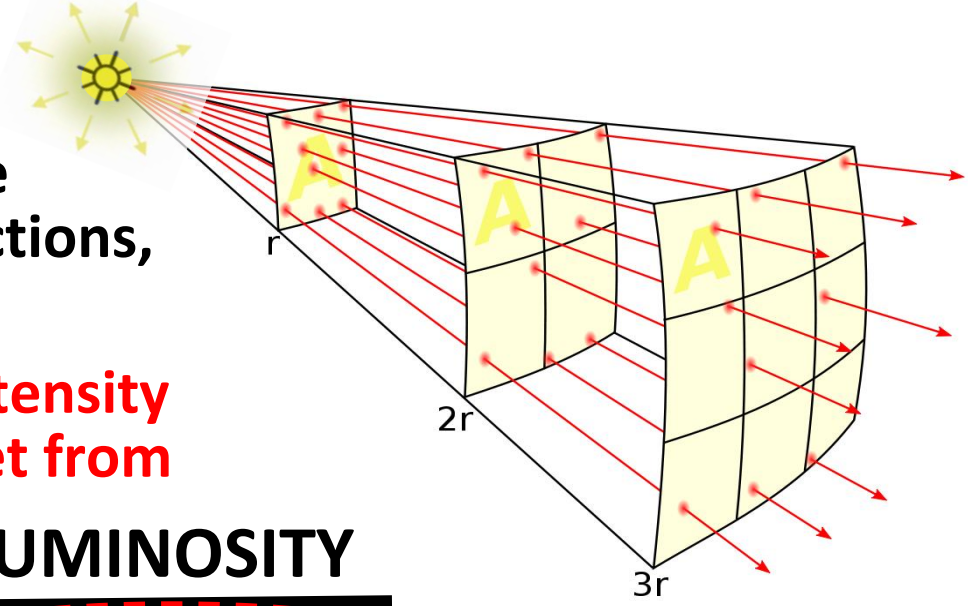
Light Intensity – How Bright?

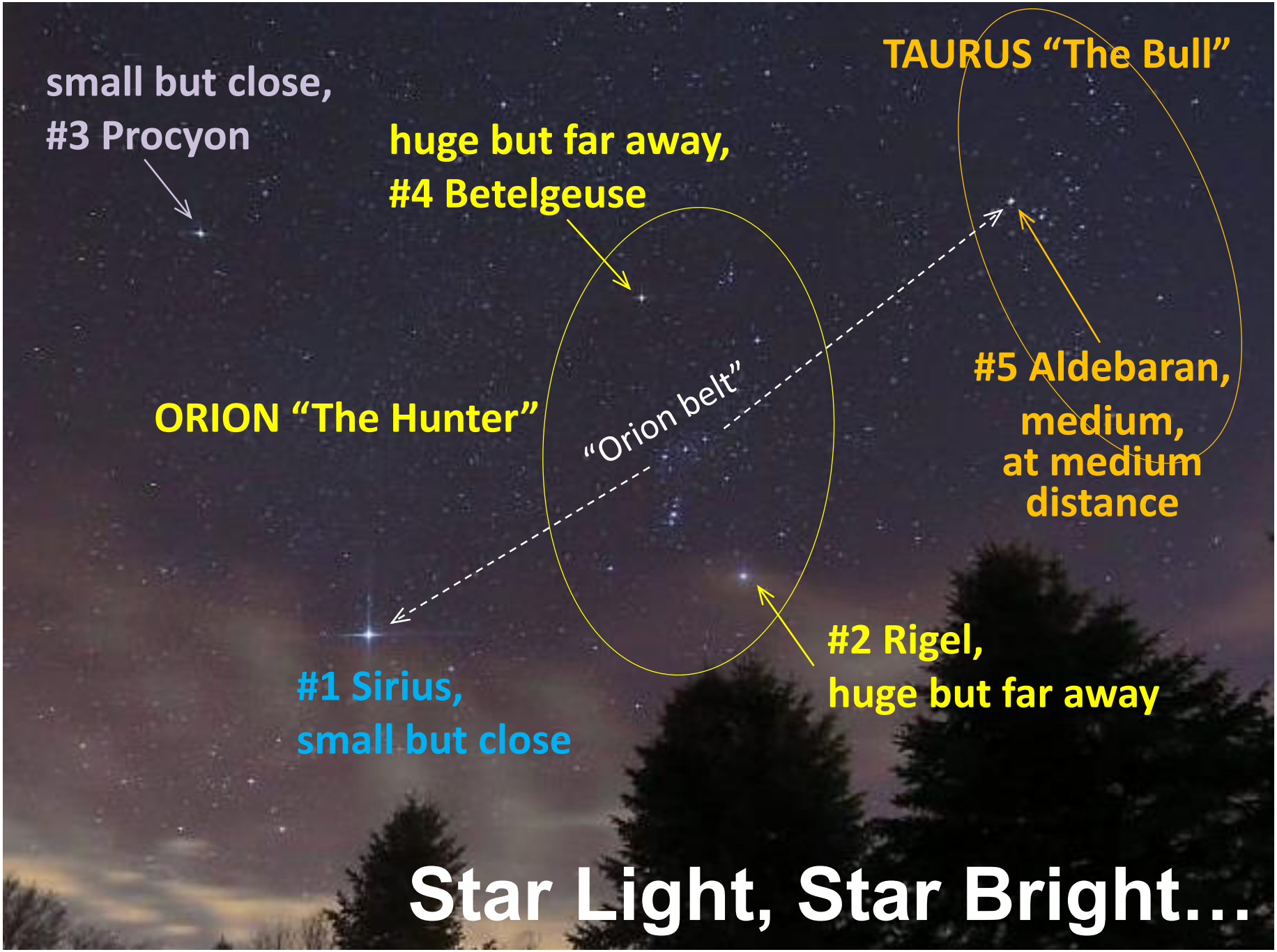
- The **total amount of light energy** a source radiates is called its **luminosity**.
- The **intensity** of light is the **amount of energy falling on a surface per a unit of time**.



