

Light is a particles in a wave motion

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Abstract—The whole universe made of light and matter. The matter is understood to some extent, still the mystery of light lies. Everyone knows the dual nature of light. Phenomena's like refraction, reflection, interference, and diffraction can be explained by wave nature of light, on the other hand the phenomena like fixed quanta emitting can be explained by the concept that it is made of particles called photons. Photo electric effect can be explained only by the particle nature of light. It was considered the photons are mass less, which travels with fixed velocity called velocity of light. Suppose if photons are mass less, how it can travel, for anything to move from one place to another, some presence is needed. Hence to support the above argument let us consider photons have mass. It is believed Electron is indivisible. Now, here, we will see that electron can be further divided into sub particles, which constitute the mass of the light particles, which when ejected from the bind of atomic nucleus gets propagated through the space in the path of waves. Here we combined the two thoughts of light into one. Light is made of sub particles of Electron, when it is gets freed from the bind of nucleus attraction travels through the space in the path of sinusoidal wave. Hence, light is a particles in a wave motion. It completely describes the nature of light both as a particle and as a wave.

Index Terms— Light, mass, photons, sinusoidal waves and velocity of light.

I. INTRODUCTION

The light is considered as one of the most important phenomena vastly experimented and studied, yet it is not complete due to its dual nature. Scientist tried to explain the various phenomena of a light depending upon the two nature of light, as a particle and as a wave, which suits it accordingly. But, it needs complete whole some explanation, which will completely explain the dual nature of light into one.

II. HISTORY

The study of light is centuries old. It is most universal in presence, without which it is not possible to imagine the creation of life, the fauna and flora of our planet. It can also be called as life giver and sustainer of the Earth. Hence, its study and understanding considered as important. Since ages many believe in dual nature of light. The various experiments conducted show the reflection of both the nature. No single theory explains both the nature of light. Now, Let us attempt to describe the dual nature of light into mono nature.

III. EXPLANATION FOR THE NATURE OF LIGHT

Light is considered as waves or particle depending upon the observed phenomena. Light is considered to be made of

photons, whose mass is assumed to be zero. For anything in the universe to have velocity, it should have a mass, without mass it cannot have velocity. Assumption of photons to have no mass is not acceptable. Surely it will have mass in order to have its velocity of 3×10^8 m/s. Instead of considering it as wave or particle, let us consider the both. It is particles in the form of Electron, when it is under the influence of Atomic nucleus attraction orbiting around the central nucleus and becomes sub particles, following sinusoidal wave pattern, when it is gets detached or dispersed from the influence of Atomic nucleus attraction, propagated through the space. In other words the Electron disintegrates into sub particles in the form of sinusoidal waves propagating in to the space. Since the wave consists of sub particles, it does have mass. Let us further examine how single Electron produces both the Electric and magnetic waves moving perpendicular to each other.

Let us consider the Magnetic wave; Magnetic wave together with Electric wave makes the Electromagnetic wave. Magnetic waves must have mass in order to experience force. Hence, both the Electric wave and magnetic wave will have mass. Mass for both Electric wave and magnetic wave comes from the mass of the Electron.

Let us take simplest atom

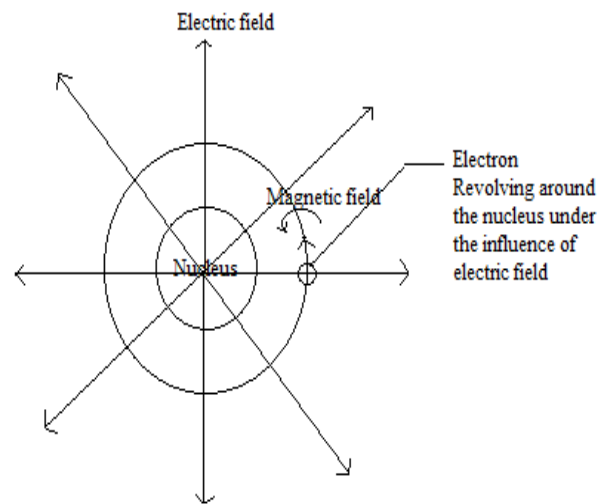


Figure 1

The above figure 1 of Atom shows the Electron is revolving around the central nucleus under the influence of established Electric field between central positive charge protons and revolving negative charge electrons. We know that moving Electric charge produces magnetic field. So, from the figure 1, we see that the Electron revolving around the central nucleus should produce magnetic field, the direction of which given by right hand palm rule. Hence, we observe the magnetic field is perpendicular to the Electric field due to the movement of Electron around the central nucleus.

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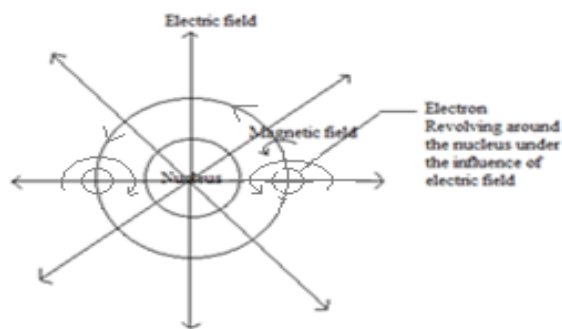


