Light more light

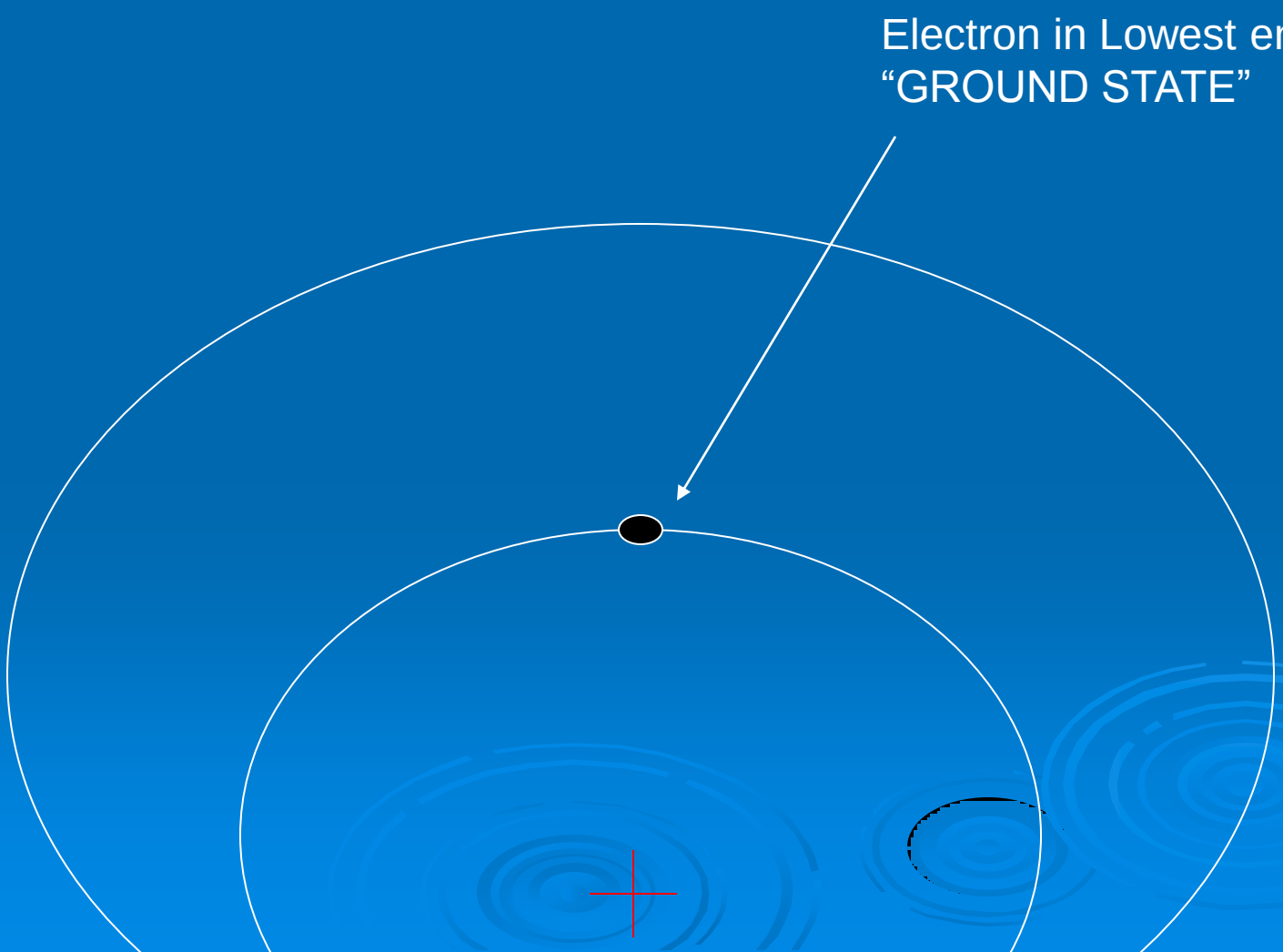
Schweitzer

What does light have to do with chemistry?

