

## The Relationship between Wavelength, Visibility and Temperature

While referring to the electromagnetic spectrum, by definition, *Wavelength* is the spatial period of the wave – The distance over which the wave's shape repeats<sup>(1)</sup> or in other words, the distance between successive crests of a wave<sup>(2)</sup>.

According to the Planck-Einstein relation<sup>(3)</sup>; The energy of a photon (light particle) is inversely proportional to the wavelength of the radiation. The shorter the wavelength, the greater the energy of each photon.

Temperature is directly proportional to a particle kinetic energy. Therefore, temperature is inversely proportional to the wavelength of a particle. Shorter the wavelength, greater the energy and higher the temperature.

Visibility for humans is limited to the light of a certain range of wavelength only. It comprises of the visible spectrum of the electromagnetic spectrum that is visible to the human eye, typically between 390 to 700 nanometers.

When one typically talks about the visibility, it is often in terms of the intensity of light. Intensity is the amount of energy passing through a specified area in a specified amount of time<sup>(4)</sup>. Light and heat are directly related to each other<sup>(5)</sup>. Increase in the intensity of light increases heat and vice versa. Therefore, Increase in the intensity of light increases the temperature and consequently causes a reduction in wavelength. It means that shorter the wavelength, brighter the light.

To summarise, wavelength, visibility and temperature are related to each other such that, a decrease in wavelength increases temperature and visibility and vice versa.

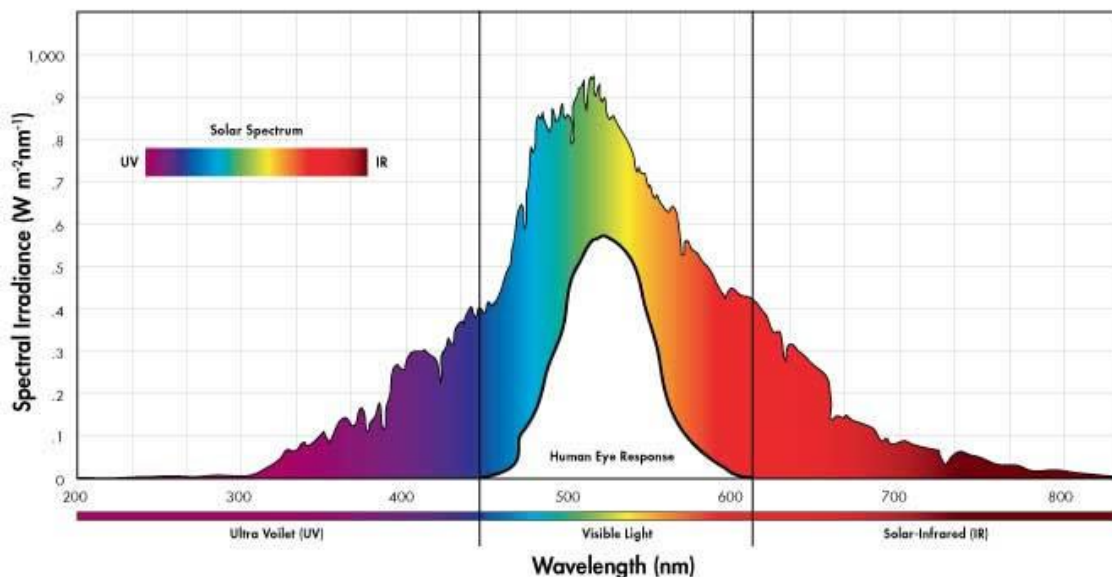


Fig 1: The image above shows the light that the human eye can see (visible light) and its relationship to UV and infrared<sup>(6)</sup>.

## References:

- (1) Hecht, Eugene (1987). *Optics* (2nd ed.). Addison Wesley. pp. 15–16.
- (2) <http://www.merriam-webster.com/dictionary/wavelength>
- (3) French & Taylor (1978), pp. 24, 55
- (4) <https://www.physicsforums.com/threads/is-there-any-relation-between-wavelength-and-brightness.652035/>
- (5) <https://yihanli.wordpress.com/2011/11/01/the-relationship-between-light-and-heat/>
- (6) <http://thinkalpen.com/resources/heat-transfer-and-visibility-in-commercial-windows-and-glass/>