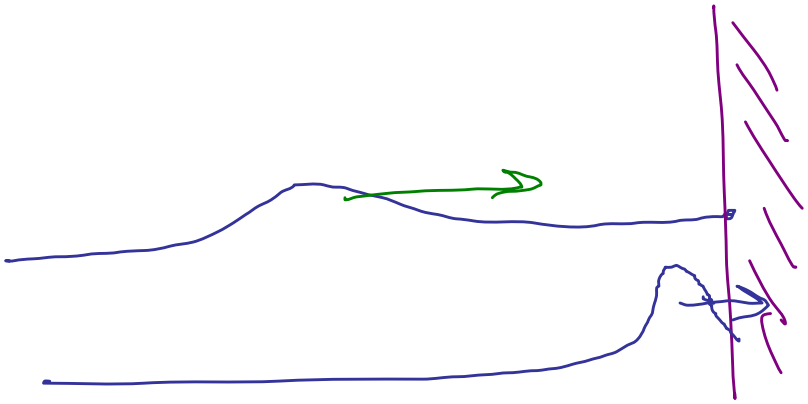
Rate = $|f_1 - f_2|$

880 Hz 883 Hz

3 Hz

Reflection

End of string is fixed.

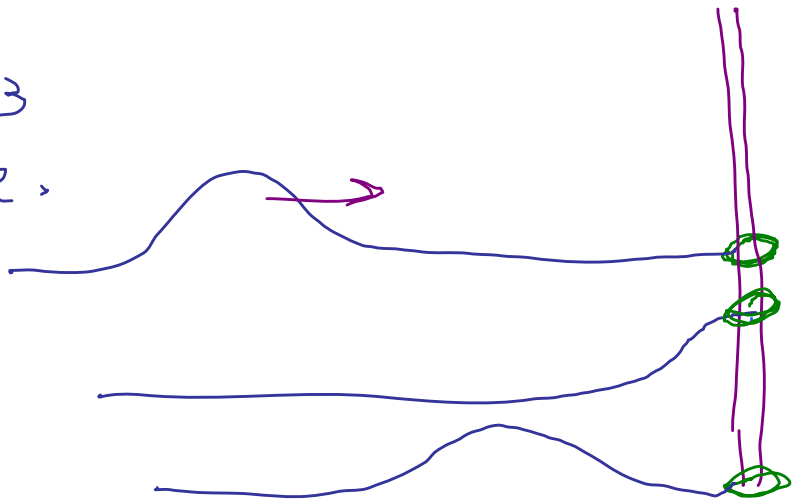


Pulse is inverted on reflection

p. 233

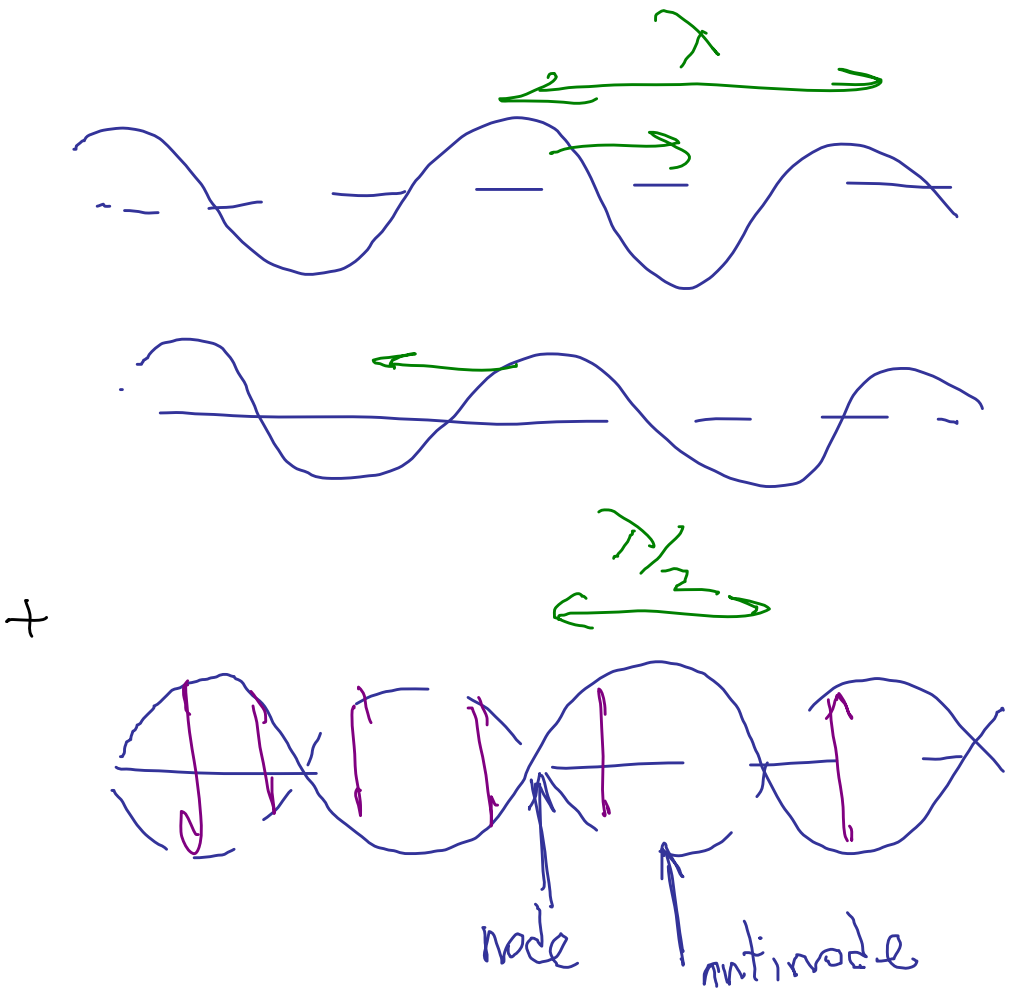
End of string is free to move.

