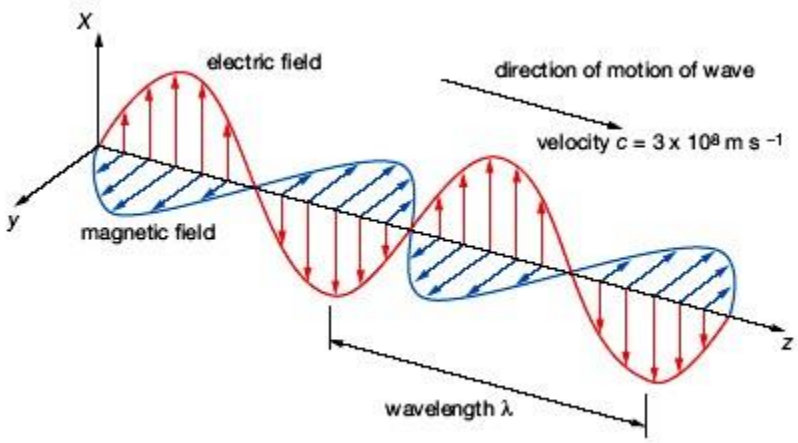
Physics with Synno – Waves-Light – Lesson 7

LW.15 Electromagnetic Spectrum

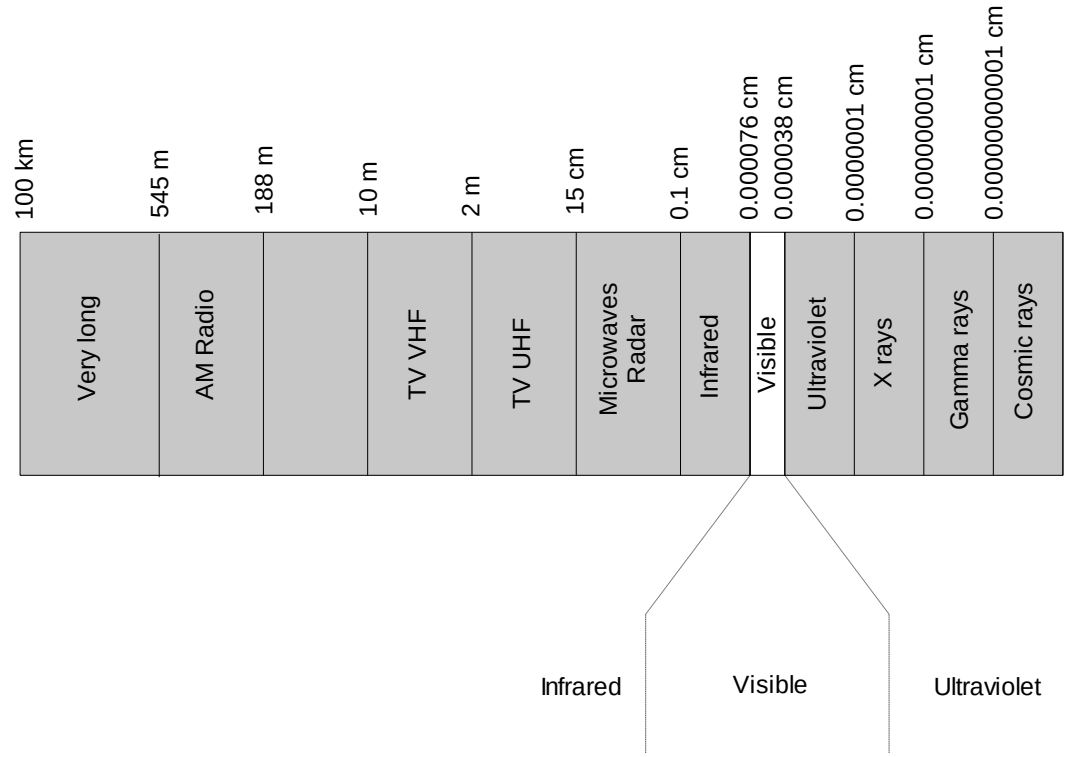
Video: The Electromagnetic Spectrum
What is Light? Maxwell and the Electromagnetic Spectrum
Electromagnetic Spectrum Science Song

Light is the only thing that we can see. But what is light? Maxwell developed an answer to question of what is the nature of light, when he discovered that light was an electromagnetic radiation within the frequency range of 4.3×10^{14} to 7×10^{14} Hz. These waves activate the "electrical antennae" in the retina of the eye. He understood that light of any kind is energy-carrying waves of electric and magnetic fields that continually regenerate each other and travel at a single fixed speed, the speed of light.

