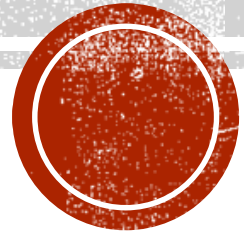
ITMD-362 WEEK 8

February 27, 2018

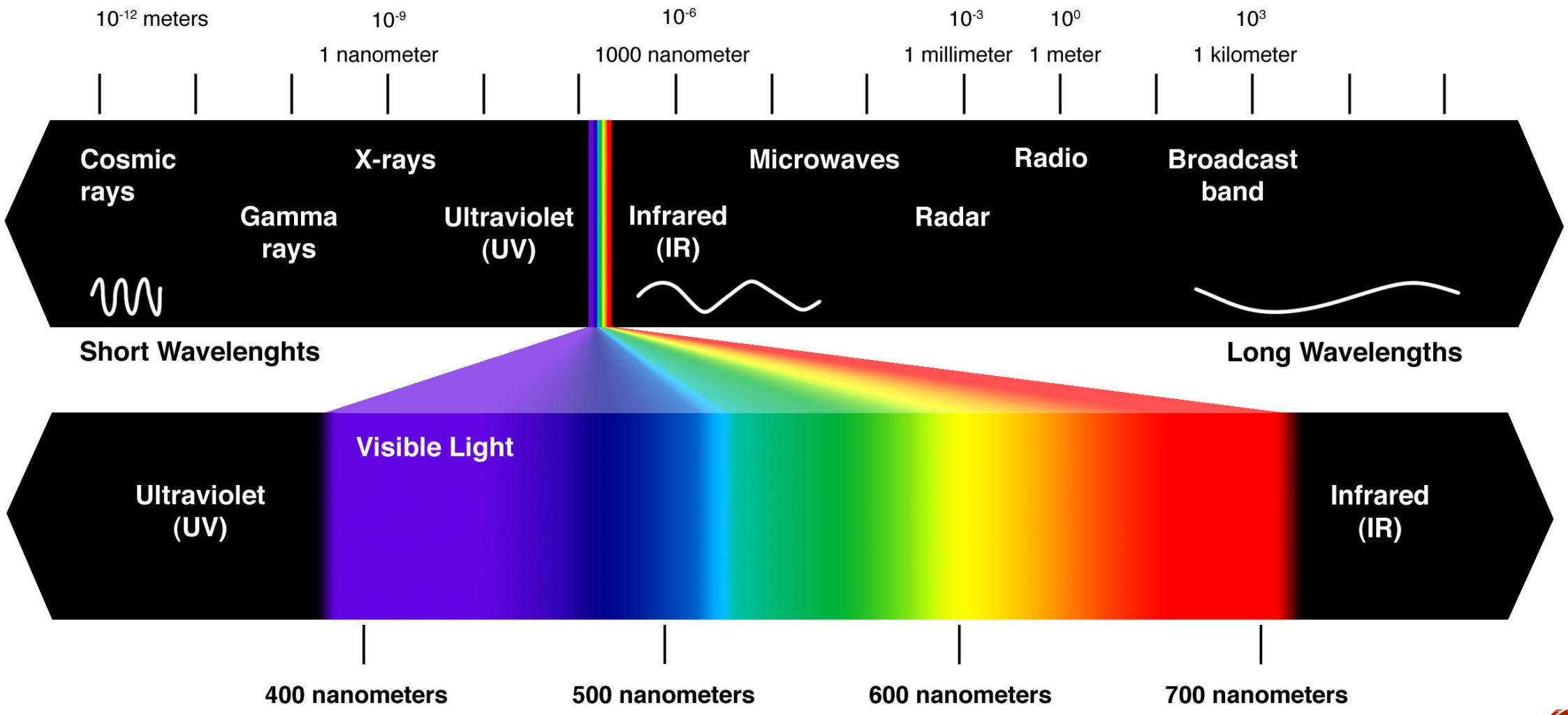


TONIGHT'S AGENDA

- Lab 4
- Color: Introduction
- Visible Light
- Color Systems
- Color Combos Matter
- Color Palette: Tools

Color: Introduction

ELECTROMAGNETIC SPECTRUM



WHAT IS A WAVE?

DESCRIBING ELECTROMETRIC WAVES

- Frequency *f*
  - Measured in Hertz
  - Cycles (peaks) per second
- Wavelength λ
  - Measured in distance between wave peaks
  - Inversely proportional to the frequency
  - Short as an atom to as long as a universe. Yes, a Universe.
- Photon energy *E*
  - Directly proportional to the wave frequency
  - Amount of energy carried by a single photon
  - Not to be confused with Watts (though related).

