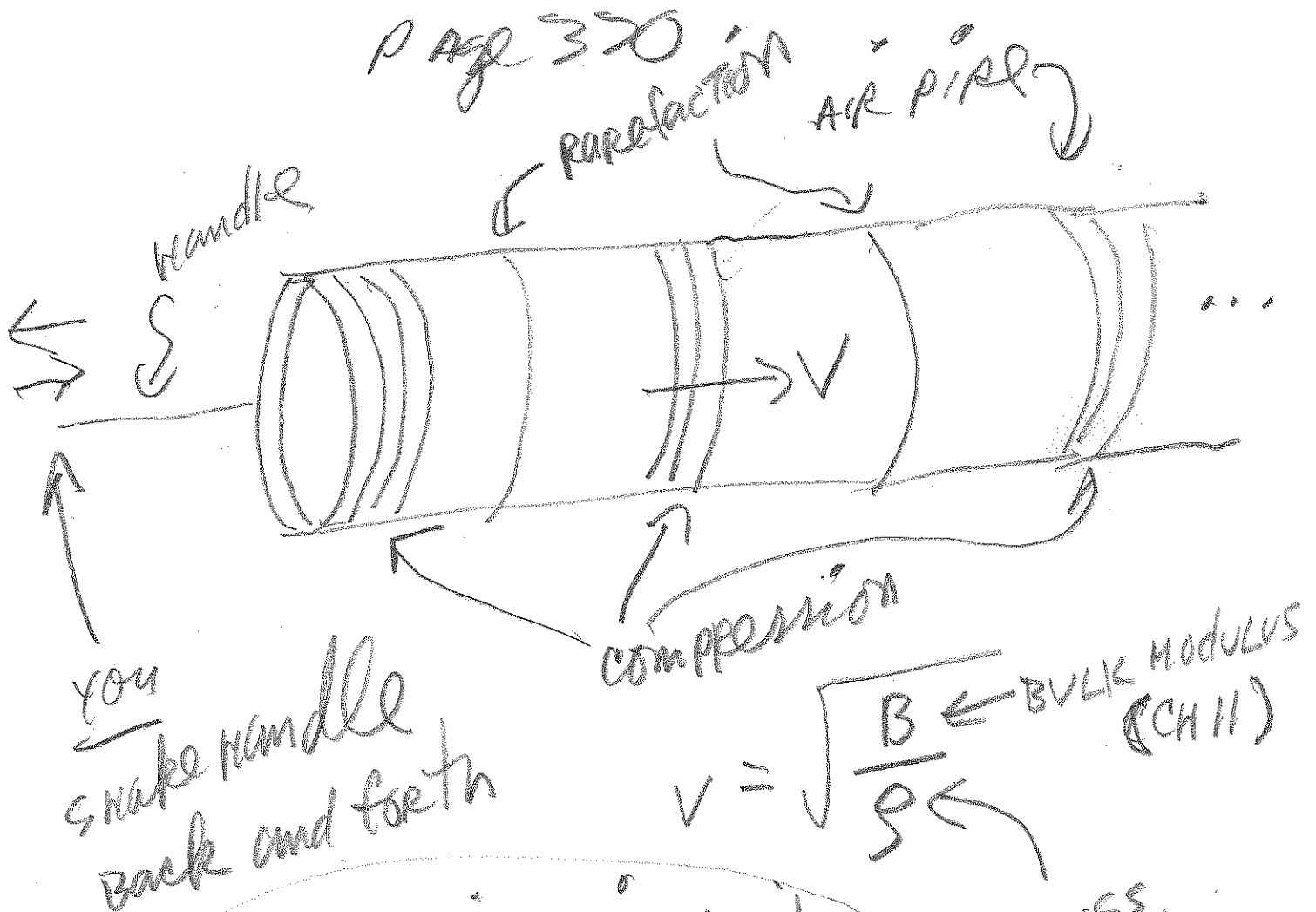


P2A
CH2