- Most light sources distribute their light equally in all directions, making a **spherical** pattern.
- Light **spreads out** and the **intensity decreases the farther you get from the source**:

$$\text{INTENSITY} = \frac{\text{LUMINOSITY}}{4 \cdot \pi \cdot (\text{DISTANCE})^2}$$

area of a sphere

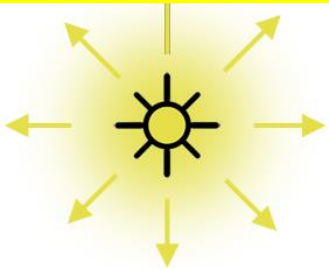


Star Light, Star Bright…

Summary: how to graph light?

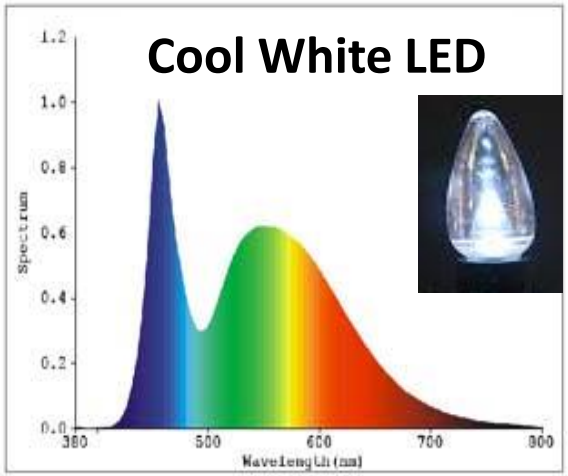
- **"What color?"** The apparent color of light is determined by the wavelength(s) of light waves.

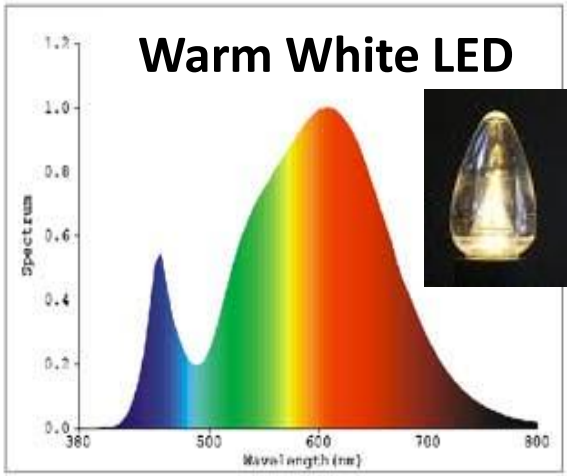
- **"How much?"** The intensity of light is the amount of light energy falling on a surface per a unit of time.



