

What is light?

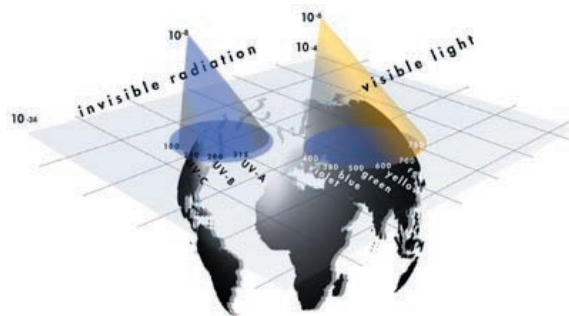
Light is the narrow part of the wide electromagnetic spectrum that our eyes can perceive and produce a visual sensation. The spectrum of (visible) light reaches from deep purple, close to UV radiation, up till warm red, close to IR radiation.

Electromagnetic spectrum

Electromagnetic radiation has a very wide spectrum reaching from ultra short wavelengths ($< 10^{-14}$ m) for cosmic radiation to radio frequencies where waves can be kilometers long. In the middle of the spectrum lies the visible light having a border around 380 nm to UV radiation and around 780 nm to IR radiation.

Visible light

Electromagnetic radiation, having a wavelength between 380 and 780 nm, is captured by the different photo receptors in our eyes and translated to colors in the human brain. When a human eye receives radiation with wavelengths of 400 to 480 nm, the brain interprets it as blue. When the radiation wavelength increases, the associated color changes to cyan – green – yellow – orange and red.



UV and IR

Ultraviolet (UV) radiation has a shorter wavelength than light and it is classified by CIE into three groups: UV-A (400-315 nm), UV-B (315-280 nm) and UV-C (280-100 nm). UV-B is for human beings the most destructive segment, because it is not filtered by air. UV-C would be even more harmful, but it is almost completely absorbed by air.

Infrared (IR) radiation has longer wave lengths than light and it is also classified as UV into three groups: IR-A (780-1,400 nm), IR-B (1,400-3,000 nm) and IR-C (3,000-1,000,000 nm).



Colors

The human eye functions very much as a camera: with the lens making a picture at the light-sensitive retina at the backside of the eye. There are different kinds of light detectors, called rods and cones. The cones are normally grouped into three types, each responding to a portion of the spectrum. Peak responses correspond to blue, green and red light. This theory is called the trichromatic theory making the basis for tristimulus colorimetry. This theory is applied in, e.g., a television.

Color Specifications

A light source color specification and measurement can be categorized into three main methods: tristimulus colorimetry, color temperature and spectroradiometry.

Tristimulus colorimetry states that all colors can be seen as mixtures of the three primary colors blue, green and red (often called RGB). There are different so called color charts giving us each color tone as a function of components. The most used of the chromacity charts is the CIE 1931 Yxy chart.

Color temperature has its origin in the color changes of an object when it is heated to various temperatures.

Spectroradiometry is the most accurate method of specifying colors analyzing the total spectral data over a given wavelength area.