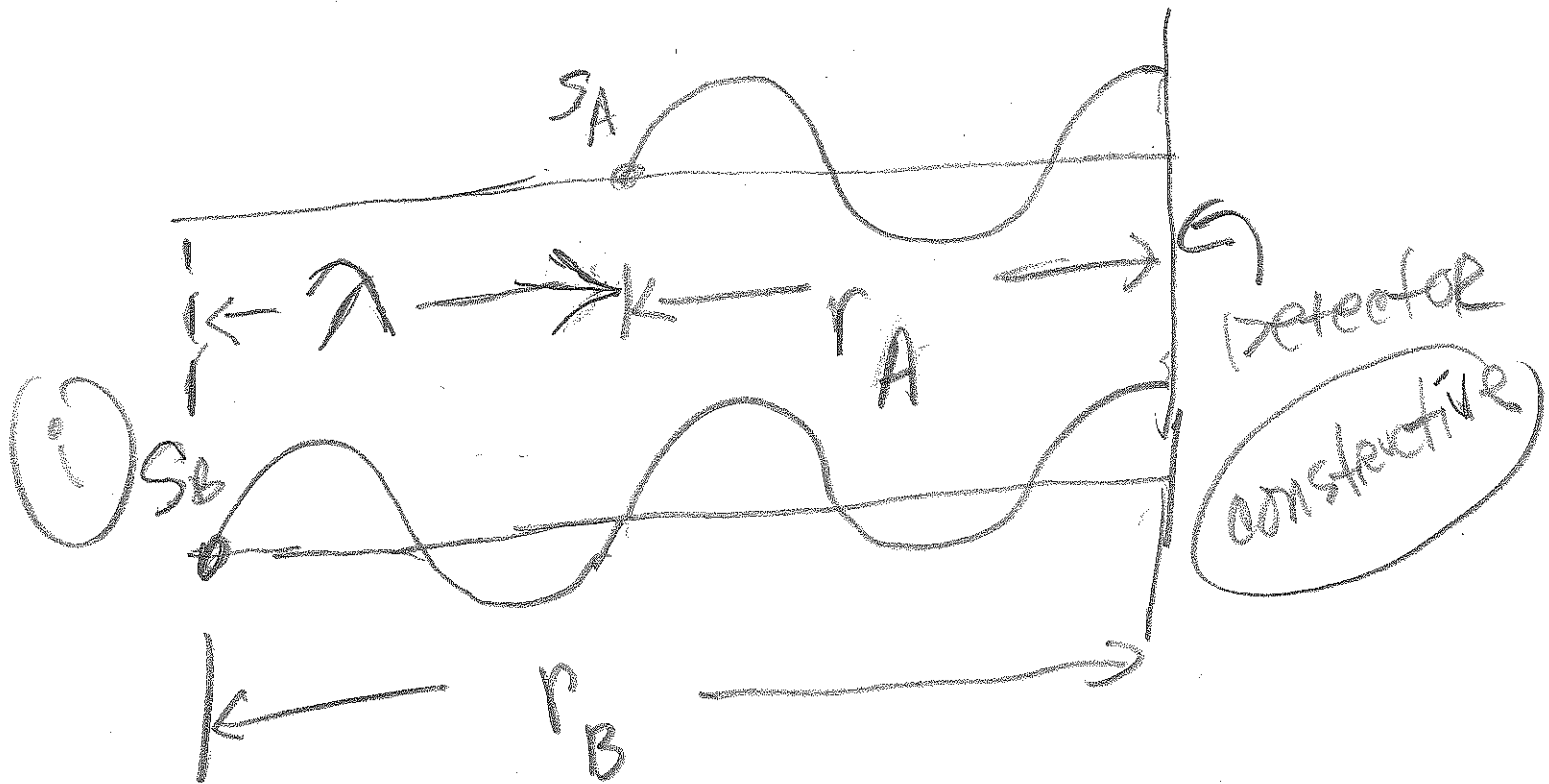
11-13-13

12.7 soundwaves ARE
Longitudinal waves.

