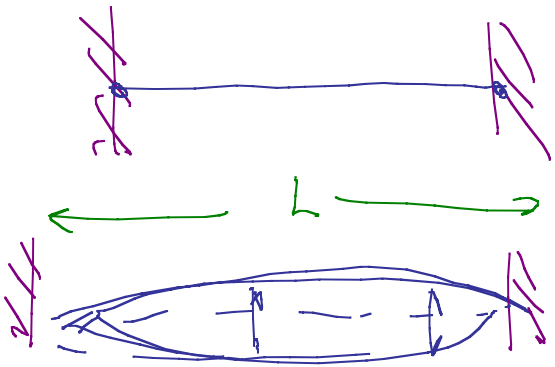
Phys 2110-3 12/6/10

Note Title 12/6/2010

Standing Waves

2 waves moving in opp. directions

Example:



Lowest mode:

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

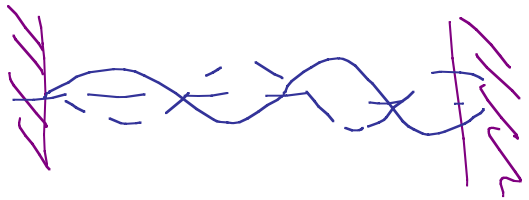
n = 1

Next mode

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

n = 2

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



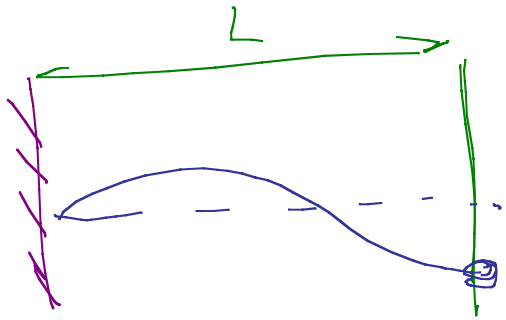
$n = 4$

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

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

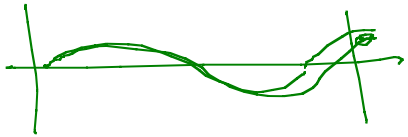
$1 : 2 : 3 : 4$

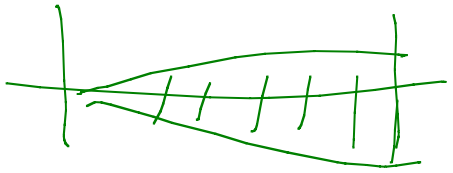
If string fixed one end free on other



$L = \frac{1}{4}\lambda, \frac{3}{4}\lambda, \frac{5}{4}\lambda$

$= \frac{n\lambda}{4}$ n odd





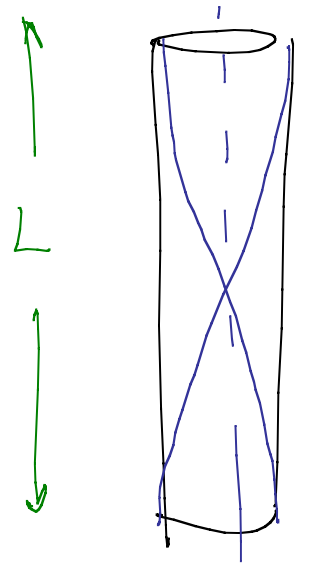
Standing Sound Waves, Pipe

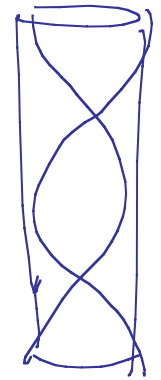
Open both ends

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

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

$$f_n : 1 : 2 : 3 : 4 : 5$$





$V = 343 \frac{m}{s}$ $\quad 331 \frac{m}{s}$ $\quad 0°C$

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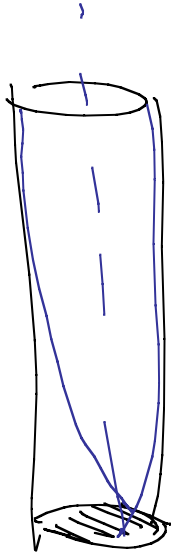
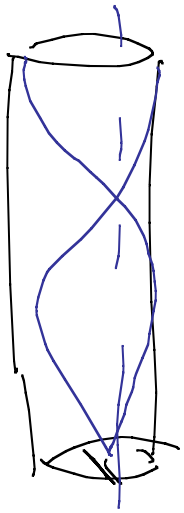
$L = \frac{n}{4}\lambda \quad n = 1, 3, 5, 7 \quad L = \frac{1}{4}\lambda$