- It has been known for centuries that when you add energy to a particular substance light is emitted.

- Different substances give different colors of light.

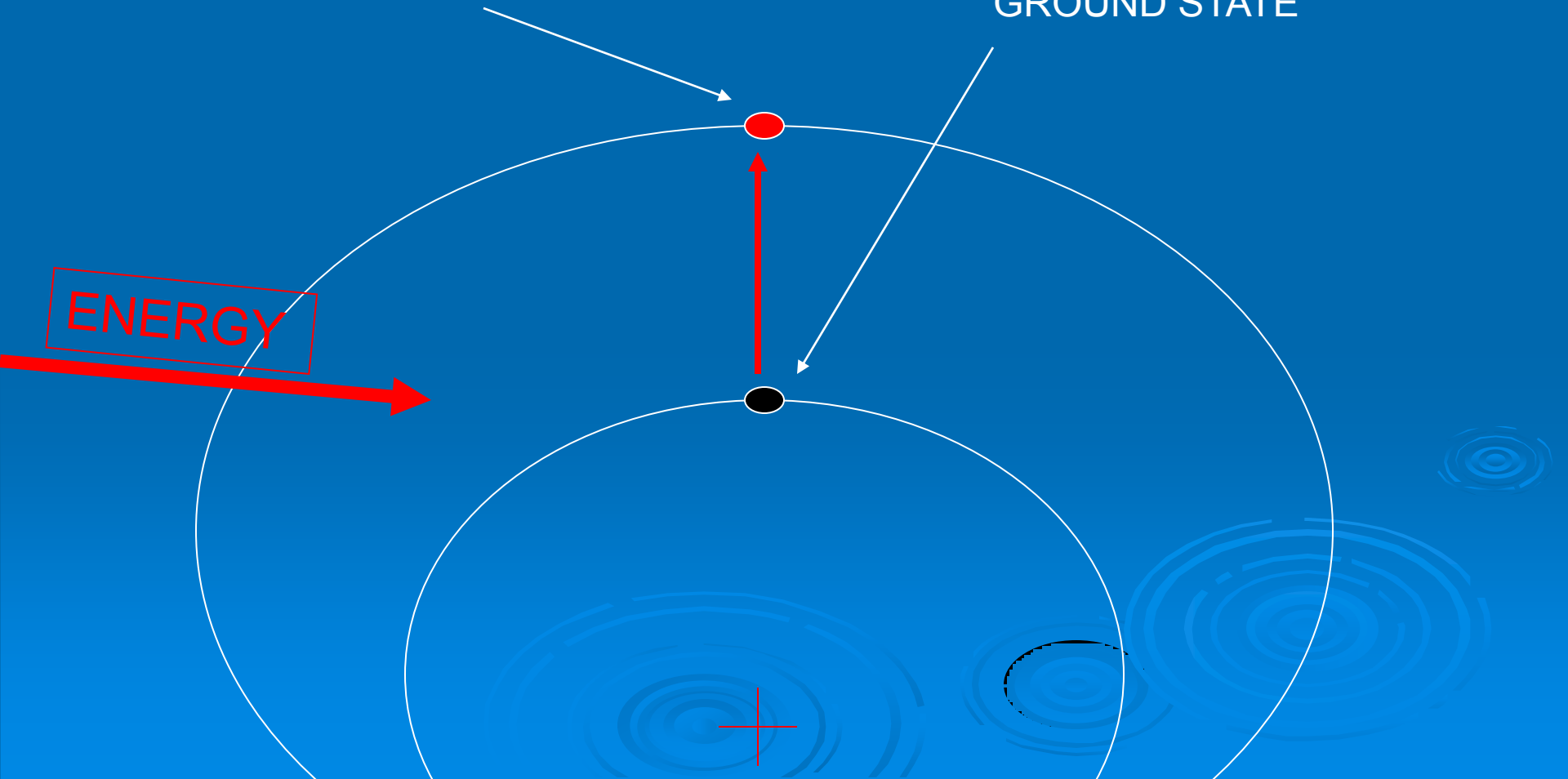
Light production



Light production
Electron jumps to a higher energy level in order to absorb energy