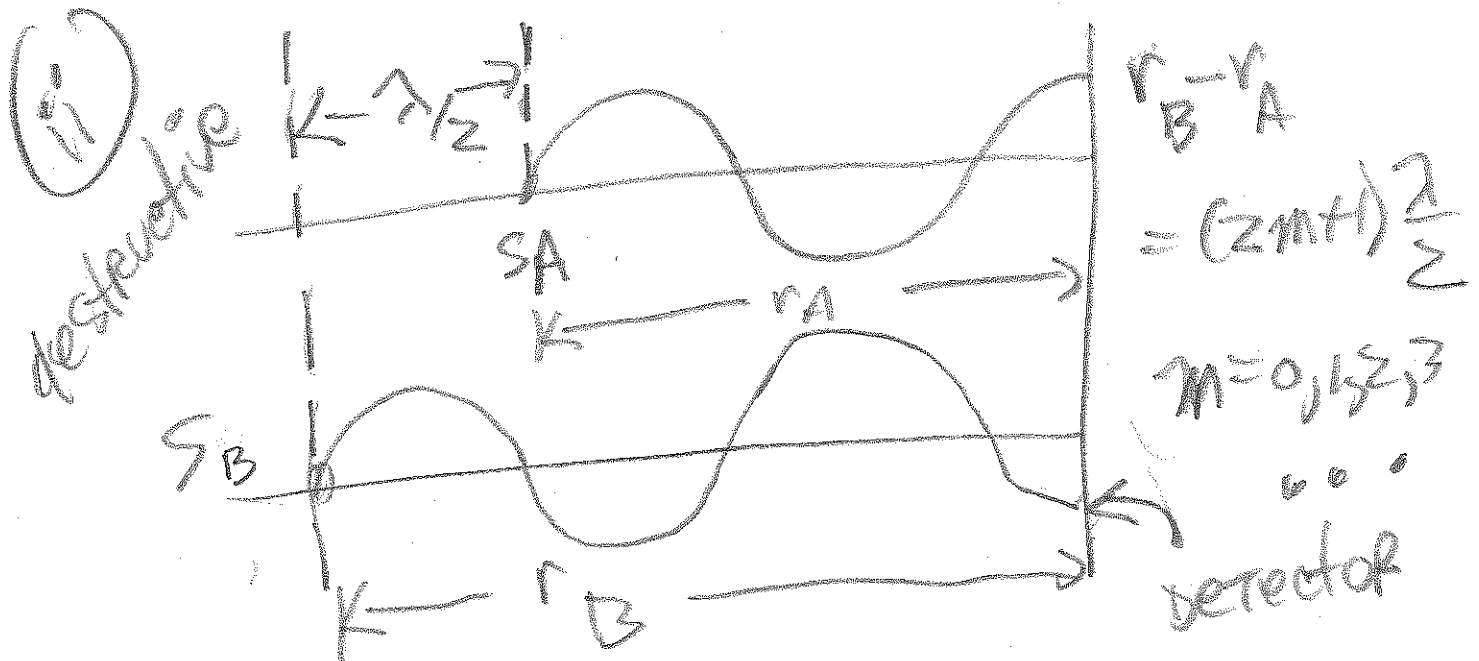


* compression: high density
* rarefaction: low density

Constructive (12.8)