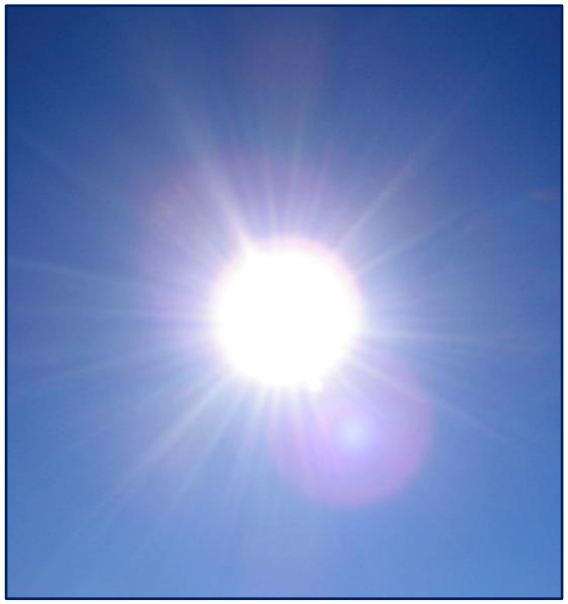
- **"How much of each color?"**

The spectrum (spectral composition) of light is the relative light intensity for each wavelength present.





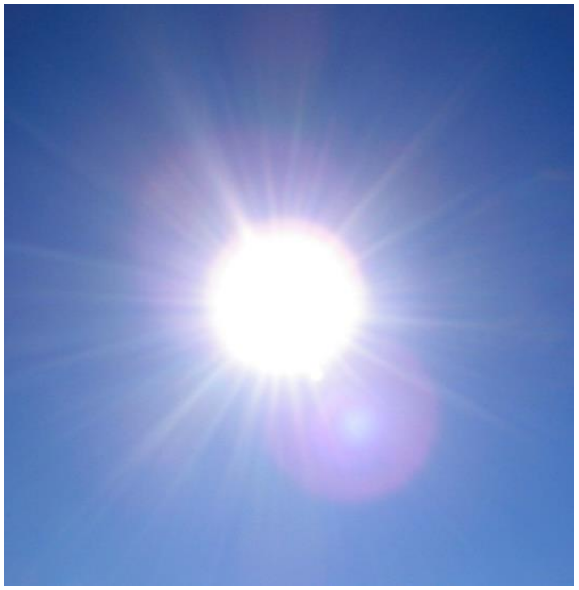
How to Make Light?

