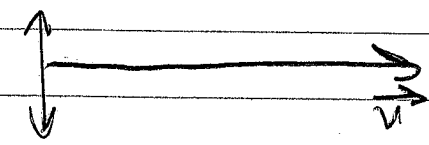


Geometric Optics - caused by wave speed

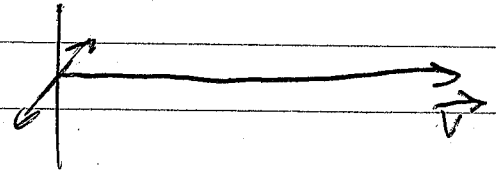
Physical Optics - caused by microscopic details

- Direction of underlying fields
- Wavelength of waves

Polarization - Direction of \vec{E} field.



~~Horizontally~~ Vertically Polarized



Horizontally Polarized

Most Light is unpolarized.

- Sunlight
- Light Bulbs

Polarized Light is more rare.

- Many Lasers
- Glare from water
- LCD's

Polarizer - Filters and Polarizes Light

$$I_{out} = \frac{1}{2} I_{in}$$

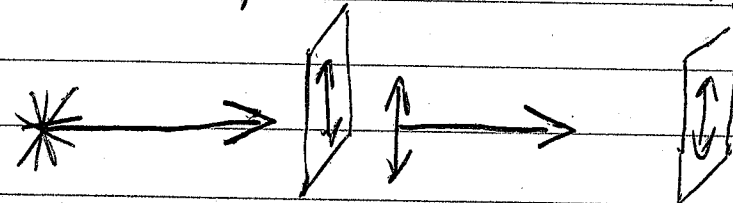
Unpolarized \uparrow

$$I_{out} = I_{in} \cos^2 \theta$$

Polarized \uparrow
Twist Angle \uparrow

(2)

Ex: Unpolarized hits Aligned Polarizers

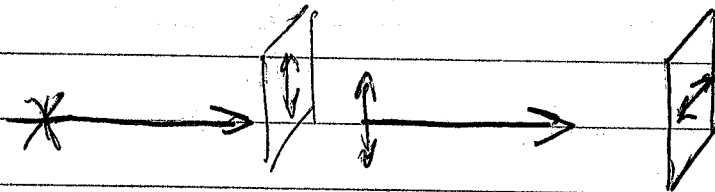


I_0

$$I_1 = \frac{1}{2} I_0$$

$$I_2 = I_1 \cos^2(0^\circ) \\ = I_1 = \frac{1}{2} I_0$$

Crossed Polarizers

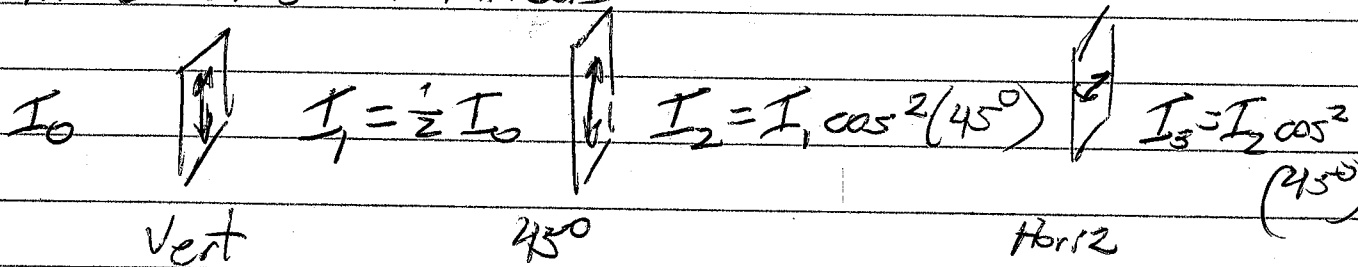


I_0

$$I_1 = \frac{1}{2} I_0$$

$$I_2 = I_1 \cos^2(90^\circ) \\ = 0$$

Three ~~crossed~~ Polarizers



I_0

$$I_1 = \frac{1}{2} I_0$$

$$I_2 = I_1 \cos^2(45^\circ)$$

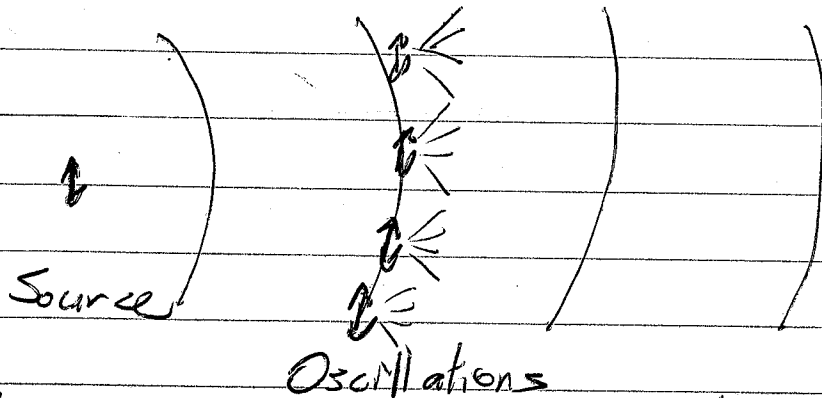
$$I_3 = I_2 \cos^2(45^\circ)$$

$$I_3 = \left(\frac{1}{2} I_0 \cos^2(45^\circ) \right) \cos^2(45^\circ) \\ = \frac{1}{8} I_0$$

Would 4 polarizers @ 30° angles get more thru?

