Review: Two loudspeakers, s_1 and s_2, are located 30 m apart. A point P is located a bit off of the perpendicular bisector. A signal generator drives the speakers in phase with the same frequency. The wave amplitude at P due to each speaker alone is *A*. The frequency is then varied between 20 Hz and 300 Hz. At what frequency or frequencies will the listener at P hear a maximum intensity?

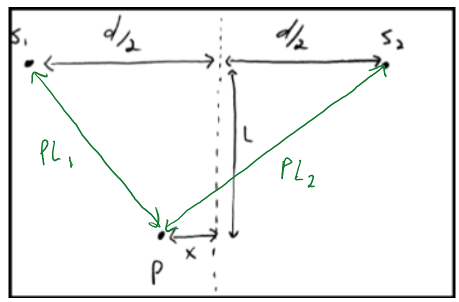
1. Density of the medium
2. Ratio of the path lengths
3. Path Length Difference
4. 42 Hz
5. Depends on what the wave tastes like

If $PLD = |PL_2 - PL_1|$

$= 1\lambda, 2\lambda, 3\lambda, \ldots$

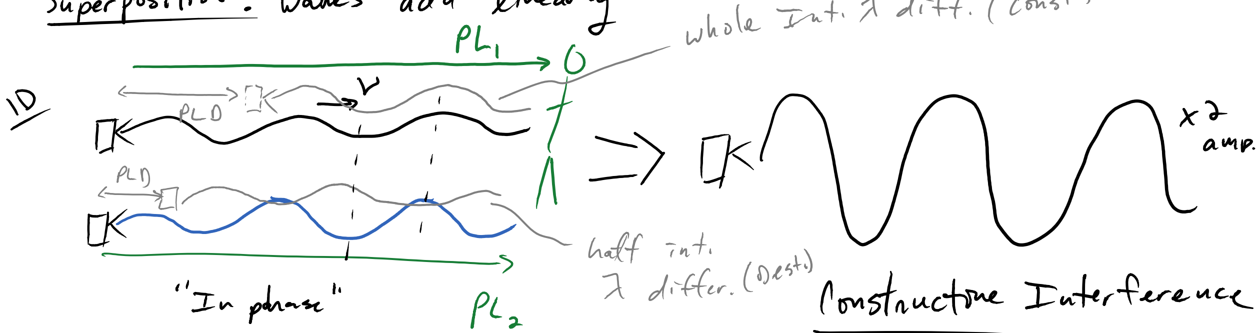
$= m\lambda$

↑ integer



Interference - caused by waves entering same space @ same time.

Superposition: waves add linearly



Constructive Interference

Sound louder

Light Brighter

Conditions for Const. & Destructive Int. (w/ no relative phase shift)

Path Length Diff. PLD

Const. if $PLD = |PL_1 - PL_2| = m\lambda$, $m = 0, 1, 2, 3 \ldots$

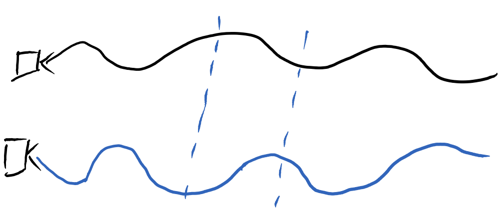
Dest. if $PLD = |PL_1 - PL_2| = (m + \frac{1}{2})\lambda$, $m = 0, 1, 2, 3 \ldots$

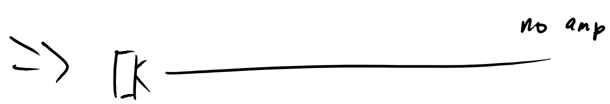
If the two sources where playing half a cycle out of phase, what would change about the conditions for the extrema?

1. **Constructive Interference would only have odd number integers (m-value)**
2. **Destructive Interference would only have odd number integers (m-value)**
3. **Destructive Interference will not be possible**
4. **There will be destructive interference everywhere**
5. **The conditions for constructive and destructive would switch**

Switches locations also

If PLD is zero





Destructive Interference

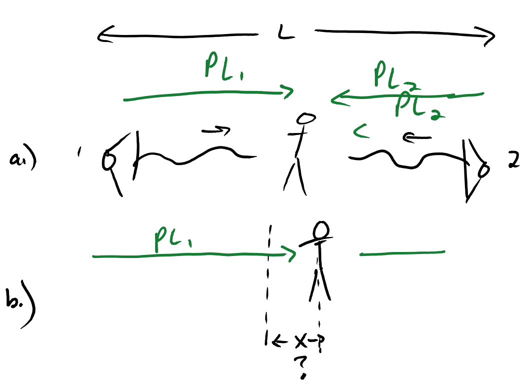
"out of phase" π or $180°$

Sound quieter

light less bright

Two in-phase loudspeakers, 15.0 m apart, are setup in an open field to avoid reflections

from objects. Each speaker is producing 250 Hz tones and the speed of sound is 340 m/s. A person stands at the midpoint between the speakers. (a) What does this person hear, constructive or destructive interference? Why?



a.) $PLD = |PL_1 - PL_2| \stackrel{?}{=} m\lambda$

$PLD = 0$, corresponds to $m = 0$.

Constructive Interference.

(b) They now walk towards one of the speakers. How far from the center must they walk before they first hear the sound become a minimum intensity?

$$PLD = PL_1 - PL_2$$
$$= (7.5 + x) - (7.5 - x)$$
$$= 2x$$

b.) In phase condition for min

$$PLD = (m + \tfrac{1}{2})\lambda$$

PLD_{min} @ $m = 0$

$$2x_{min} = (\cancel{m}^{0} + \tfrac{1}{2})\lambda \qquad v = f\lambda$$

$$x_{min} = \frac{\lambda}{4} = 0.34m$$

(c) How far must they walk from the center before they first hear a sound intensity maxima?

c.) In phase $PLD = m\lambda$ + $m=1$ first max.

