Doppler Effect (§20.7) CONT

source approaching:

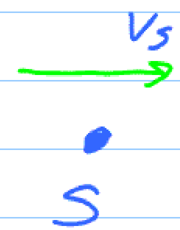
- λ decreases
- f increases

source receding:

- λ increases
- f decreases

$t = 0$

source emits a wave front ①

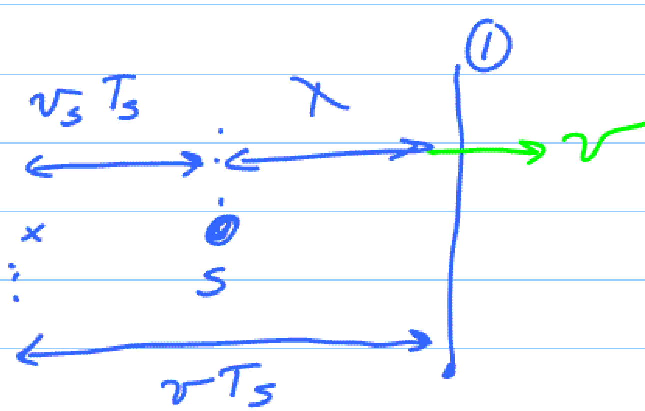


v = speed of wave

T_s = freq. of source

$t = T_s$

later emits wave front 2



$$vT_s = v_s T_s + \lambda \leftarrow$$

$$\Rightarrow \boxed{f_{wave} = \frac{f_o}{1 - v_s/v}} > f_o$$

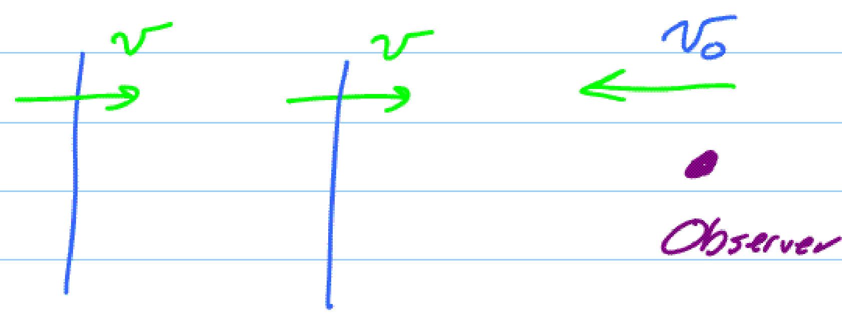
source approaching

$$f_o = \frac{1}{T_s}$$

source receding:

$$\boxed{f_{wave} = \frac{f_o}{1 + v_s/v}}$$

Stationary source, moving observer



$$f_{obs} > f_{wave} \Rightarrow$$

Eqn 20.40

Light waves — will discuss in relativity

Exptl Test 1845

Doppler proposed the effect in 1842

effect involves the term $\frac{v_s}{v}$

for everyday speeds prior to 1800's $\frac{v_s}{v}$ negligible

---

CHAPTER 21 - SUPERPOSITION

§21.1, §21.2 & §21.3 combined

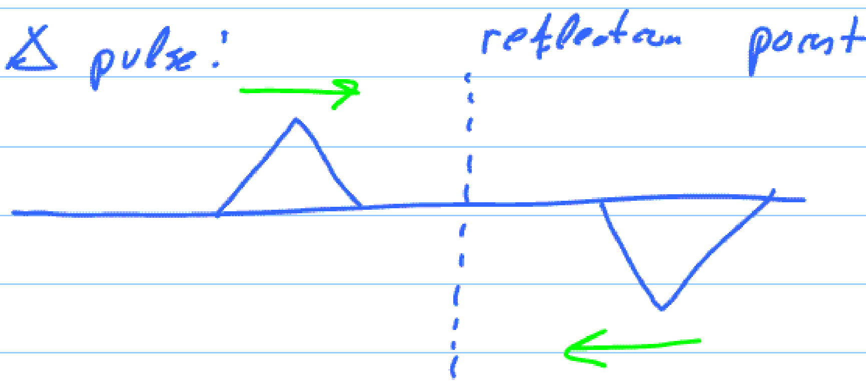
Superposition:

$$D_{tot}(x,t) = \sum_i D_i(x,t)$$

[usually true]

Reflected wave from a fixed end: inverted

Δ pulse:



2 sine wave in opposite directions:

$$y_{tot}(x,t) = a\sin(kx - \omega t) + a\sin(kx + \omega t)$$

$$= \boxed{2a\sin(kx)}\cos(\omega t)$$

$$= \boxed{A(x)}\cos(\omega t)$$

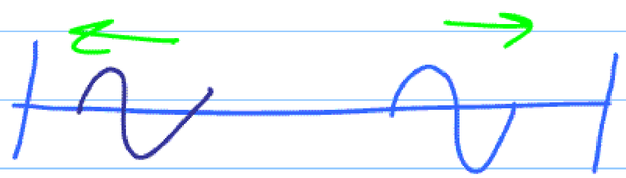
Each particle: SHM

amplitude depends on position

amplitude = 2a "anti-node"

amplitude = 0 "node"

Reflection from left side: same story



If 2 superpositions match up: "Standing wave"

Sound wave!

① Wave of displacement
② Wave of pressure

Reflected wave: free end
not inverted

anti-node at reflection