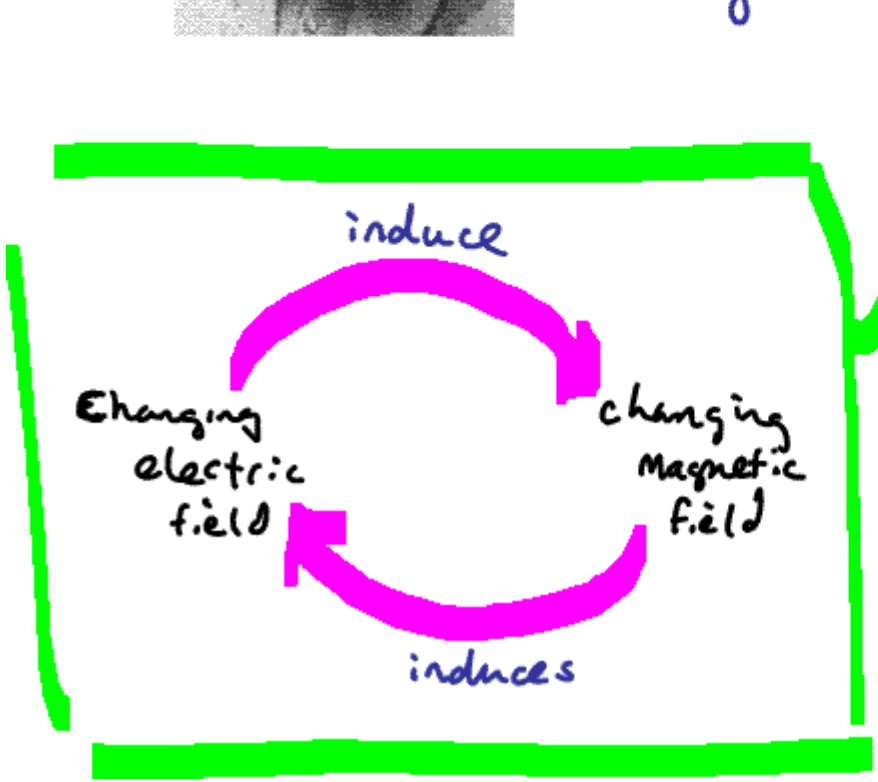
Physics 100 - September 26, 2007

James Clerk Maxwell - 1873

4 equations

"unify" electricity + Magnetism

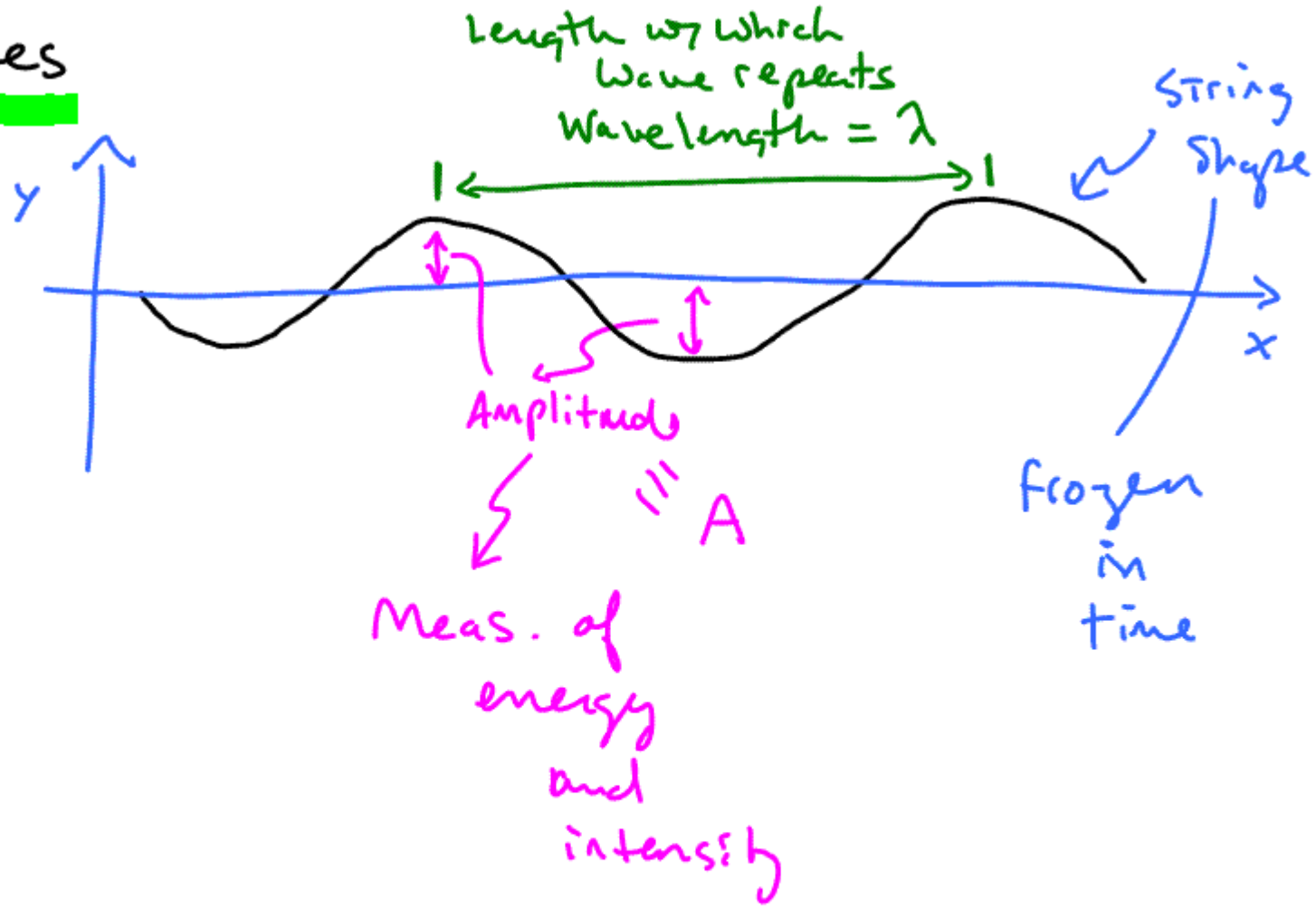


Light

Also —

Light is a Wave

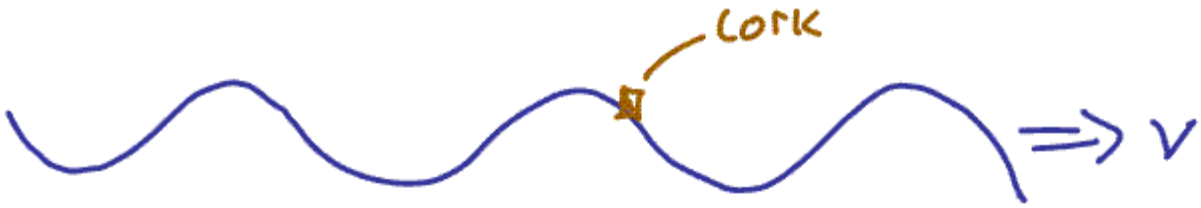
Waves



Waves "9" us →

- Water waves
- Earthquakes
- Waves on strings
- Sound

* JUST STAY Tuned



Frequency of wave $= \frac{1}{T} = \frac{1}{\text{seconds}} \equiv$ Hertz $\equiv$ Hz

Sound waves at high frequency → you perceive as having high pitch

low frequency → low pitch

frequency corresponds to pitch in sound waves.