$$2x_1 = \lambda \quad , \quad \boxed{x_1 = 0.68m}$$

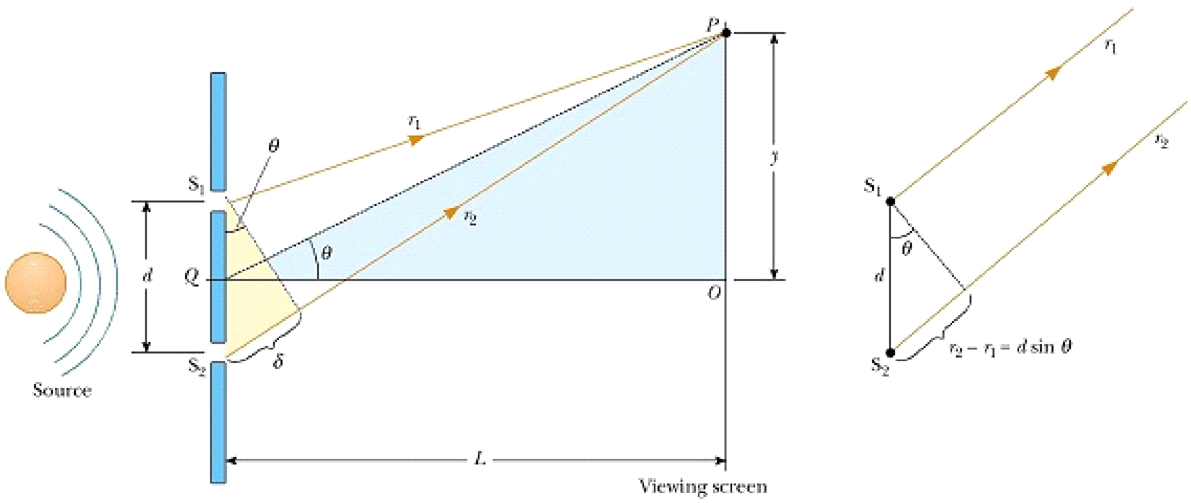
(d) Repeat (a) through (c) if the speakers are 180° out of phase.

d.) (a) Dest. (b) + (c) will swap.

Youngs Double Slit Exp.

* Coherent Sources - phase is not chang w/ time.

* sources w/ same f, λ, + ϕ ← phase in their cycle.



(a) (b)

Conditions for extrema

$d \sin\theta_m = m\lambda$, $m = 0, 1, 2, 3 \ldots$ Constructive

$d \sin\theta_m = (m + \frac{1}{2})\lambda$, $m = 0, 1, 2, 3 \ldots$ Destructive

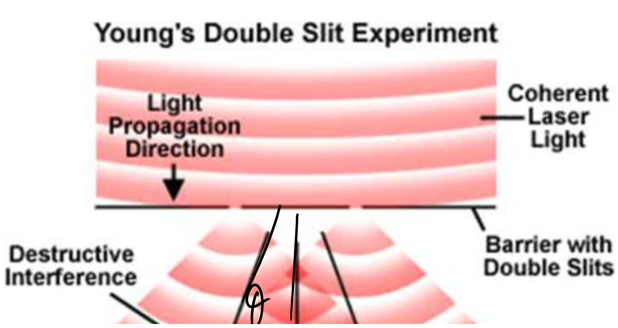
$\tan\theta_m = \frac{y_m}{L}$ ← use for Bright fringes

when θ very small (less $10°$) $\sin\theta \approx \tan\theta \approx \theta$ ... $y_m = \frac{m\lambda L}{d}$

$d\theta_m = m\lambda$

↑ radians

In a Young's double slit experiment, single frequency light is sent through two small closely spaced slits. This produces an interference pattern on a screen some distance from the slits.



Sketch the intensity of the light as a function of position on the screen.

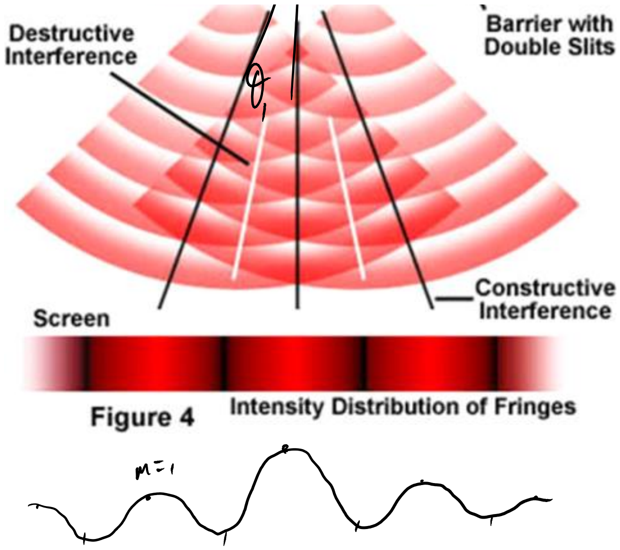
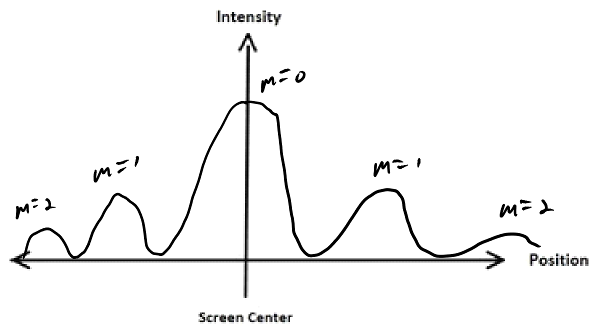


Figure 4



Which of the following are required to see an interference pattern in a Young's double slit experiment?

