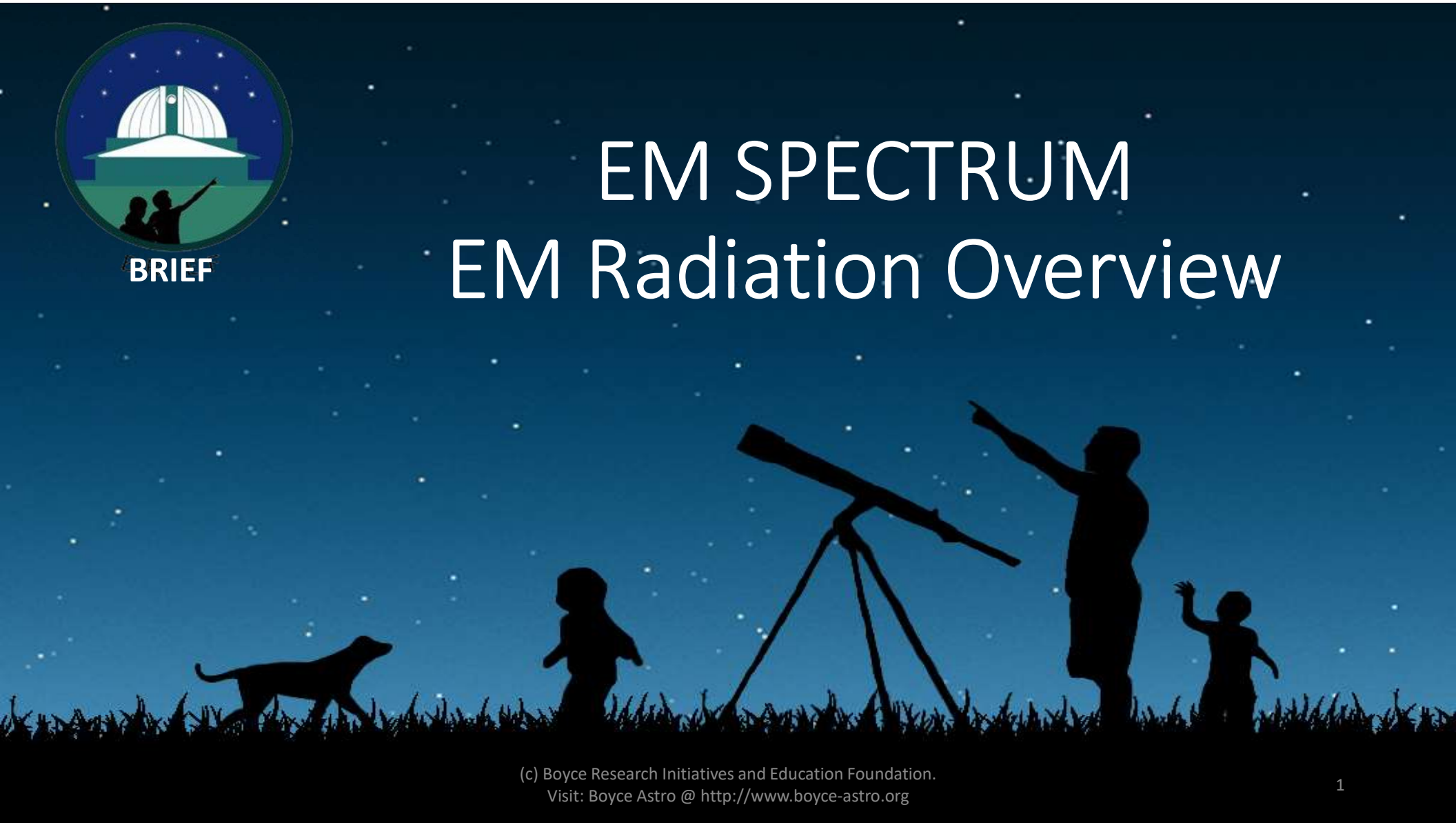
BRIEF

EM SPECTRUM
EM Radiation Overview



Overview

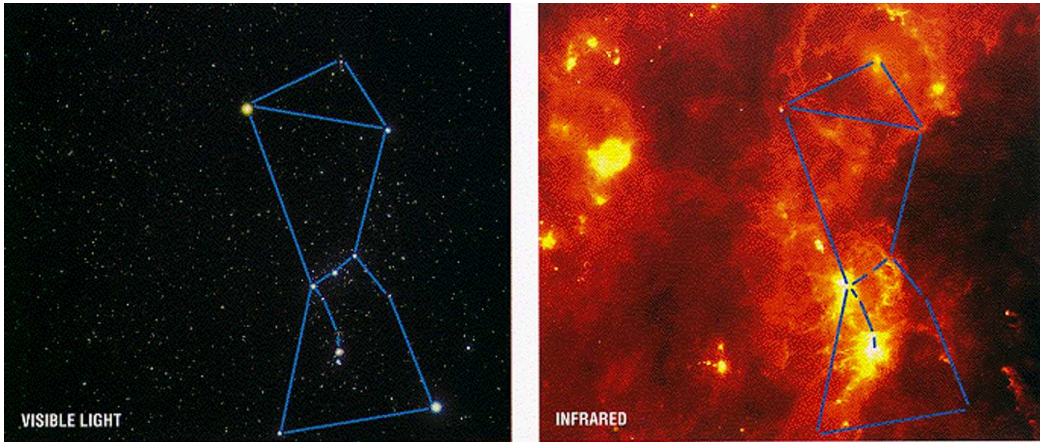
This lesson provides an introduction into Light.

Light is important to astronomers since this, basically, is what we have available from a celestial source from which to study it.

Understanding Electromagnetic (EM) Radiation is at the source of understanding Light

It is measured in Angstroms and Nanometers, for the most part.