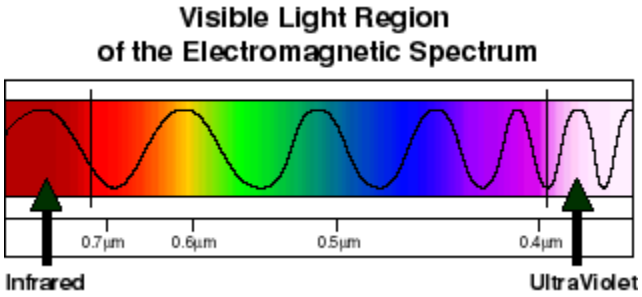
Visible light is a part of what is known as the electromagnetic spectrum. All electromagnetic waves are created by accelerating charges which result in a rapidly changing magnetic field and electric field travelling out from the source at the speed of light. Note that the electric field component and the magnetic field component are at right angles to each other and to their direction of travel.

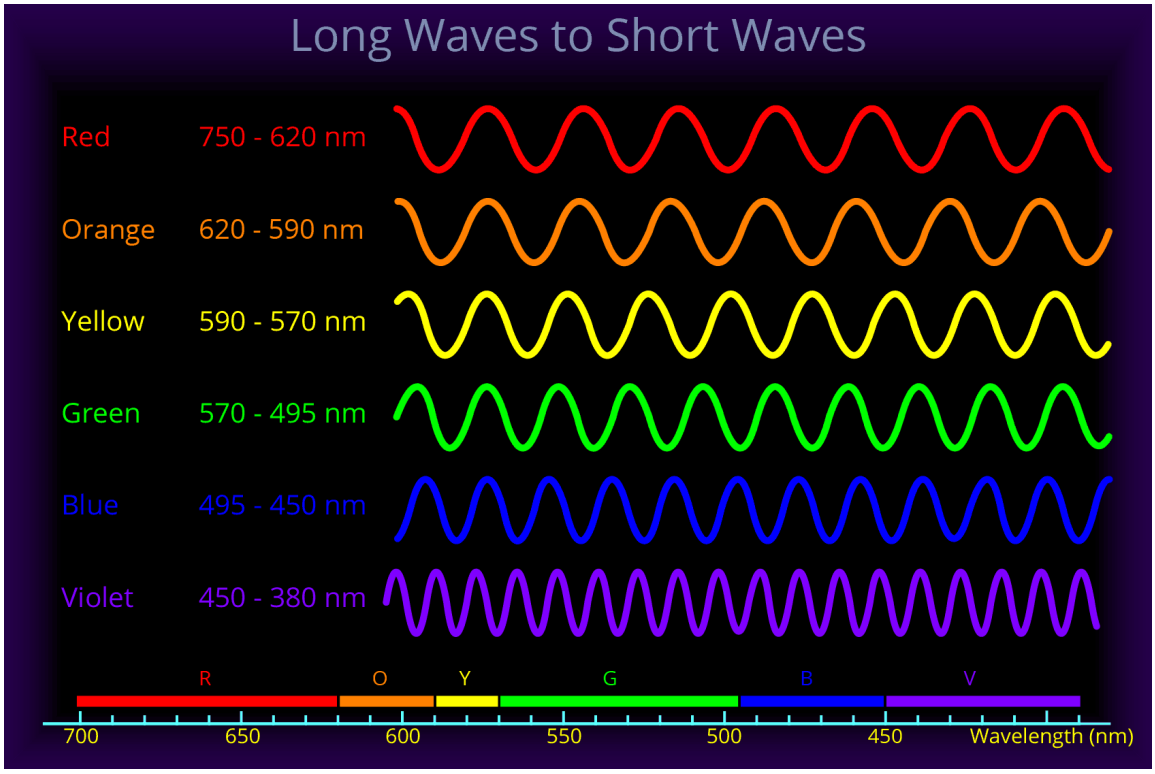


The electromagnetic spectrum is a continuum of all electromagnetic waves arranged according to frequency and wavelength.



Visible light waves are the only electromagnetic waves we can see. We see these waves as the colours of the rainbow. Each colour has a different wavelength. Red has the longest wavelength and violet has the shortest wavelength. When all the waves are seen together, they make white light.





Name	Generated by	Detected by	Properties
Gamma-rays	Changes of energy levels in the nucleus	a) Photography b) Ionisation chamber	a) Penetrates matter b) Ionise gases c) Causes photo-electric emission
X-rays	Rapid deceleration of fast moving electrons (e.g. by tungsten target)		
UV	Orbital electrons of atoms. E.g. the Sun	a) Photography b) Photoelectric cell	a) Absorbed by glass b) Can cause many chemical reactions (e.g. the tanning of human skin) c) Ionise atoms in the atmosphere resulting in the ionosphere
Visible light	Re-arrangement of outer orbital electrons in atoms and molecules. (e.g. incandescent solids)	a) Eye b) Photography c) Photocell	Can cause chemical action
Infra-red	Outer electrons in atoms and molecules	a) Photography by special plate b) Heating effect	a) Useful for 'seeing' molecular structures b) Less scattered than visible light by atmosphere
Micro-waves	Micro-wave generators	Micro-wave receivers	a) Microwave ovens b) Radar communication
Radio Waves	Oscillating electrons in radio aerials	Tuned electric circuit	Different wavelengths find specialised uses in radio communications

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