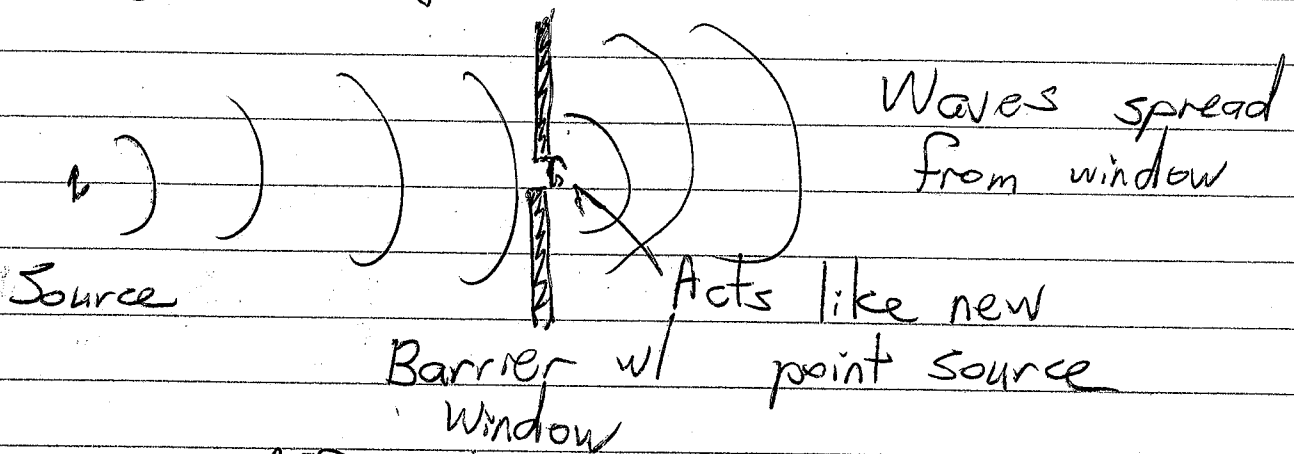
5

Diffraction & Interference



Huygens' Principle - each wave front generates the next, just like a line of sources would.

Blocking part of a beam leaves only the Huygens sources in the iris, window, or slit.

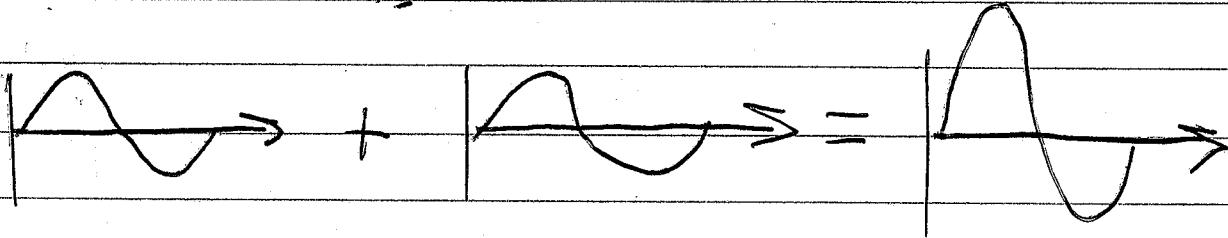


This is diffraction.

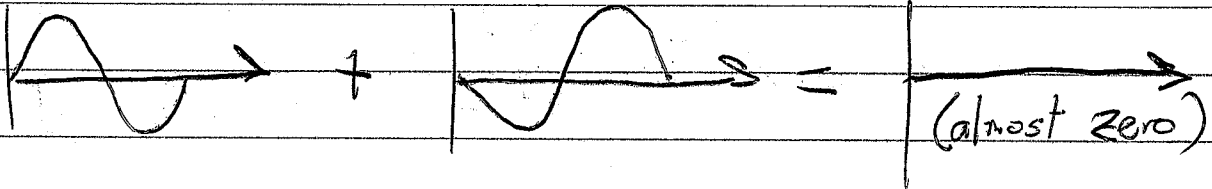
4)

Multiple waves can (re)combine in an organized fashion.

Constructive



Destructive



To see this, we must combine beams from the same source.

A laser generates coherent, organized sinewaves.

Introducing a phase delay allows controlling the interference.

Constr.	No shift	$\Delta t = 0$	$\Delta l = 0$
Destr.	Half-cycle	$\Delta t = T/2$	$\Delta l = \lambda/2$
Constr.	Full-cycle	$\Delta t = T$	$\Delta l = \lambda$