Figure 2

Secondly the spin of the Electron around its own axis also due to the force induced by revolution of negative charge Electron around the central nucleus. The movement of Electron around the nucleus can be imagined as a circulation of Electric current (due to movement of electrons) around the central nucleus in the Electric field existing between positive charge proton and negative charge Electron. According to Fleming's left hand or right hand rule, we observe the force is induced on the Electron, this force makes Electron spin around its own axis, the direction of rotation is given by right hand palm rule, which says if thumb points along the direction of Electric current, the curled fingers of that hand gives the direction of magnetic field due to current. This we call as the spin of the Electron around its own axis. This is one of the fundamental quantum number of an Atom. The spinning of Electron is perpendicular to the direction of its orbit around the central nucleus. The spin of the Electrons are said to be pair, mainly because in the figure 2 we can see the Electron on the right hand side orbiting around nucleus experiences spin motion anti clockwise, while the same electron is on the left hand side of the nucleus experiences spin motion in the clockwise direction according to right hand palm rule. Hence, if two Electrons are simultaneously revolving around nucleus, both will have opposite spin. Because of this reason the Electron spins are said to be paired. This explains the reason for Pauli's exclusion principle, which states that in an atom no two Electrons can have the same four electronic quantum numbers. We can infer that an Electron's orbital motion around central nucleus may produce Electric field and spin motion of an Electron around its own axis may produce magnetic field. Also, the direction of the spin of an Electron and the corresponding direction of its motion around the Nucleus are perpendicular to each other. Hence, the Electric field generated by orbital motion of Electron around the nucleus and magnetic field generated by spin motion of an Electron around its own axis are mutually perpendicular to Each other. When Electrons are accelerated both the above fields gets originated due to two motions of rotation and revolution of an Electron and spreads into space as Electromagnetic waves

The circular movement of Electron in the Electric field around central nucleus produces force which makes Electron to spin on its axis called as Electron spin, this Electron spin in turn produces magnetism, although it is only an Electric field, which makes it to spin on its axis, Also as it is originated from an Electron. There is no such thing as separate magnetism or magnetic wave, it is only due to the Electric field and

Electricity in the atomic level gives rise to the concept of magnetism and magnetic field.

Lets us do some further calculations to find approximate mass of the Photons.

We have

Mass * velocity = momentum

Mass of Electron * velocity of Electron in its orbit=mass of photons * velocity of photons

$$M_e v_e = m_p v_p$$

$$9.1083 * 10^{-28} \text{g} * 2.19 * 10^6 \text{ m/s} = m_p * 3 * 10^8 \text{ m/s}$$

We get $m_p = 6.6490 * 10^{-30} \text{g}$

Hence, mass of photons = $6.6490 * 10^{-30} \text{g}$

This mass gets dispersed in the form of smaller particles distributed across the sinusoidal waves.

The length of one sinusoid arc from mathematics is 7.64

Hence, the frequency multiplied by a factor of 7.64 gives the total length of the wave .But, since a single Electron gets divided into both Electric and magnetic wave perpendicular to each other, the length travelled would be twice. Hence, multiply by two.

Let us consider for Ultra Violet radiation

The Frequency = $8 * 10^{14} / \text{sec}$

Total Length of wave particles travelled

$$= 2 * 8 * 10^{14} * 7.64 = 1.222 * 10^{16}$$

From above we see total mass of the photons

$$= 6.6490 * 10^{-30} \text{g}$$

Hence mass of sub particles of Electron having the above frequency

$$= 6.6490 * 10^{-30} / 1.222 * 10^{16}$$

$$= 5.439 * 10^{-46} \text{g}$$

This is the mass, which travels on the wave path most probably elastic in nature. Mass of sub particle varies depending upon its wave length.

Let us consider the equation

$$\text{Momentum of photon} = m * c = h / \lambda,$$

Where m = mass of photon, c = speed of light, h = Planck's constant and λ = wave length of light

Since c remains constant, the above equation shows the mass of sub particles of Electron called as Photons is inversely proportional to its wavelength. Hence, mass of sub particles of Electron varies depending upon its wavelength.

IV. GENERATION OF ELECTROMAGNETIC WAVES

The Electromagnetic waves are produced either by acceleration of charged particles or by excitation of an atom. The electrons can be accelerated in a conductor by alternating current.

We have for $E = E_m \sin(kx - \omega t)$

Where E_m = amplitude and $k = 2\pi / \lambda$ and $\omega = 2\pi f$

We can see from the Equation, the frequency of the current decides the frequency of the Electromagnetic wave which propagates into space.

.Orbital frequency of Electron in the first orbit

$$v = me^4 / 4\epsilon_0^2 n^3 h^3$$

Substituting values we get $v = 6530 * 10^{12} \text{ Hz}$

The Electromagnetic waves can also produced by excitation of an atom by supplying suitable amount of Energy above the thresh hold frequency, which makes Electron jump from the lowest energy level to next higher energy levels(excited state) and when it jumps back to lowest energy level, it emits Electromagnetic waves.

V. CONCLUSION

Hence, from above argument we can conclude that light is a both wave and particle .Light is particles in a wave motion .It completely explains the all the observed phenomena and nature of light. It can be extended to all the other Electromagnetic waves. Mass of sub-particles varies depending upon its wavelength. Though the original mass (Electron) remains same. The above idea of mass of Electron getting divided into further sub particles, explains a single line getting split in a number of very closely related spectral lines, which is supposed to be only one spectral line from an Electron between any two given energy states examined under a spectroscope of strong resolution. It also explains the splitting of spectral lines into a group of finer lines under the influence of magnetic field (Zeeman Effect) and Electric field (Stark Effect) suggesting that Electrons are further divisible. It also explains the photoelectric effect as some metals emit Electrons, when light falls on them. It means Electrons are stored in the form of light. When a light of suitable frequency falls on the some metal, the photon of light gets converted to Electron revolving around the nucleus. The extra Electron gained gets liberated from the metals.

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