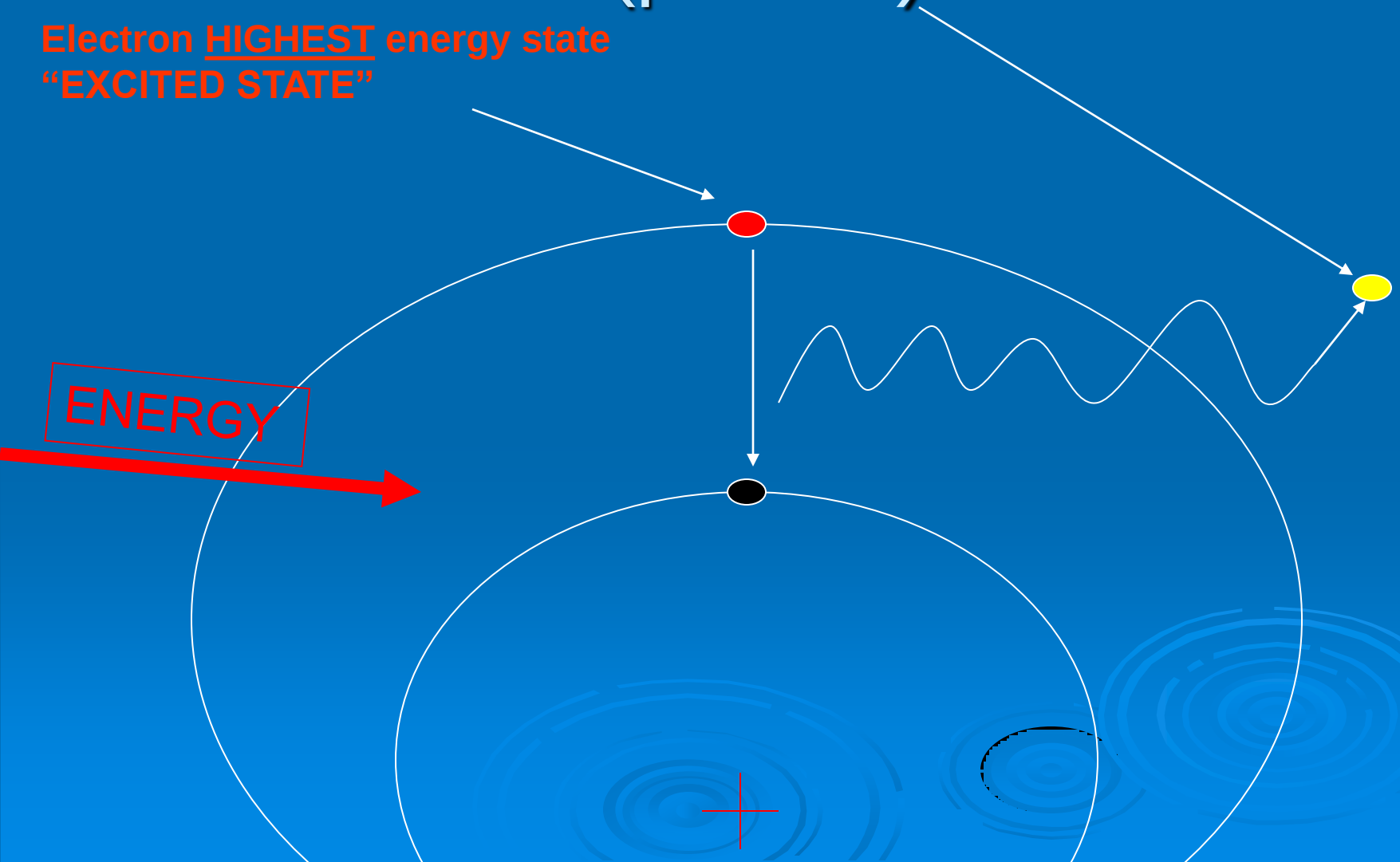
Electron HIGHEST energy state
"EXCITED STATE"

