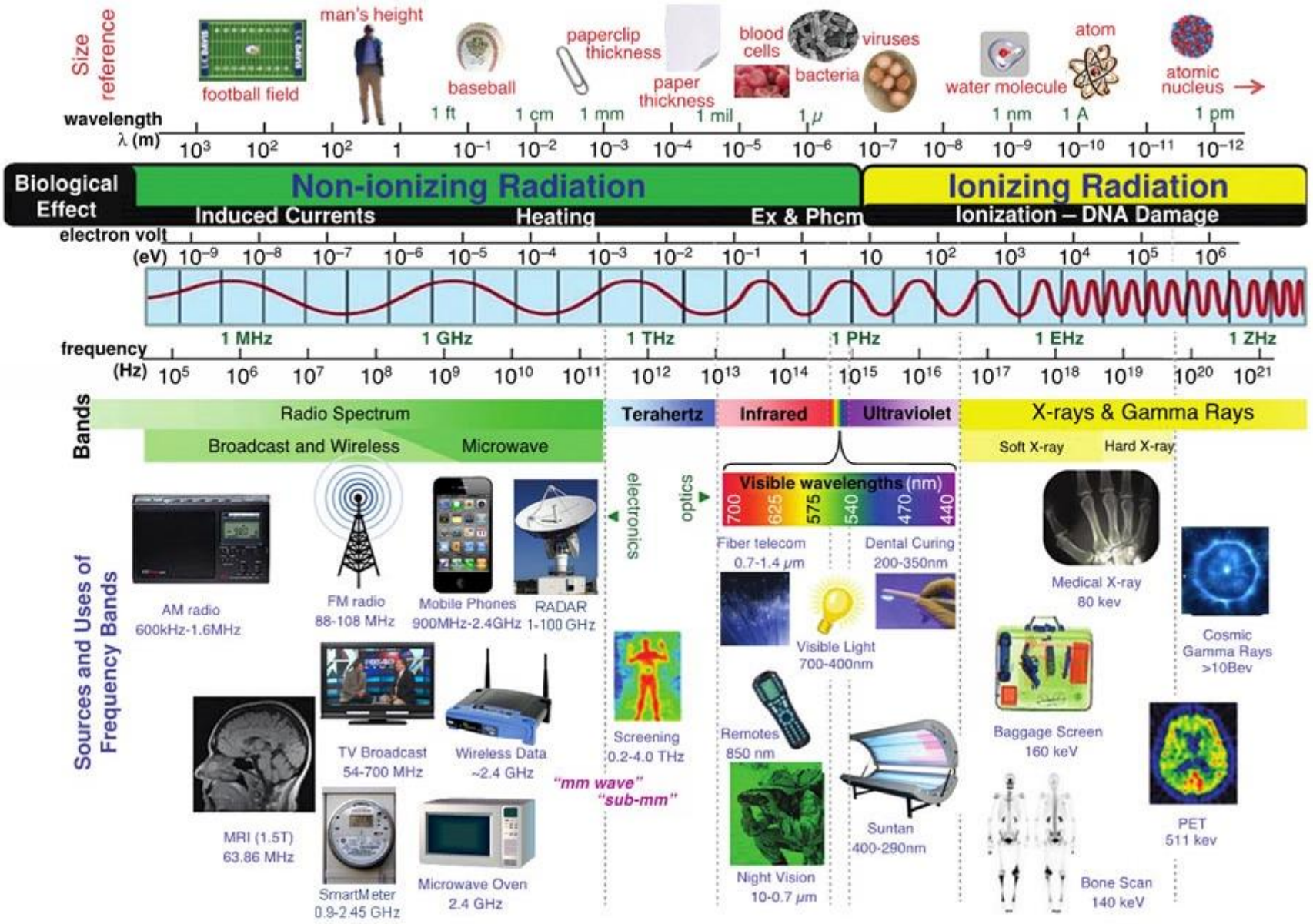
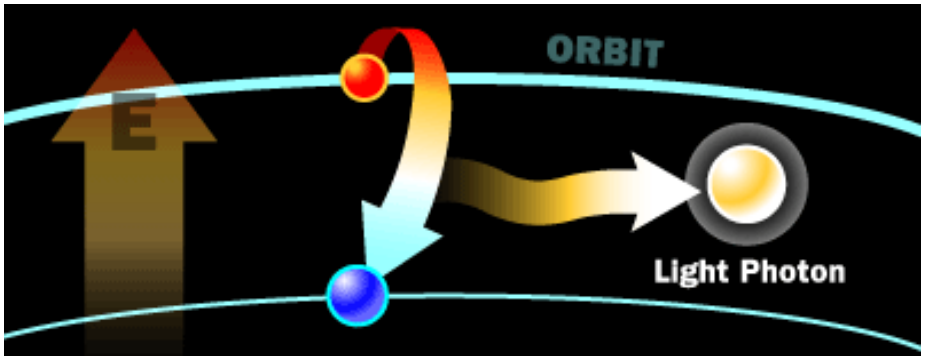
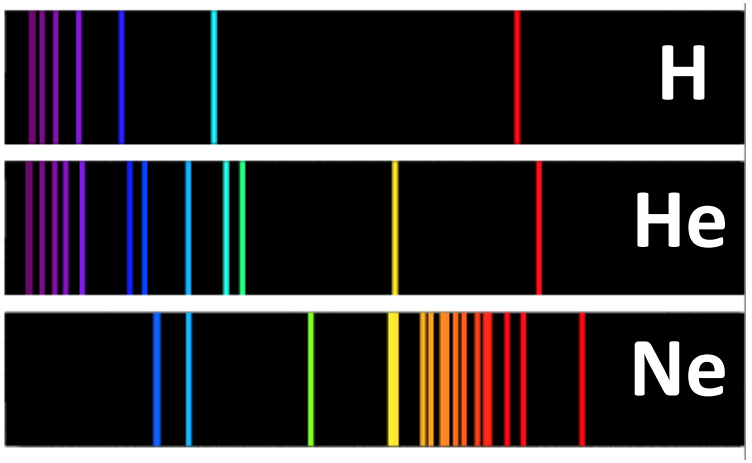
Light Emission Part 2