light waves ~ high frequency more blue

low frequency more red

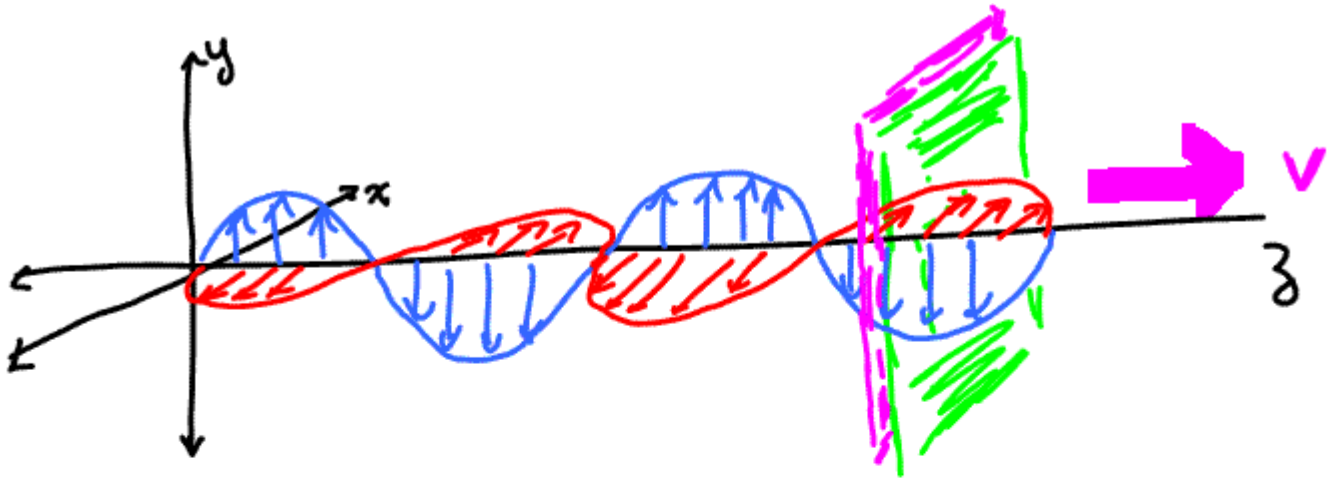
frequency corresponds to color in light waves

$$\text{frequency} = \frac{1}{T} = f \leftarrow \text{sound (music)}$$

$$= \nu \leftarrow \text{light}$$

$$V = \frac{\lambda}{T} = \lambda f$$

light in vacuum $\quad c = \lambda \nu$



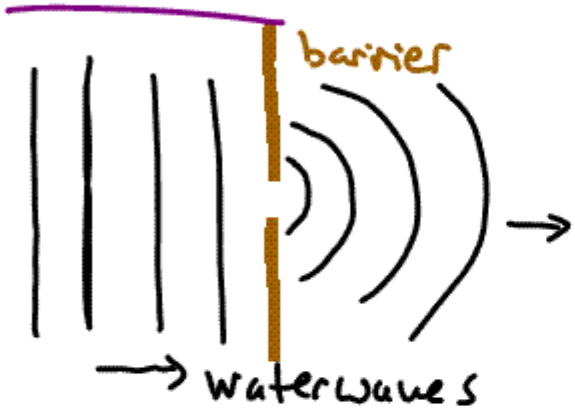
Wave propagates in z direction

↑ represents direction and magnitude of E field in plane TRANSverse to motion

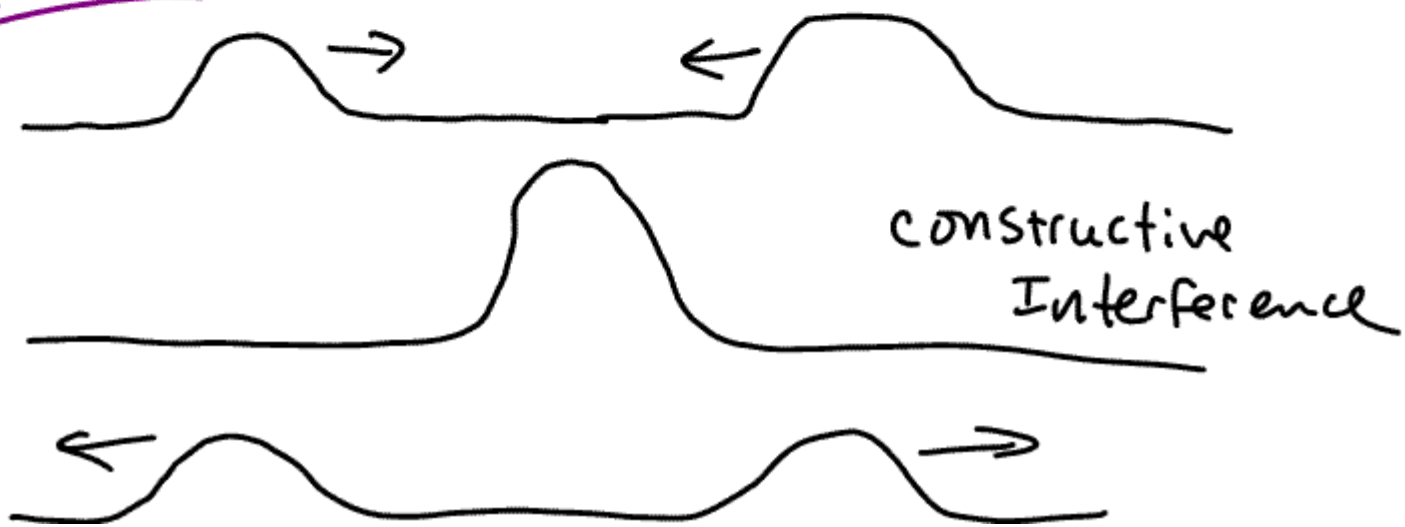
↑ represents direction and magnitude of B field in plane TRANSverse to direction of motion