We will use our understanding of Light when we: Select filters for imaging, study stellar properties, examine host stars for exoplanets, and other such areas of interest.

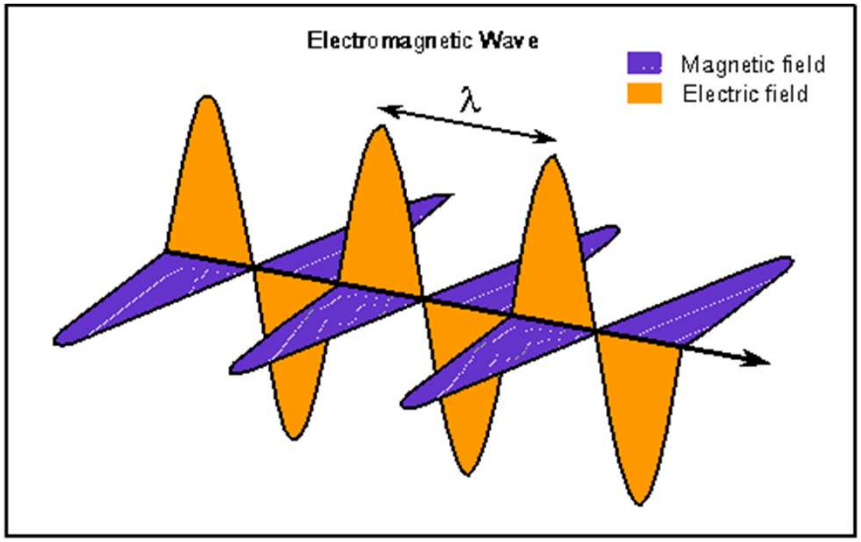


Light and EM Radiation As a Wave

In early 1800's scientists learned that electric & magnetic fields are intimately related: A moving electric charge creates a magnetic field

Said another way: A change in one, dictates a change in the other

Together the Electric Field & Magnetic Field for a self-propagating wave. They trigger each other.