FREQUENCY

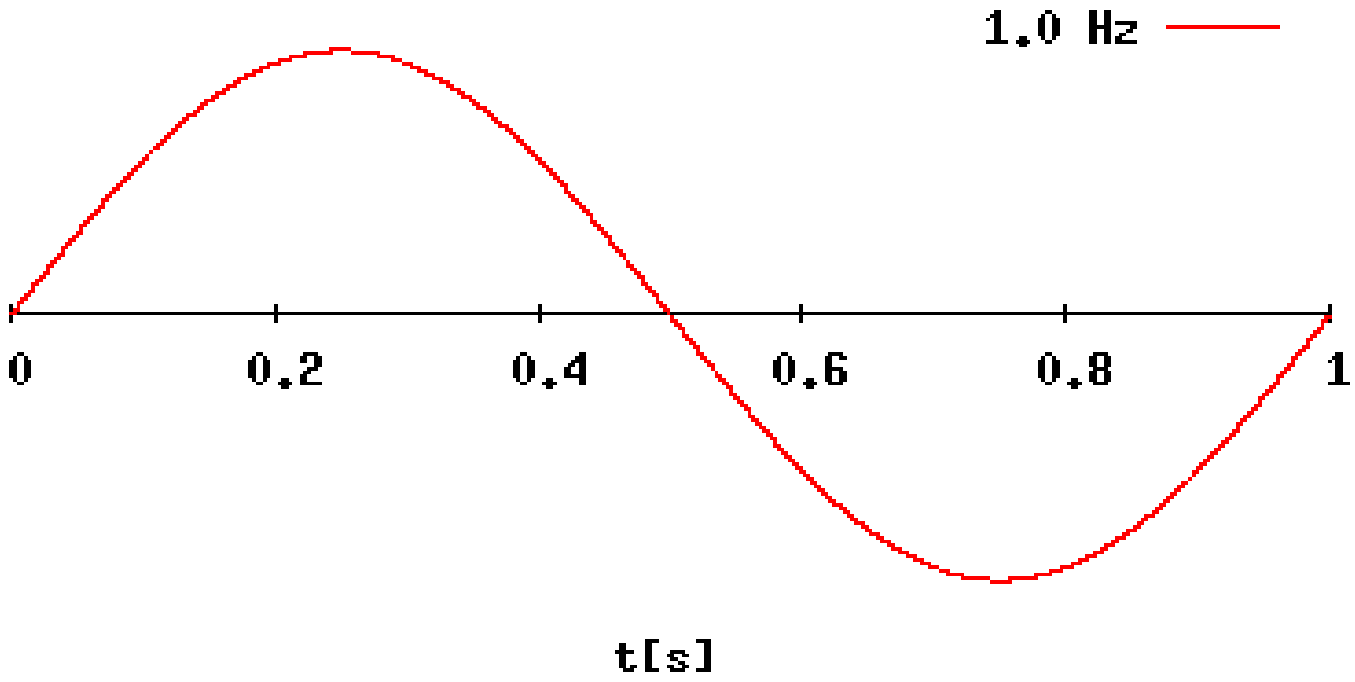
Hz = CYCLES PER SECOND

f = 0.5 Hz
T = 2.0 s

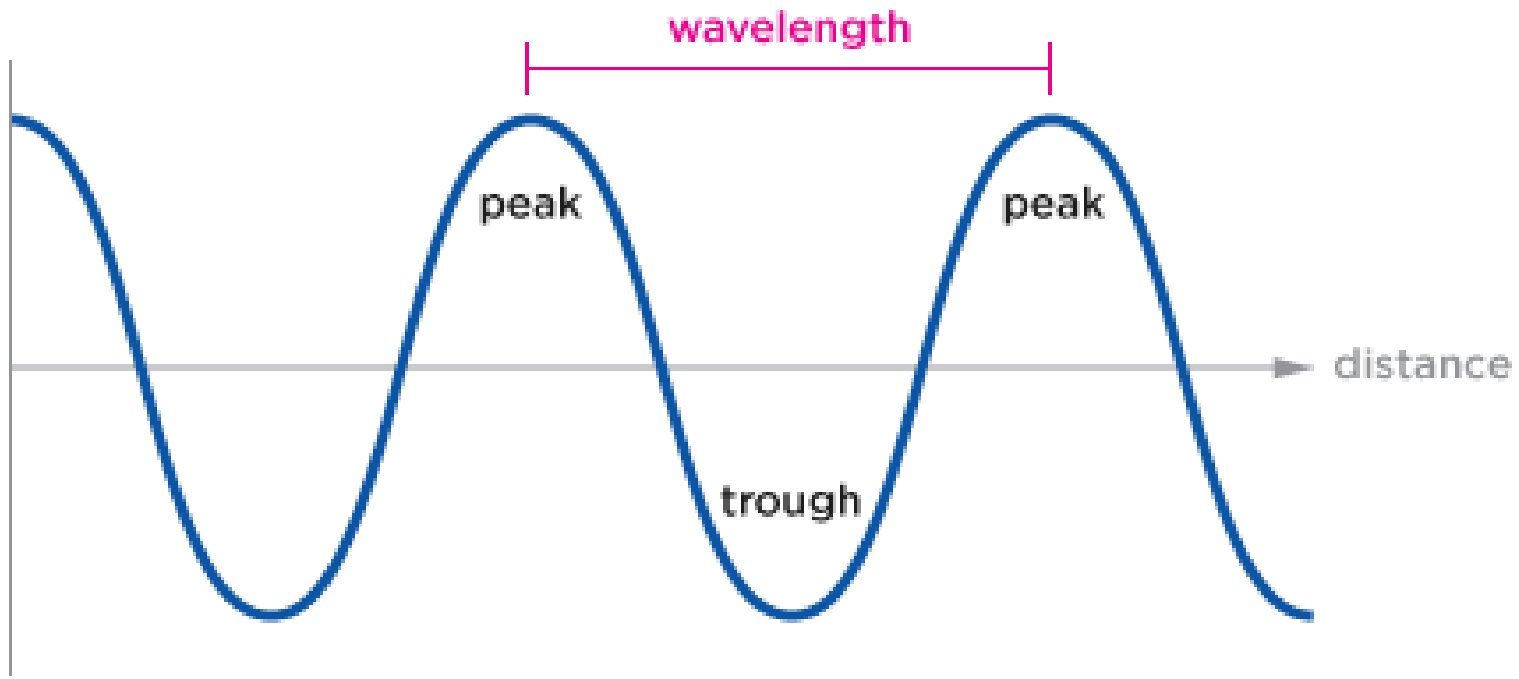
f = 1.0 Hz
T = 1.0 s

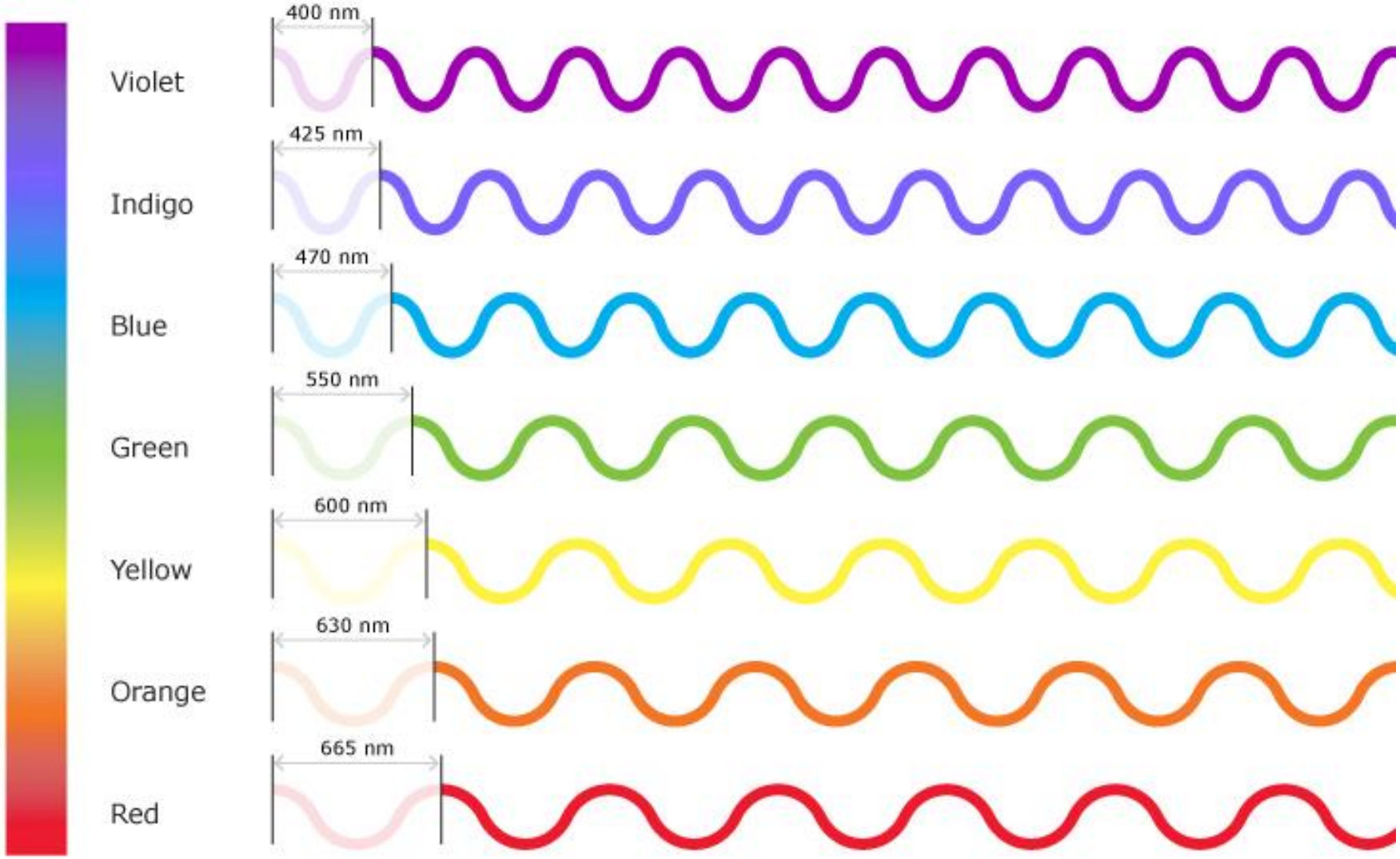
f = 2.0 Hz
T = 0.5 s

FREQUENCY

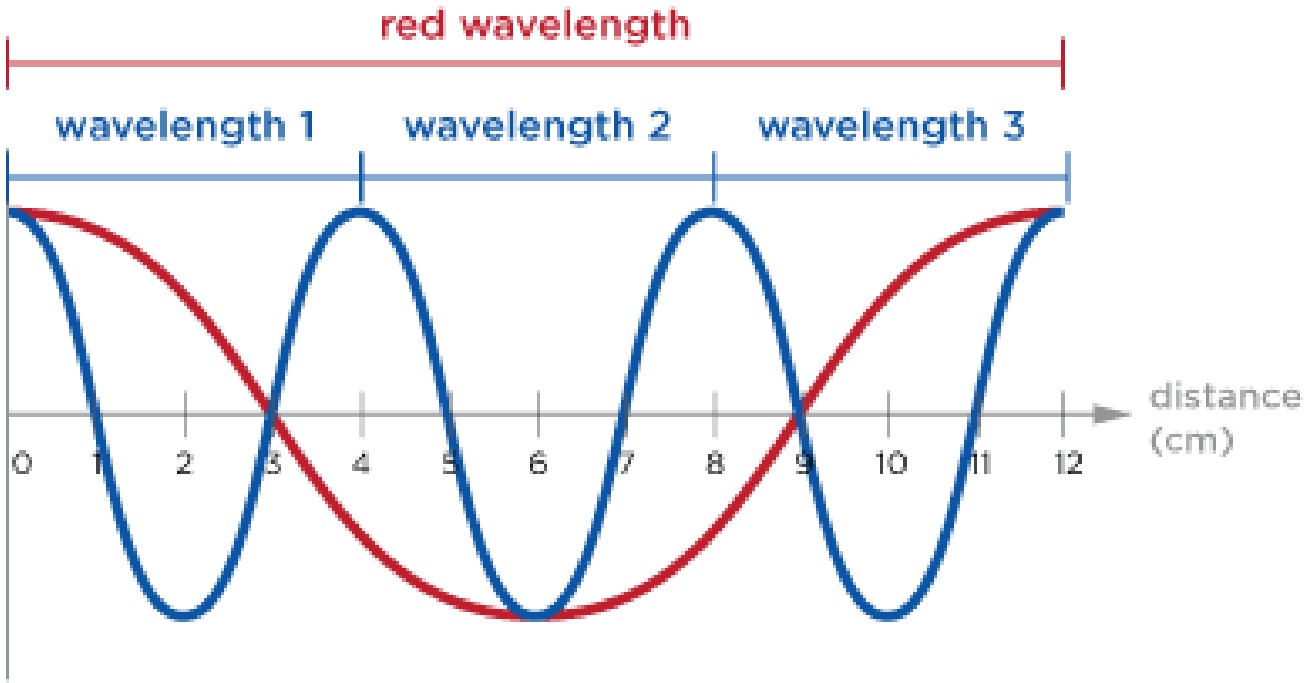


WAVELENGTH: DISTANCE BETWEEN PEAKS



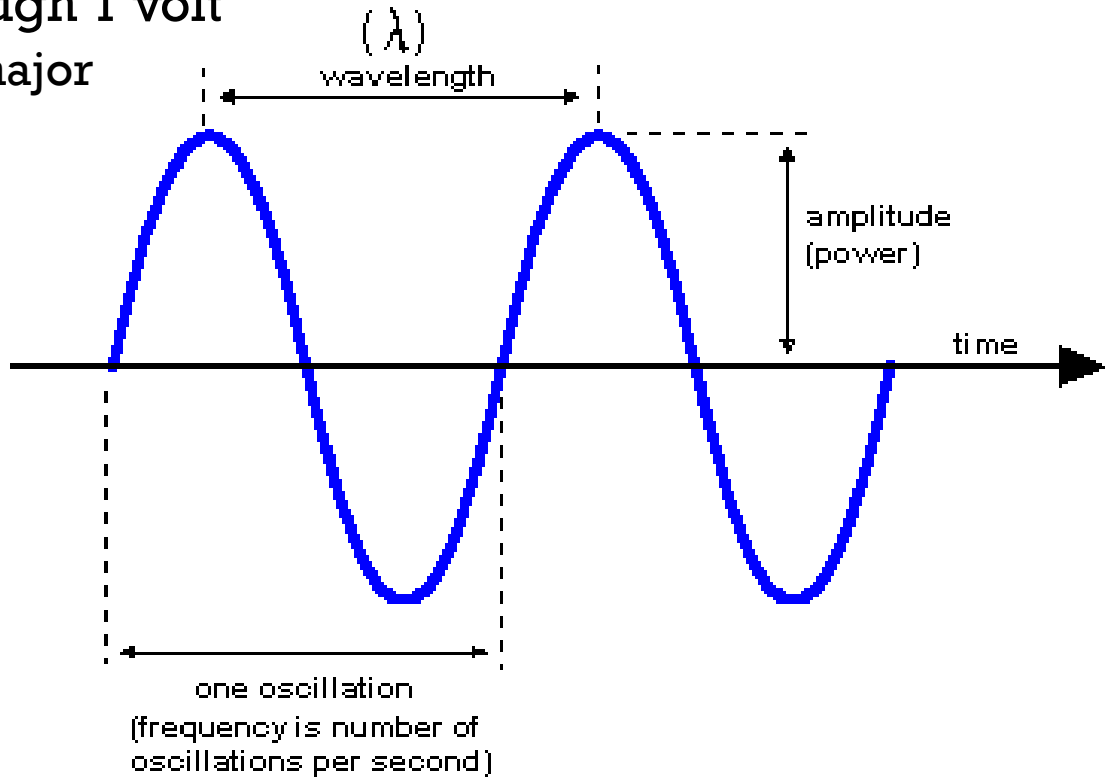


WAVELENGTH: RELATIVE COMPARISON



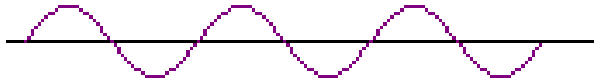
POWER (AMPLITUDE): WAVE HEIGHT

- Watt = work done by 1 amp flowing through 1 volt
  - Not a physics class and I'm not a physics major
- Increased power, increases wave height
  - Does not increase wave frequency
- Again, related to Photon power
  - But different

