

Phys 1402

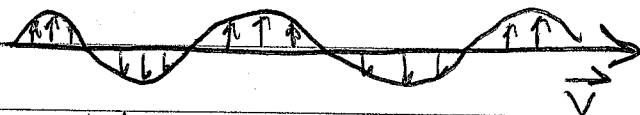
2017-11-30

Lec 25

## Physical Optics

- Polarization - Amplitude
- Diffraction / Interference - Wavelength

EM Waves are transverse



E-Field is perpendicular to  $\vec{v}$ .  
There lots of directions for  $\vec{E}$ .

If  $\vec{E}$  is disorganized, light is unpolarized.

- Sunlight
- Light bulbs

If  $\vec{E}$  is consistent, the light is polarized.

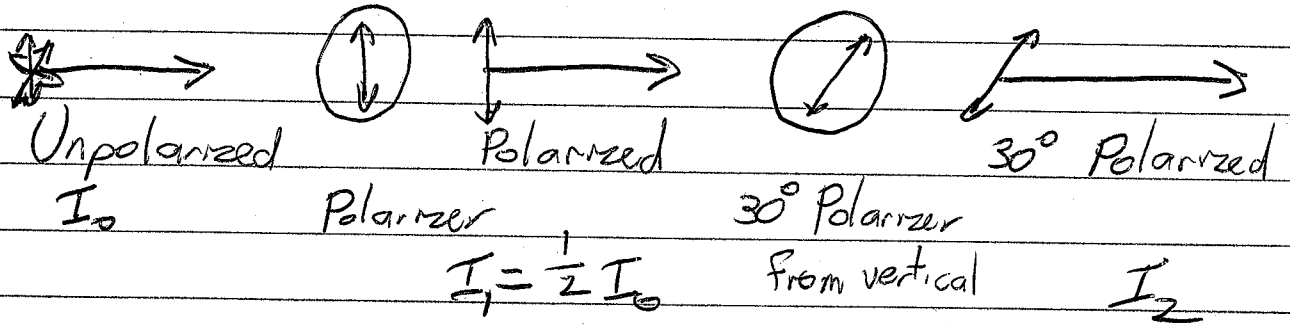
- Many Lasers
- Glare from water
- ~~•~~ • LCD TV's

Polarizer - Forces  $\vec{E}$  to point in a particular dir.

- Unpolarized Light  $\rightarrow$  Polarizer  $\rightarrow$  Half gets thru
- Polarized Light  $\rightarrow$  Polarizer  $\rightarrow$  Orientation Matters

②

A polarizer works by taking a vector component of  $\vec{E}$ .



$$I_2 = I_1 \cos^2(30^\circ) = 0.75 I_1$$

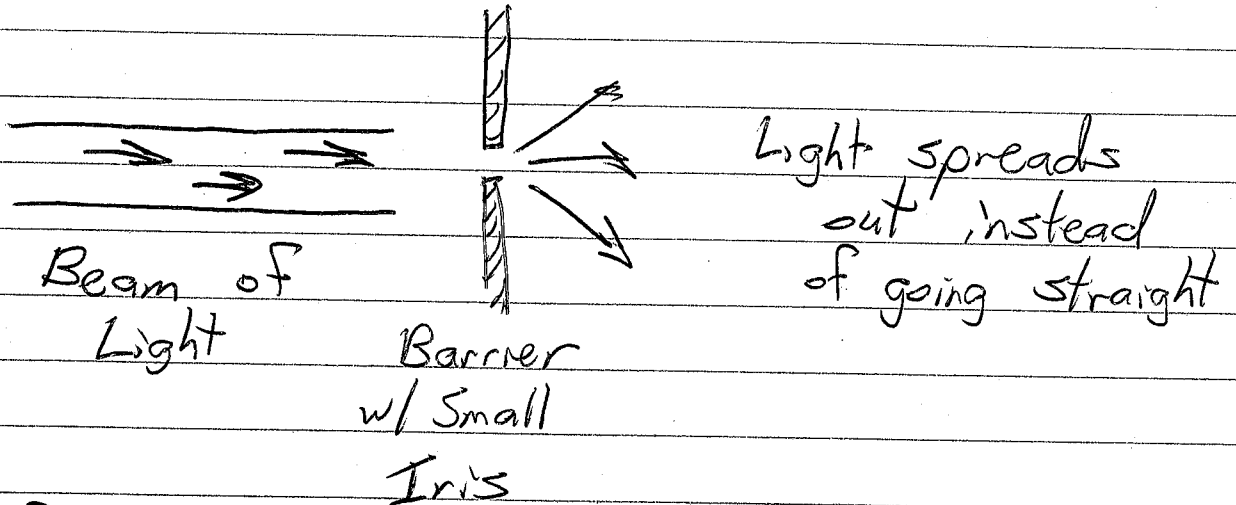
↖ Angle between light's Polarization and the new polarizer.

Note:  $\cos^2(90^\circ) = 0$  Crossed Polarizer Blocks all light.