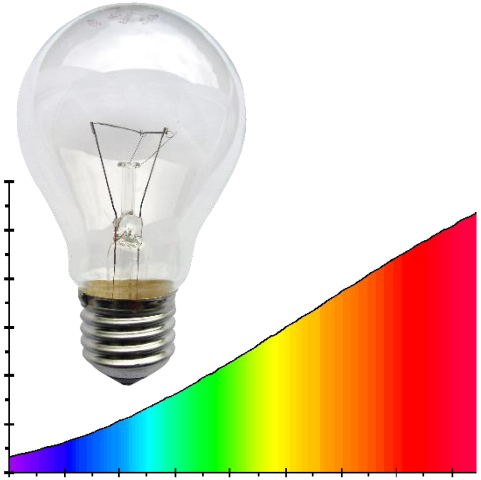


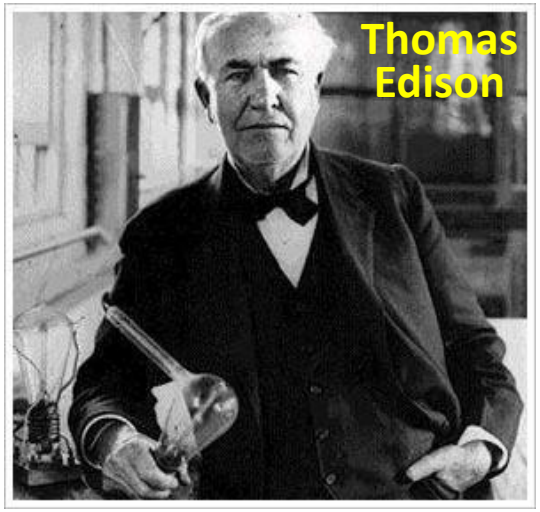
Incandescence

Incandescence (from Latin "glowing white") is a special case of thermal radiation, specifically **emission of visible light by a hot body.**

Sunlight is the incandescence of the "white hot" surface of the Sun.

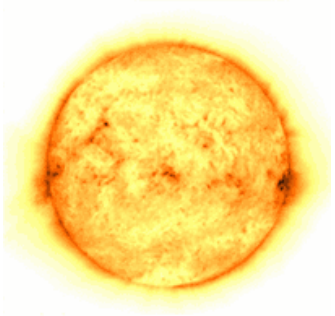






Incandescent bulb:

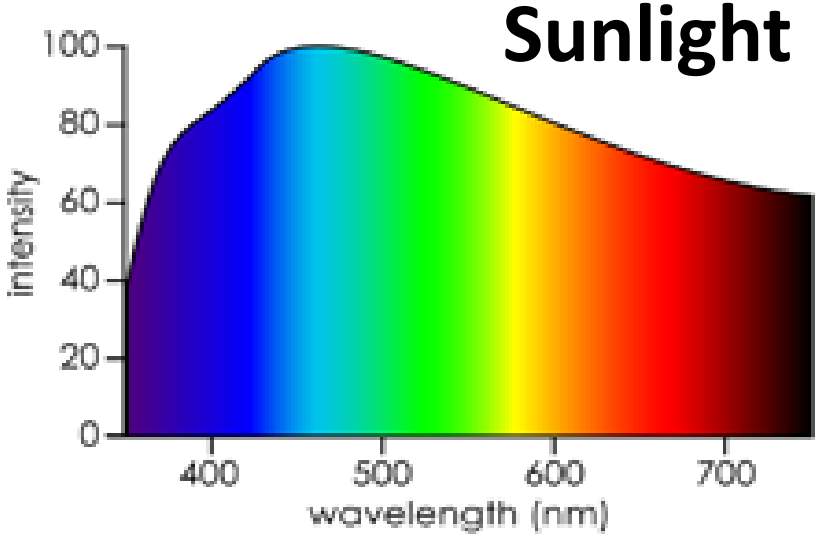
- electricity passes through a thin piece of metal wire called a filament
- the filament heats up and gives off thermal radiation composed of ~5% visible light and ~95% infrared light…
- …very low energy efficiency!

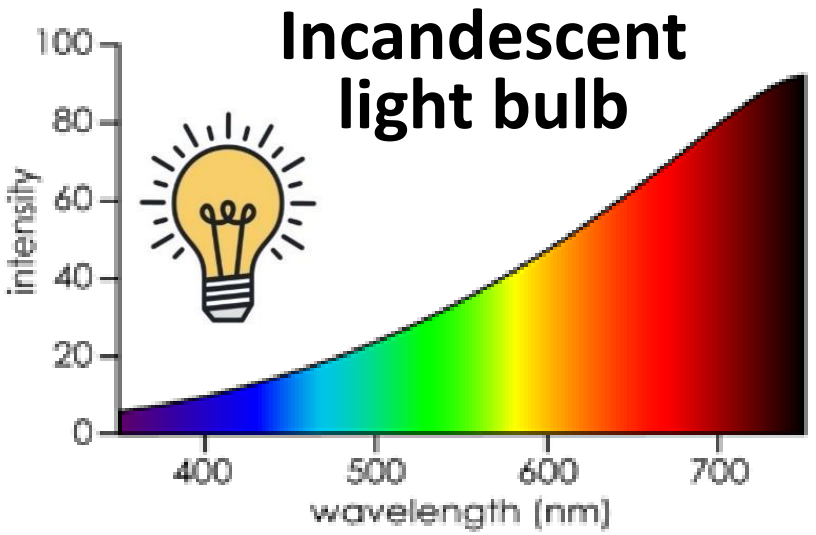


Incandescent Spectrum

"How much of each color is made?"