1. **White light**
2. **Experimental apparatus in air**
3. **Single frequency source**
4. **λ<d**
5. **λ>d**
6. **λ=d**

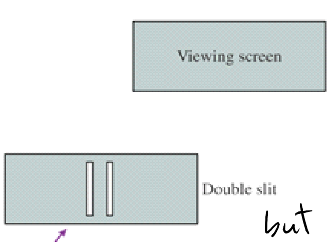
$d \sin\theta = m\lambda$

look @ $\frac{\sin\theta}{m} = \frac{\lambda}{d}$, $\lambda < d$

b/c

$\sin\theta|_{max} = 1$

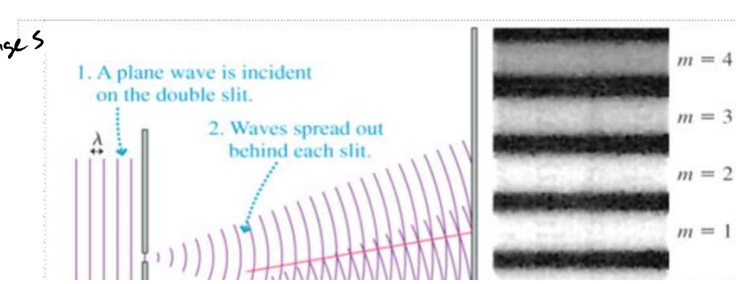
Suppose the viewing screen in the figure is moved closer to the double slit. What happens to the interference fringes?

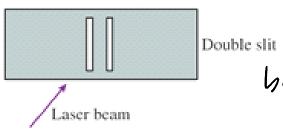


no changes

$d \sin\theta = m\lambda$

but $\tan\theta = \frac{y_m}{}$





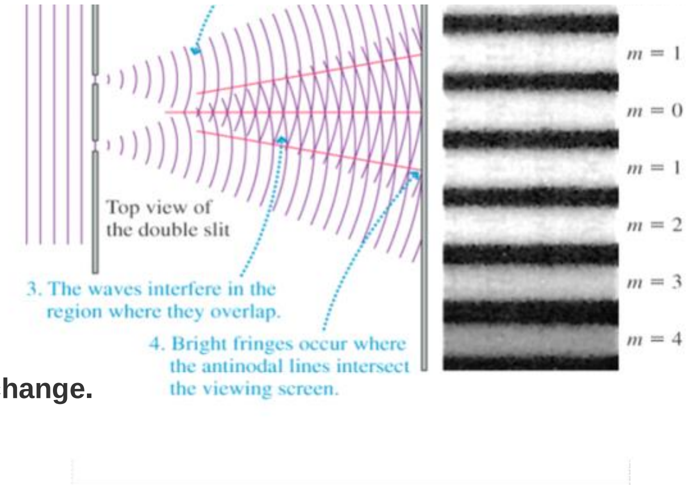
$d \sin\theta = m\lambda$

but $\tan\theta = \frac{y_m}{L}$

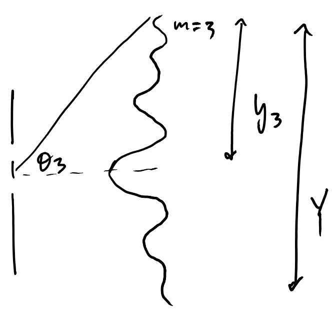
Const.

if $L\downarrow$, $y_m\downarrow$

1. They fade out and disappear.
2. They get out of focus.
3. They get brighter and closer together.
4. They get brighter and farther apart.
5. They get brighter but otherwise do not change.



Red light (λ = 664 nm) is used in a double slit experiment with the slits separated by a distance of 1.2 x 10^{-4} m. The screen is located at a distance of L = 2.75 m from the slits. Find the distance on the screen between the two third order bright fringes.



$\tan\theta_3 = \frac{y_3}{L}$, + $d\sin\theta_3 = 3\lambda$

$\tan\left[\sin^{-1}\left(\frac{3\lambda}{d}\right)\right] = \frac{y_3}{L} \Rightarrow y_3 = 0.0456\,\text{m}$

but... $Y = 2y_3 = \underline{\underline{0.0913\,\text{m}}}$

Light of wavelength λ_1 illuminates a double slit, and interference fringes are observed on a screen behind the slits. When the wavelength is changed to λ_2, the fringes get closer together. How large is λ_2 relative to λ_1?

$d\sin\theta_m = m\lambda$, $\tan\theta_m = \frac{y_m}{L}$ $\Rightarrow$ if $y_m\downarrow$ then $\theta_m\downarrow$

$d \sin\theta_m = m\lambda$, $\tan\theta_m = \frac{y_m}{L}$ $\Rightarrow$ $y_m \downarrow$ $\theta_m \downarrow$

$\Rightarrow$ if $\theta_m \downarrow$, $\lambda \downarrow$ so $\boxed{\lambda_2 < \lambda_1}$

In a location where the speed of sound is 354 m/s, a 2000-Hz sound wave impinges on two slits 30.0 cm apart. At what angle is the first maximum located?

$d \sin\theta_m = m\lambda$, $f\lambda = v$

so $d \sin\theta_1 = 1\left(\frac{v}{f}\right)$ $\Rightarrow$ $\underline{\theta_1 = 36.2^\circ}$

If a double slit light apparatus was setup and the slit separation is 1.00 µm, what frequency of light gives the same first maximum angle as in the case of the sound?

1. **25 Hz**
2. **3.03x10^8 Hz**
3. **3.03x10^{15} Hz**
4. **5.08x10^{14} Hz**
5. **7.34x10^{16} Hz**

$d \sin\overset{36.2^\circ}{\theta_1} = 1\lambda$, $\lambda f = v$

so, $d \sin\theta_1 = \frac{v}{f}$ $\Rightarrow$ $\underline{f = 5.08 \times 10^{14}\ Hz}$

Conditions for extrema

$d \sin\theta_m = m\lambda$, $m = 0, 1, 2, 3 \ldots$ Constructive

$d \sin\theta_m = (m+\frac{1}{2})\lambda$, $m = 0, 1, 2, 3 \ldots$ Destructive

$\tan\theta_m = \frac{y_m}{L}$ ← use for Bright fringes

$d \sin\theta_m = (m + \frac{1}{2})\lambda$, $m = 0, 1, 2, 3 \ldots$

$\tan\theta_m = \frac{y_m}{L}$ ← use for Bright fringes

$$\boxed{\begin{array}{ll} \text{when } \theta \text{ very small (less } 10^\circ) & \sin\theta \approx \tan\theta \approx \theta \ \ldots \ y_m = \frac{m\lambda L}{d} \\ & d\theta_m = m\lambda \end{array}}$$

radians

Light of wavelength λ_1 illuminates a double slit, and interference fringes are observed on a screen behind the slits. When the wavelength is changed to λ_2, the fringes get closer together. How large is λ_2 relative to λ_1?