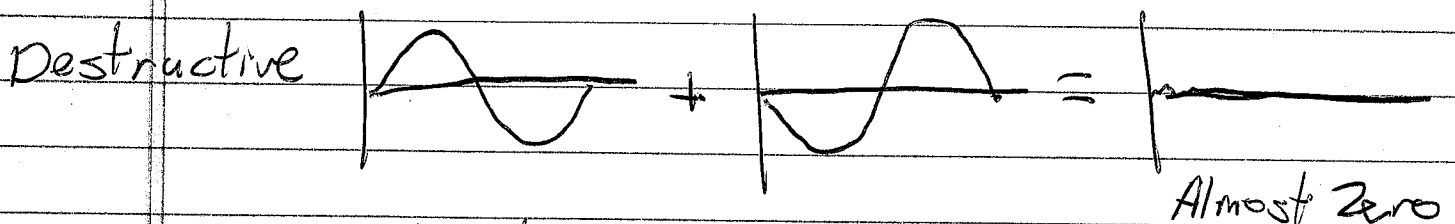
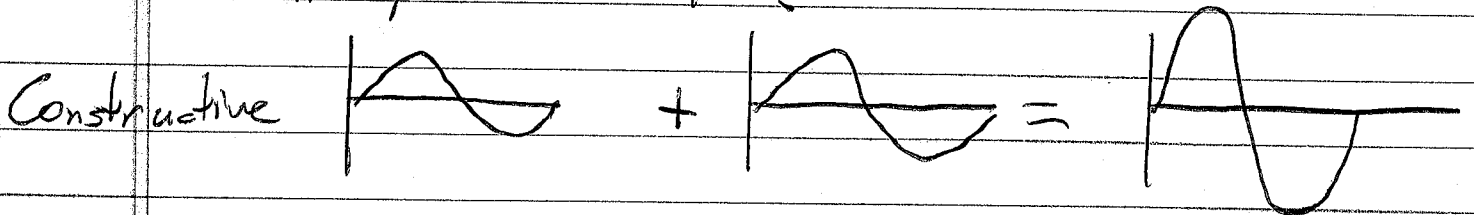
3

## Diffraction & Interference

Diffraction - Spreading of a beam after going through a window, iris, or slit.



Interference - Multiple beams of light can be organized to always add or always subtract.

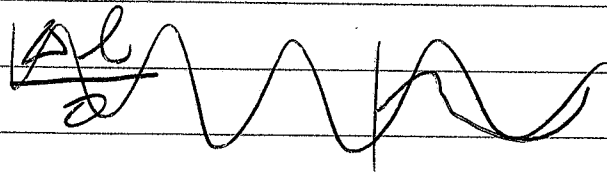


To be coherent, they must come from the same source.

- Regular light - reorganizes constantly.
- Laser light - consistent organization.

4)

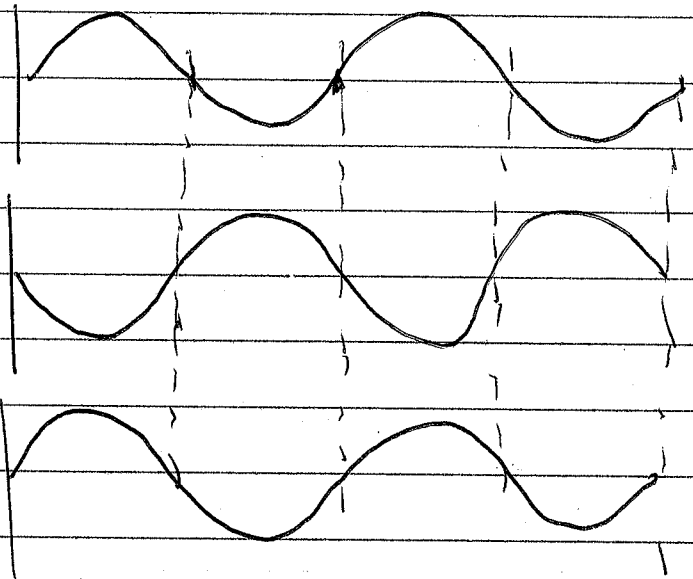
Easiest way of changing the relative values of two sine waves is a phase change. This can be with a path length difference.



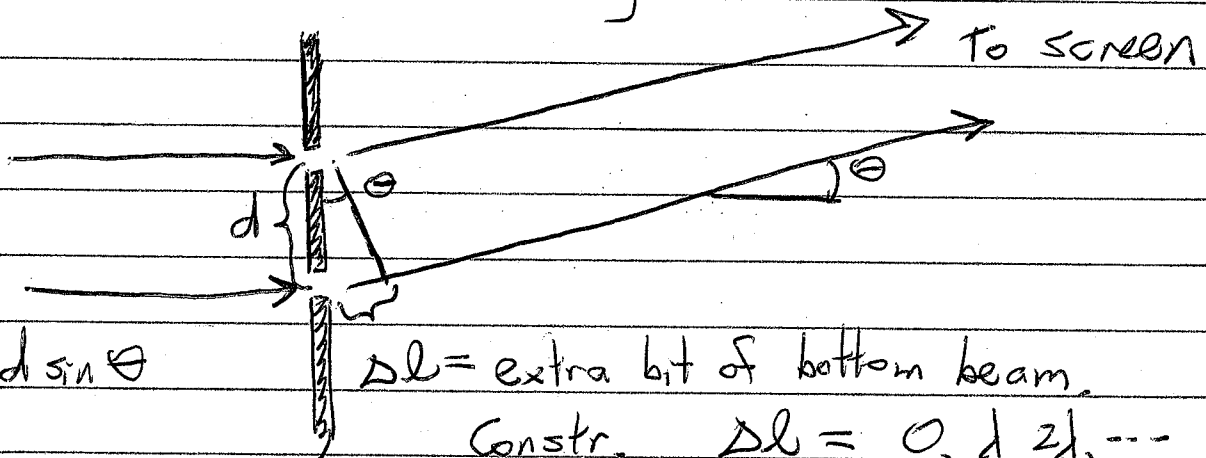
$$\frac{\Delta l}{\lambda}$$

Half- $\lambda$  is out-of-phase  $\lambda/2$

Full- $\lambda$  is in-phase  $\lambda$



Two-slit or Diffraction Grating



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

$\Delta l =$  extra bit of bottom beam.

Constr.  $\Delta l = 0, \lambda, 2\lambda, \dots$

Destr.  $\Delta l = \lambda/2, 3\lambda/2, \dots$

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