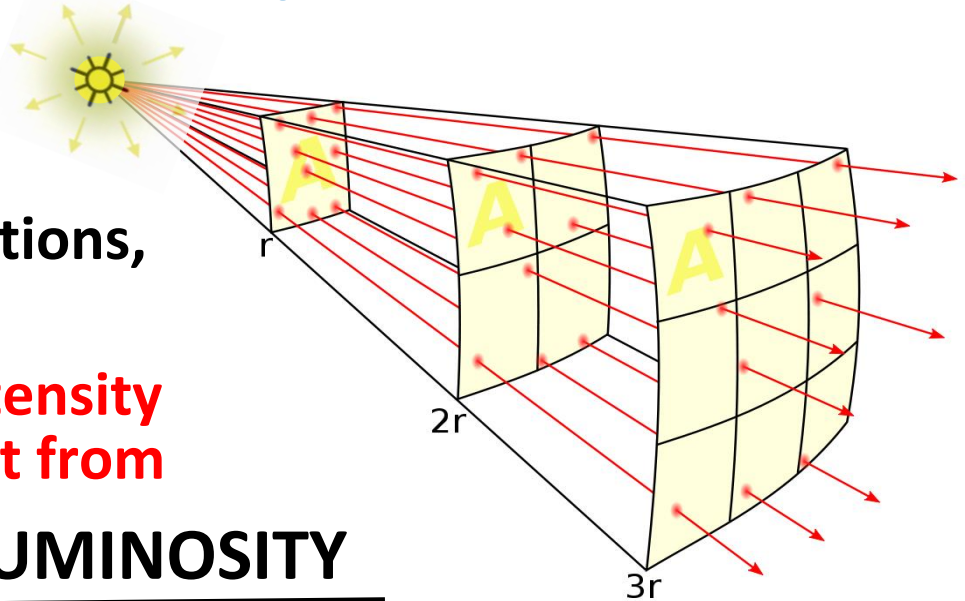


Light Intensity – How Bright?



- 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

small but close,
#3 Procyon



huge but far away,
#4 Betelgeuse



TAURUS "The Bull"

#5 Aldebaran,
medium,
at medium
distance



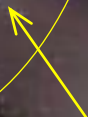
ORION "The Hunter"

"Orion belt"



#1 Sirius,
small but close

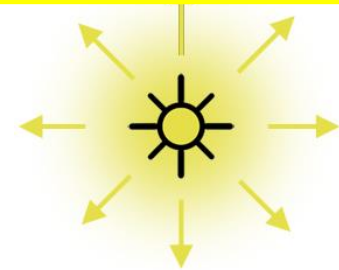
#2 Rigel,
huge but far away



Star Light, Star Bright...

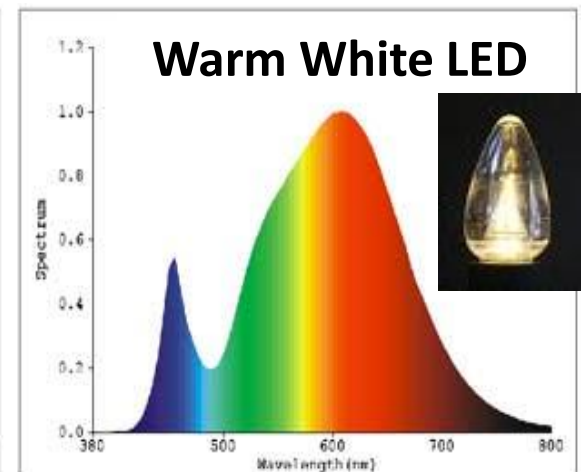
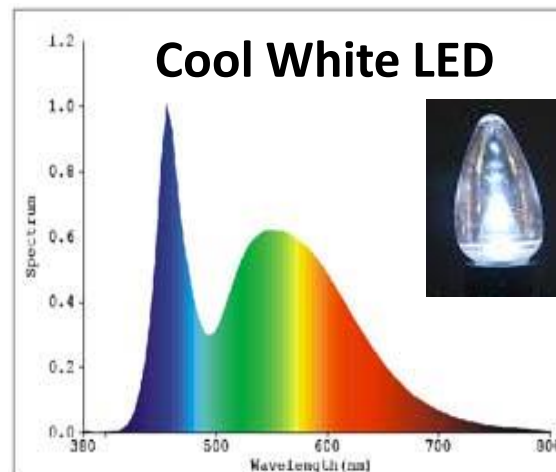
Summary: how to graph light?

- “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.