$d \sin\theta_m = m\lambda$, $\tan\theta_m = \frac{y_m}{L}$ $\Rightarrow$ if $y_m \downarrow$ then $\theta_m \downarrow$

$\Rightarrow$ if $\theta_m \downarrow$, $\lambda \downarrow$ so $\boxed{\lambda_2 < \lambda_1}$

For a double slit apparatus where $\lambda/d \ll 1$, which of the following can be said about adjacent bright fringes?

1. **The spacing between the mth and (m+1)th fringe increases with increased m.**
2. **The spacing between the mth and (m+1)th fringe decreases with increased m.**
3. **The spacing between the mth and (m+1)th fringe remains constant with increased m.**

$\sin\theta_m = \frac{m\lambda}{d}$, $\tan\theta_m = \frac{y_m}{L}$

if $\frac{\lambda}{d} \ll 1$, $\sin\theta_1 \ll 1$ & θ is very small....

so $\sin\theta \approx \theta$, $\cos\theta \approx 1$, $\tan\theta = \frac{\sin\theta}{\cos\theta} \approx \theta$

& $y_m = \frac{m\lambda L}{d}$ ... linear w/r to m

What is the difference between diffraction and interference?

1. **Diffraction refers multi-slit scattering while interference refers to double slit scattering.**
2. **Diffraction is relevant only to single slit apparatus. Interference is relevant to all wave phenomena.**
3. **Diffraction is the focusing of light to a spot. Interference is the sinusoidal wave patterns of traveling light.**
4. **Diffraction is a process that changes the direction of light rays. Interference occurs when two light rays (waves) meet at a point.**
5. **There is no difference between diffraction and interference.**

A double slit and a diffraction grating experiment is setup. The slit spacing is the same as the spacing between lines in the grating and the same coherent light is sent through both. If the distance from the scattering target is the same in both cases, which of the following statements are true?

1. **The bright fringes are twice as far apart in the case of the grating.**
2. **The bright fringes are sharper in the case of the grating.**
3. **The dark fringes are wider in the case of the double slit.**
4. **The uncertainty in a measurement is the same in both cases.**
5. **The uncertainty in a measurement is greater in the case of the double slit.**
6. **The uncertainty in a measurement is greater in the case of the multi-slit.**
7. **The spacing between the bright fringes is the same in both cases.**

Same equation for bright spots but gratings are much sharper.

White light passes through a diffraction grating and forms rainbow patterns on a screen behind the grating. For each rainbow,

1. **the red side is farthest from the center of the screen, the violet side is closest to the center**

1. **the red side is farthest from the center of the screen, the violet side is closest to the center**
2. **the red side is closest to the center of the screen, the violet side is farthest from the center.**
3. **the red side is on the left, the violet side on the right.**
4. **the red side is on the right, the violet side on the left.**

$d \sin\theta_m = m\lambda$, if $\lambda \uparrow$, $\sin\theta \uparrow$ thus $\theta \uparrow$

$\lambda_R > \lambda_V$

600-nm-light passes through a diffraction grating with 2500 lines per centimeter. At what angle is the 3rd order bright fringe?

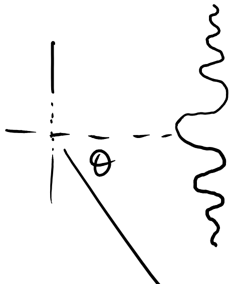
1. **41.1°**
2. **12.4 °**
3. **8.63 °**
4. **26.7 °**
5. **17.3 °**

$d\sin\theta_m = m\lambda$, d? $\frac{2500 \text{ lines}}{1\times10^{-2}\text{ m}} \Rightarrow \frac{1\times10^{-2}\text{ m}}{2500 \text{ lines}} = 4\times10^{-6}\ \text{m/line} = d$

so $\sin\theta_3 = \frac{3\lambda}{d} \Rightarrow \underline{\theta_3 = 26.7°}$

irrelevent info

If a screen is placed 115 cm away from the grating, how many total fringes will be observed?



$\theta_{max} \overset{?}{=} 90°$ + $d\, \cancel{\sin\theta_{max}}^{\,1} = M_{max}\lambda$

$M_{max} = \frac{d}{\lambda} = 6.\bar{6}$ or 6

but $2M+1$ fringes, so $\underline{13 \text{ total}}$

A reflection grating produces its first-order bright spot at an angle of 40°. If you want to reduce this angle to 20° for the same wavelength of light, by what factor must the spacing between the groves change?

1. **0.342**
2. **0.500**
3. **0.532**
4. **0.643**
5. **1.88**
6. **2.00**

$$d\sin\theta_1 = \lambda \quad \Rightarrow \quad \sin\theta_1 = \frac{\lambda}{d}$$

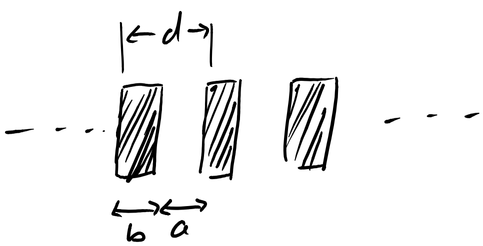
$\sin(40) \longrightarrow \sin(20)$ which changes by factor of 0.5321

So, $\frac{\lambda}{d} \longrightarrow 0.5321\,\frac{\lambda}{d}$ ... $\lambda = \text{const.}$

$d \rightarrow \frac{1}{0.5321}\,d$ or by factor $\frac{1}{0.5321} = \underline{1.88}$

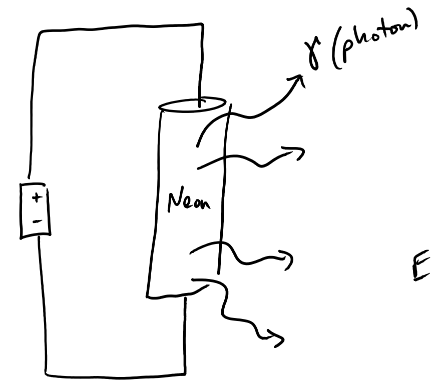
A diffraction grating is described by its groove spacing ***d***. But each groove consists of a clear aperture ***a*** and an opaque part ***b***. For fixed ***d*** how does changing ***a*** and ***b*** (the ratio ***a/b***) affect the diffracted light?