Pulse stays right-side up.



Abs. free to move

Standing Waves



Combine two waves.
Same wavelength, λ
Same freq f

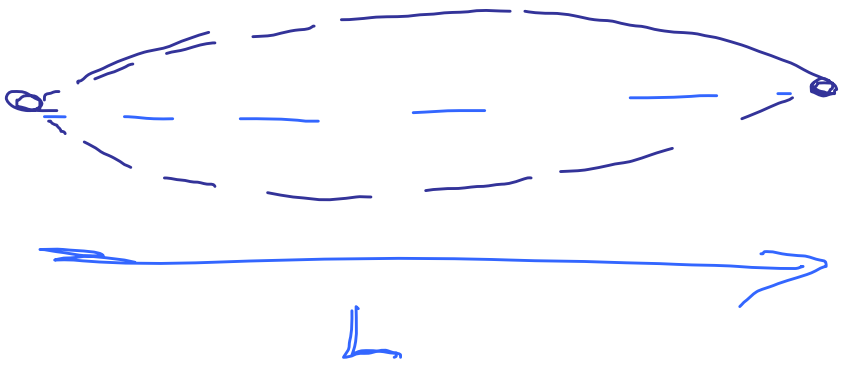
They go in opp dir.

Same amplitude

Standing wave
freq same

To set up a standing wave,

string fixed at two points.



Pluck string,

Basically, see this pattern

$L = \frac{\lambda}{2}$

$\lambda f = v$

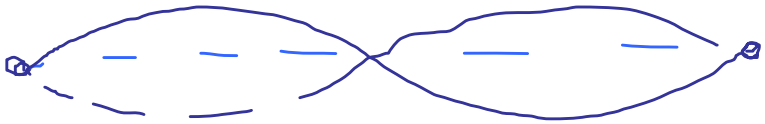
Freq. of vibr. string:

$f = \frac{v}{\lambda} = \frac{v}{2L}$

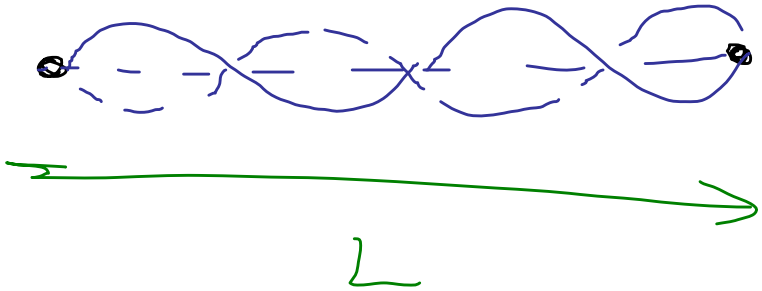
$v = \sqrt{\frac{F}{\mu}}$

"fundamental" mode

Next mode



$L = \lambda$ $\quad f = \frac{v}{\lambda} = \frac{v}{L}$ $\quad$ 2× freq lowest mode.