Electron in Lowest energy state
"GROUND STATE"



Light production
Releases energy in the form of light (photon)

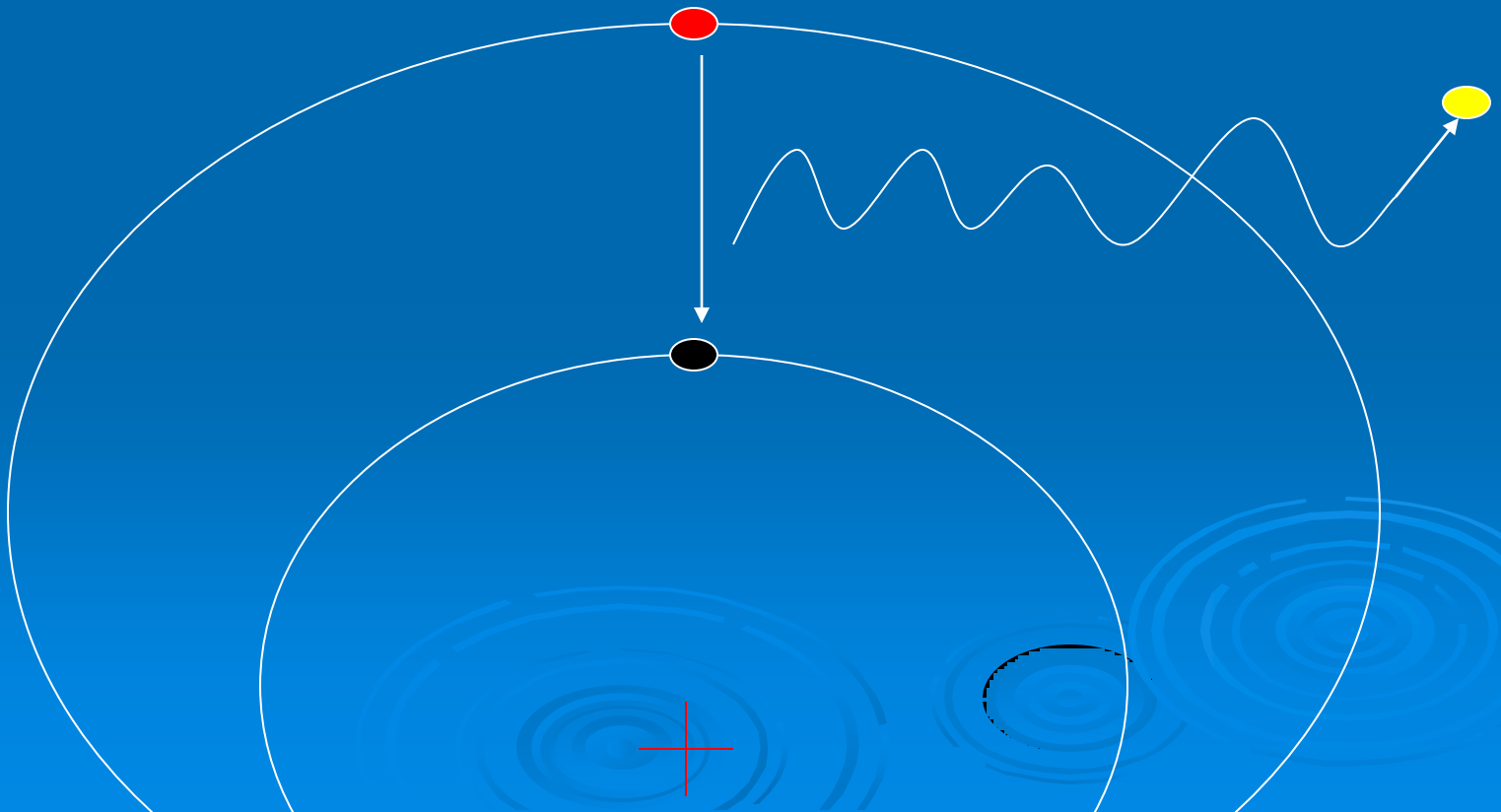
Electron HIGHEST energy state
"EXCITED STATE"