1. As b increases and a decreases, more light is transmitted but the diffraction is strong.
2. As b increases and a decreases, more light is transmitted and the diffraction is weak.
3. As b increases and a decreases, less light is transmitted but the diffraction is strong.
4. As b increases and a decreases, less light is transmitted and the diffraction is weak.
5. As b decreases and a increases, more light is transmitted, diffraction increases and most of the light goes into higher orders.
6. As b decreases and a increases, more light is transmitted, diffraction decreases and most of the light goes into zero order.

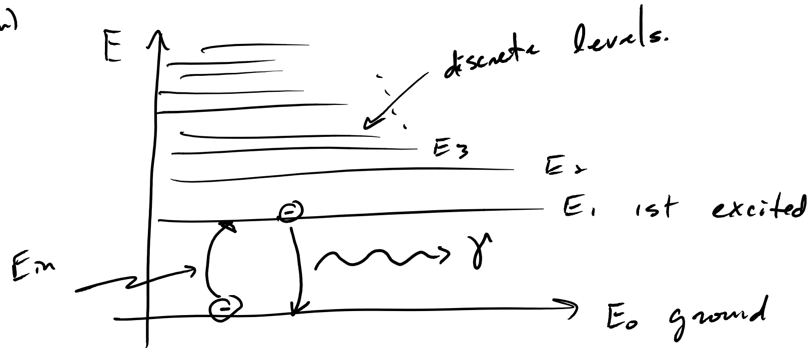


smaller aperture ... more diffraction (spreading)

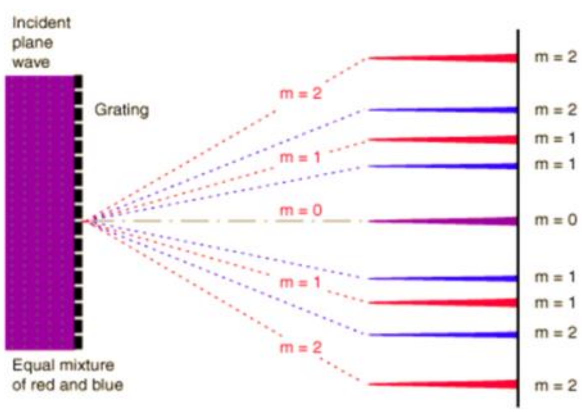
Spectroscopy



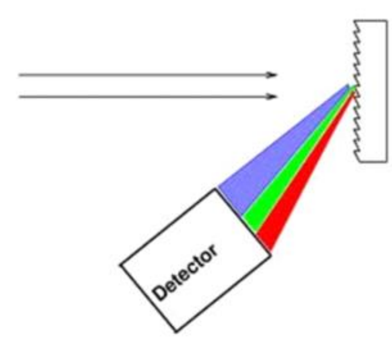
Energy levels of Electrons in neon



* as e^- relaxes to ground state releases a photon
* Each element produces only a discrete set of λ photons
  * These are "fingerprint" of element.



Use Diffraction or Reflection grating to seperate light & determine material Composition.

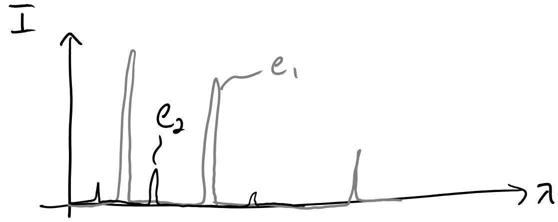


Physicists analyze the electromagnetic spectrum of astrophysical objects to make inferences about which of the following?

1. **Temperature** ← all bodies w/ $T > 0$ radiate E&M waves
2. **Velocity**
3. **Gas pressure** ← $P + T$ are related
4. **Overall composition**

The spectral lines of a distance star are shown to match only two elements. What feature of the lines can be used to determine the percentage of each element in the star?

1. **Frequency**
2. **Wavelength**
3. **Intensity**
4. **Doppler shift**

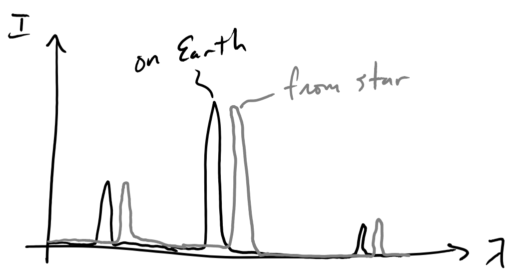


w/ $I_1 > I_2$, there is more e_1 than e_2

What feature of the spectral lines could be used to determine the relative motion of the star to Earth?

Doppler

ex.



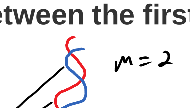
* each peak is shifted to greater λ

* $\lambda \uparrow$, $f \downarrow$, $|\Delta \vec{r}| \uparrow$

* moving away

The spacing of ruled lines on a diffraction grating is 1900 nm. The grating is illuminated at normal incidence with a parallel beam of white light in the 400 nm to 700 nm wavelength band. The angular width of the gap between the first order spectrum and the second order spectrum is closest to:

1. **3.3°**

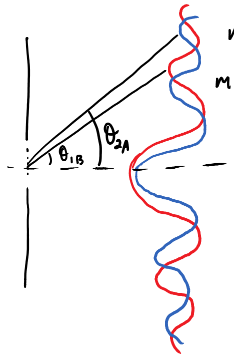


Angular Seperation

$\lambda_A = 400\text{nm}$, $\lambda_B = 700\text{nm}$

width of the gap between the first order spectrum and the second order spectrum is closest to:

1. **3.3°**
2. **4.3°**
3. **5.3°**
4. **6.3°**
5. **2.3°**



Angular Seperation

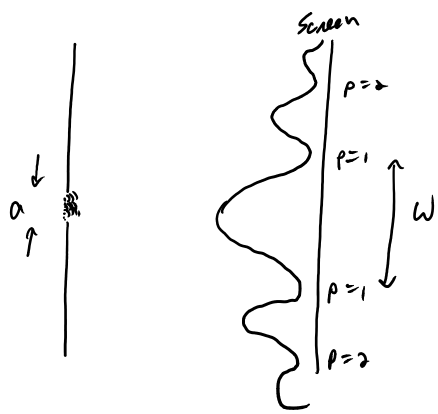
$\lambda_A = 400nm$, $\lambda_B = 700nm$

$\theta_{2A} - \theta_{1B}$

$\sin\theta_m = \frac{m\lambda}{d} \Rightarrow \theta_{2A} = 24.9°$, $\theta_{1B} = 21.6$

$\Delta\theta = 3.3°$

Single Slit Interference & Diffraction



* single slit Int. pattern differs from multi slit.

* describe by dark fringes

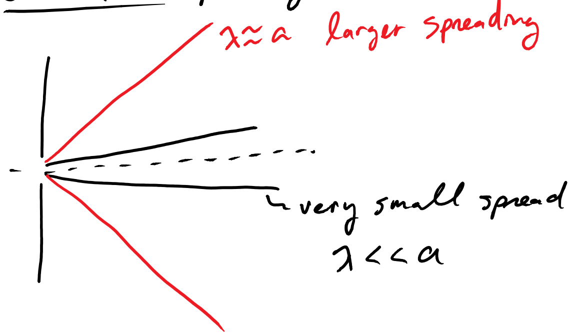
Single Slit eq (Dark fringes)

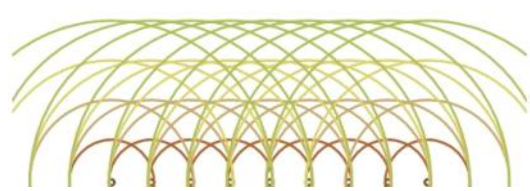
$a \sin\theta_p = p\lambda$, $p = 1, 2, 3, 4 ...$

$y_p = \frac{p\lambda L}{a}$ w/ $\lambda << a$

$W = \frac{2\lambda L}{a}$

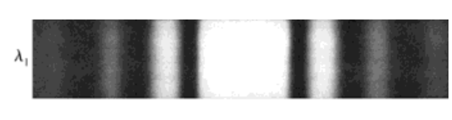
Diffraction - Spreading of light



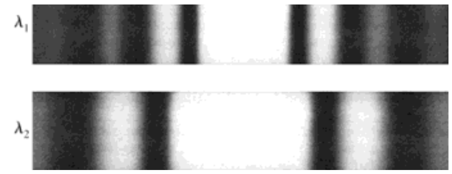


The figure shows two single-slit diffraction patterns. The distance between the slit and the viewing screen is the same in both cases. Which of the following could be true?

1. **The wavelengths are the same for both; a1 > a2**
2. **The wavelengths are the same for both; a2 > a1**
3. **The slits and the wavelengths are the same for both; p1 > p2**



1. The wavelengths are the same for both; a1 > a2
2. The wavelengths are the same for both; a2 > a1
3. The slits and the wavelengths are the same for both; p1 > p2
4. The slits and the wavelengths are the same for both; p2 > p1



$a \sin\theta_p = p\lambda$, $\theta_1 < \theta_2$, so $\frac{\lambda_1}{a_1} < \frac{\lambda_2}{a_2}$

slit width

wavelength

Green light is incident on a very thin slit and illuminates a distant screen. Which of the following statements are true if small angles are assumed.

1. **If the slit width is doubled than the width of the central maximum will increase by a factor of two.**
2. **If the slit width is doubled than the width of the central maximum will decrease by a factor of two.**
3. **If the distance to the screen is doubled than the width of the central maximum will increase by a factor of four.**
4. **If the distance to the screen is doubled than the width of the central maximum will decrease by a factor of four.**

$W = \frac{2\lambda L}{a}$ ~ dist to screen, slit width

if $a \to 2a$, $W \to \frac{W}{2}$

A screen is placed 50.0 cm from a single slit, which is illuminated with 690-nm light. If the distance between the first and third minima in the diffraction pattern is 3.00 mm, what is the width of the slit?

1. **0.23 mm**
2. **0.42 mm**
3. **0.11 mm**
4. **0.37 mm**
5. **0.18 mm**

w/ $\Delta y_{31} = y_3 - y_1 = 3\times10^{-3}$ m + $L = 0.5$m ... small angles

$y_p = \frac{p\lambda L}{a}$, $y_3 - y_1 = \frac{3\lambda L}{a} - \frac{\lambda L}{a} = \frac{2\lambda L}{a}$

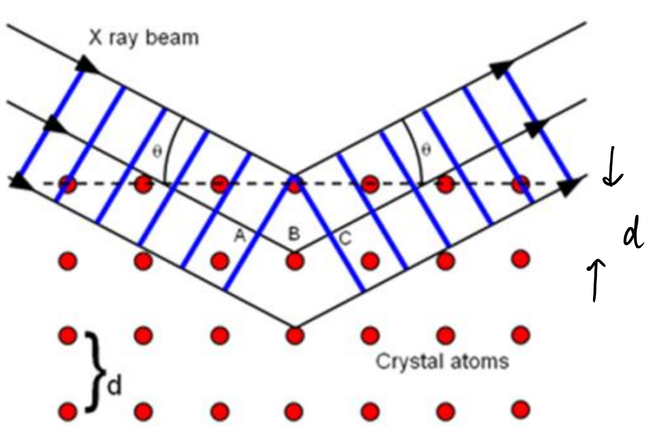
$a = \frac{2\lambda L}{\Delta y_{31}} = \underline{23\times10^{-5}\text{m}}$

Which one of the following statements best explains why the diffraction of sound is more apparent than the diffraction of light under most circumstances?

