Earth Science

With

Mr. Thomas

Stars

give us

Energy

and

Light

Stars

- Definition of Light:
  - A form of electromagnetic energy (Energy that travels in waves)
  - This energy travels at a speed of:

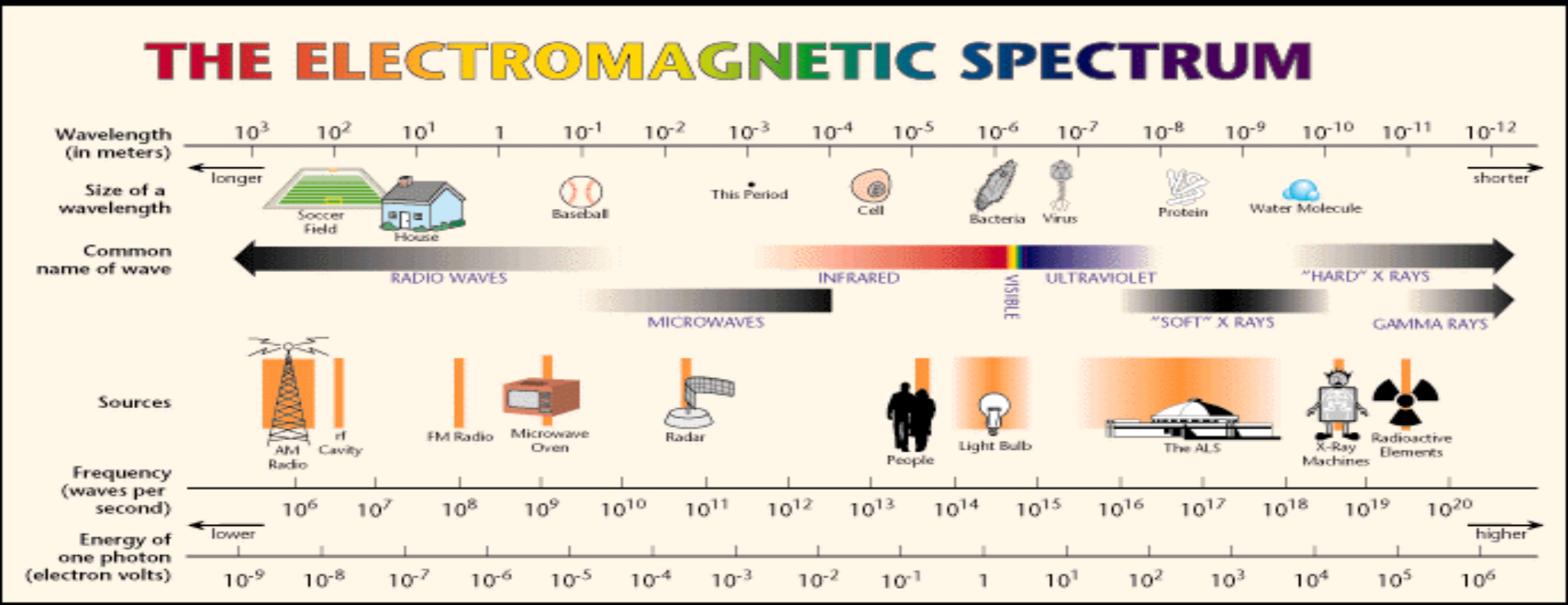
300,000 km/s

The speed of light!