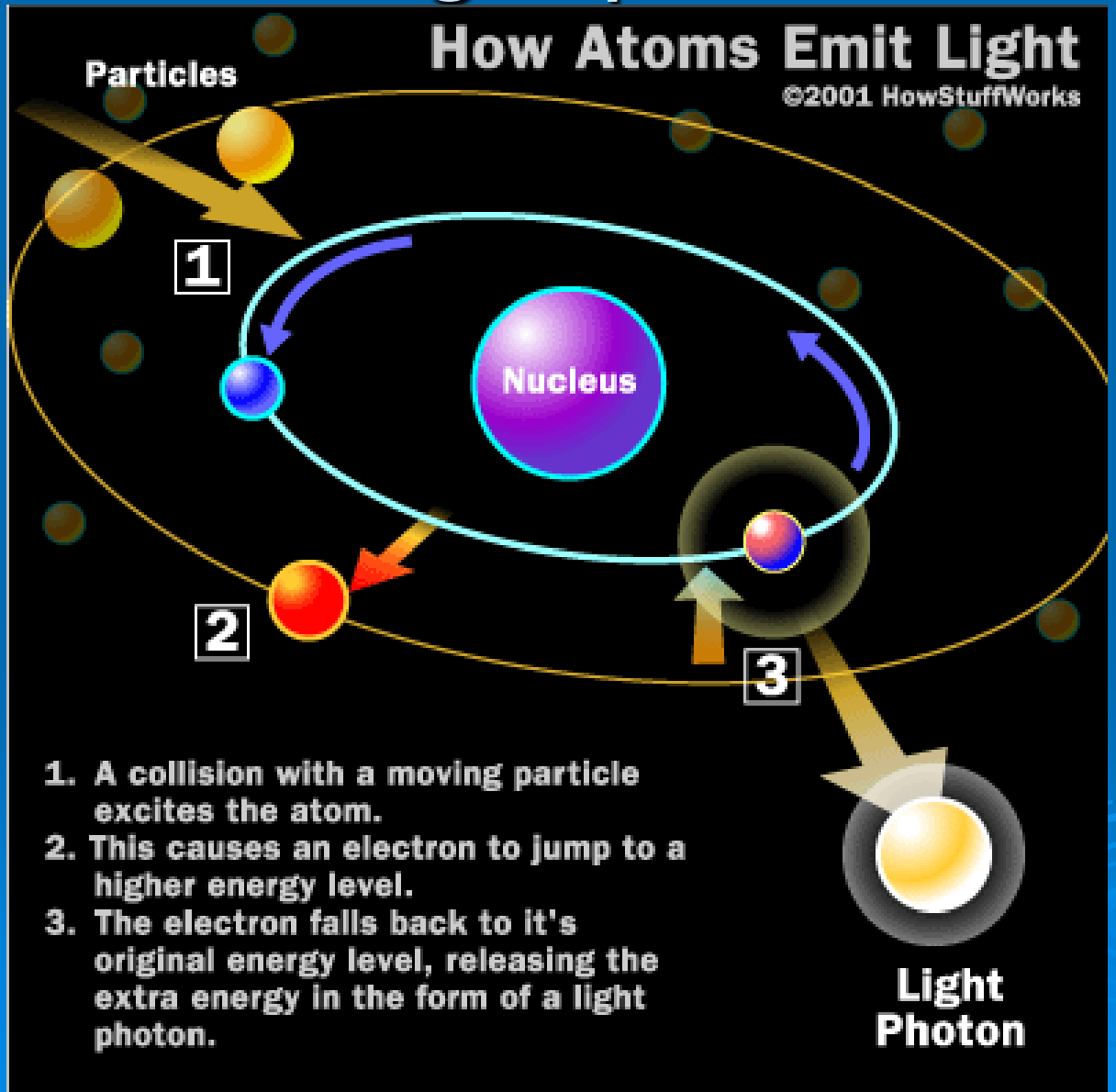
Light production
Releases energy in the form of light (photon)

Difference between energy levels determines energy of light

Different atoms will have different structures producing different Energies of light.