Light: a Form of Energy that Travels

- **Light waves are <u>electromagnetic radiation</u>.**
- **<u>Emission</u> of electromagnetic radiation <u>happens when electrons in atoms oscillate</u>, or "jump" between energy levels.**

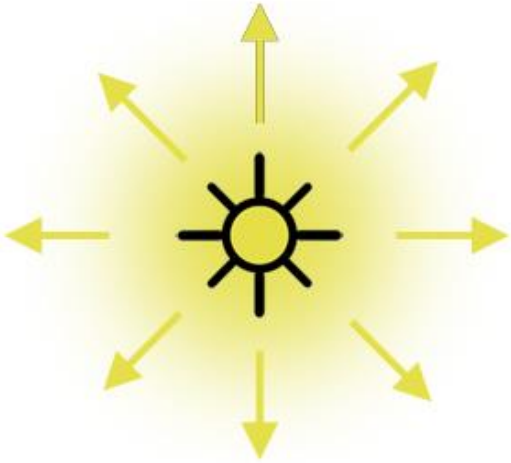




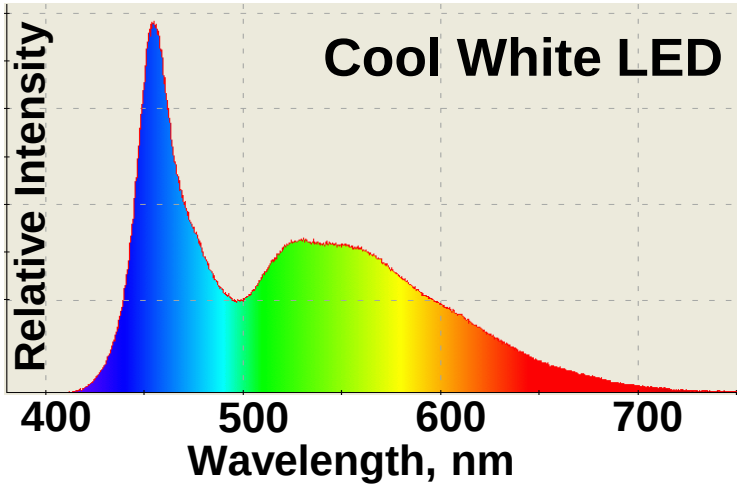
- **<u>Each particular chemical element has</u> a unique electron configuration (*set of possible energy levels*) and hence <u>its own unique set of distinct colors</u> called line emission spectrum or atomic spectrum.**

How to Describe Light?

- **The intensity of light is the amount of energy falling on a surface per a unit of time.**
  - **"Amount" of photons.**
  - **Most light sources distribute their light equally in all directions, making a spherical pattern.**
  - **Because light spreads out in a sphere, the intensity decreases the farther you get from the source.**