Light and EM Radiation As a particle: Photon

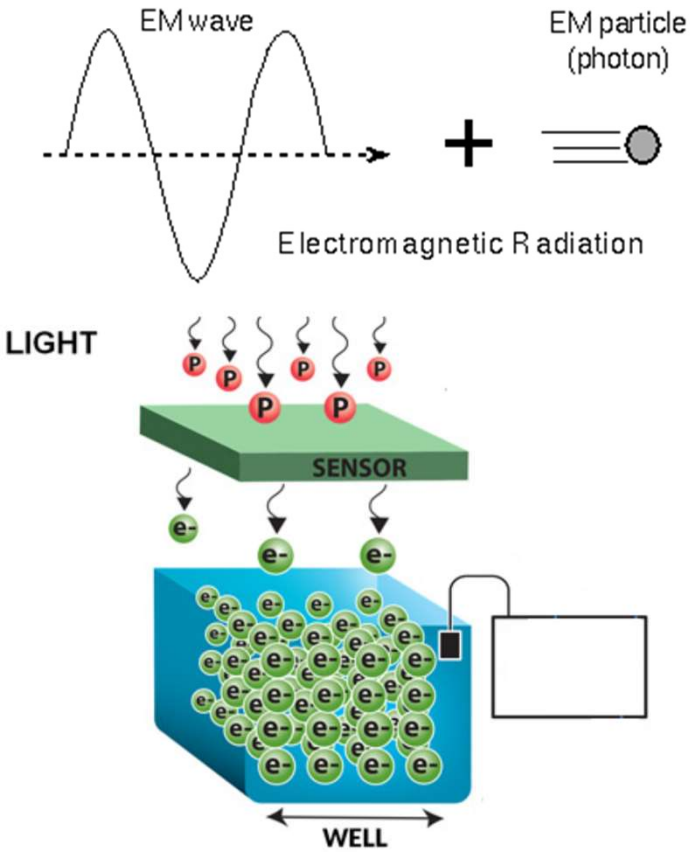
Einstein proposed that light is also similar to *packets* of energy: Photons - A massless particle of Electromagnetic Radiation traveling at the speed of light

Experiments have found this to be true

Astrophotography CCD (Charged Coupled Device) cameras operate on this Photon principle

EM does not need a medium to “move" in as Sound needs air as a medium.

Travel at the speed of light (c)
This is the **same for all light waves**:
c = 299,792.458 km/sec (Yes, the same “c” as Einstein’s $E=mc^2$)
c=299,792.458km/sec
c=186,000 miles/sec