$$r_B - r_A = n\lambda ; n = 1, 2, 3, 4, \dots$$



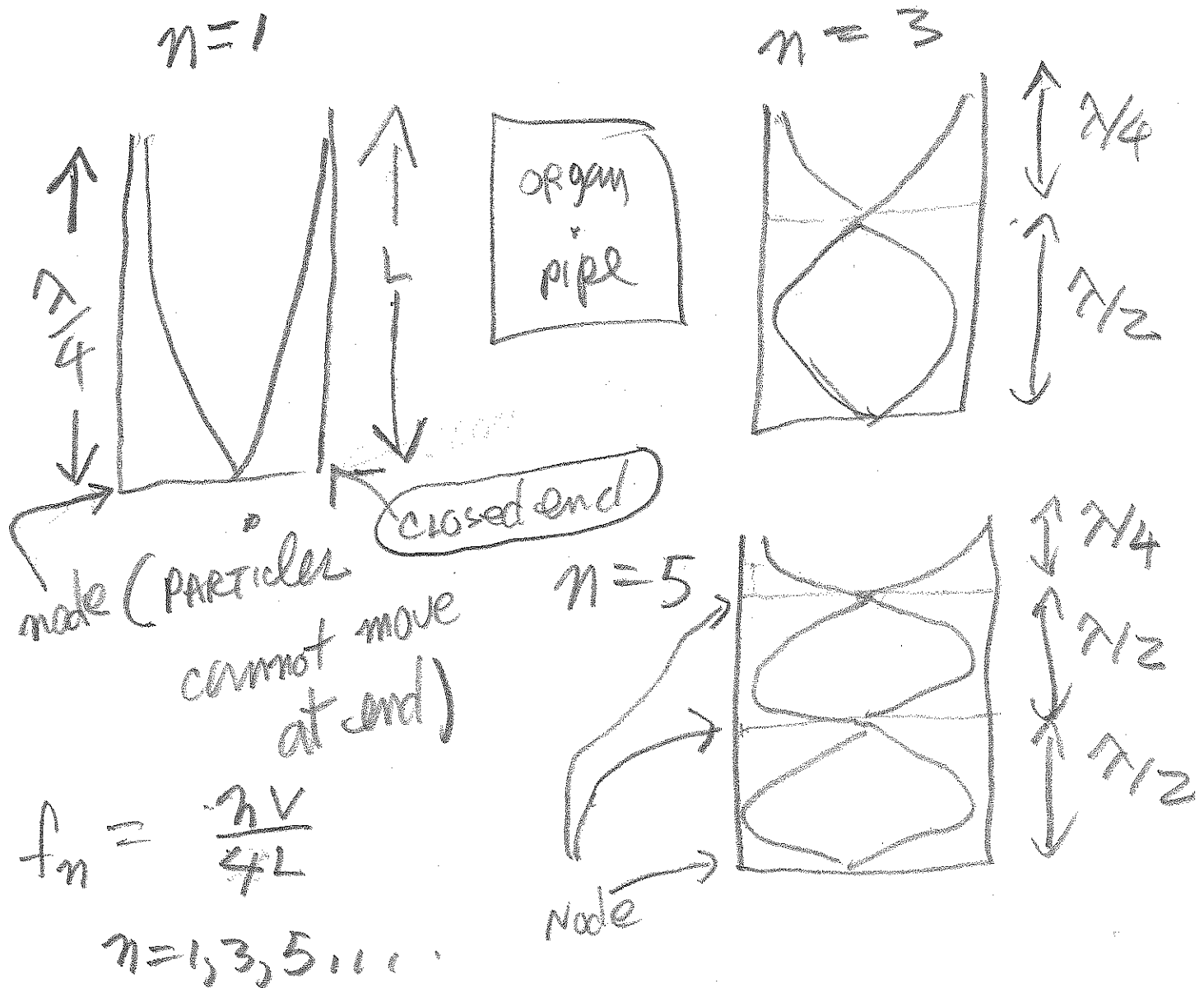
$$r_B - r_A = (2m+1)\frac{\lambda}{2}$$

$$m = 0, 1, 2, 3, \dots$$

Standing waves (SOUND)

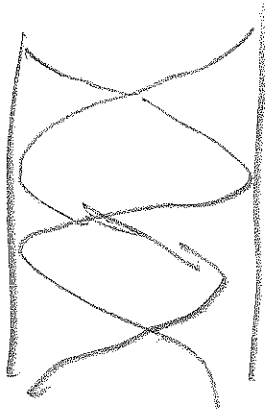
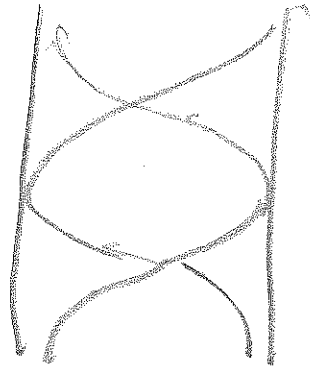
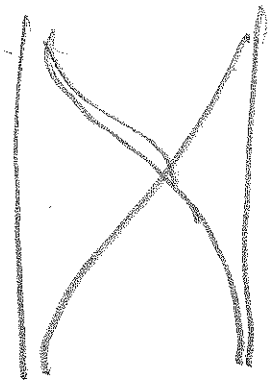
Section 12.7

Organ pipes: one end open -
other " closed.