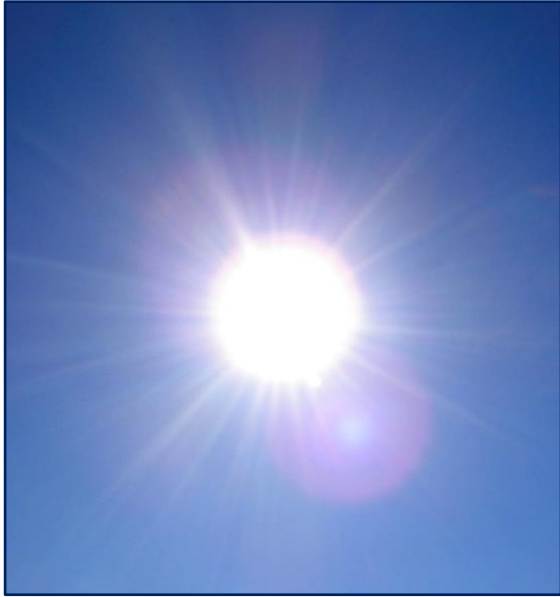


- **“How much of each color?”**

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



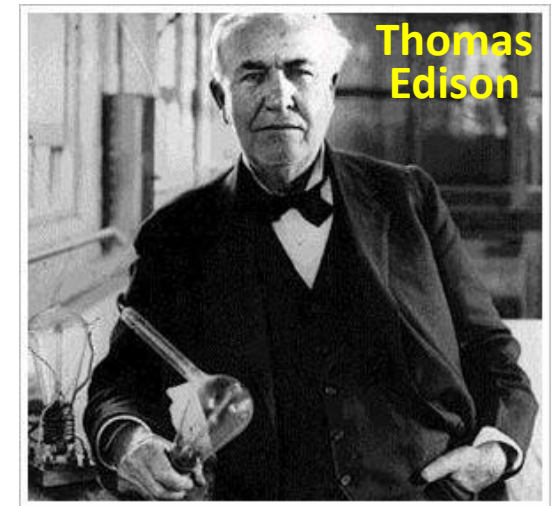
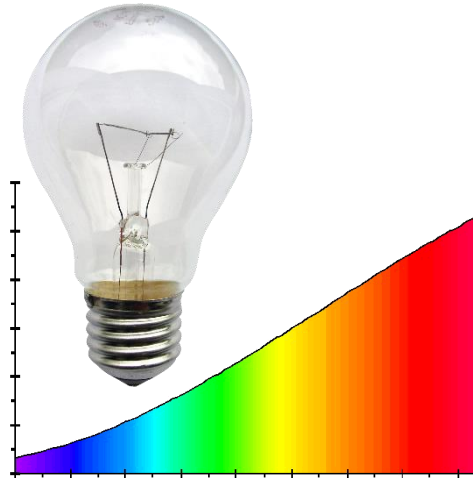
How to Make Light?



Incandescence

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

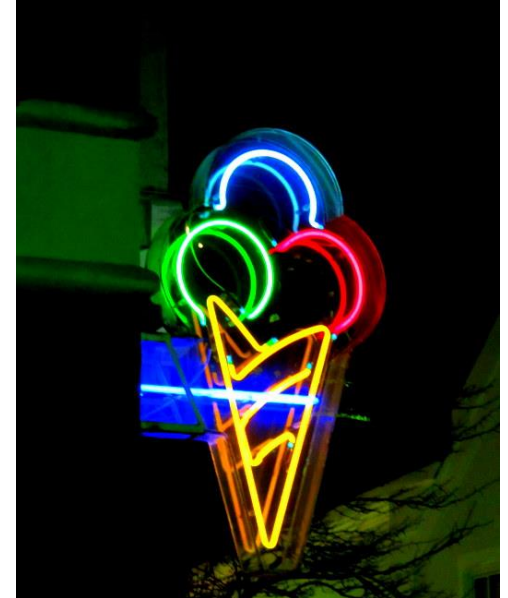
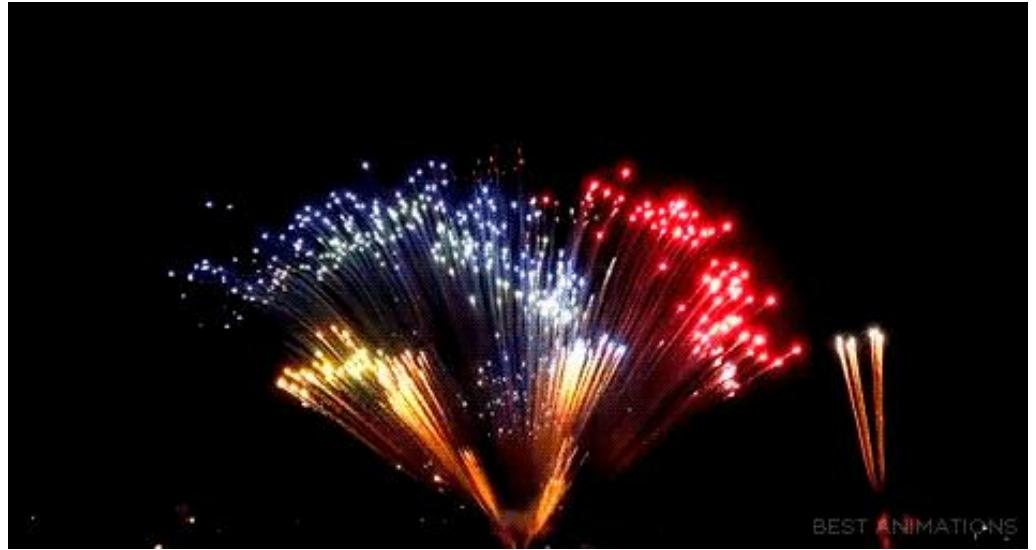
Sunlight is the incandescence of the “white hot” surface of the Sun.