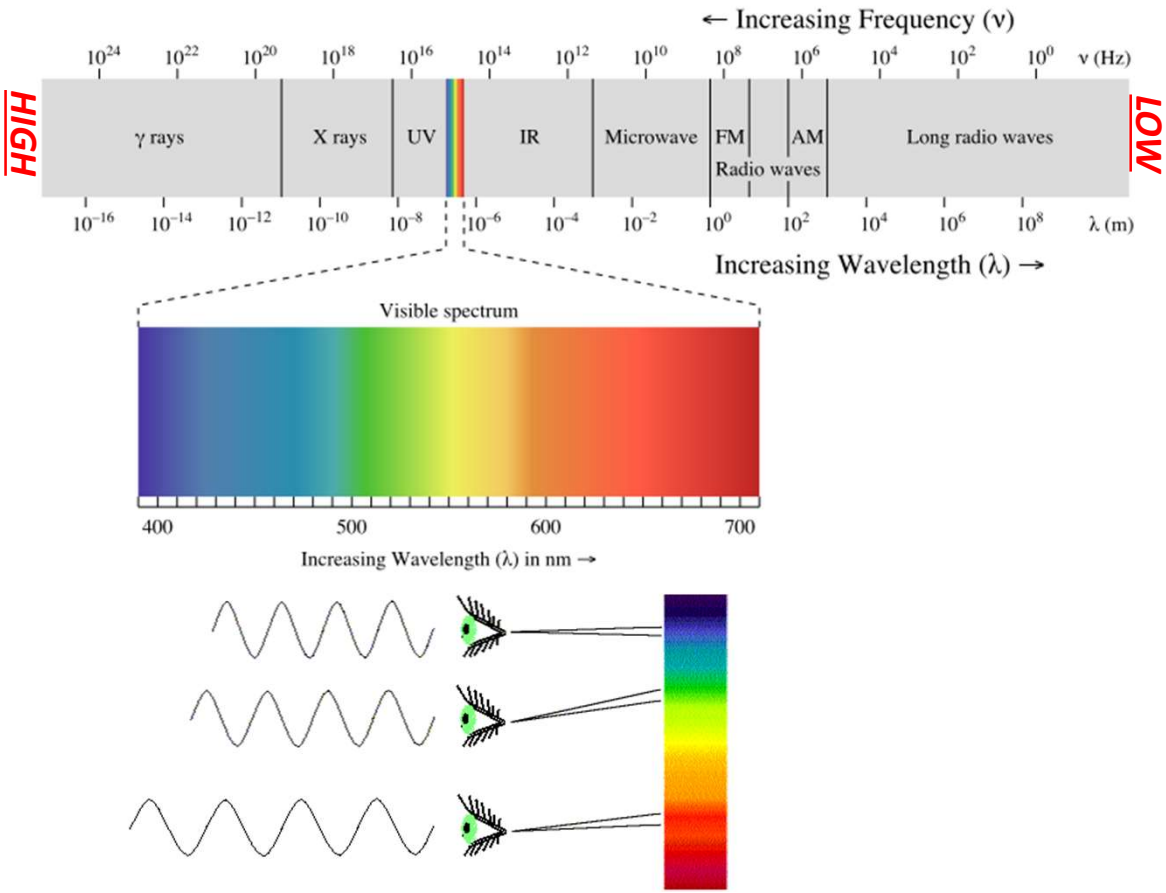


The Electromagnetic Spectrum

The sequence of **photon energies** running from low energy to high energy

High energy = high frequency = short wavelength
Ex. Ultraviolet, X-rays, Gamma Rays

Low energy = low frequency = long wavelength
Ex. Radio Waves, Infrared



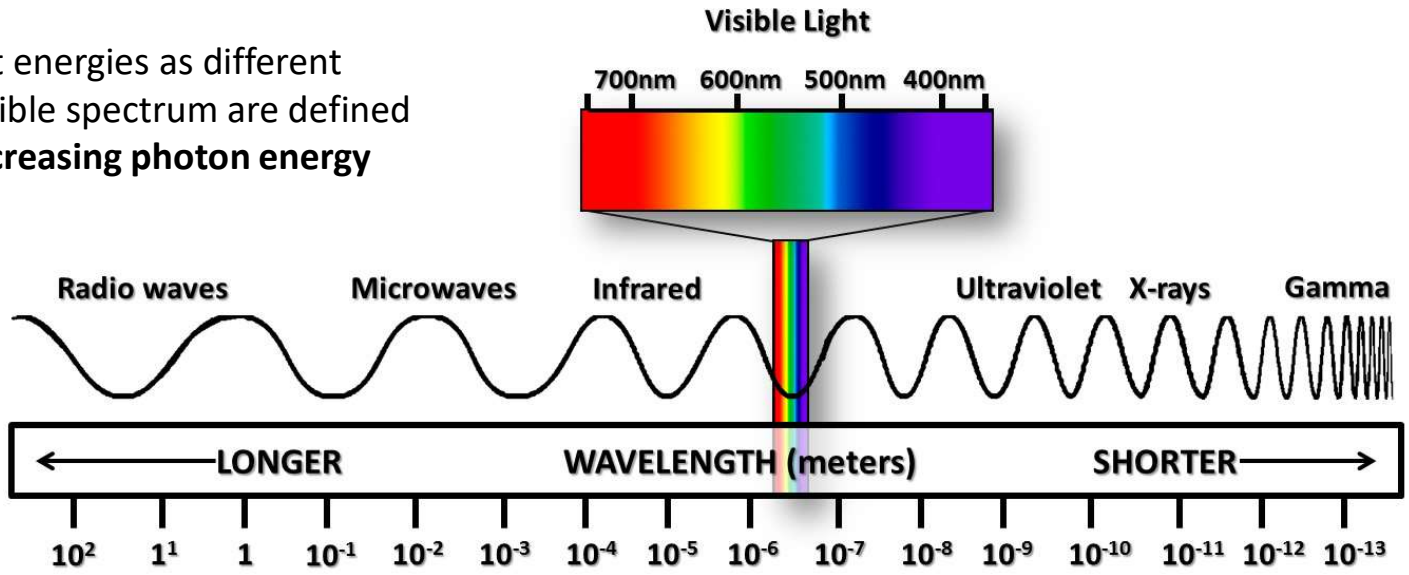
Electromagnetic Radiation: The Visible Spectrum

Visible Spectrum: All forms of light we can see with our eyes.