$L = n\frac{\lambda}{2}$

$f = v$

$v = \sqrt{\frac{E}{\mu}}$

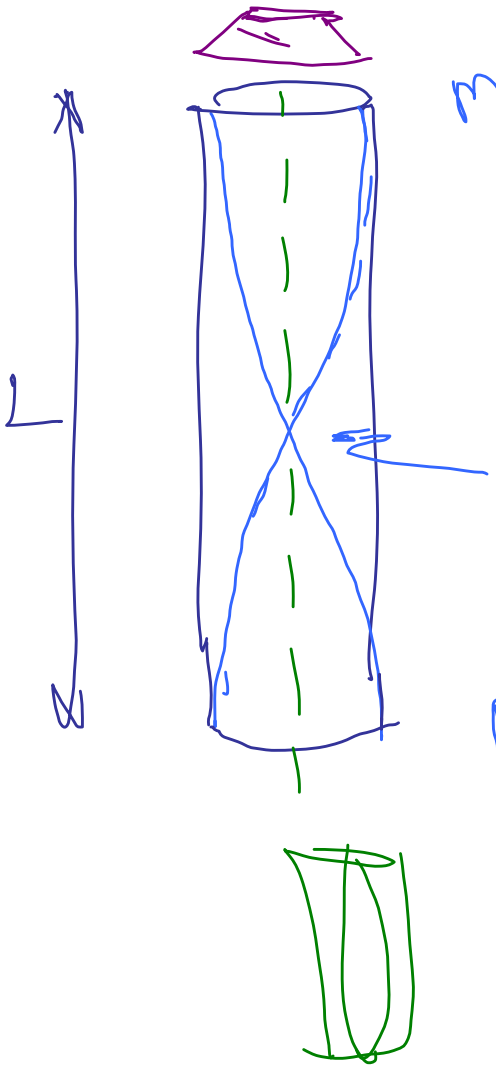
$f_n = \frac{v}{\lambda} = \frac{v}{2L/n}$

$= n\frac{v}{2L}$

Standing transverse wave

Standing longitudinal wave

Open on both ends



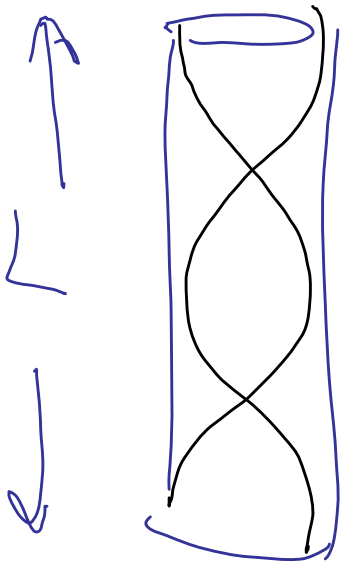
Max air motion
Min press

$$L = \frac{\lambda}{2}$$

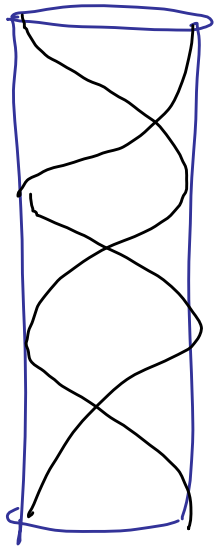
$$f = \frac{V}{\lambda} = \frac{V}{2L}$$