Waves (all types) exhibit Diffraction
Interference
Refraction

Diffraction – waves spread out passing thru small hole

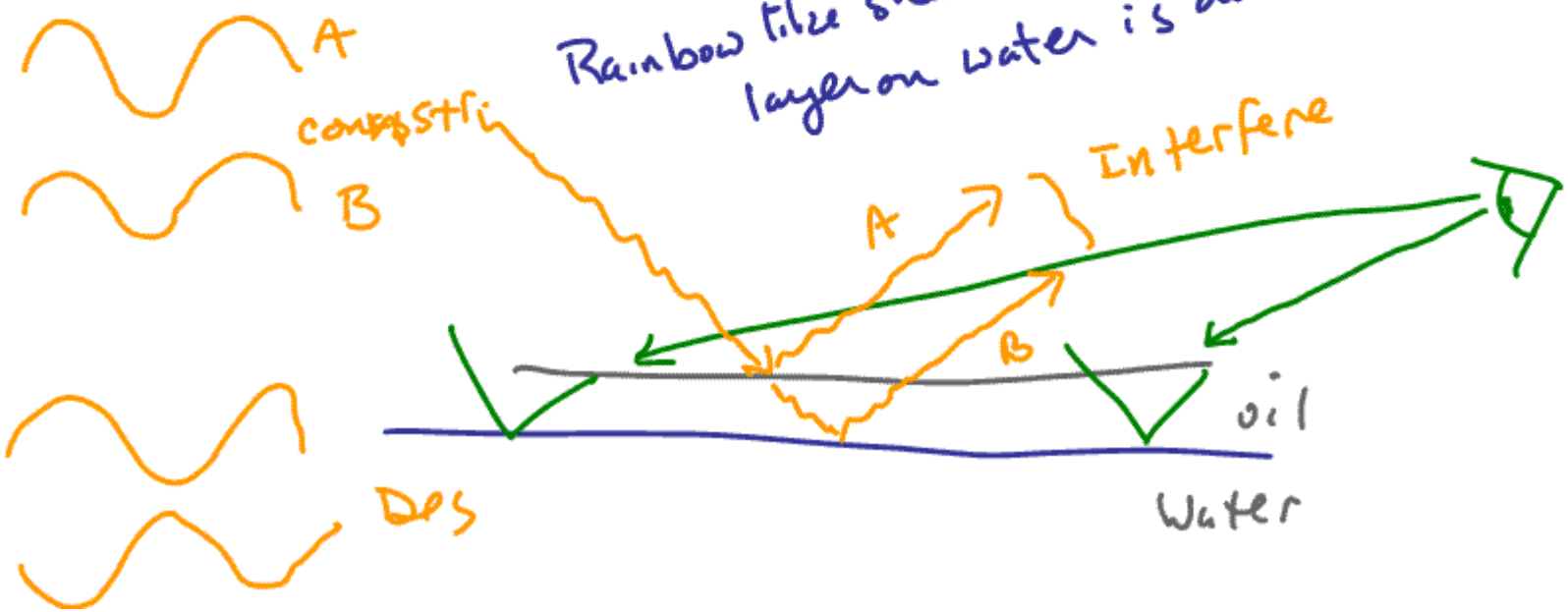


Interference



destructive
Interference

Rainbow like sheen of oil
layer on water is due to interference



Refraction

air