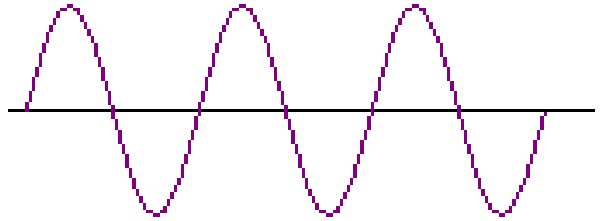


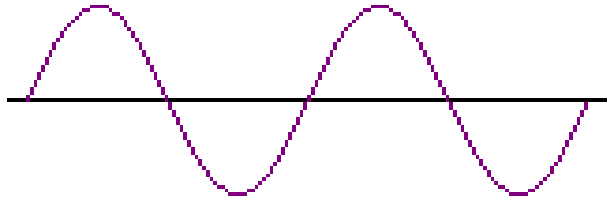
POWER VS. FREQUENCY

Low Power

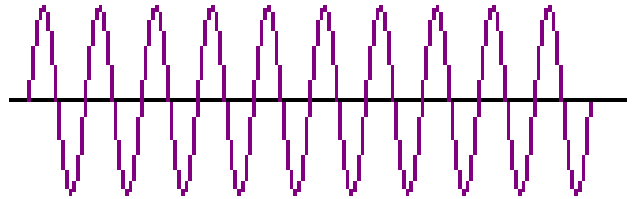


High Power





Low Frequency

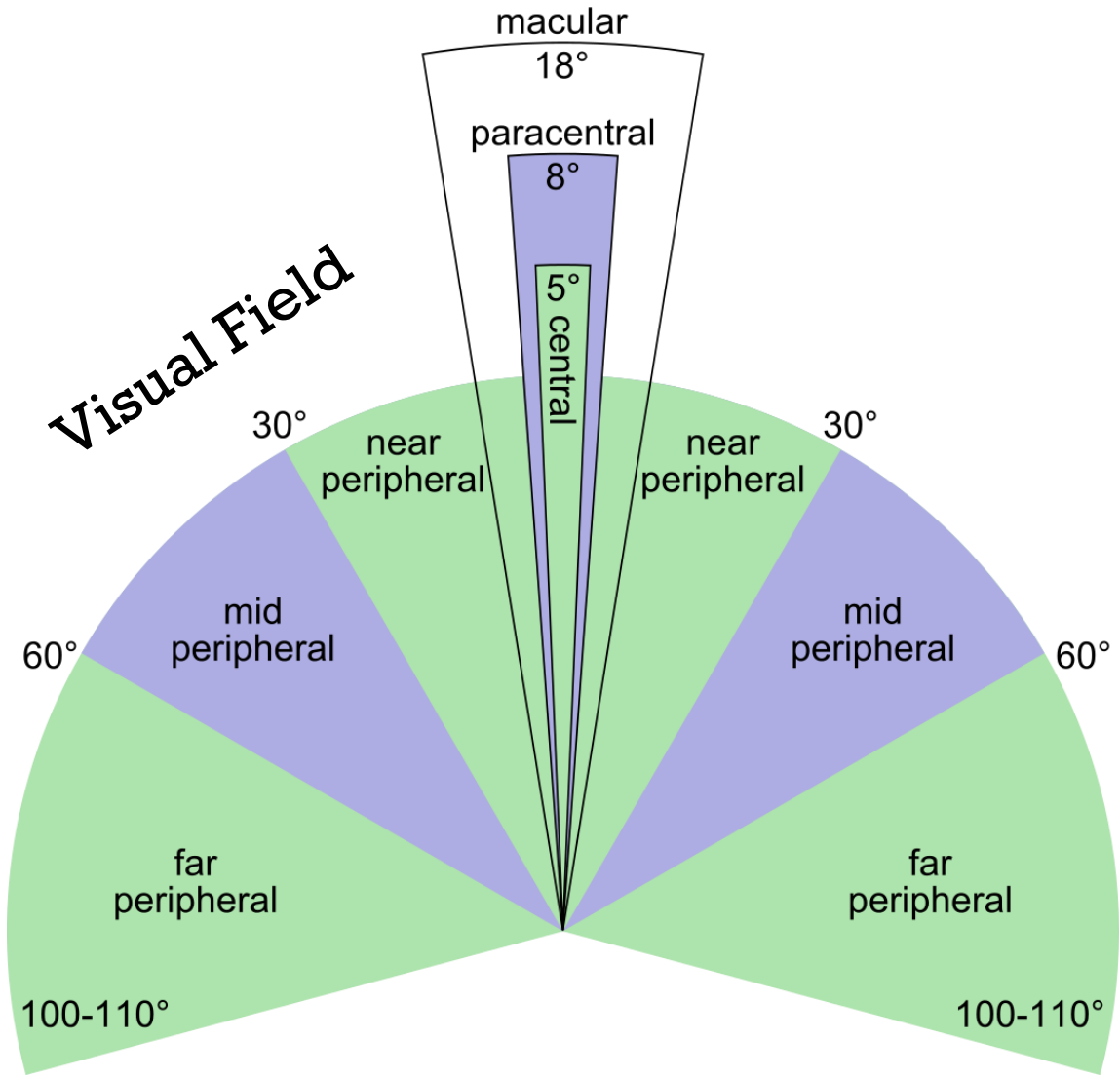


High Frequency

Visible Light

VISIBLE LIGHT

- Cones and Rods
  - Cones see color
  - Rods see shape
- Photosensitive retinal ganglion
  - New receptor (1990)
  - circadian rhythms
  - pupillary reflex
  - conscious vision

