Phys 1402 2017-07-31 Lec 16

Wave - a cascading oscillation in a set of connected oscillators.

Generally, disturbance travels in straight lines.
- Rays of light
- Velocity vector of wave

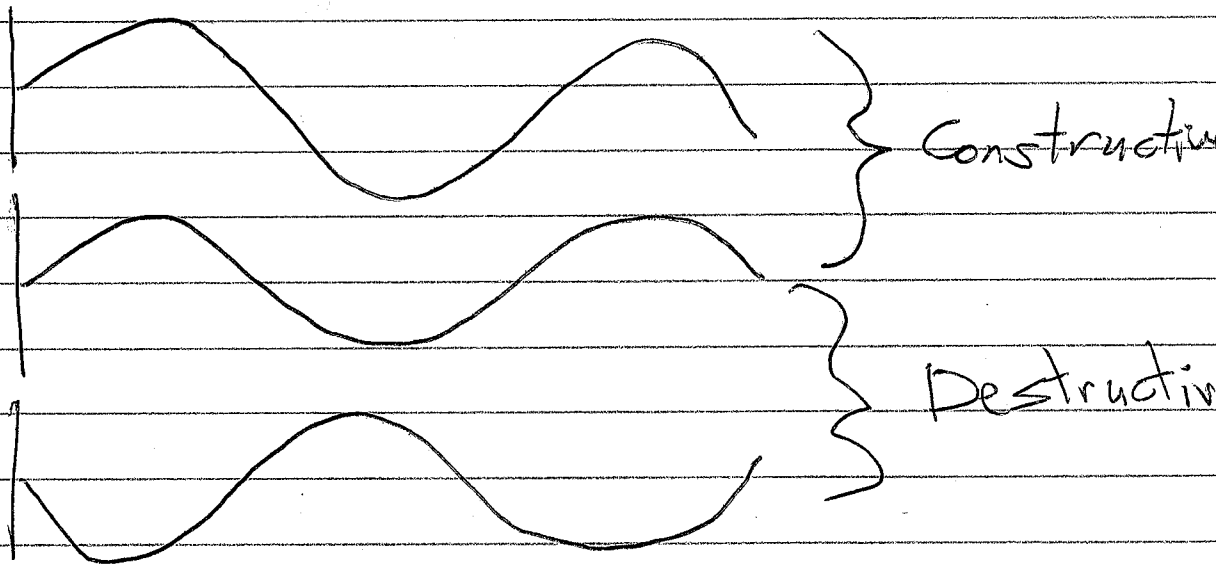
$$v = f\lambda$$

What keeps a wave from going forever in a straight line?
- Refraction } Newtonian ~~Optics~~ Optics
- Reflection }
- Diffraction } Physical Optics
- Interference }

Why do waves diffract?
- Think about why they go straight to begin with. All of the oscillators.
- Change the oscillators, change the wave.
- Separate disturbances combine via addition.

Constructive Interference - Two waves combine at a point w/ matching peaks and valleys.

Destructive Interference - Waves combine with valleys - peaks opposite.



A sideways shift can control the interference,
How? • Time Delay
• Path Length Difference

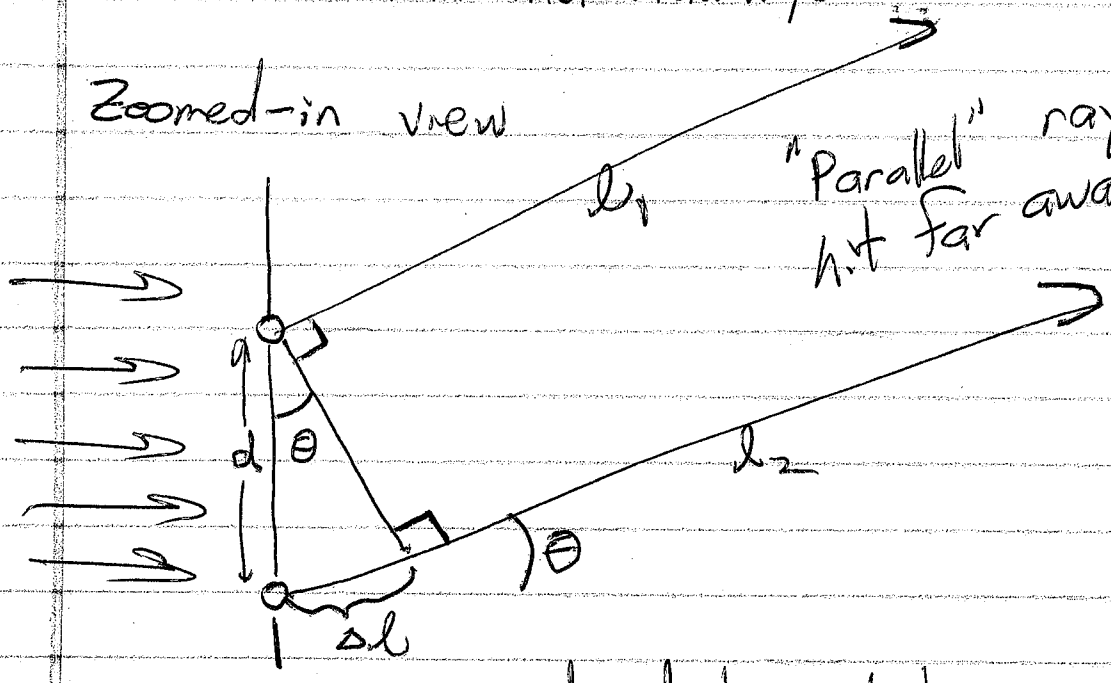
$\Delta l = 0$ → in phase = constructive
$\Delta l = \lambda/2$ → out of phase = destructive

Ex: $l_1 = 3840$ nm, $l_2 = 4100$ nm
260 nm = $\lambda/2$
520 nm = λ

(3)

A diffraction grating has many stripes or lines or rulings.

They are so close together that we can't see them individually.



d = distance between openings

θ = observation angle from "straight"

Δl = path length difference

If $\Delta l = 0, \lambda, 2\lambda, 3\lambda$ constructive

$\Delta l = d \sin\theta$ From triangle

$d \sin\theta = 0, \lambda, 2\lambda, \ldots$ constructive

If $m\lambda = d \sin\theta$, and m = integer, constructive