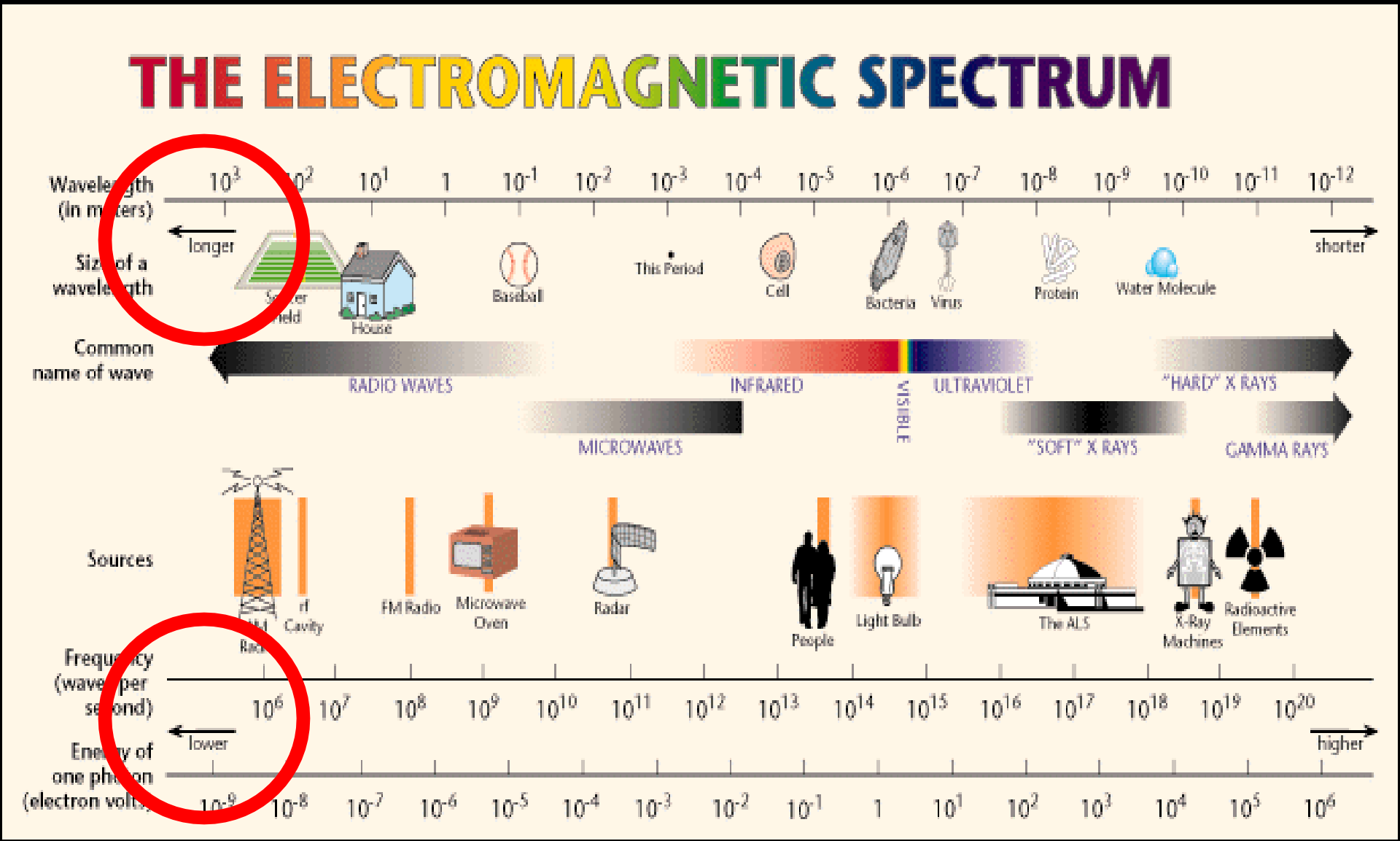
Stars

- Stars like our sun emit a wide range of wavelengths that create the

Electromagnetic Spectrum



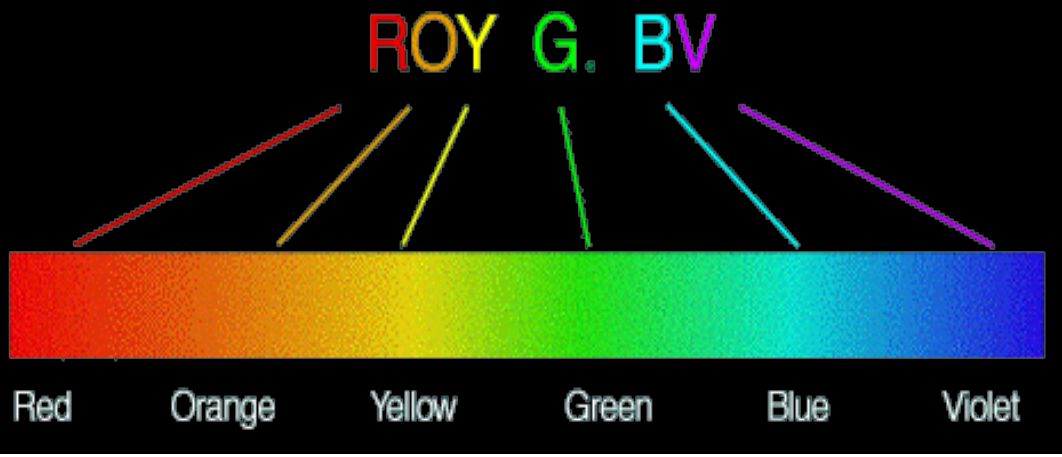
Stars

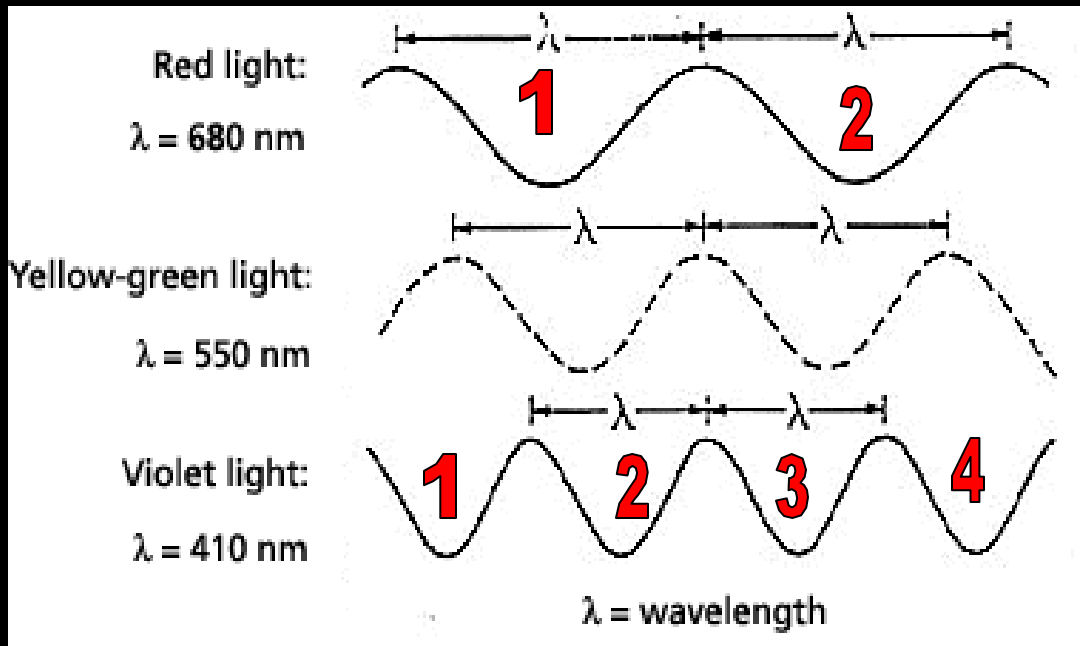

THE ELECTROMAGNETIC SPECTRUM
Wavelength (in meters)
10^{3} 10^{2} 10^{1} 1 10^{-1} 10^{-2} 10^{-3} 10^{-4} 10^{-5} 10^{-6} 10^{-7} 10^{-8} 10^{-9} 10^{-10} 10^{-11} 10^{-12}
longer
shorter
Size of a wavelength
Soccer Field
House
Baseball
This Period
Cell
Bacteria
Virus
Protein
Water Molecule
Common name of wave
RADIO WAVES
INFRARED
VISIBLE
ULTRAVIOLET
"HARD" X RAYS
MICROWAVES
"SOFT" X RAYS
GAMMA RAYS
Sources
Radio
rf Cavity
FM Radio
Microwave Oven
Radar
People
Light Bulb
The ALS