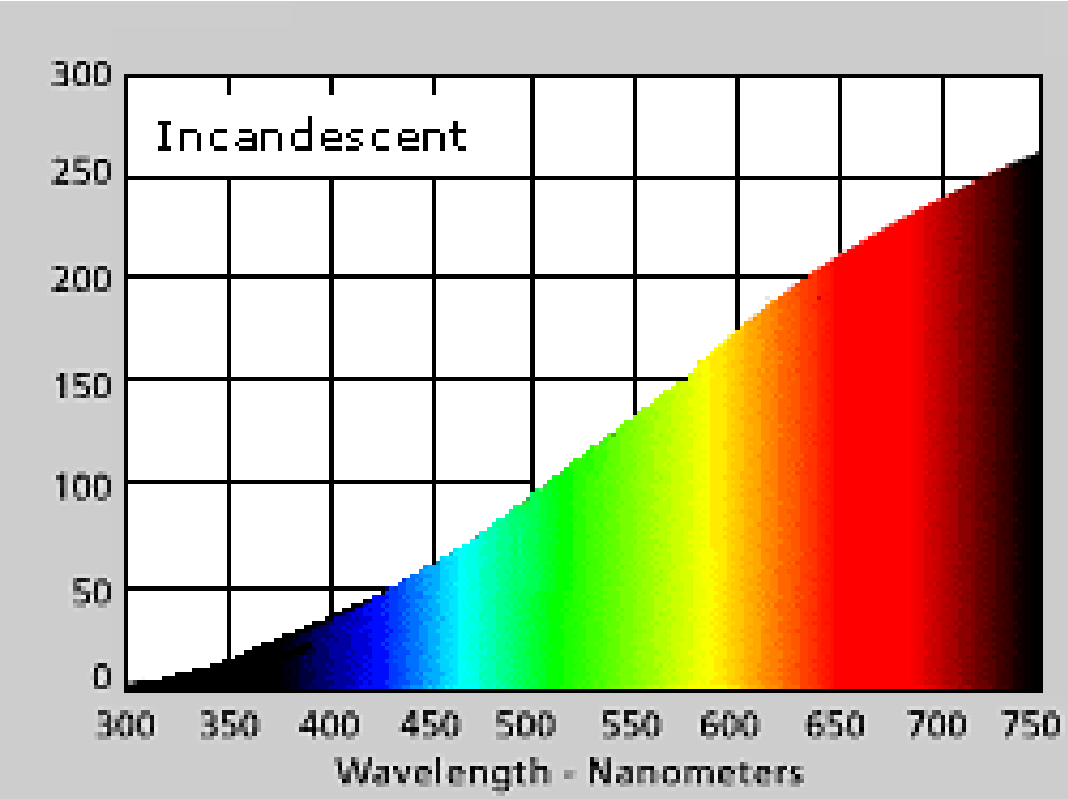


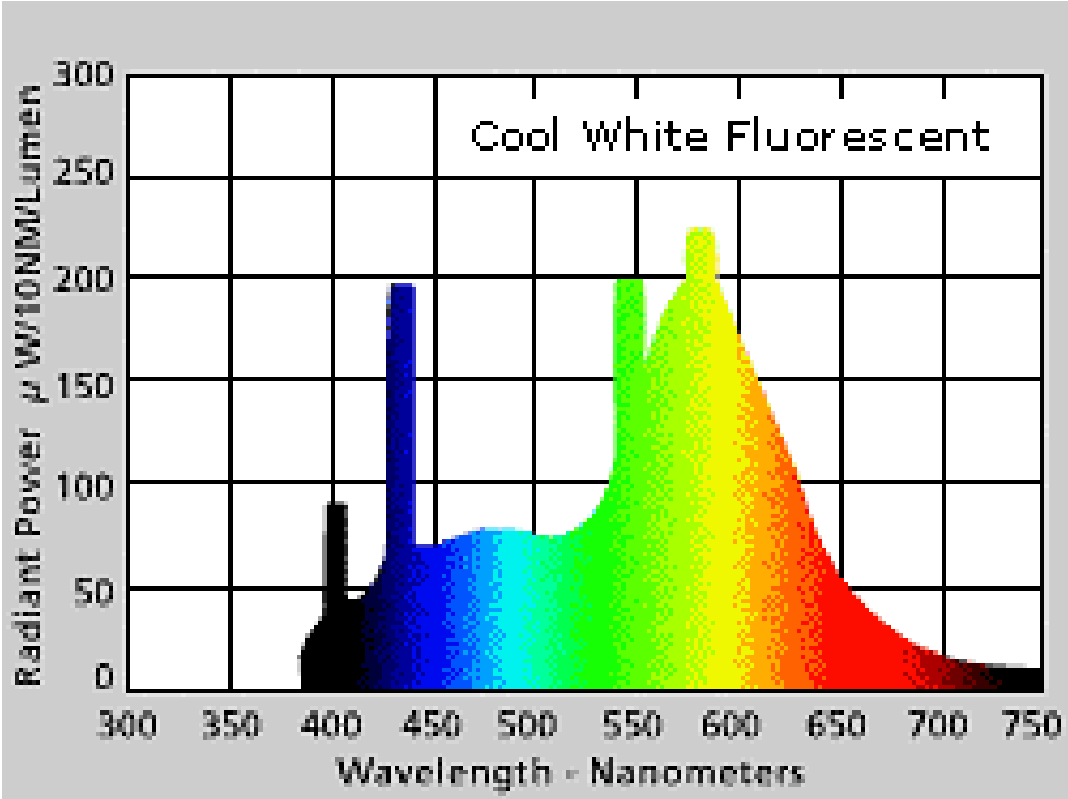
DESCRIBING VISIBLE LIGHT

- Photometric (experience) vs. Radiometric (real power)

Photometric	Radiometric
Lumen	Watt
Luminance	Radiance
Luminous Flux	Radiant Flux
Luminous Intensity	Radiant Intensity