1. **Sound requires a physical medium for propagation.**
2. **Sound waves are longitudinal, and light waves are transverse.**
3. **Light waves can be represented by rays while sound waves cannot.**
4. **The speed of sound in air is six orders of magnitude smaller than that of light.**
5. **The wavelengths of visible light is considerably smaller than the wavelengths of sound.**

$a \sin\theta_1 = (1)\lambda$ if $\lambda \uparrow$, $\theta \uparrow$

X-Ray Bragg Diffraction - determining crystalline structure



* $PLD = 2d \cos\theta_m = m\lambda$, $m = 1, 2, 3 \ldots$ Const.

  ↑ lattice spacing

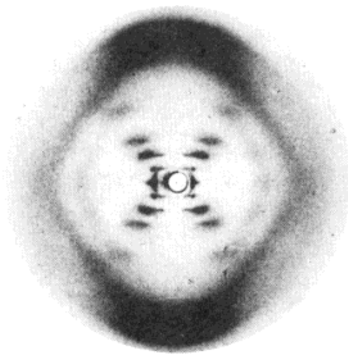
* Each structure has a unique Interference pattern.

* Symmetry of scattering object is maintained in Interference pattern.

ex. DNA

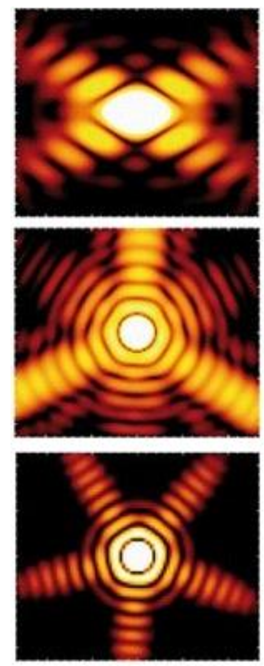
maintained in interference pattern.

ex. DNA



The scattering pattern for 3 different geometries is shown in the figure. The three geometries, which were used as targets to scatter off of, are also shown. Match each target with their associated scattering pattern.

C A B

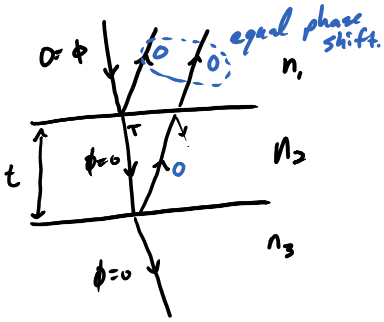


Symmetry: 5 point or 72° | 4 point or 90° | 3 point or 120°

Index Refraction - effective speed light in medium

$$n = \frac{c}{v_{eff}} \geq 1 , \qquad \lambda_s = \frac{\lambda_{vac}}{n_s}$$

Thin Film Interference



* Normal Icedence PLD = 2t

* light reflecting off higher n undergoes π phase shift.

* no phase for transmitted light

ex. $n_1 > n_2 > n_3$

Relative phase Shifts

	even	odd
$2t = \frac{m\lambda_{vac}}{n_2}$	Const.	Dest.
$2t = (m+\frac{1}{2})\frac{\lambda_{vac}}{n_2}$	Dest.	Const.

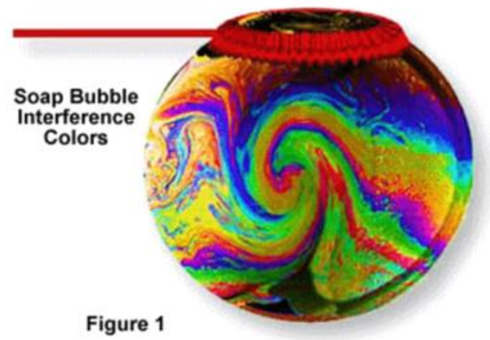
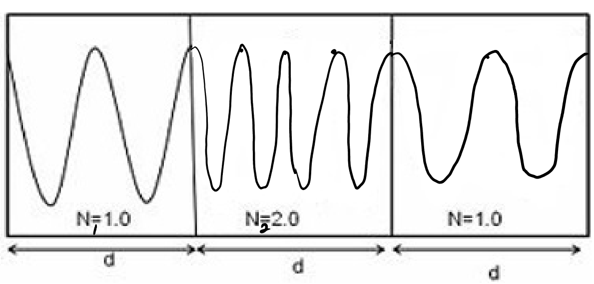


Figure 1

A light wave is incident from the left on a medium with a higher index of refraction. The light then emerges back into air on the other side. Sketch the wave through the medium and back into the air.



$f_1 = f_2$, $n = \frac{c}{v}$, $f\lambda = v$

$\frac{v_1}{\lambda_1} = \frac{v_2}{\lambda_2} \Rightarrow \frac{1}{\lambda_1}\frac{c}{n_1} = \frac{1}{\lambda_2}\frac{c}{n_2}$

$\boxed{\lambda_1 n_1 = \lambda_2 n_2}$

if $n_2 = 2$ & $n_1 = 1$

$\lambda_1 = 2\lambda_2$

Orange light (λ_{vacuum} = 611 nm) shines on a soap film (n = 1.33) that has air on either side of it. When the light travels from the air into the soap, which features remain unchanged?

1. **Wavelength** — $f\lambda = v$
2. **Speed** — $n = \frac{c}{v_{eff}}$
3. **Wave number** — $k = \frac{2\pi}{\lambda}$ in reality k is a vector & points in
4. **Amplitude** —

$\vec{k} = 2\pi \langle \frac{1}{\lambda_x}, \frac{1}{\lambda_y}, \frac{1}{\lambda_3} \rangle$

2. Speed $n = \frac{c}{v_{eff}}$ $K = 2\pi \langle \frac{1}{\lambda_x}, \frac{1}{\lambda_y}, \frac{1}{\lambda_z} \rangle$
3. Wave number $K = \frac{2\pi}{\lambda}$ in reality K is a vector & Points in direction of ray propagation
4. Amplitude
5. Frequency
6. Intensity

$I_{incident} = I_{reflected} + I_{transmitted}$, Conservation of Energy

What is the effective speed of the light in the film?