X-Ray Machines
Radioactive Elements
Frequency (waves per second)
10^{6} 10^{7} 10^{8} 10^{9} 10^{10} 10^{11} 10^{12} 10^{13} 10^{14} 10^{15} 10^{16} 10^{17} 10^{18} 10^{19} 10^{20}
lower
higher
Energy of one photon (electron volts)
10^{-9} 10^{-8} 10^{-7} 10^{-6} 10^{-5} 10^{-4} 10^{-3} 10^{-2} 10^{-1} 1 10^{1} 10^{2} 10^{3} 10^{4} 10^{5} 10^{6}

Stars

- Looking at just the part of the E.M. spectrum that contains visible light & the energy waves associated with a few colors:

- Higher Energy = Higher Frequency





Stars

- Because each color has a specific energy & associated wavelength, we can use a

Spectroscope

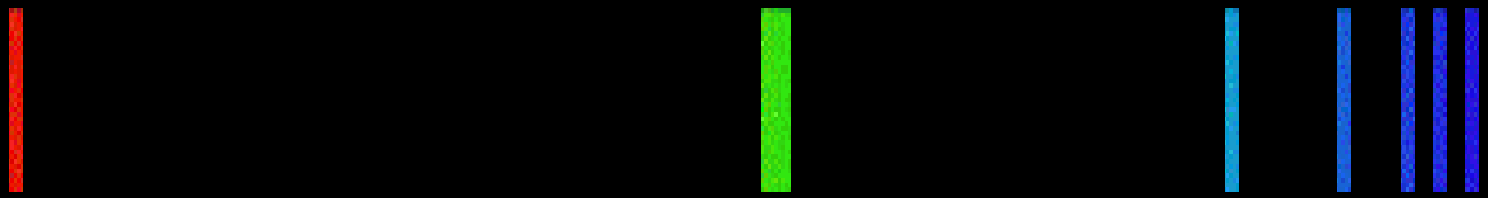
to identify which wavelengths are being produced by a distant star!