SPECTRAL POWER: DIFFERENT EXPERIENCE

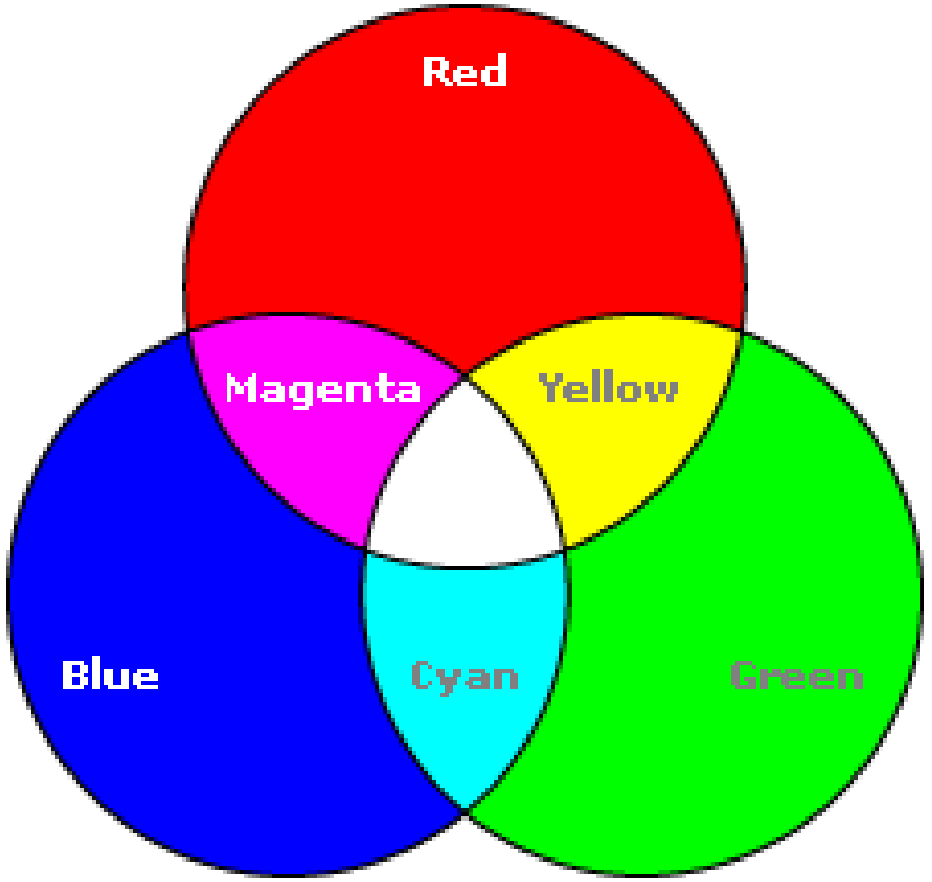




Color Systems

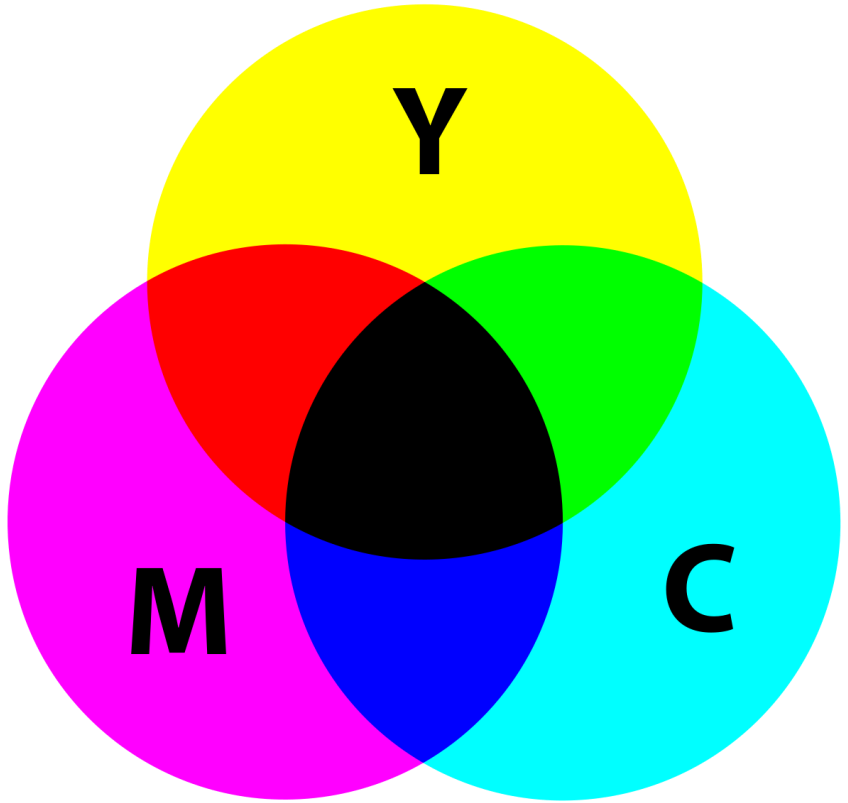
ADDITIVE: LIGHT EMITTING SOURCE

- Red, Green, and Blue (RBG)
- New Colors made from mixing wavelengths
  - White=all/many colors emitted
  - Black=no color/light emitted

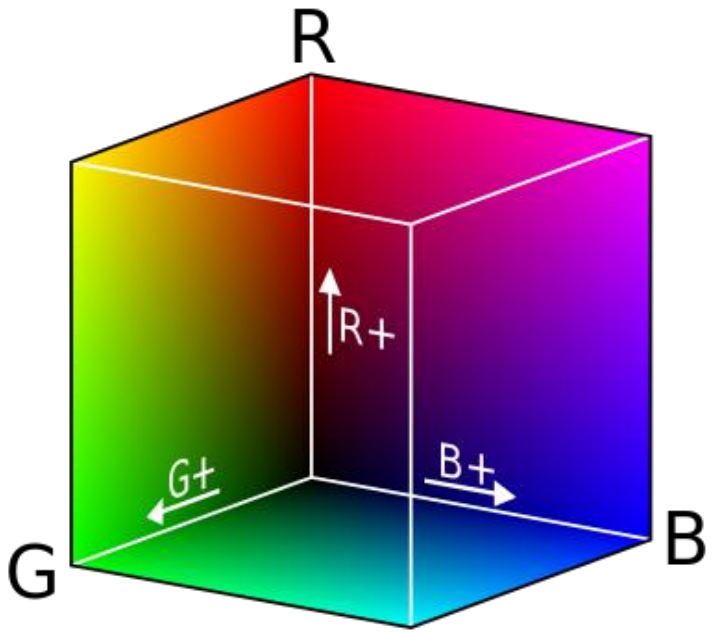


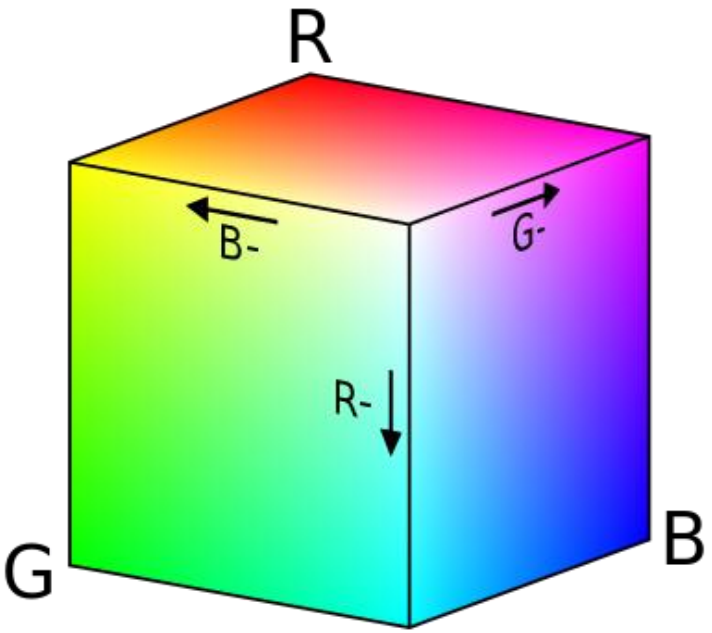
SUBTRACTIVE: LIGHT REFLECTIVE SOURCE

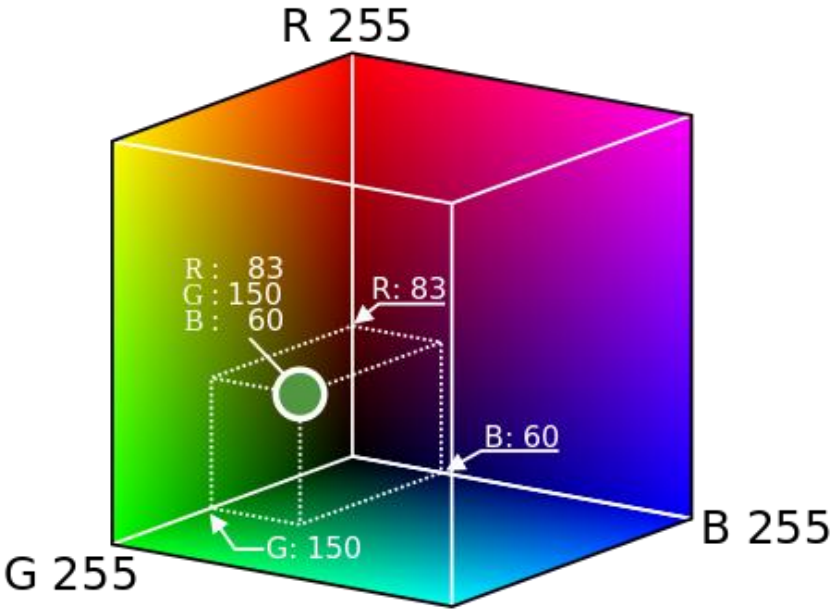
- Cyan, Magenta, and Yellow (CMY)
- New Colors made from reflecting wavelengths
  - White=all/many colors reflected
  - Black=no color/light reflected
- Black is CMY+Key = (CMYK)
  - 100% CMY mix is wet and messy
  - Black ink is special low water mix
- Why black hats are hotter than white hats