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!**

How to Make Light?



Luminescence

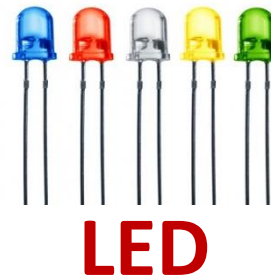
Luminescence is emission of light by a substance not resulting from heat:

- *Chemiluminescence* (including *bioluminescence*), a result of a chemical reaction.

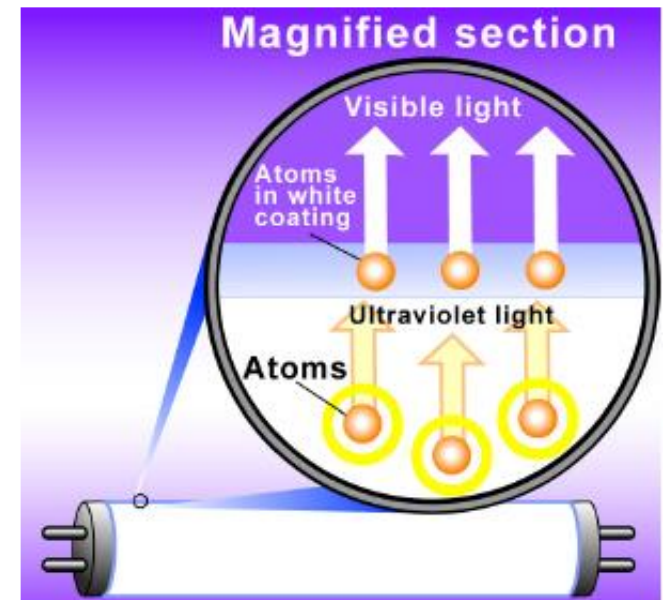


Glow Sticks

- *Electroluminescence*, emission of light due to electric current passed through a substance.



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

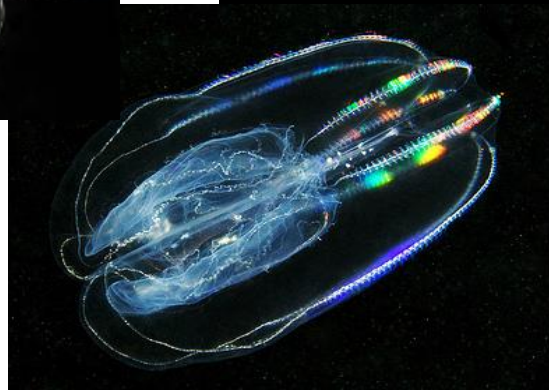
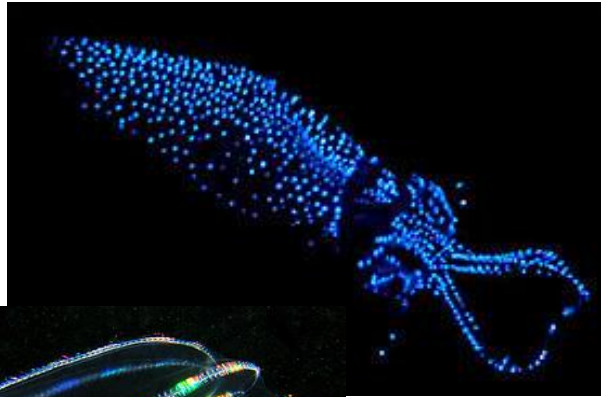


Fluorescent Lamps

- Some other types.