How is light produced?



Structure of the atom vs. light

- The Structure of the atom is reflective of the type of light given off.

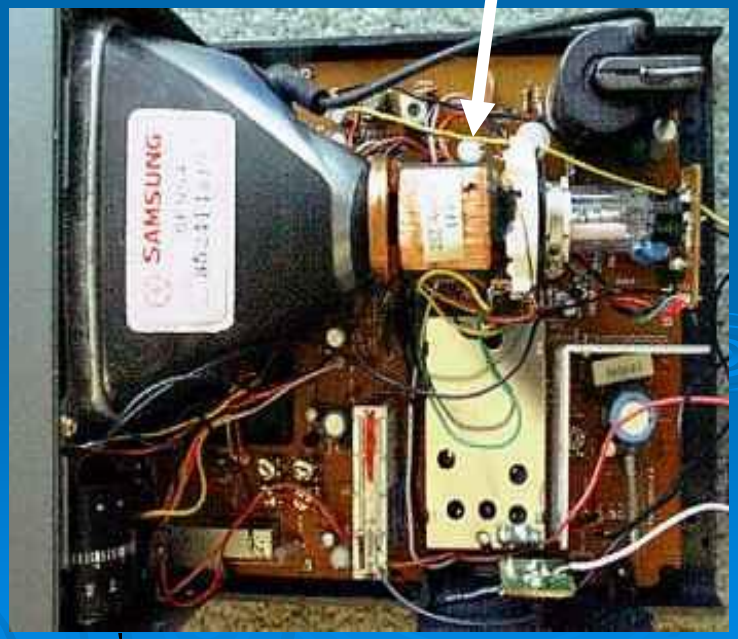
There are many ways to get electrons excited.

- Heat

Hit it with other electrons.

Positive

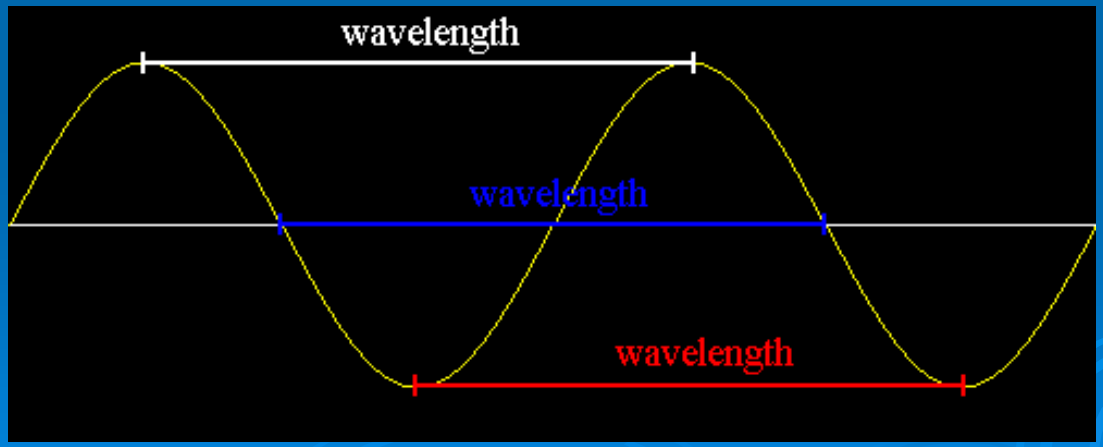
Negative source



Electrons jump across hitting the other side lighting up a phosphorus laden screen