RBG = COORDINATES

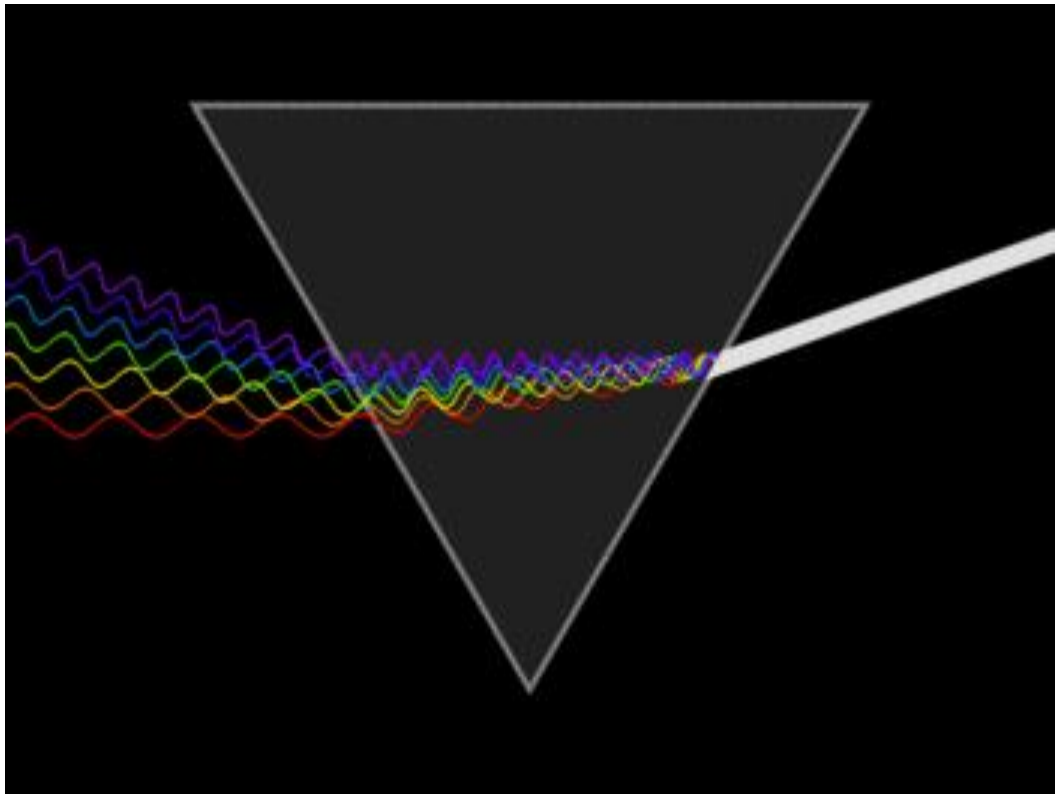




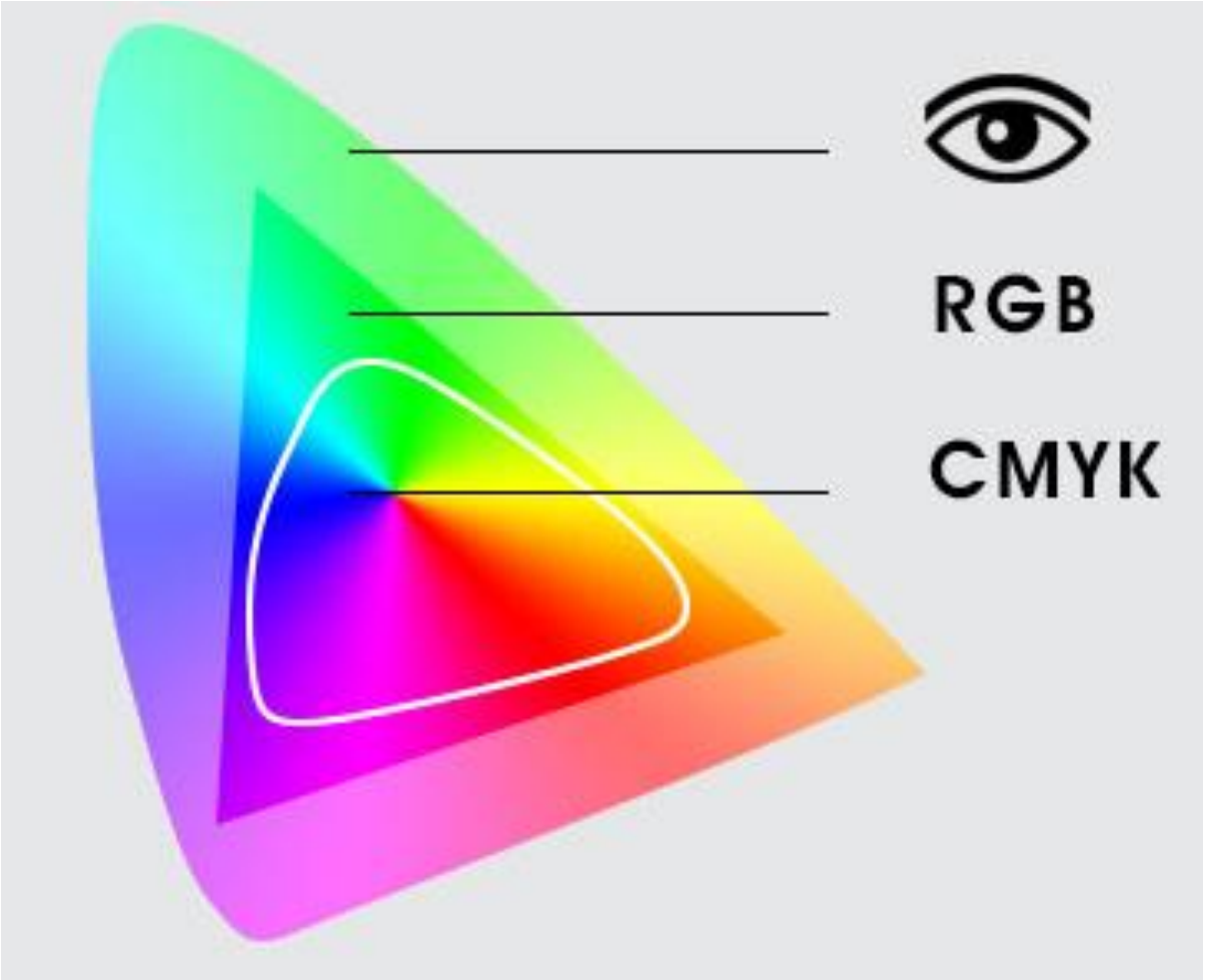


NEITHER MIX IS THE FULL COLOR SPECTRUM

We actually don't have a means of perfectly producing the full spectrum except by splitting pure white light.