- **X-AXIS: wavelength**
- **Y-AXIS: relative light intensity**





Incandescent light sources produce light waves in a wide continuous range of wavelengths with gradually changing intensities; the spectrum is smooth.

How to Make Light?

Luminescence

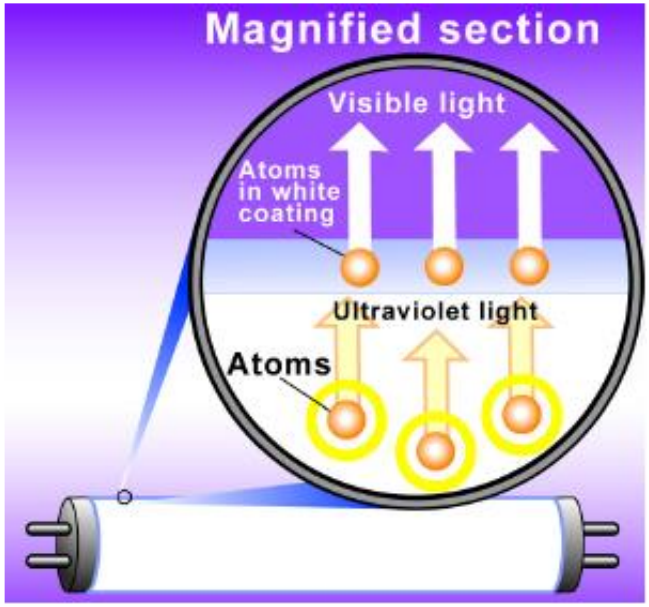
Luminescence is **emission of light** by a substance **not resulting from heat**:

Glow Sticks

- ***Chemiluminescence*** **(including *bioluminescence*), a result of a chemical reaction.**
- ***Electroluminescence*, emission of light due to electric current passed through a substance.**

LED

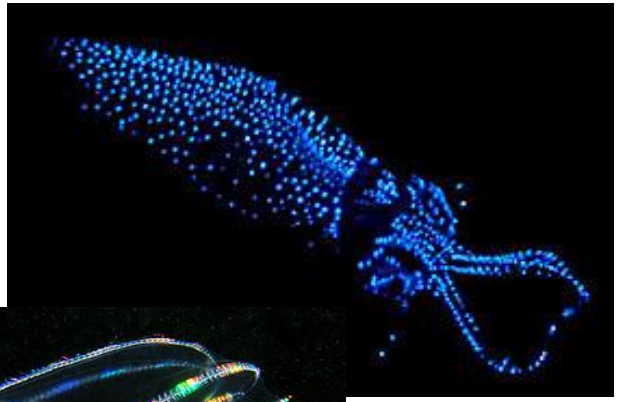
- ***Photoluminescence*** **(*fluorescence* and *phosphorescence*) due to absorption of light with subsequent re-emission.**
- **Some other types.**

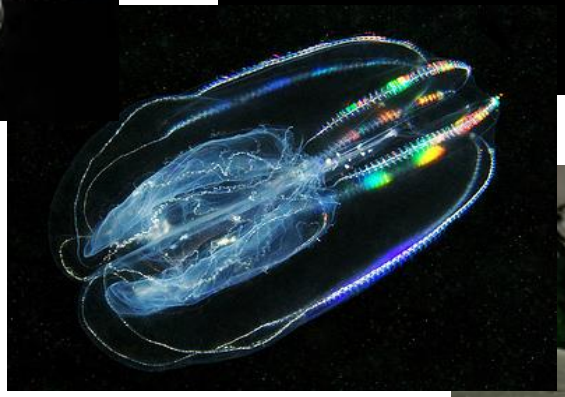


Fluorescent Lamps

Bioluminescence

Bioluminescence is emission of light by a living organism by means of a chemical reaction (type of *Chemiluminescence*).