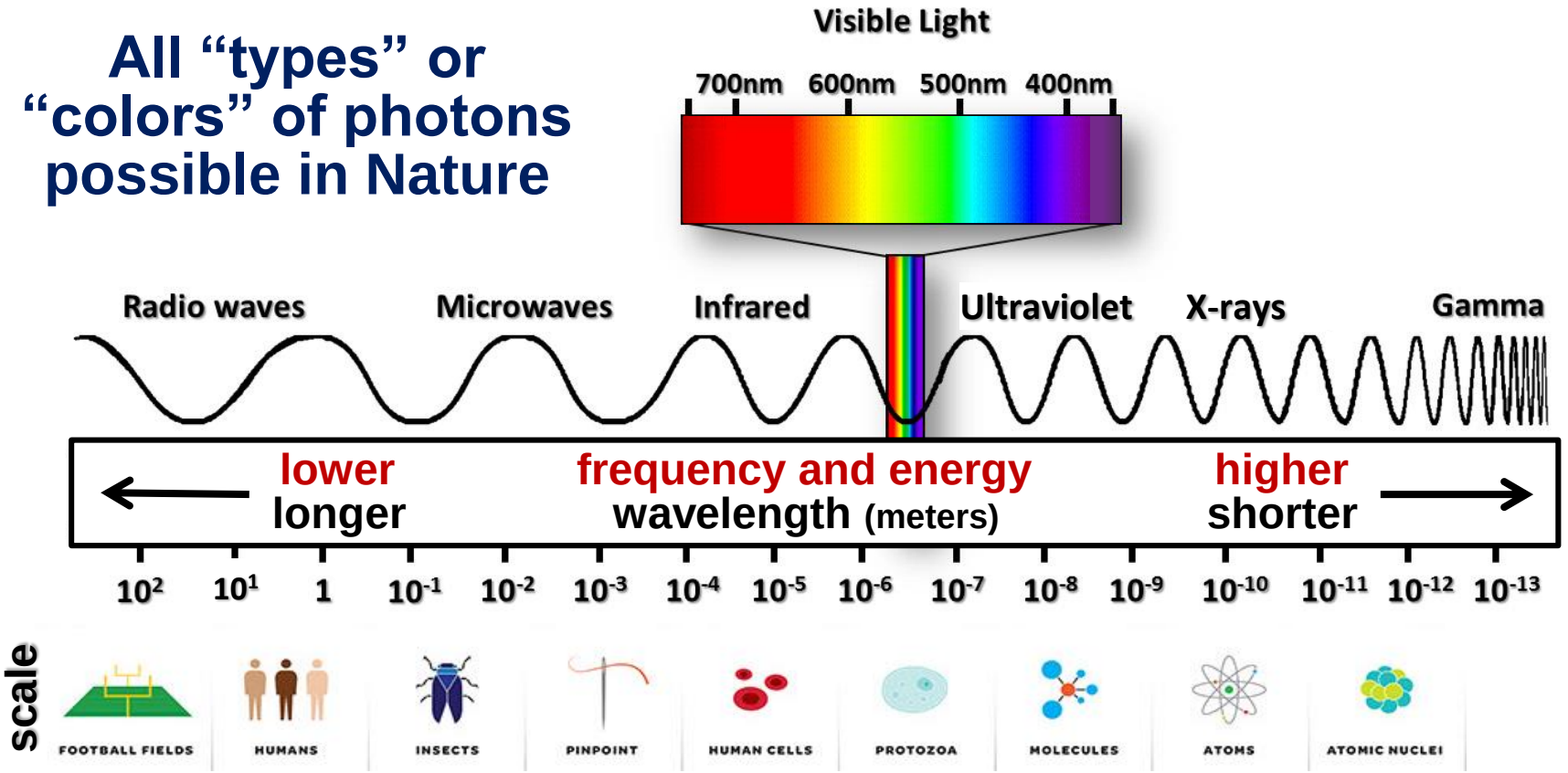


- **The spectral composition of light is the relative light intensity for all emitted colors (wavelengths).**