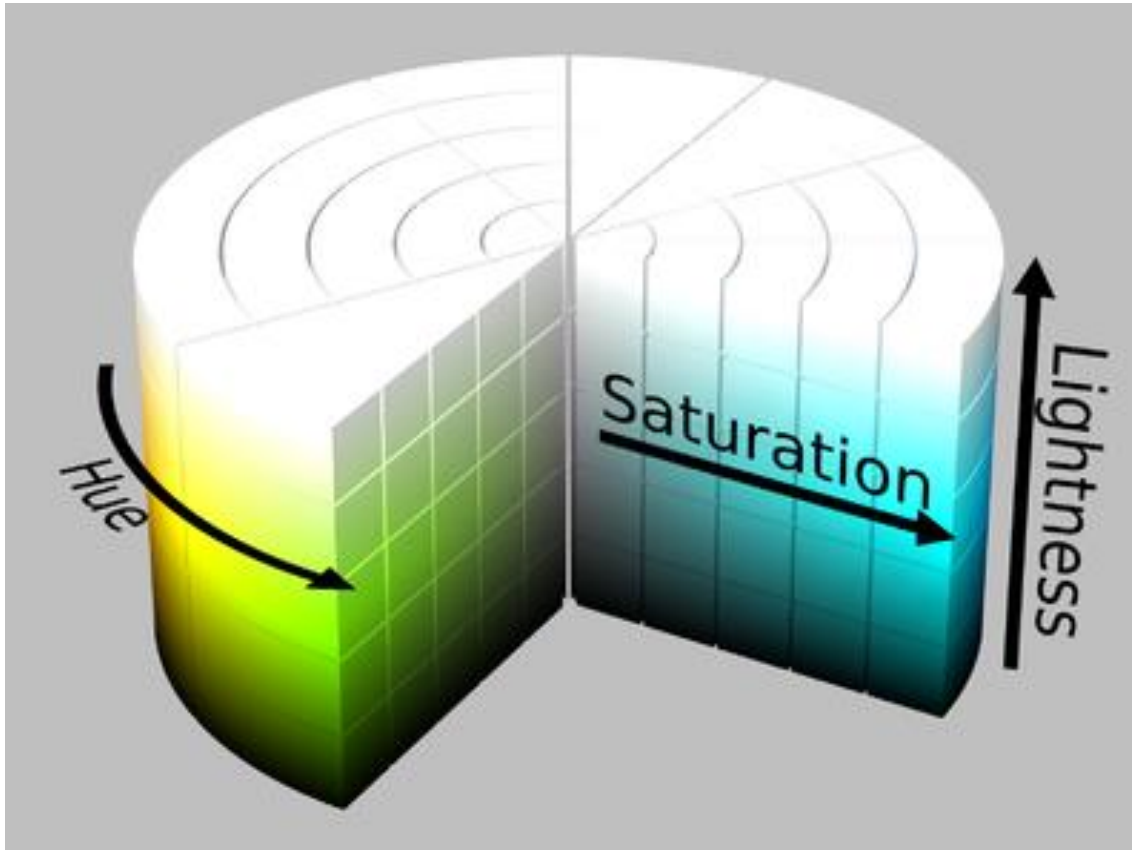


COLORS WE CAN MAKE: "COLOR GAMUT" 16 MILLION COLORS



COMPONENTS OF COLOR

- Hue: Position on the color wheel
  - 0 to 359°
- Saturation: Bandwidth of wave
  - (pixel purity on a screen)
- Brightness: Experience
  - Light type determines color experience



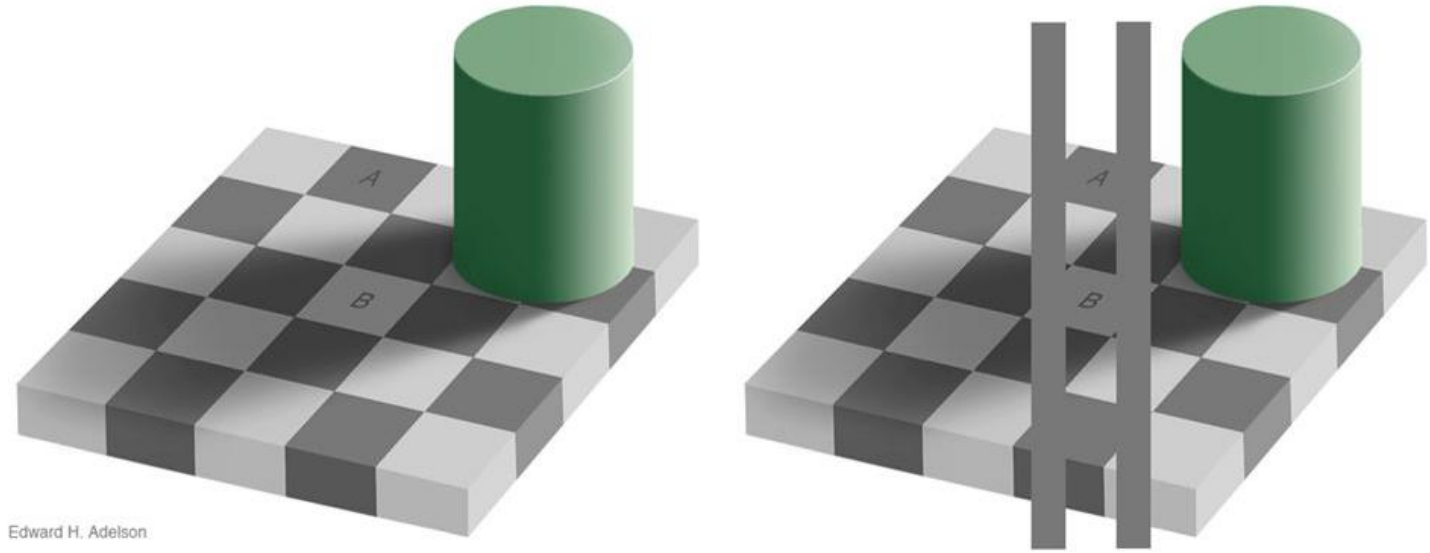
WHITE LIGHT:
COLOR TEMPERATURE

Temperature	Source
1700 K	Match flame, low pressure sodium lamps (LPS/SOX)
1850 K	Candle flame, sunset/sunrise
2400 K	Standard incandescent lamps
2550 K	Soft white incandescent lamps
2700 K	"Soft white" compact fluorescent and LED lamps
3000 K	Warm white compact fluorescent and LED lamps
3200 K	Studio lamps, photofloods, etc.
3350 K	Studio "CP" light
5000 K	Horizon daylight
5000 K	Tubular fluorescent lamps or cool white/daylight compact fluorescent lamps (CFL)
5500 – 6000 K	Vertical daylight, electronic flash
6200 K	Xenon short-arc lamp[3]
6500 K	Daylight, overcast
6500 – 9500 K	LCD or CRT screen
15,000 – 27,000 K	Clear blue poleward sky
These temperatures are merely characteristic; there may be considerable variation.	

Color Combos Matter

COLOR COMBOS CHANGE THE EXPERIENCE

Link



Proof: They are the same. The shadow causes an illusion of white.

Color Palette: Tools

FREE TOOLS: CHOOSE YOUR SCHEME

- Steps:
  1. Chose Color Rule
  2. Pick hue (color)
  3. Focus in on shade.
- Paletton: Link
  - Simple: for beginners
  - Three steps are separate
- Adobe Color CC: Link
  - More detailed
  - More control
  - Easier to get confused


Thank you
Thank you very much