

PHY132 - Class 6 - Wednesday January 21

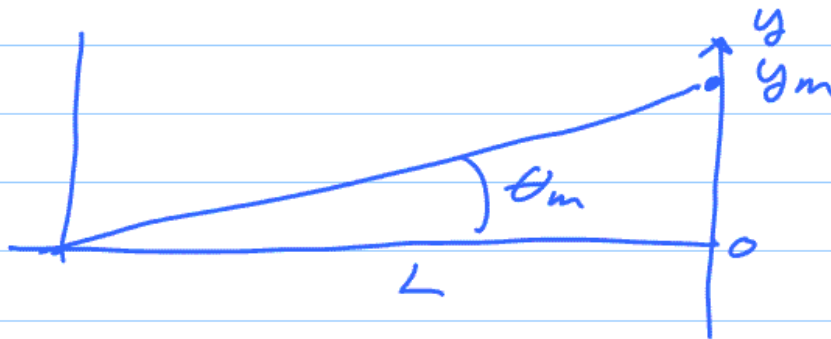
Maxima: $r_2 - r_1 = m\lambda \quad m = 0, 1, 2, \dots$

$L \gg d$ $r_2 - r_1 \approx d \sin \theta$

$$d \sin \theta = m\lambda$$

θ small $\sin \theta \approx \theta$

$$\theta_m = \frac{m\lambda}{d}$$



$$\tan \theta_m = \frac{y_m}{L}$$

$$\tan \theta_m \approx \theta_m = \frac{y_m}{L}$$

$$y_m = \frac{m\lambda L}{d}$$

Scales as $\frac{\lambda}{d}$

decrease d - increase θ_m & y_m

↕ vice versa.



Small Text Correction

Single Slit



intensity decreases with θ

\therefore I of maxima decreases with θ

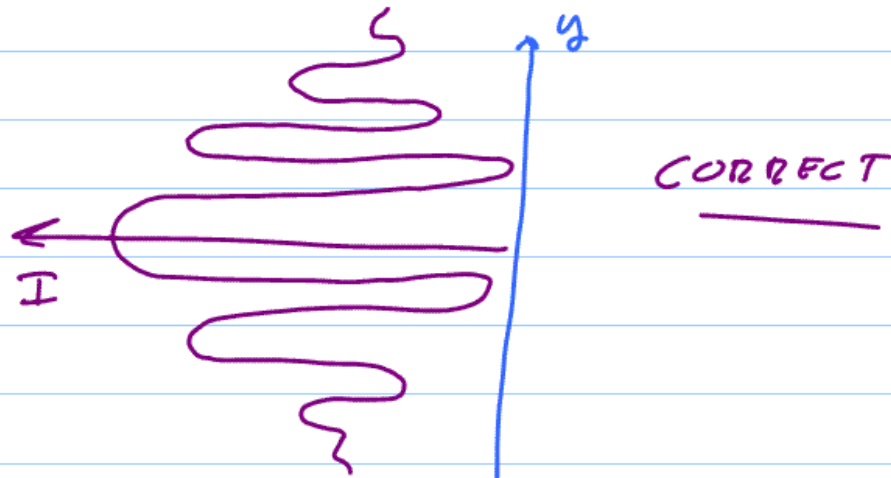
CORRECT

$$\underline{\theta} > 0$$

P where have, say,
a minima different
distances from the
2 slits

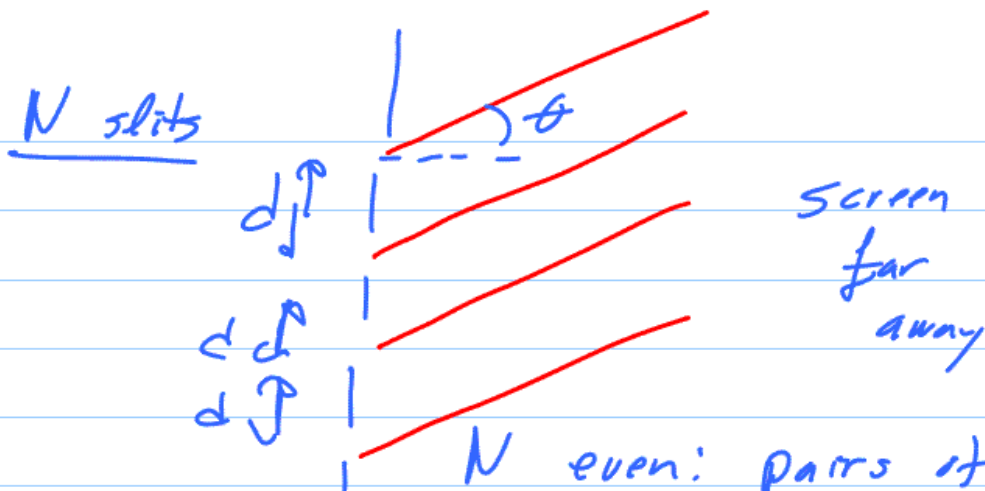
$$a_1 \neq a_2$$

do not get total
destructive interference



§ 29.3 - Diffraction Grating

not quite appropriate



N even: pairs of double slits

N odd: one slit left over

N large: left over doesn't matter

Same analysis

1 slit: I_1

2 slits: $I_{tot} = (2)^2 I_1$

N slits: $I_{tot} = N^2 I_1$

very bright

Reflection Grating

Diffraction - Qualitative



"Turns out" similar to
interference

Large d compresses the
diffraction pattern
} vice versa

Example Loudspeakers

bass note: need to pump
a lot of air

Big Speaker:

diameters 0.3 m or more

treble note: $f = 5000 \text{ Hz}$

$\lambda = 0.07 \text{ m}$

large speaker: beams

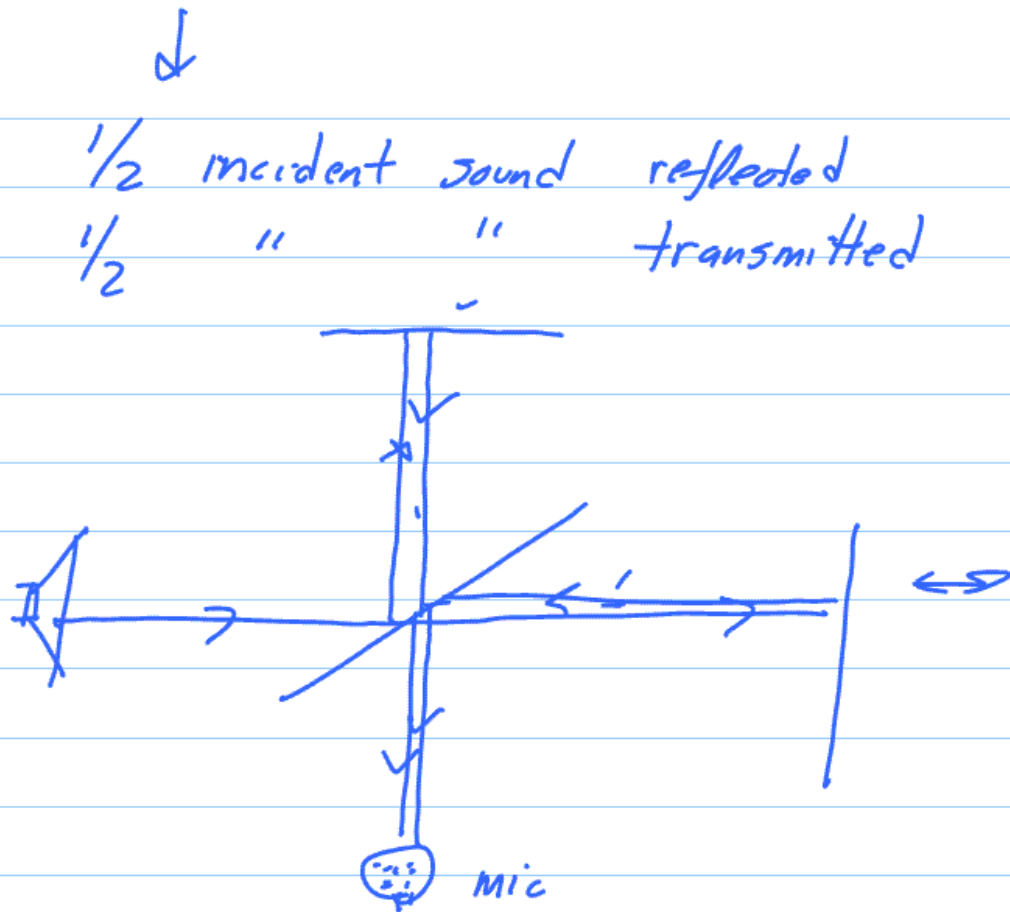
small speaker

§22.6 - Interferometers

glass reflects sound

paper: "beam splitter"

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Holograms

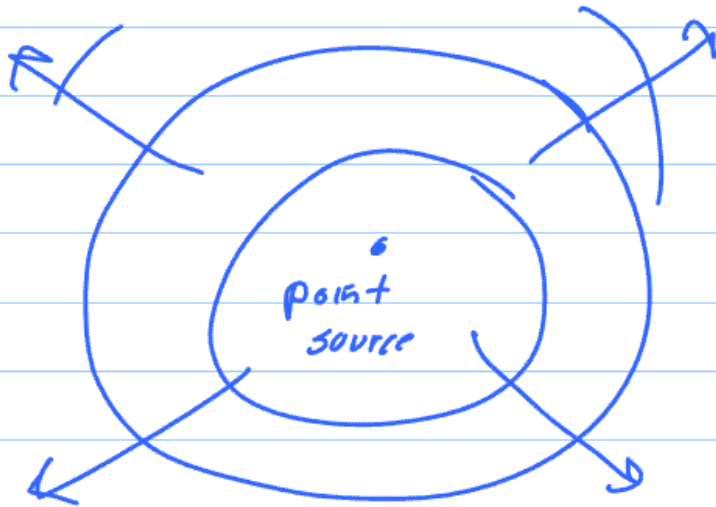
On plate: interference pattern
 between object & no-object

Normal photo: cut in $\frac{1}{2}$
lose $\frac{1}{2}$ picture

Hologram: cut in $\frac{1}{2}$
entire picture but fuzzier

CHAPTER 23 - RAY OPTICS

§29.1 Ray Model for Light



circles!
wave fronts

arrow:
propagation
(velocity)

Arrows are "Light Rays"

Properties of Model

Light Rays

- ① Traveled in straight lines
- ② Can cross
- ③ Object source for light rays
- ④ Eye sees by focusing