Wavelength

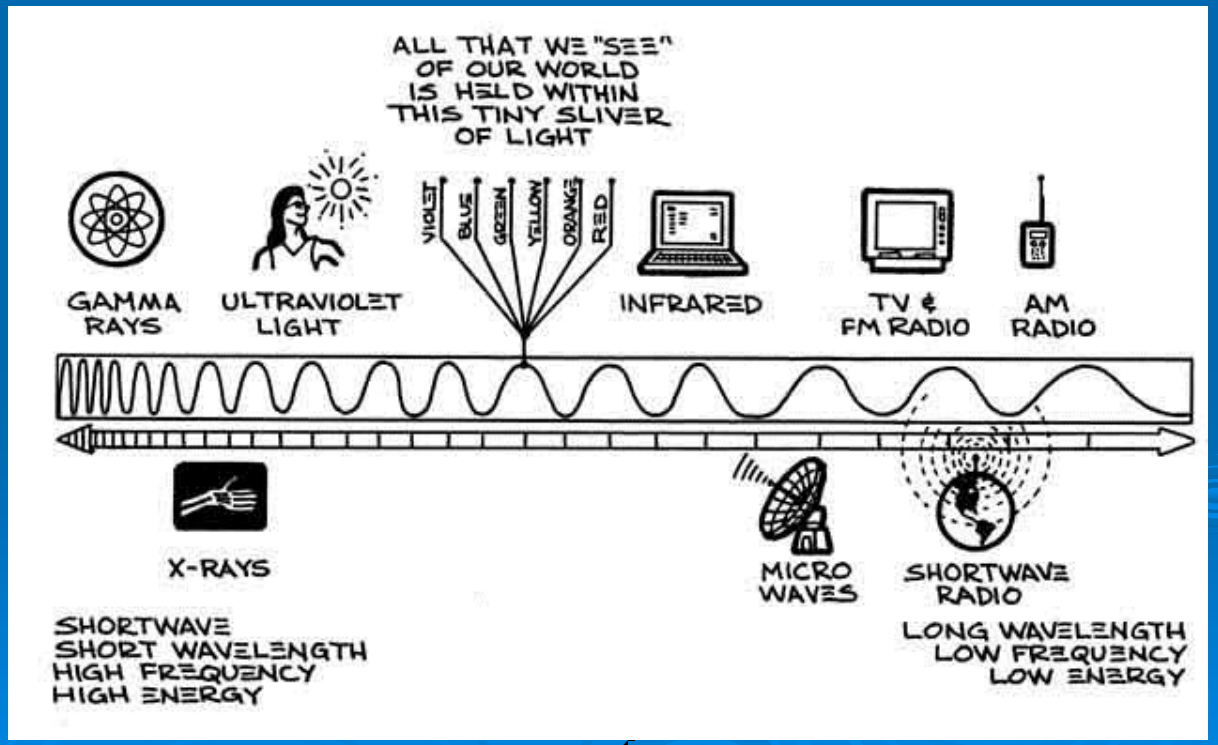
- Wavelength: Distance between a point on a wave and the same point on the adjacent wave. Symbolized: λ (lambda)



Frequency

- Wavelengths that pass a point in a second
- Cycles/sec
- Hertz (Hz)
- 1/s
- Symbol “v”

Pronounced “nu”