Electromagnetic Spectrum

All "types" or "colors" of photons possible in Nature



$$\text{Wavelength} = \frac{c}{\text{Frequency}}$$

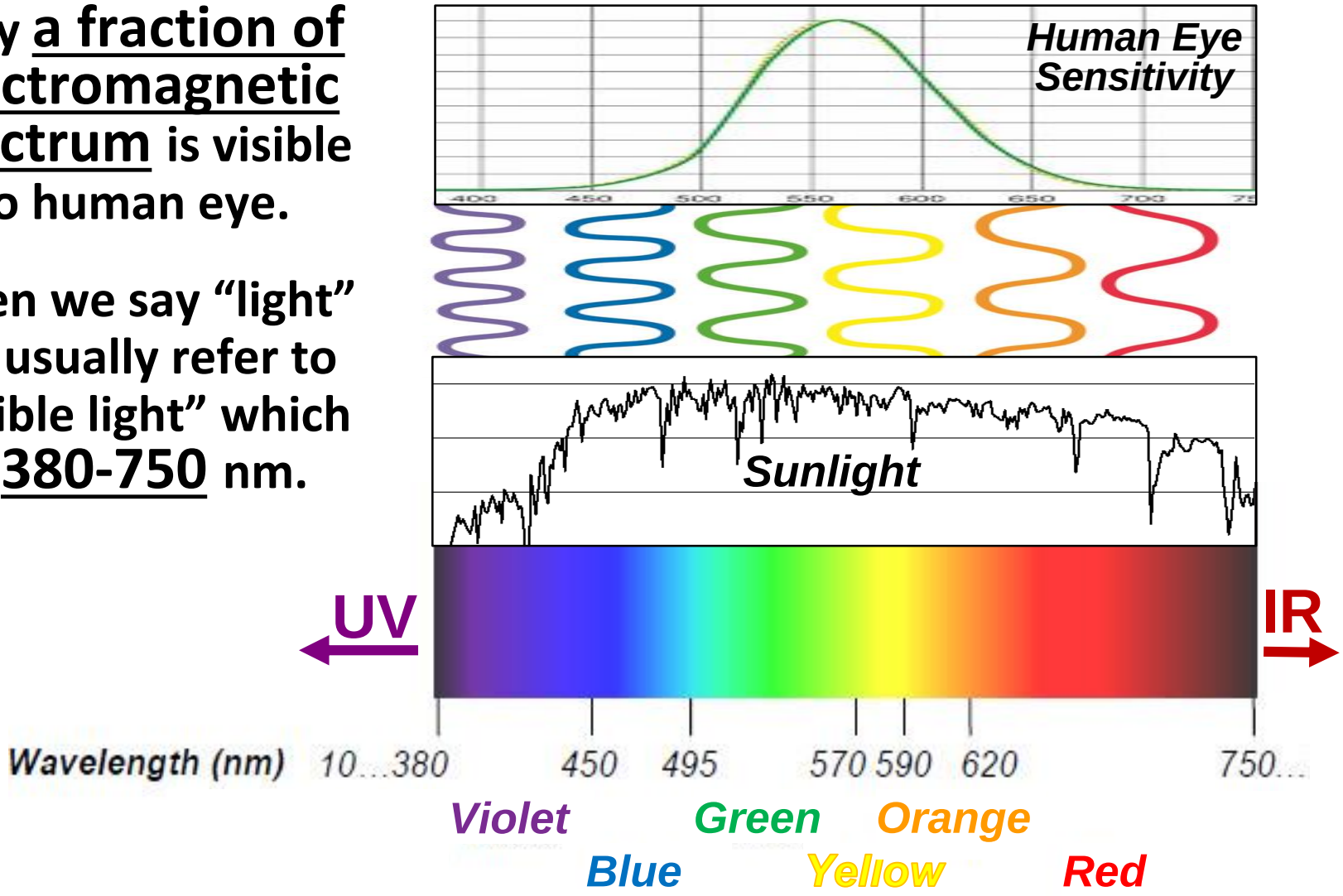
c is the speed of light

Energy ~ Frequency

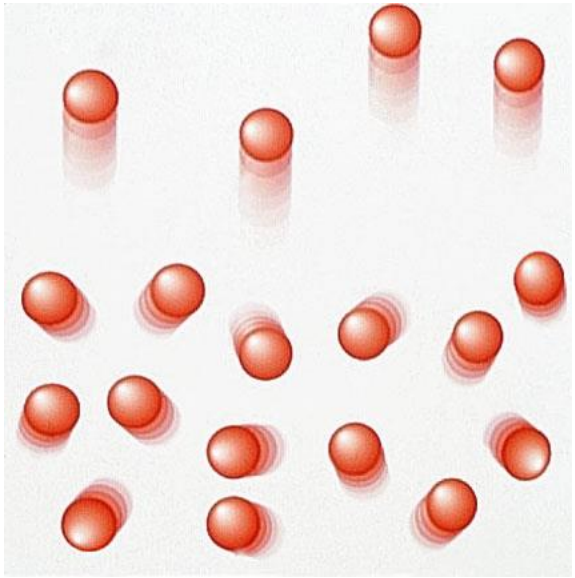
Visible Light

Only a fraction of electromagnetic spectrum is visible to human eye.

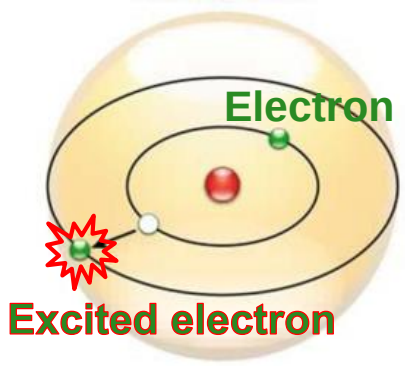
When we say "light" we usually refer to "visible light" which is 380-750 nm.