1. 0.45c
2. 0.62c
3. 0.75c
4. 0.98c
5. 1.33c
6. 1.00c

$$V_{eff} = \frac{c}{n} = \frac{1}{1.33} c = \frac{1}{4/3} c$$

$$\underline{v = \frac{3}{4} c}$$

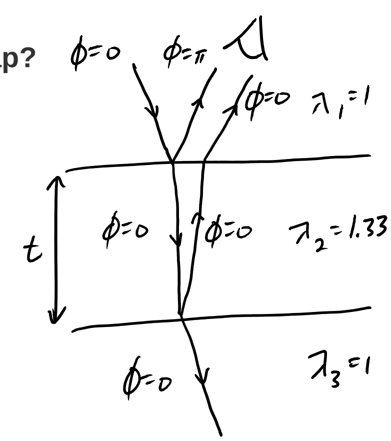
What is the wavelength of the light in the soap?

1. 459 nm
2. 611 nm
3. 492 nm
4. 763 nm
5. 333 nm

$$\lambda_1 n_1 = \lambda_2 n_2$$

$$\lambda_2 = \frac{\lambda_1 \cancel{n_1}^{1}}{n_2}$$

$$= 459 nm$$



What are the thicknesses of the film for which the orange light will appear bright?

Constructive w/ π phase shift: $2t = (m + \frac{1}{2}) \lambda_2$,

$$\boxed{t = (m) 230 nm + 115 nm \quad , m = 0, 1, 2, 3 \ldots}$$

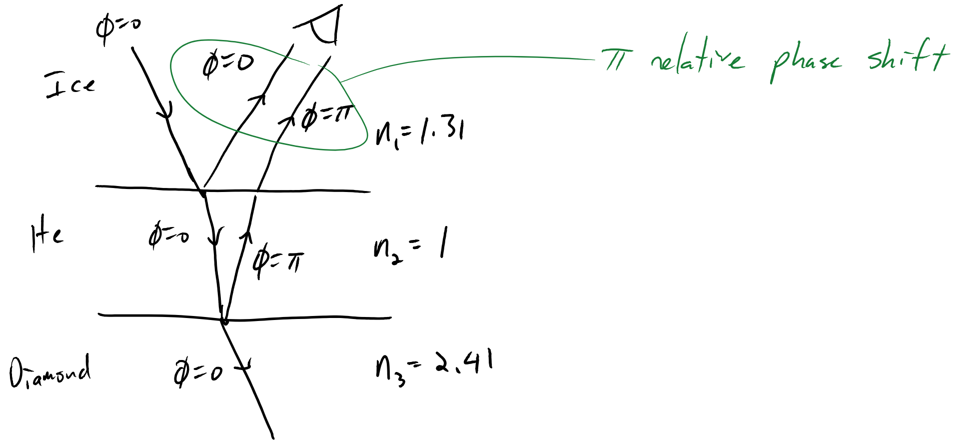
So 115, 345, 575 nm ...

Light traveling through ice (n = 1.31) is incident on a thin film (thickness t) of Helium gas (n = 1) that has

diamond (n = 2.41) on the other side. Match the following conditions with their respective constructive or destructive interference.

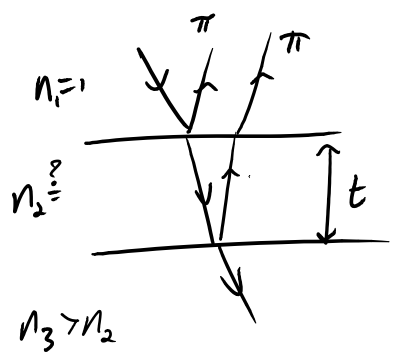
A. 2t = (m+0.5)λ → **1. Constructive**

B. 2t = (m)λ → **2. Destructive**



The Decepticons are building an new top secret skin for their jets that makes them invisible to the Transformer's X-Band radar detectors. The X-Band operates at 12 GHz and the material they want to make the skin out of has an effective speed of light of 55.5% the speed of light. What is the minimum thickness of the film?

1. **32 mm**
2. **15 mm**
3. **11 cm**
4. **4.2 cm**
5. **783 mm**
6. **0.35 cm**



Con

$2t = m\lambda_2$, $\lambda = \frac{c}{f} = 0.025m$

Dest

$2t = (m+\frac{1}{2})\frac{\lambda}{n_2}$

$n_2 = \frac{c}{v} = \frac{\cancel{c}}{0.55\cancel{c}} = 1.8$

$t_{min} = \frac{\lambda}{4n_2} = 3.47 \times 10^{-3} m$

≈ 0.35 cm

Light travels through an interferometer as shown in the diagram below creating constructive interference at the detector. If the mirror on the right is able to move left and right, what is the shortest distance it can be moved to show destructive interference?

1. **λ**

$PLD = 2d$

mirror

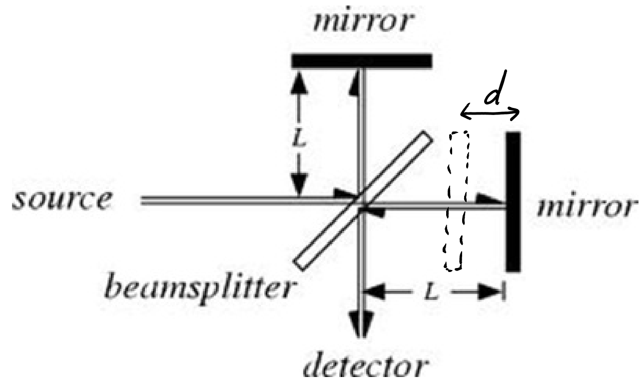
shortest distance it can be moved to show destructive interference?

1. λ
2. λ/2
3. L/2
4. 2λ
5. λ/4
6. L/4

$PLD = 2d$

$2d = (m+\frac{1}{2})\lambda$

$d_{min} = \frac{\lambda}{4}$



If a time delay is placed along the path to the mirror on the right, what is the shortest time delay, other than zero, that will create constructive interference at the detector?

1. T
2. T/2
3. T/4
4. 2λ
5. λ/4
6. λ /2

let Time Delay one Way $\equiv \Delta t$

if $2\Delta t = mT$, $m = 1,2,3$

then Const.

$\Delta t_{min} = \frac{(1)T}{2}$