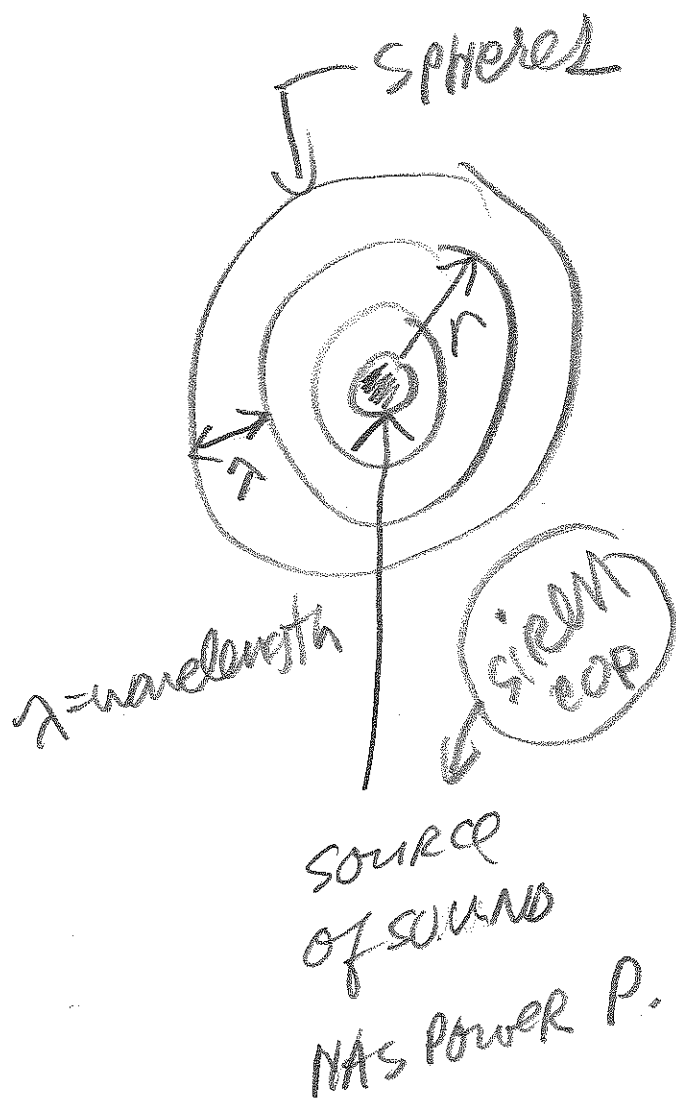


open pipes: open at both ends

$$f = \frac{nv}{2L}, \quad n = 1, 2, 3, 4.$$



Hearing and Intensity



$$\text{Power} = \frac{\text{Energy}}{\text{Time}}$$

(J/s)

= (W)

$$\text{Intensity} = \frac{\text{Power}}{\text{Area}}$$

$$\left(\frac{\text{J}}{\text{m}^2 \cdot \text{s}} \right) = \left(\frac{\text{W}}{\text{m}^2} \right)$$


P

$$I = \frac{P}{4\pi r^2}$$

Db scale: $\beta = (10 \text{ dB}) \log \frac{I}{I_0}$

$$I_0 = 10^{-12} \frac{\text{W}}{\text{m}^2} \text{ THRESHOLD}$$

<u>table</u>	12.2	I
	Db	
concert	140	100
traffic	70	10^{-5}
sewer	10	10^{-11}
Threshold	0	10^{-12}

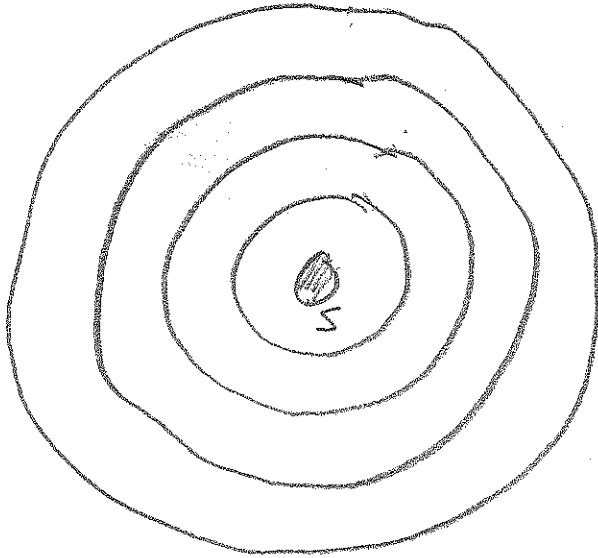


 ppm

 defects

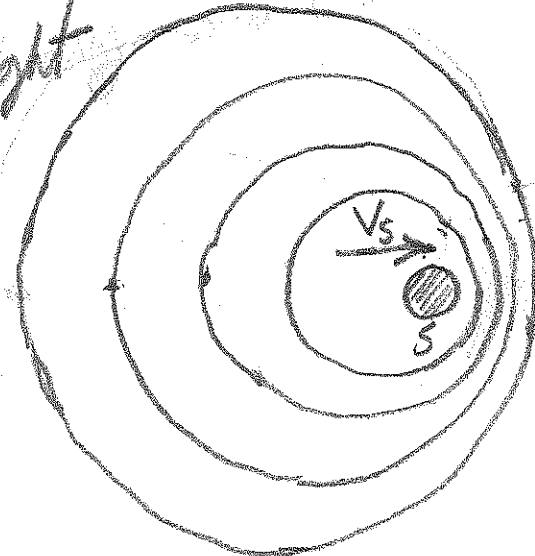
Doppler effect

(A) STATIONARY SOURCE:



f = frequency

(B) MOVING SOURCE:
SOURCE MOVES RIGHT



v = speed of sound
 v_s = source speed
 v_L = listener speed
 (see (C) below.)

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

↑
DOPPLER SHIFT UP

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

↑
DOPPLER SHIFT DOWN

(C) MOVING LISTENER



L
LISTENER NEARS:

$$f' = \left(\frac{v + v_L}{v} \right) f$$



L
LISTENER NEARS:

$$f'' = \left(\frac{v - v_L}{v} \right) f$$