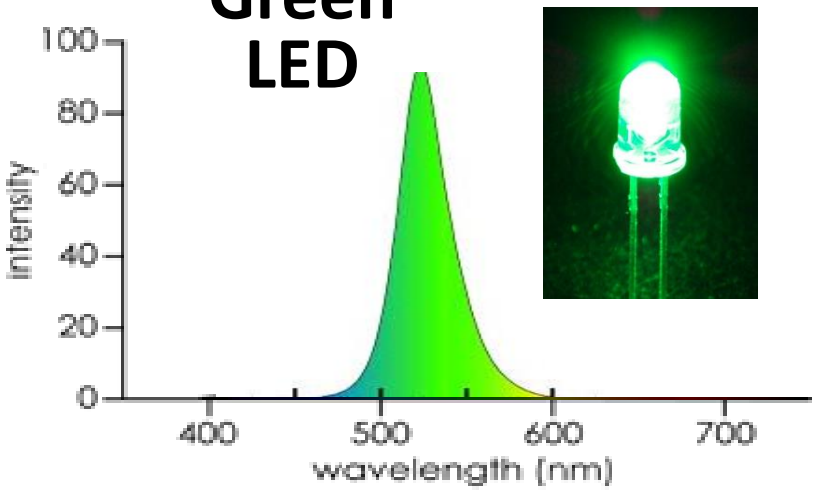




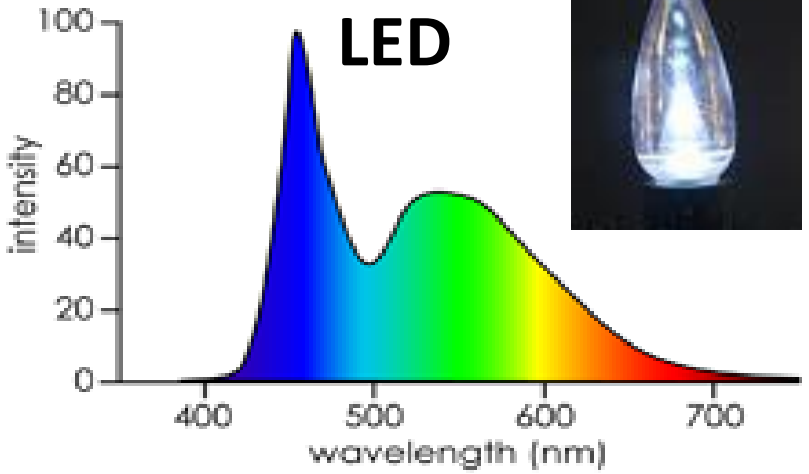
It occurs widely among animals (many creatures of the open sea, and insects) as well as in some fungi and bacteria.

Luminescent Spectrum

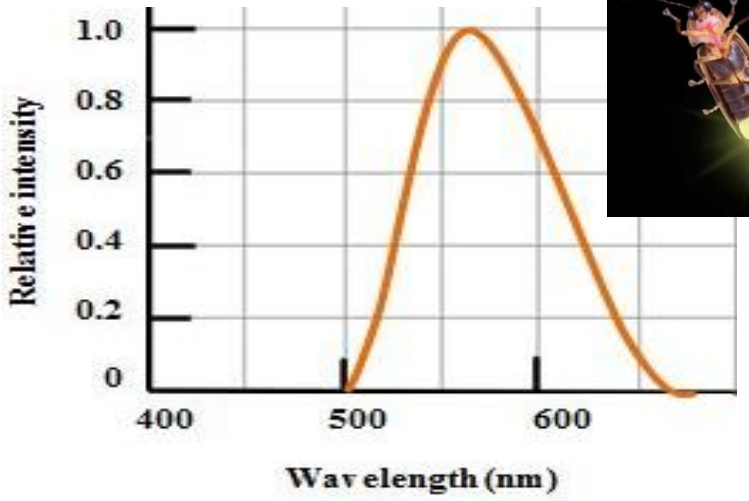
Green LED



Cool White LED



Yellow Firefly



Luminescent light sources produce light waves in rather narrow "peaks" of wavelengths; the resulting light often appears to have a "distinct color".