$\lambda = 4L/n$

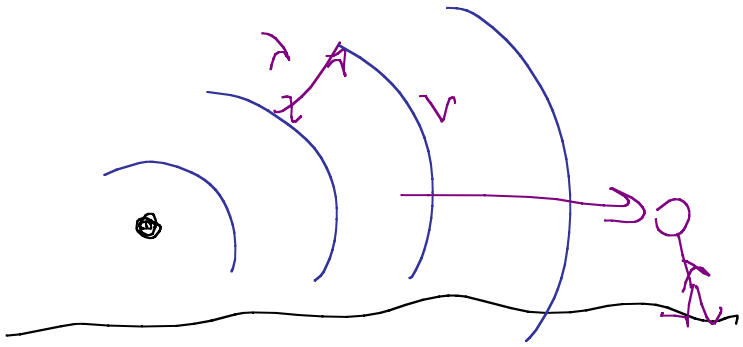
$f_n = \frac{v}{\lambda_n} = \frac{nv}{4L}$ $\quad n$ odd

$L = \frac{3}{4}\lambda$

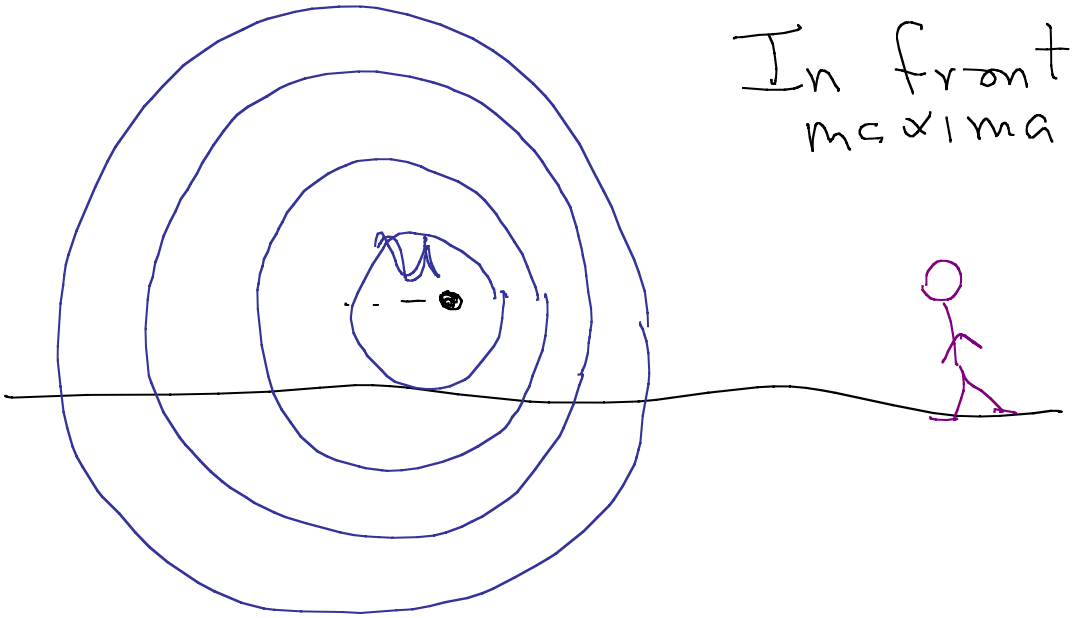


$1 : 3 : 5 : 7 : \ldots$

Doppler Effect



Source is moving



In front, dist between maxima is shorter

λ got smaller

$f\lambda = v$

$f_{observed} = f'$ is bigger

Moving source

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

− toward

+ away

Moving observer

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

+ toward

− away