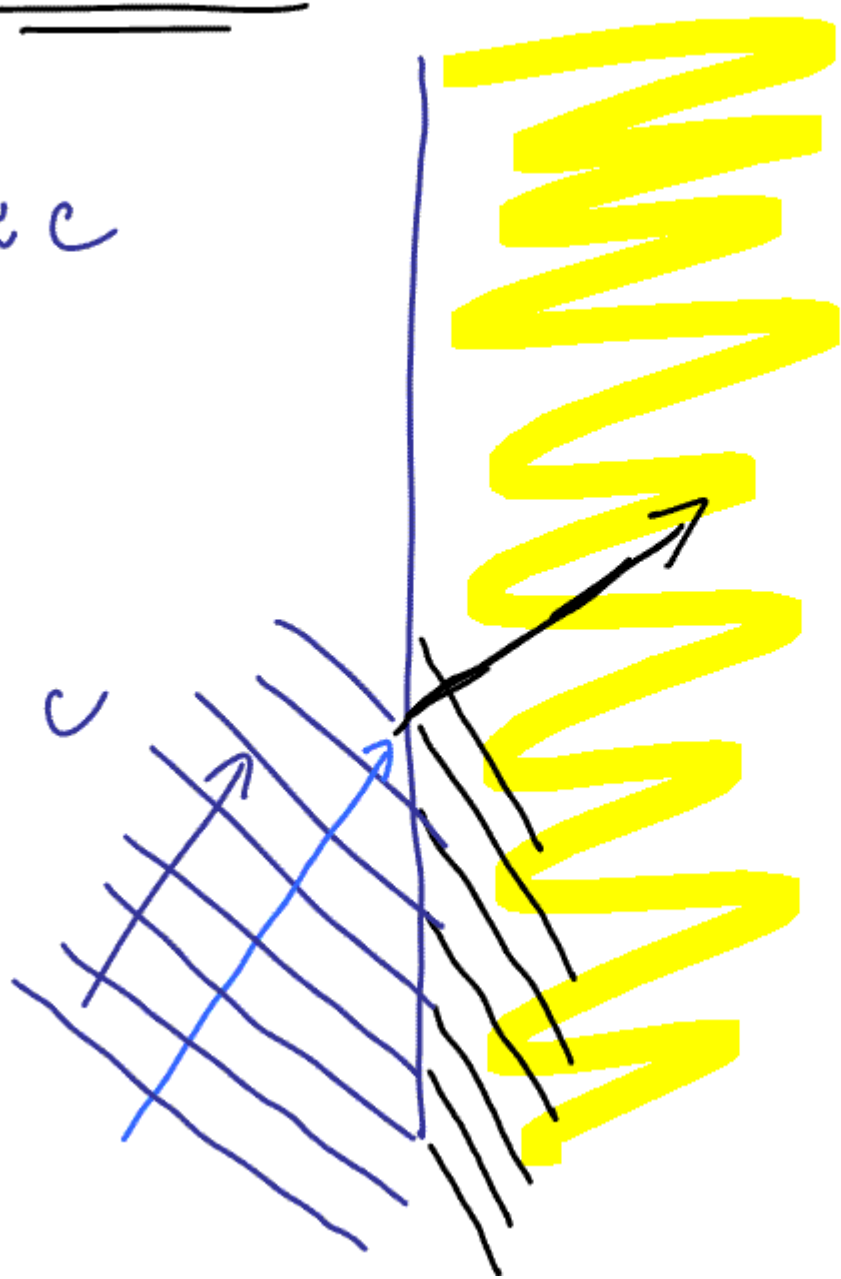
$v_{air} \approx c$

$v_{glass} = \frac{c}{n}$

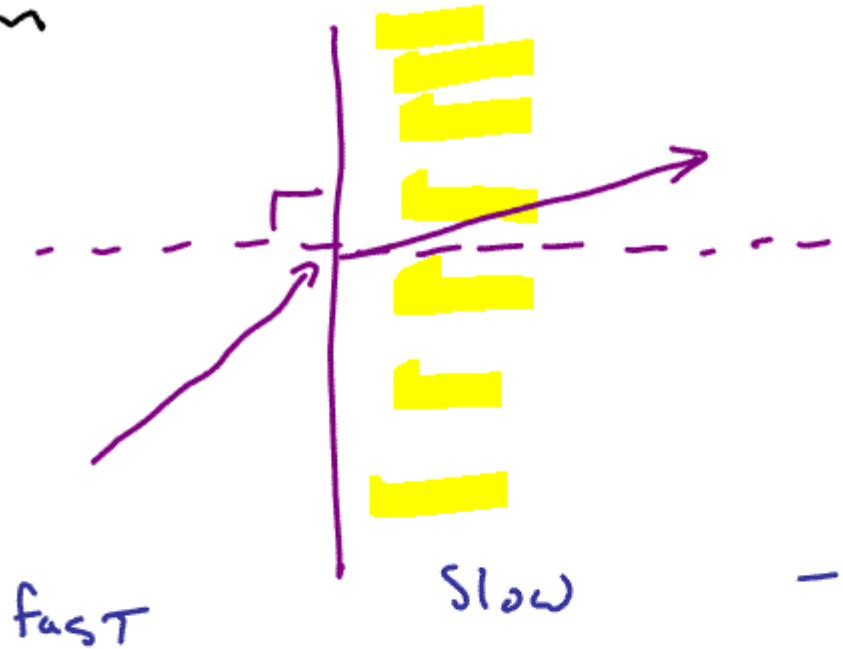
1.3

Index of refraction

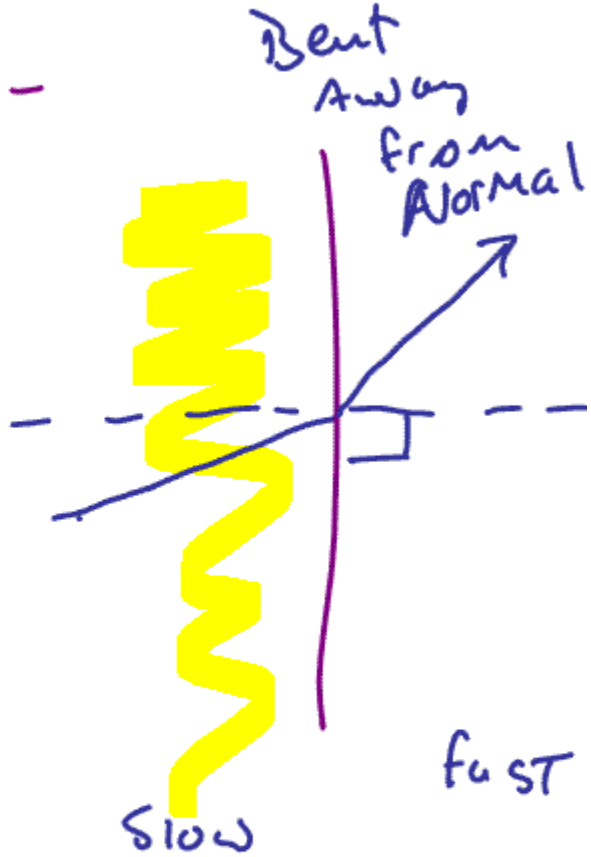
Glass



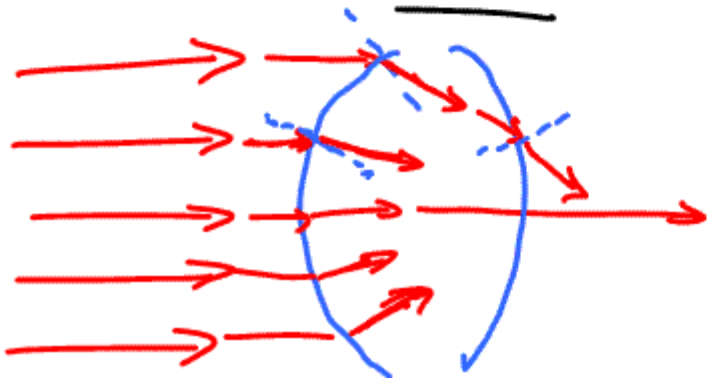
Refraction



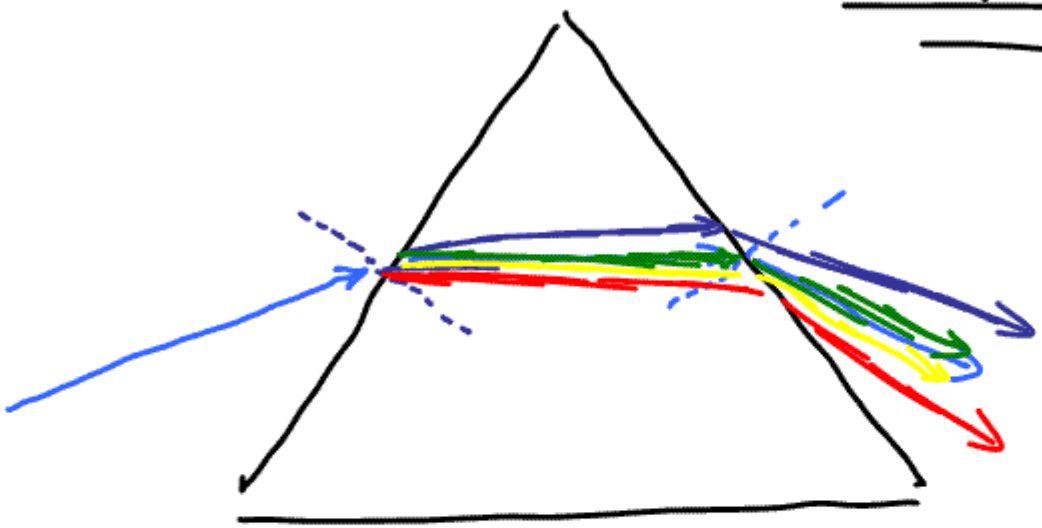
Bent Toward Normal