- Every gas when burned, creates a specific pattern of colors/wavelengths:

Emission Spectrum

Stars

- For example, if we look at the emission spectra for hydrogen:

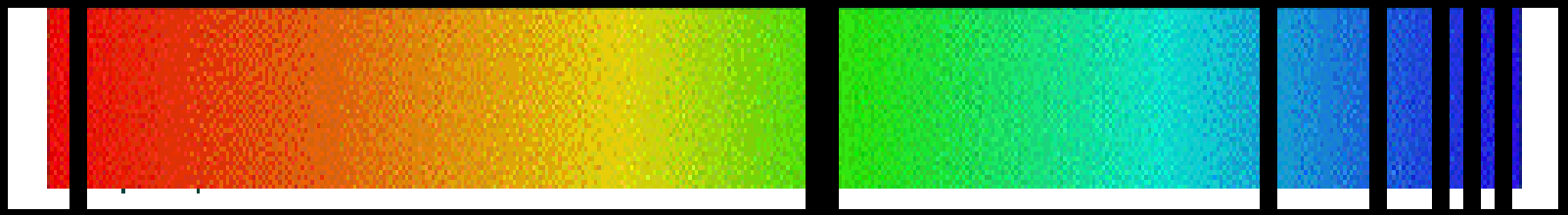


- For some gases, the color bands can be wide, while other times they are narrow.

stars

- The colors that are missing comprise the:

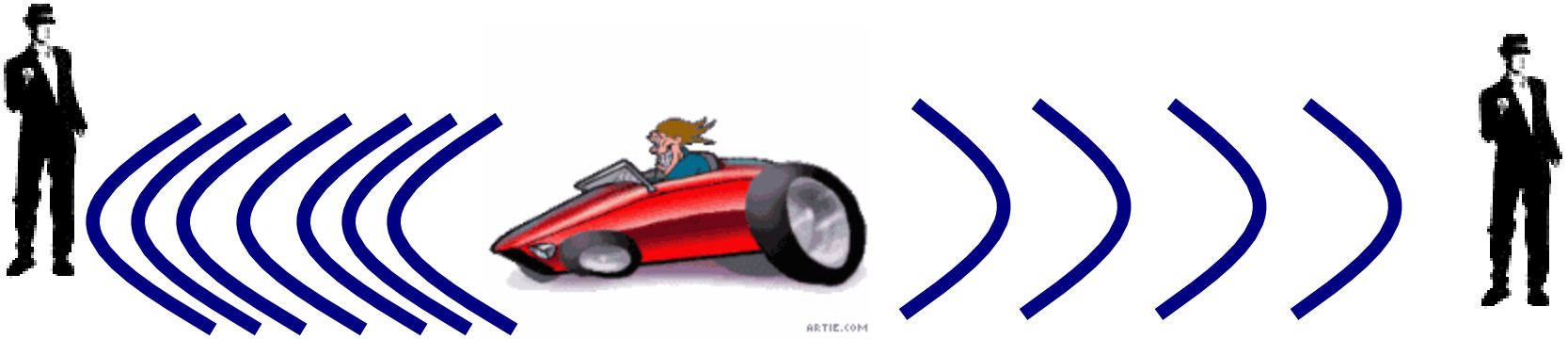
Absorption Spectrum



- Therefore, if we are looking through a spectroscope and see the color pattern for hydrogen, we know that particular star is burning hydrogen!

- Why does an ambulance sound higher pitched when it is coming towards you and lower pitched when it is going away from you?

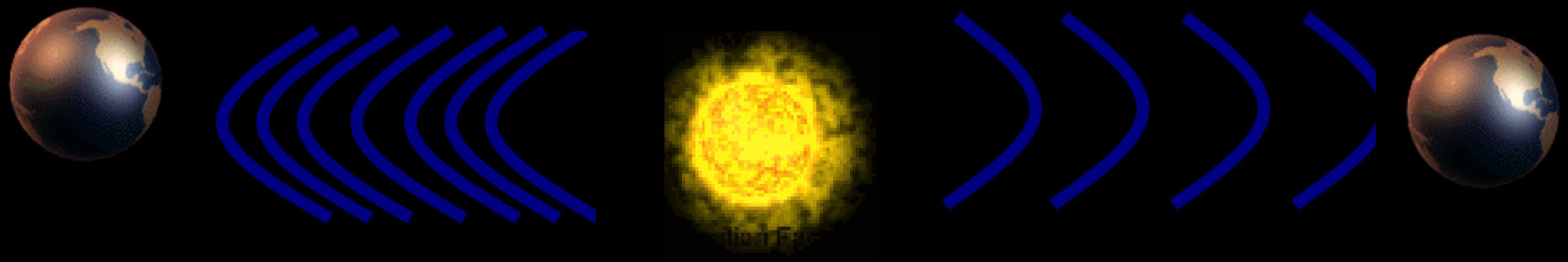
The Doppler Effect



Higher Energy
Higher Pitch

Lower Energy
Lower Pitch

- Now let's replace the car with a star!



Higher Energy

Colors shifted towards

Violet

Lower Energy

Colors shifted towards

Red

That's it