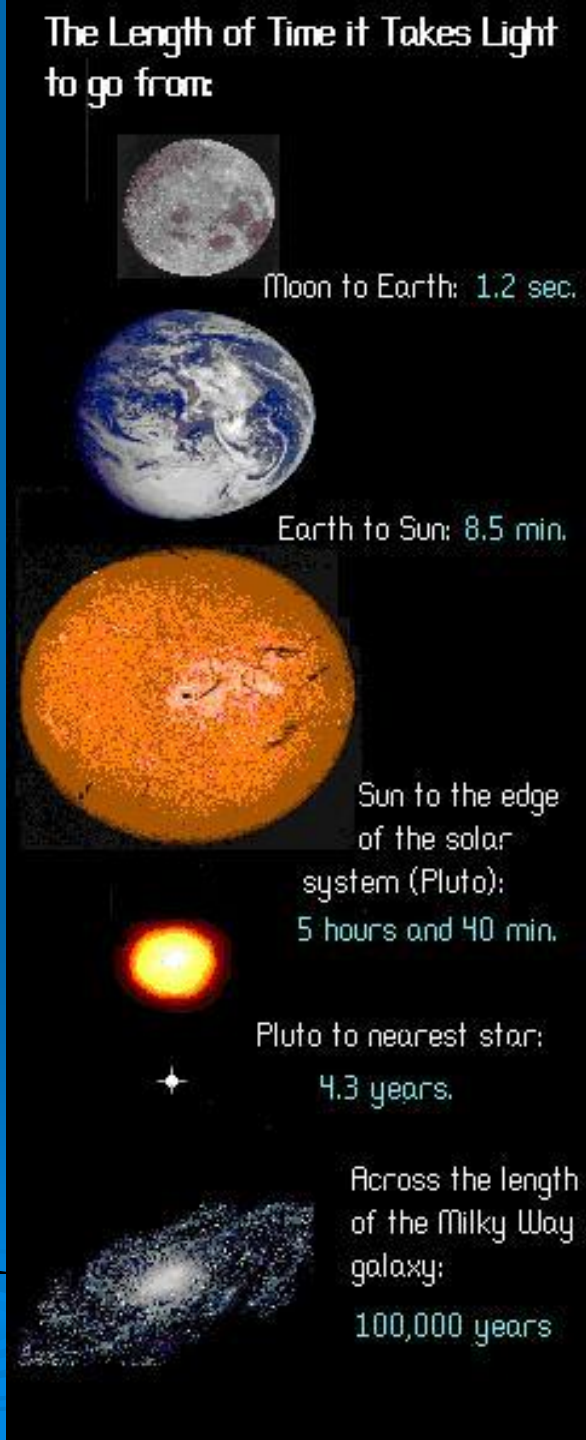


period

- Time for one wavelength
- period = 1/v

Speed of light

- 299,792,458. m/s
- That is 2.5 times around the earth is 1 second.
- 3.0 E8 m/s = speed of light
- Symbol = c



Wavelength vs Frequency

- Inverse proportions

↑ Frequency ↔ Wavelength ↓

↓ Frequency ↔ Wavelength ↑

$$c = v \lambda$$

Speed of light = frequency * wavelength

Wavelength vs. Frequency Example

- Radiowaves are examples of light
- 101.1 MHz FM
  - FM: Frequency Modulation, Code signal of song in to wave using frequency. Interestingly you can code more then one signal into the wave.
  - Hence we have stereo.

Wavelength vs. Frequency Example

- What is the wavelength of a 101.1MHz
  - 101.1 MHz = 101.1 Million Hz = 101.1E6 Hz

$$c = v \lambda$$

$$c/v = \lambda$$

3.0E8m/s/101.1E6 1/s = 3.01 meters

Determine the wavelength

- 1150 kHz AM (Remember k stands for kilo or 1000)

Determine the wavelength

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$$c/v = \lambda$$

3.00E8 m/s/1150E3 1/s = 260.8 meters

Determine the energy of a photon

$$E = h\nu$$

Energy of a wave = Planck's constant * frequency

Plank's constant = 6.626E-34 J*s

101.1E6 1/s * 6.626E-34 J*s = 6.699E-26J

Determine the energy of a photon

- Determine the energy of a WHBY 1150 AM radio wave.

Determine the energy of a photon

- Determine the energy of a WHBY 1150 AM radio wave.

- E = hv
  - 6.626 E-34J * s * 1150E3 1/s = 7.199E-28 J

Behavior of light

- Light
  - absorbed
  - Reflected
  - transmitted