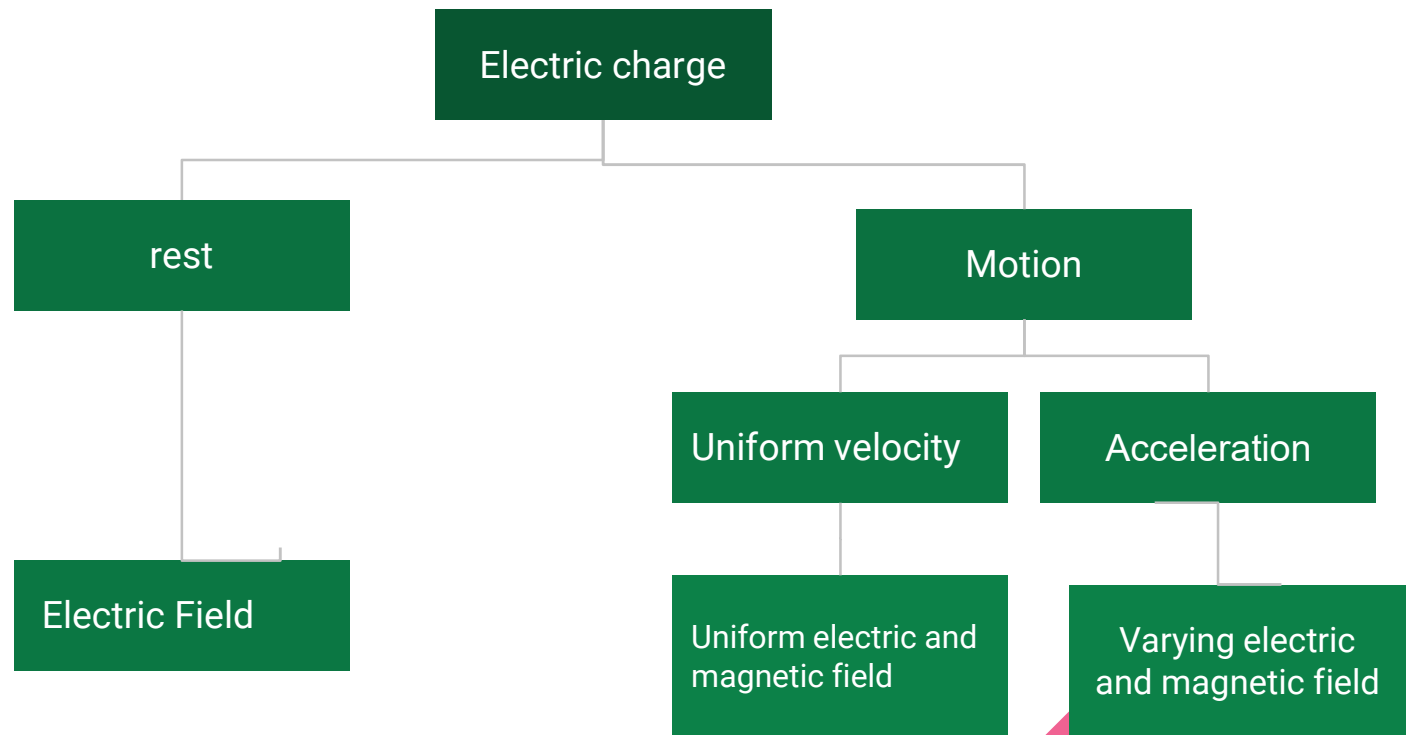


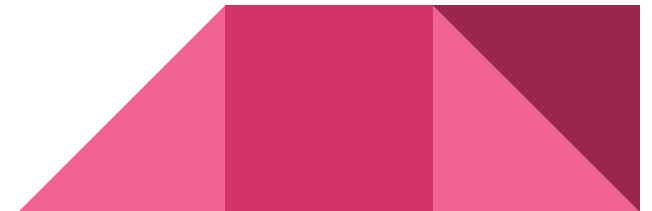
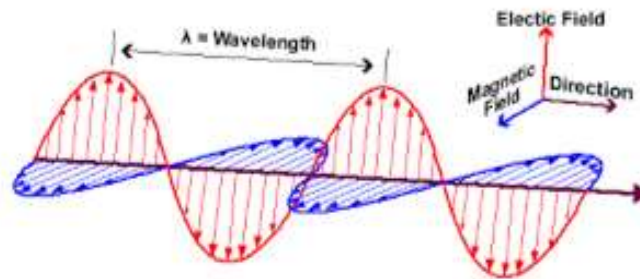
ELECTROMAGNETIC WAVES

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Maxwell's Suggestions

- In 1864, The British scientist James Clerk Maxwell Suggested that accelerated electric charges can generate coupled electric and magnetic disturbances in the space around the charges and these disturbances can travel indefinitely through the space.
- If the electric charges undergo periodic oscillations, Then the electric and magnetic disturbances can propagate as waves in space.
- These waves are called electromagnetic waves.