$V = V$ sound $340\ m/s$

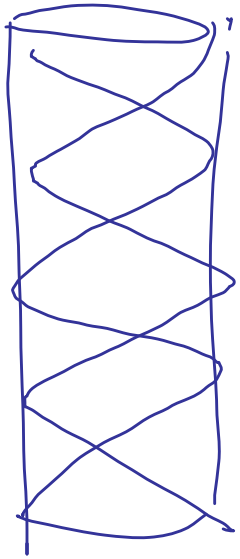
Max
min press



$L = \lambda$



$L = \frac{3}{2}\lambda$



$L = \frac{4}{2}\lambda$

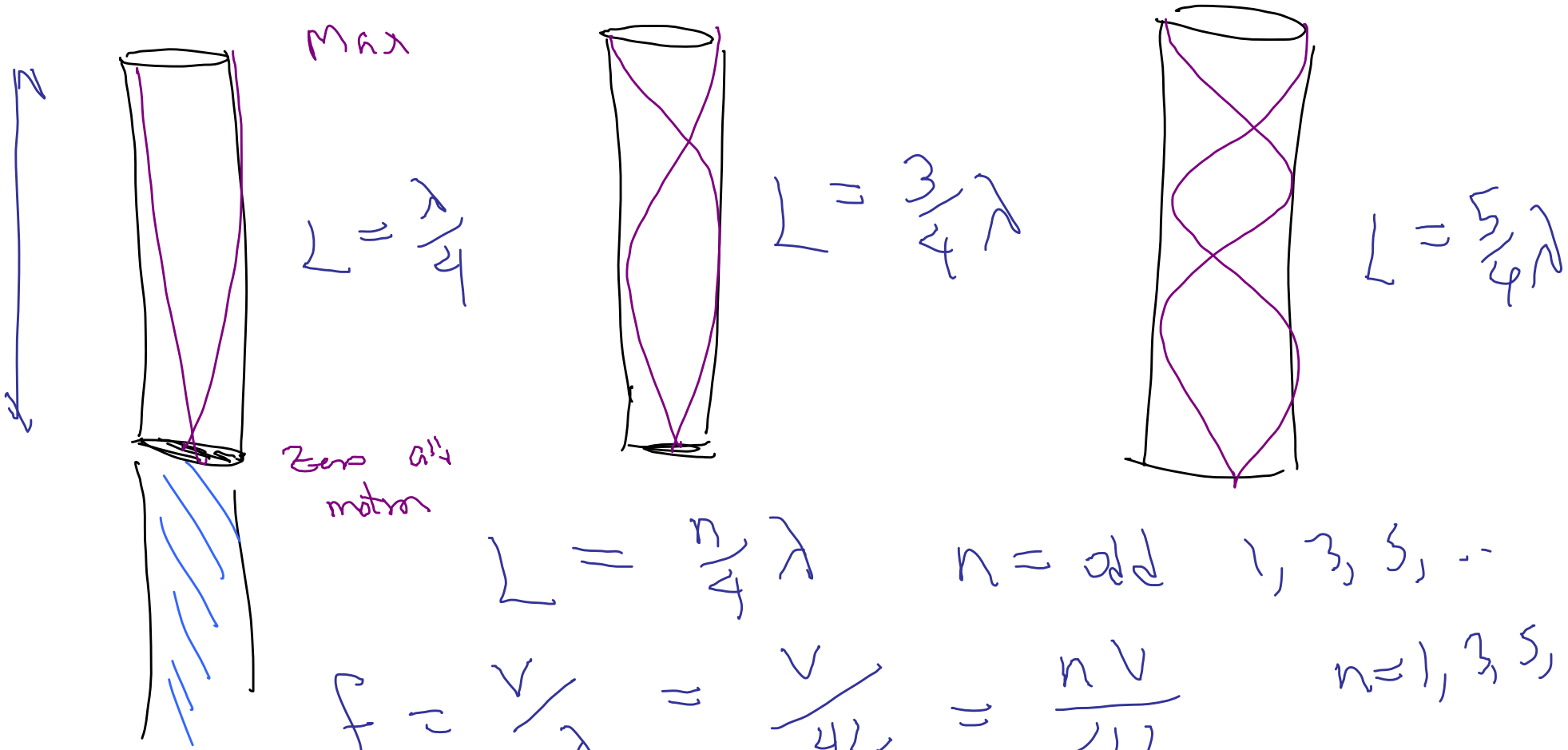
Open both ends

$$L = n\frac{\lambda_n}{2}$$

$$f_n = \frac{v}{\lambda_n} = \frac{v}{\frac{2L}{n}} = \frac{nv}{2L}$$

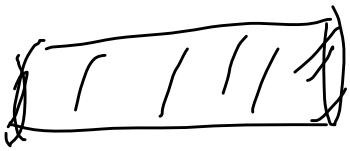
$v = v_{sound}$

Pipe closed on one ends