Gases

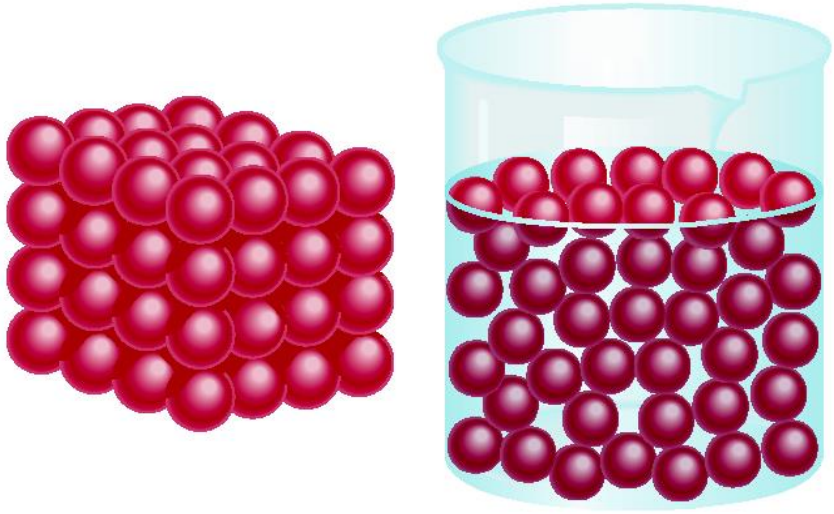


atoms far apart

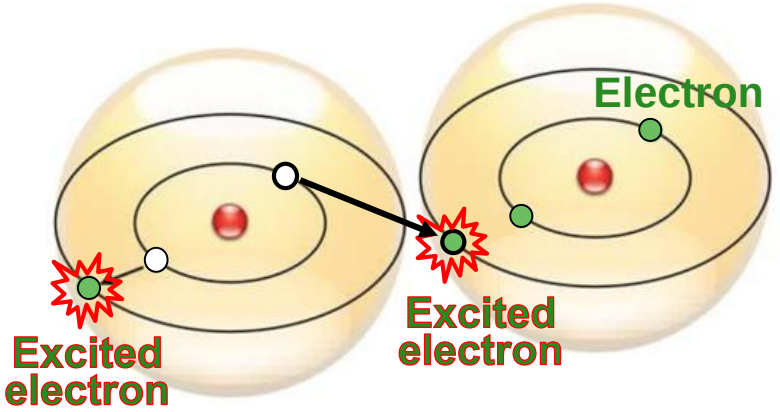


VS

Solids/Liquids



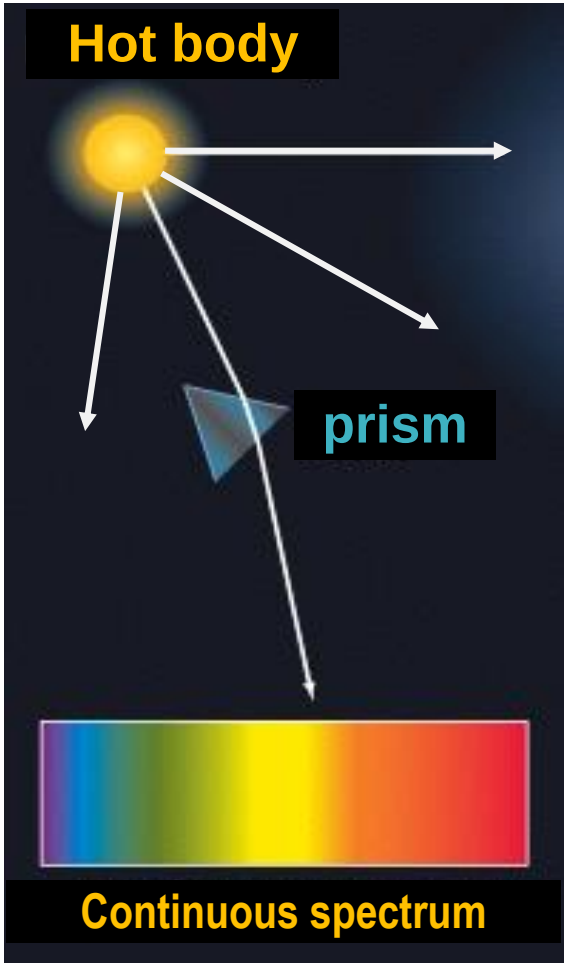
atoms close to each other



Thermal Radiation

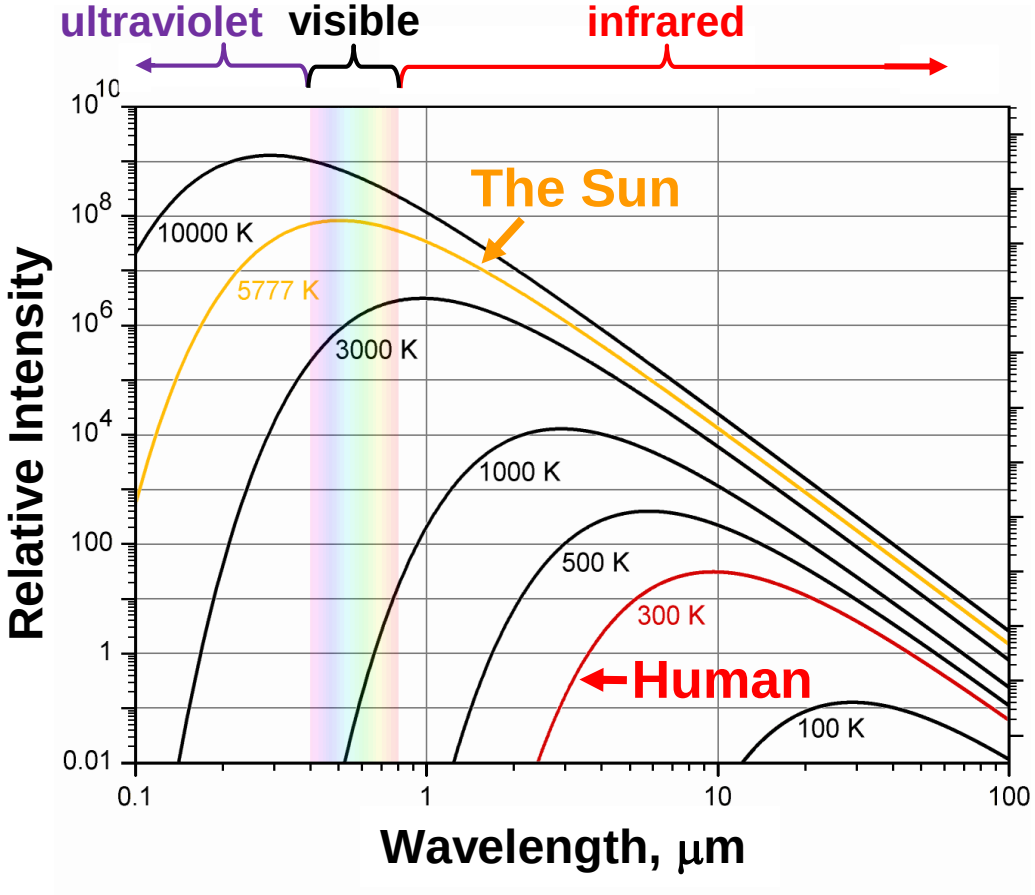
All normal matter emits electromagnetic radiation when it has a temperature above absolute zero.

- **This radiation represents a conversion of a body's thermal (heat) energy into electromagnetic energy, and is therefore called thermal radiation.**
- **When the atoms are in a condensed state (solid or liquid matter), the "hot" electrons can make transitions not only within the energy levels of their own atom, but also between the levels of neighboring atoms (that can be of same or different kind).**
- **This results in a much larger number of possible transitions with corresponding frequencies of radiant energy, producing a continuous color spectrum.**



Thermal Radiation Spectrum

The exact thermal radiation spectrum depends upon properties of the material and the temperature. As the temperature decreases, the peak of the radiation curve moves to lower intensities and longer wavelengths.



- The temperature at which all solids glow a dim red is about 798 K (~976 F).
- A very hot object would emit a significant amount of energy in the ultraviolet region of the spectrum.
- People are emitters of energy in the infrared region (peak ~9.5μm).