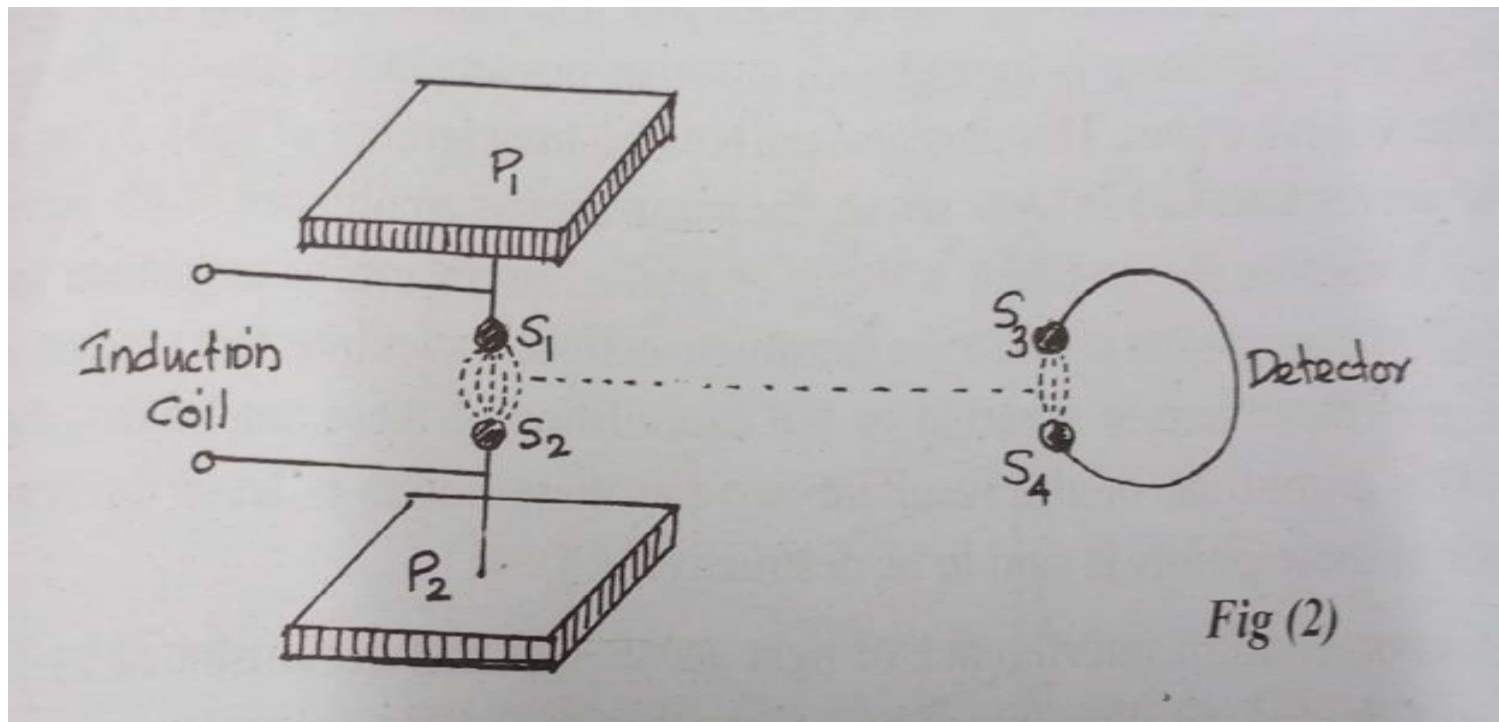


Maxwell calculated the speed of electromagnetic wave in free space as 2.998×10^8 m/s.