Wavelengths: 400 - 700 nanometers (nm) (4000-7000 **Å**)

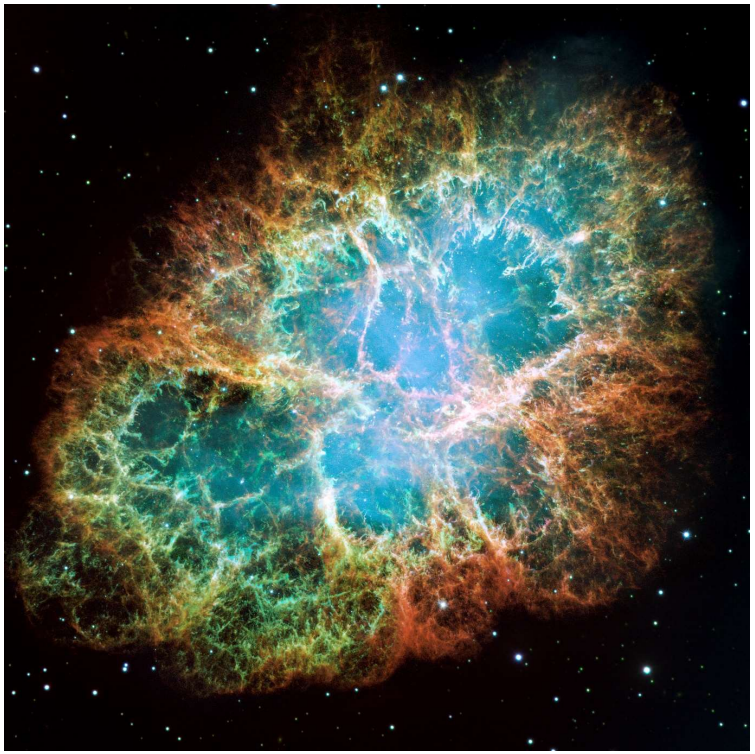
We sense visible light of different energies as different **colors**. The basic colors of the visible spectrum are defined roughly as follows, in order of **increasing photon energy**

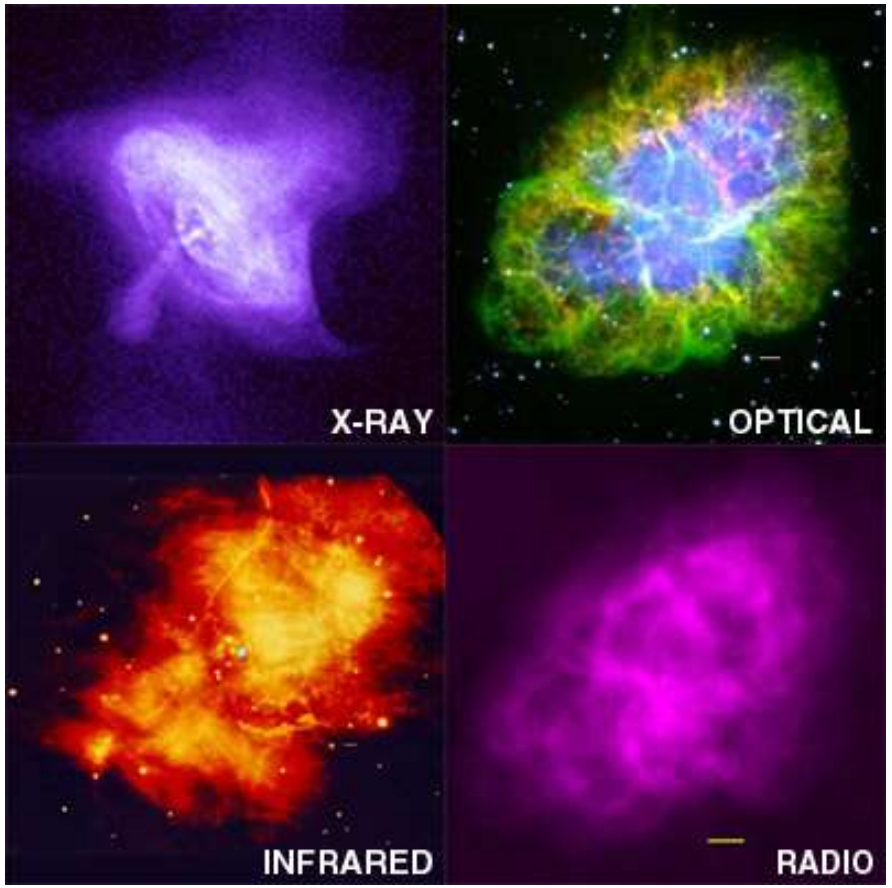
Color Name	Red	Orange	Yellow	Green	Blue	Indigo	Violet
Approximate Wavelength	700nm	650nm	600nm	550nm	500nm	450nm	400nm