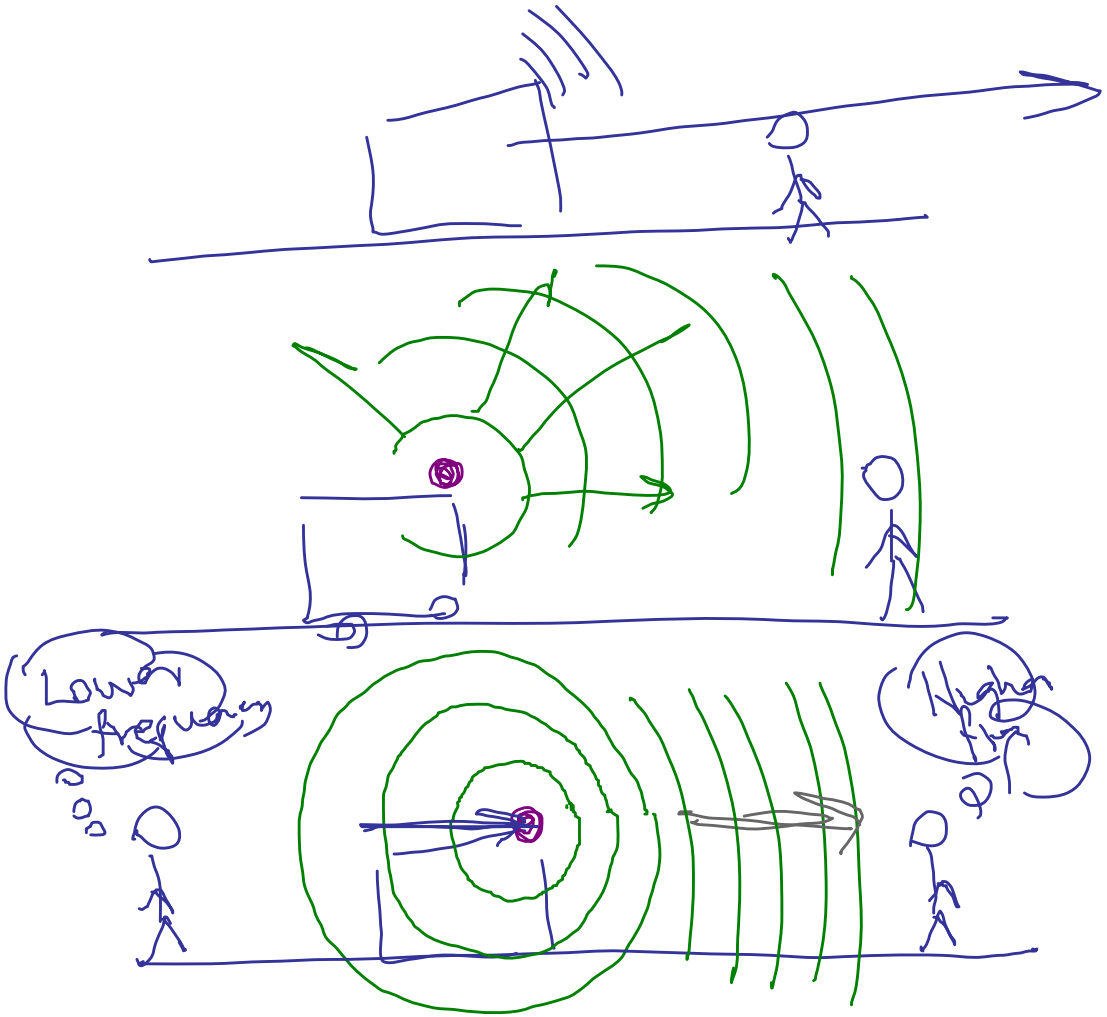


$L = \frac{n}{4}\lambda$ $\quad n = \text{odd}\ 1, 3, 5, \ldots$

$f_n = \frac{v}{\lambda_n} = \frac{v}{\frac{4L}{n}} = \frac{nv}{4L}$ $\quad n = 1, 3, 5,$



Doppler Effect



Moving source

Wavelength small

Speed of waves still same.

$\lambda f = v$

f increases

Man hears higher frequency.

Toward means the terms:

$$f' = \frac{f}{1 \mp \frac{V_{source}}{V_{sound}}}$$

$-$ + Toward / Away