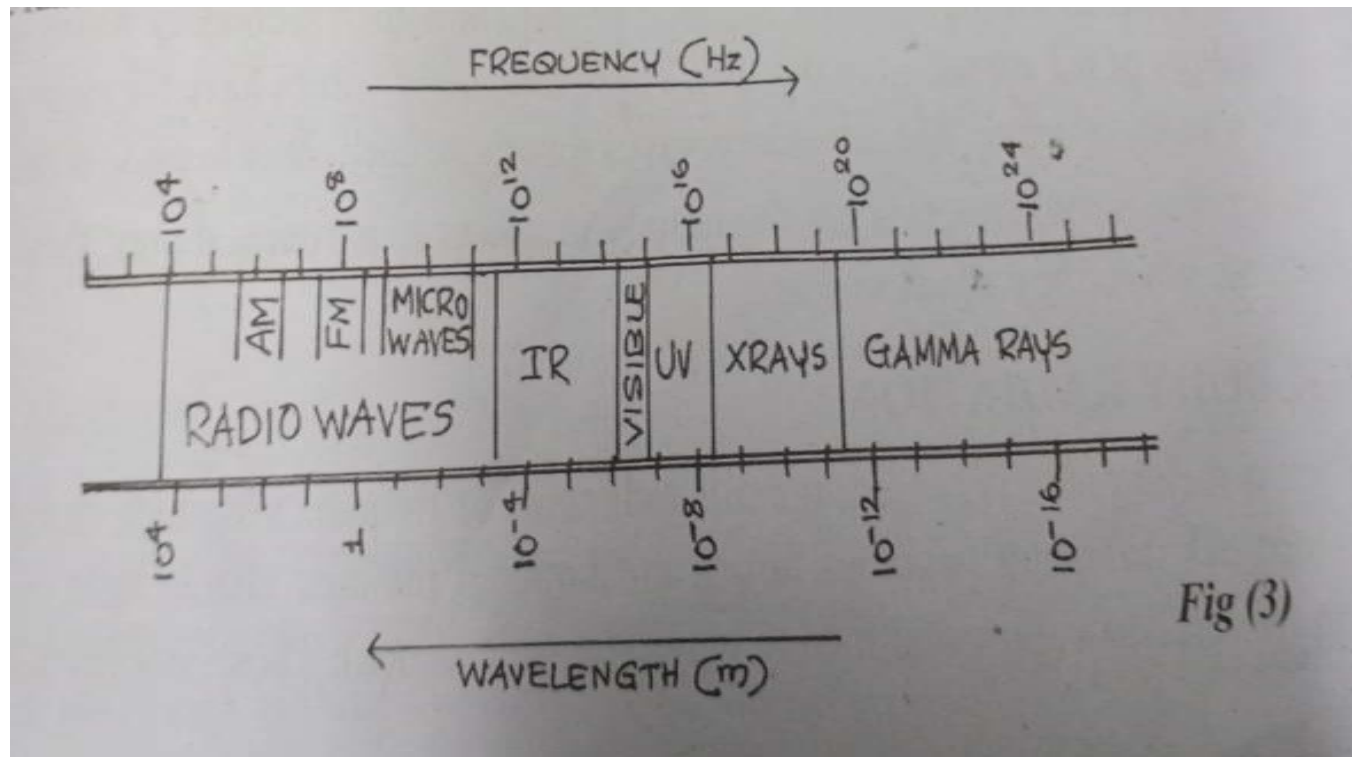
The speed of electromagnetic waves in free space is same as that of light. This coincidence made Maxwell to conclude that **light consist of Electromagnetic wave.**



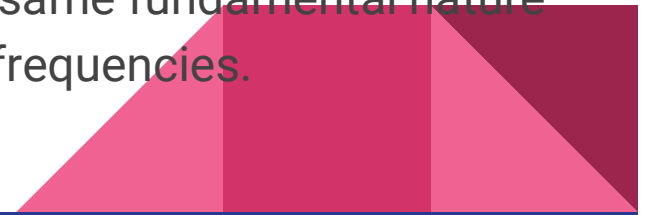
Experimental verification by Heinrich Hertz



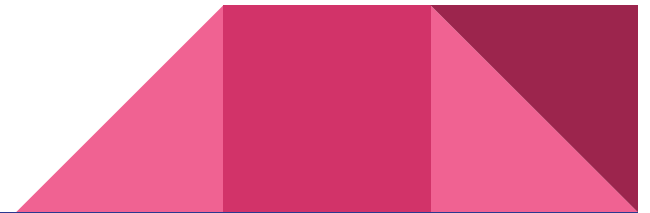
Electromagnetic Spectrum



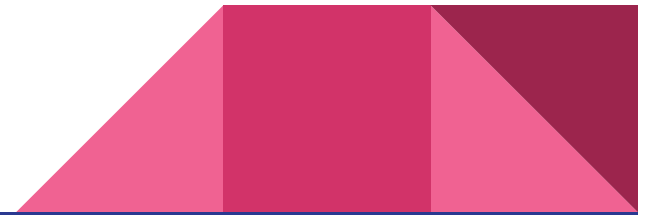
- Light waves are electromagnetic waves within the frequency range of about 4.3×10^{14} for red light to 7.5×10^{14} for violet light.
- Wavelength range is $4 \times 10^{-7} \text{m}$ for violet light to $7 \times 10^{-7} \text{m}$ for red light.
- All the components of electromagnetic waves have same fundamental nature ,But their interaction with matter depend upon their frequencies.



- A wave is a propagation of variation of some quantity in space. The maximum value of that quantity is called Amplitude. The value of this quantity at any place at any time is called instantaneous amplitude.
- When an electromagnetic wave propagates through space, the quantities that vary are electric field and magnetic field.
- Therefore the value of E or B at any instant at any point represent the instantaneous amplitude of the electromagnetic wave.
- The maximum values E_0 and B_0 are the amplitudes of the wave.
- E and B are related through $E=cB$



- ❖ For light waves interaction of electric field with matter is responsible for all common optical effects.
- ❖ Electromagnetic waves obey **superposition principle**. "When two or more waves of same nature propagate at same time in same space ,then the instantaneous amplitude at any point is the sum of the instantaneous amplitudes of the individual waves at that point."
- ❖ The phenomenon of **Interference** was first demonstrated by Thomas Young using a double slit illuminated by a monochromatic source.
- ❖ The experiment is a proof to show that light consists of waves. Maxwell's theory suggests that the nature of light wave is electromagnetic.



- ❑ **Diffraction** is another phenomena exhibited by waves. When light wave encounters an obstacle or passes through a narrow slit ,then secondary wavelets produces. These secondary waves superpose each other to cause diffraction.
- ❑ Interference and Diffraction are found only in waves.