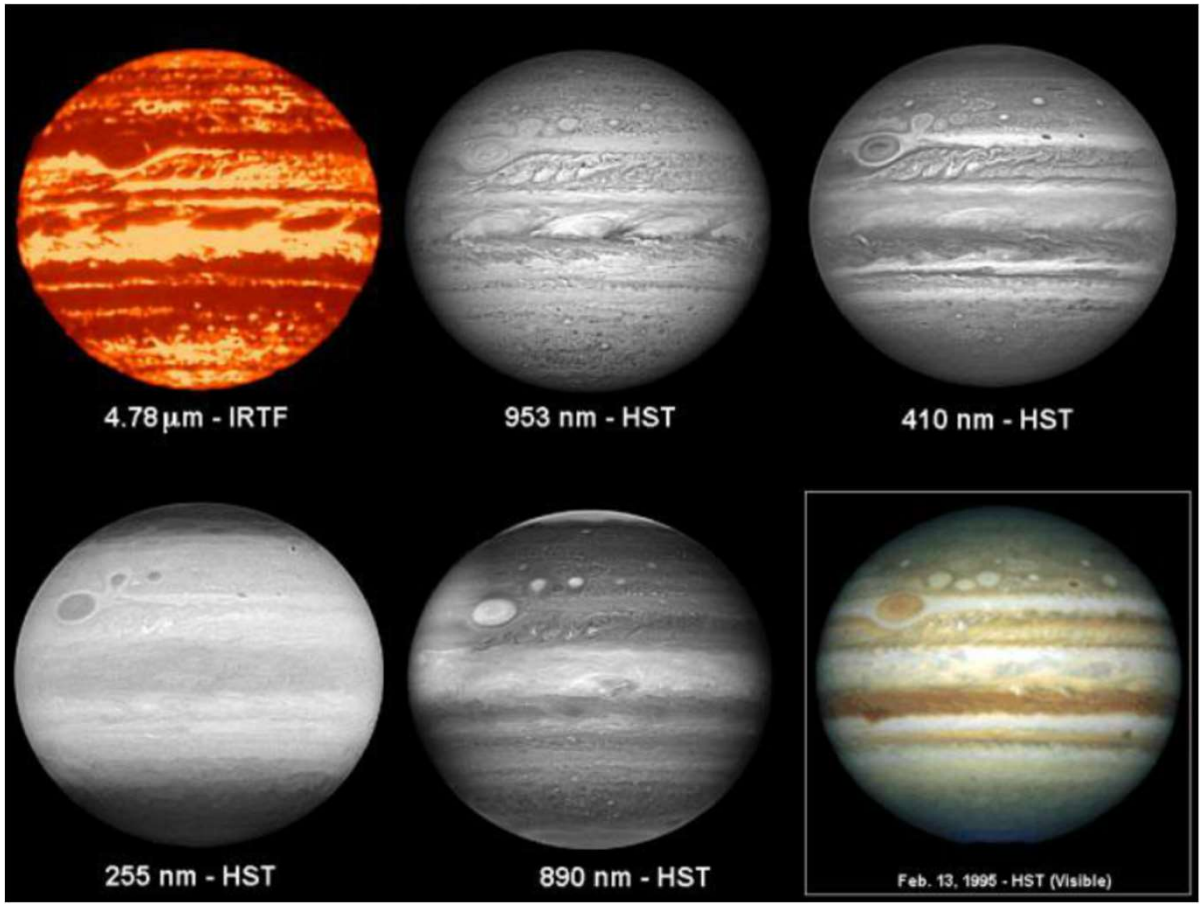
EM SPECTRUM - EM Radiation Overview

Practical Example





Practical Example



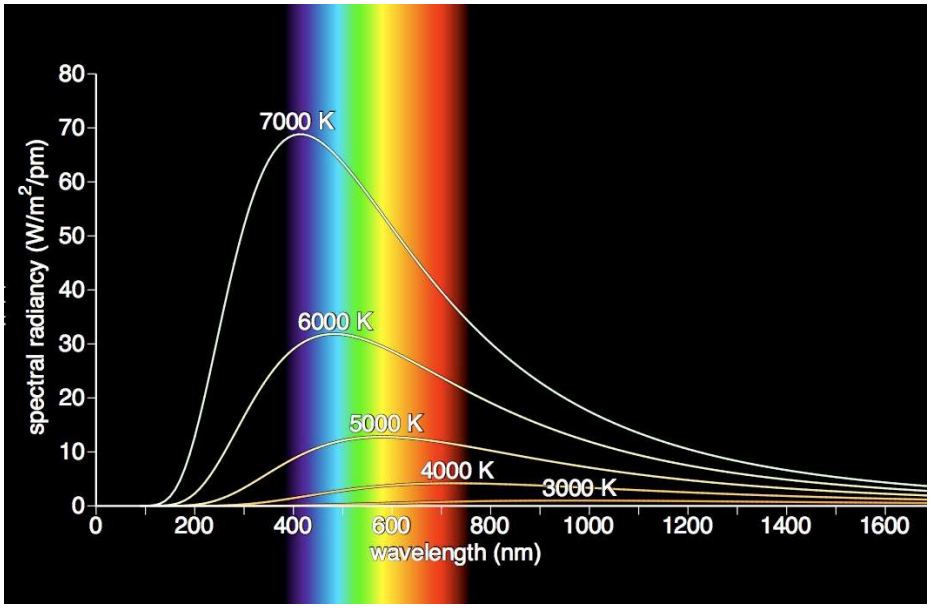
Summary

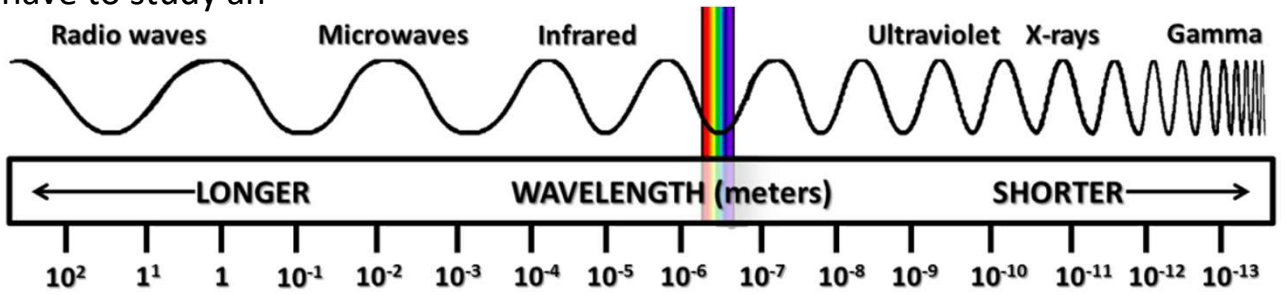
The Electromagnetic (EM) Spectrum describes light.

As you will see in the lesson on Wien' Law, all objects above a temperature of 0 Kelvin, emanate light.

From this, we can learn much about the object we are studying and how to study it.

The study of light is central to the science of Astronomy since, for the most part, this is basically what we have to study an object from.





Questions?