Lens

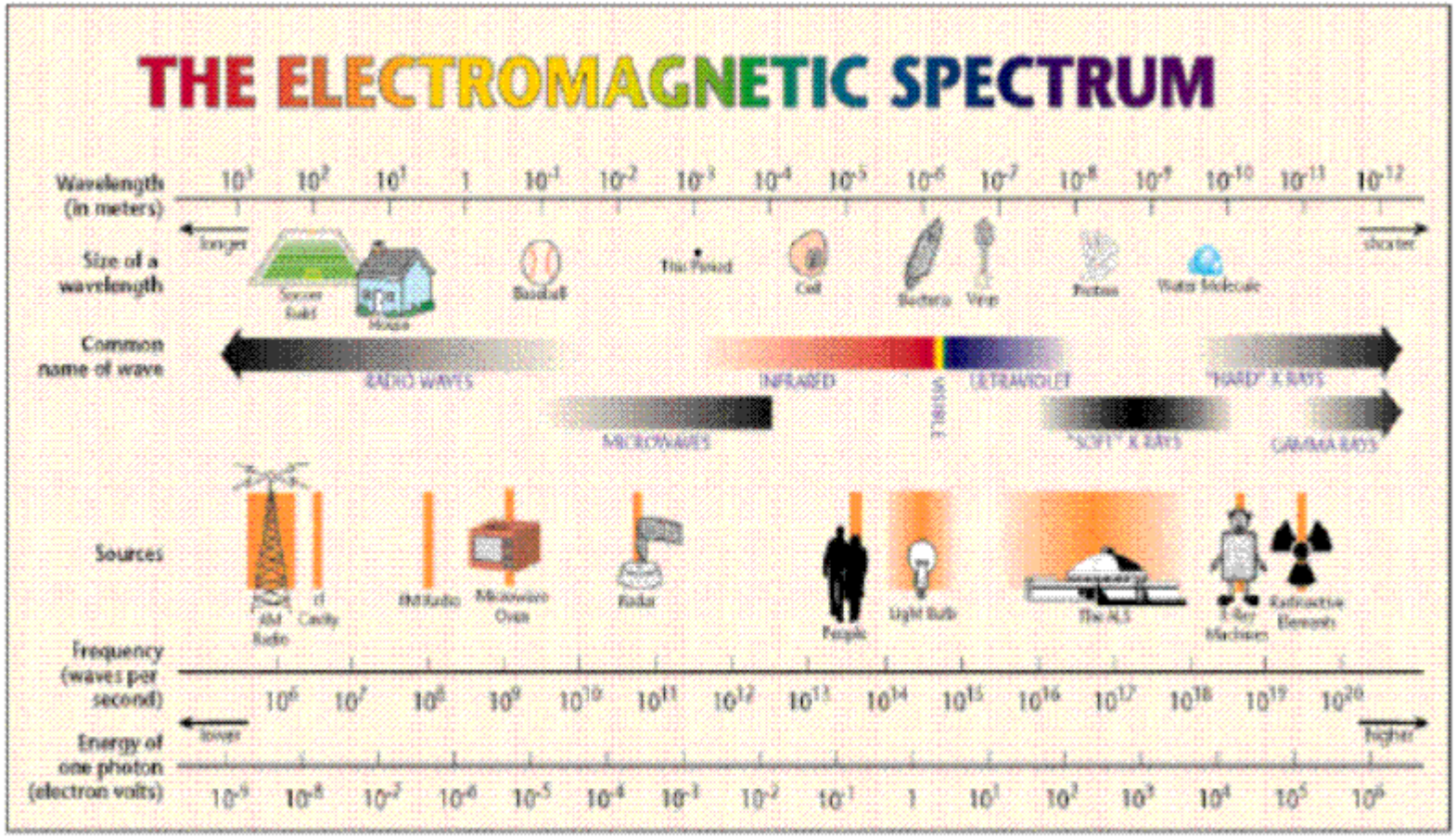


dispersion



Prism

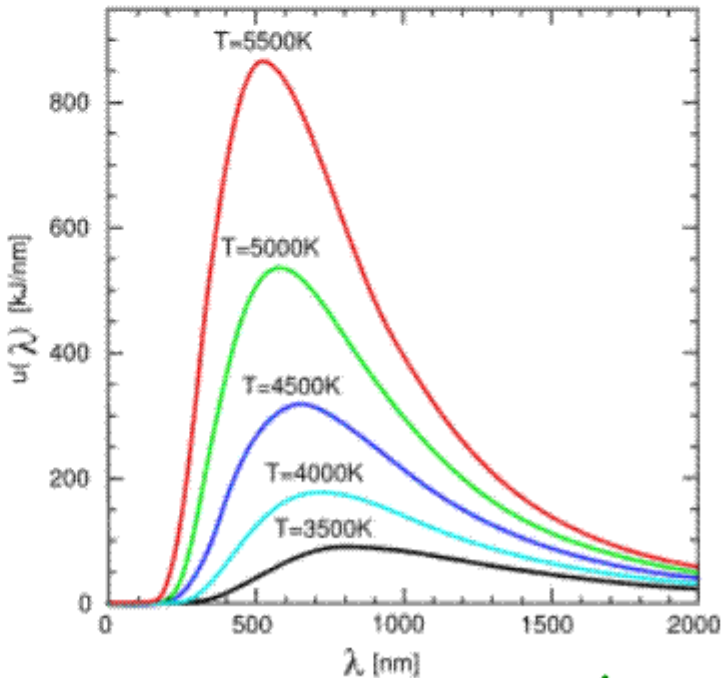
degree by which light is bent
depends on freqency


THE ELECTROMAGNETIC SPECTRUM
Wavelength (in meters)
Size of a wavelength
Common name of wave
Sources
Frequency (waves per second)
Energy of one photon (electron volts)
Longer
Shorter
Lower
Higher
Soccer Field
House
Basketball
Pinhead
Cell
Bacteria
Virus
Protein
Water Molecule
RADIO WAVES
MICROWAVES
INFRARED
VISIBLE
ULTRAVIOLET
"SOFT" X RAYS
"HARD" X RAYS
GAMMA RAYS
AM Radio
FM Radio
Microwave Oven
Radar
People
Light Bulb
The Sun
X-Ray Machines
Radioactive Elements

Max Planck
(1858-1947)
German national

Awarded 1918 Nobel Prize in physics for analysis of blackbody radiation which contributed to rise of quantum Mechanics

http://www-history.mcs.st-andrews.ac.uk/Mathematicians/Planck.html



-fig from Wikipedia - "blackbody"