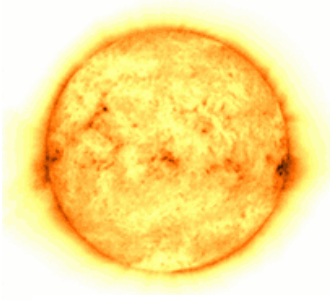
Bioluminescence

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



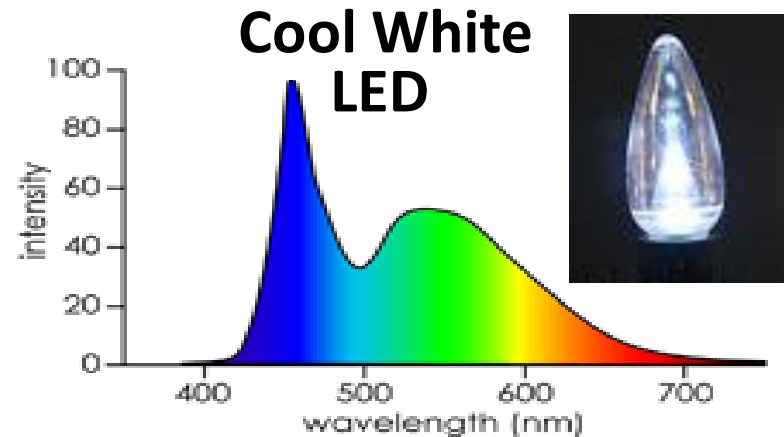
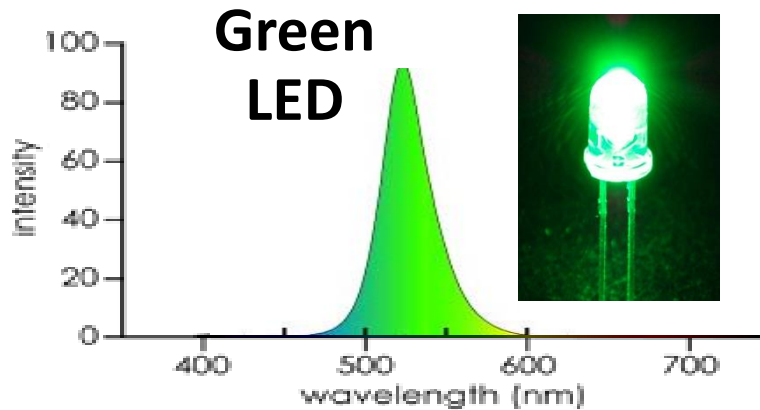
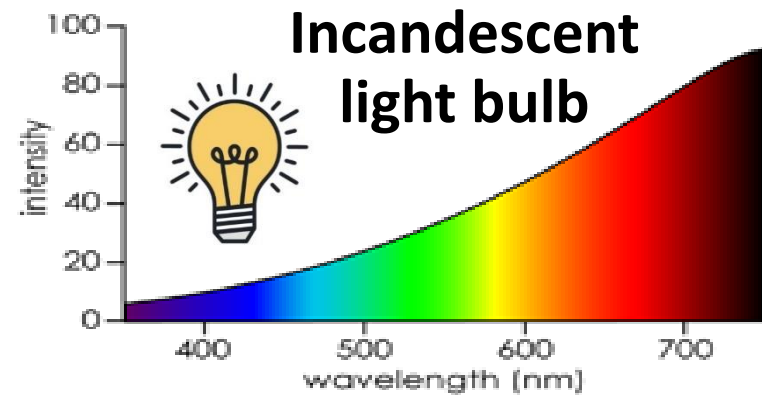
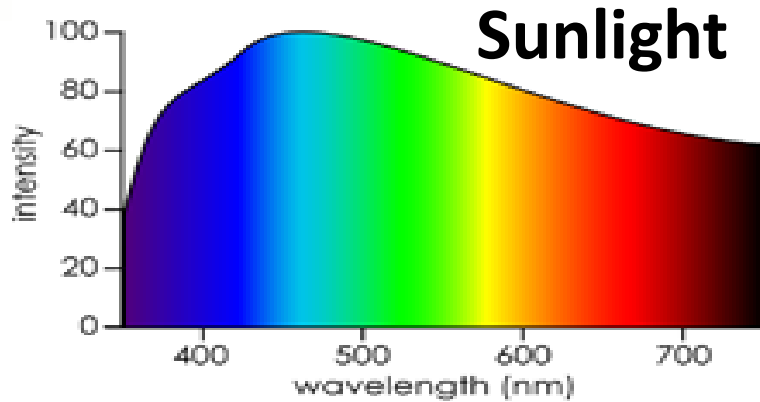
It occurs widely among animals (many creatures of the open sea, and insects) as well as in some fungi and bacteria.





Light Source Spectrum

“How much of each color is made?”



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