A new interpretation of photon

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The present interpretation of photon is as: A photon = a quantum of radiation energy + energy $h\nu$, where the quantum of radiation energy constitutes the photon and provides the particle like physical existence to it, similarly, as the quantum of charge (-e) constitutes the electron and provides the particle like physical existence to it, and the energy $h\nu$ enables the photon to travel with velocity c, spin with frequency ν (which the photon obtains from the orbiting electron, from which the photon is emitted), scatter electron in Compton scattering, and eject electron penetrating into metals in photoelectric effect. The present interpretation of photon enables to provide very clear and complete explanations of all the phenomena related to photons, including the phenomena of interference and diffraction

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1. Introduction

As we know, the concept of quantum came across the floor after the Planck's quantum theory to explain the energy distribution in radiation chamber. Plank, in his theory, instead of assuming the radiation chamber to be filled with radiation energy in continuous form, he assumed the radiation chamber filled with radiation energy in quantized form (i.e. in the form of bundles). These quanta (bundles) of radiation energy were later on interpreted as photons.

1.1 The current interpretation of photon

As photons suffer the phenomena of interference and diffraction, the photons were reinterpreted as: The photons are discrete quanta of radiation energy given by $h\nu$, which involve the frequency ν of radiation. These, unlike the light corpuscles of Newton, include in their very concept the wave nature also of radiation, because this alone and not the other quantum idea can account for the phenomena of interference and diffraction.

1.2 Faults in the current interpretation of photons

In the current interpretation of photons (Section 1.1), there are actually two statements:

1. The photons are discrete quanta of radiation energy given by $h\nu$, which involve the frequency ν of radiation.
2. These, unlike the light corpuscles of Newton, include in their very concept the wave nature also of radiation, because this alone and not the other quantum idea can account for the phenomena of interference and diffraction.

As the concept of wave nature of electrons, nucleons, photons, and so forth, cannot be true (see Section 1.1, [1] for verification of its truth), and the phenomena of interference and diffraction of electrons and photons cannot take place due to their wave nature (see Section 1.2, [1] for verification of its truth), the second statement is ruled out. Moreover, in the first statement, the portion “The photons are discrete quanta of radiation energy given by $h\nu$” is faulty and incomplete. It gives rise to question: The energy $h\nu$ is whether of the amount of radiation contained in photon, or of photon, that enables photon to travel as a particle with velocity c, scatter electron colliding with that in Compton scattering, and eject electron penetrating into metals in photoelectric effect, and so forth?

As we know, photon travels as a particle with velocity c, scatters electron colliding with that in Compton scattering, and ejects electrons penetrating into metals in photoelectric effect, and so forth, for photon, two things are necessary:

1. As electron exists physically as a particle, and the bundle of charge -e (which is actually the electrical energy) provides the physical existence and rest mass (m_e) to electron, similarly, photon should also exist physically as a particle, and there should be a bundle of something (radiation) that provides physical existence and rest mass to photon.

2. Photon should possess some energy that enables it to travel as a particle with velocity c, scatter electron colliding with that in Compton scattering, and eject electron penetrating into metals in photoelectric effect.

If the energy $h\nu$ is of the bundle of radiation that provides physical existence to photon as a particle, then where is the energy that enables photon to travel as a particle with velocity c, scatter electron colliding with that in Compton scattering, eject electrons penetrating into metals in photoelectric effect, and so forth? Moreover, if $h\nu$ is the energy that enables photon to travel as a particle with velocity c, scatter electron colliding with that in Compton scattering, and so forth, then where is the energy in the form of a bundle that provides physical existence and rest mass to photon as a particle?

1.3 Current solution to counter the faults in the current interpretation of photon

Currently, as the rest mass of photon has been assumed to be equal to zero, to counter the above faults in the current interpretation of photon (see Section 1.2), the moving mass $h\nu / c^2$ and momentum $h\nu / c$ have been assigned to photon. The $h\nu / c^2$ and $h\nu / c$ although succeed to explain the phenomena of Compton scattering, photoelectric effect, and so forth, but $h\nu / c^2$ and $h\nu / c$ give rise to several very fundamental questions. For example:

1. What is the physical interpretation of moving mass?

2. Does the moving mass of photon $h\nu / c^2$ provide physical existence to photon as a particle? and if provides, how? Otherwise, the photons cannot collide with electrons and scatter them in Compton scattering, and penetrate into metals in Photoelectric effect.

3. If the moving mass $h\nu / c^2$ and momentum $h\nu / c$, which depend upon the frequency ν of wave nature of photons, have been assigned to photons, such moving mass and momentum should be assigned to electrons too, depending on the frequency of their wave nature, but no such moving mass and momentum have been assigned to electrons. Why is this double standard?

4. In $h\nu / c^2$, since every term h, ν and c has finite value, $h\nu / c^2$ should also be finite. Whereas, if in expression $m_{mov} = m_0 / \sqrt{(1 - \mathrm{v}^2 / c^2)}$ [where m_0 and m_{mov} respectively are the rest and the moving mass of the particle moving with velocity v], substituting the rest mass m_0 of photon = 0 (because m_0 of photon has been assumed to be = 0), the m_{mov} of photon is obtained to be indeterminate. Why is this discrepancy?

5. The term ν, used in $h\nu / c^2$, $h\nu / c$ and $h\nu$, is assumed as the frequency of the wave nature of photon (i.e. ν is the characteristic of the wave nature of photon), while it is believed that the phenomena of Compton scattering, Photoelectric effect, and so forth, take place due to

the particle nature of photons. Further, then how do $h\nu/c$ and $h\nu$ succeed to explain these phenomena?

2. Present interpretation of photon

When an orbiting electron is excited and a photon is emitted from it, during the excitation of the orbiting electron, some radiation energy is filled in it, and after reaching at its excited energy state E_f, it suddenly contracts (shrinks), as the consequence of which the radiation energy, that was filled in it during its excitation, is emitted from it collectively all together at a time in the form of a bundle (or quantum), and the orbiting electron comes down to its lower energy state E_i (see Section III B, [3] for detail).

Because the electrons possess spin motion too along with their linear motion, they possess energy $= E_K$ (kinetic energy) + E_S (spin energy) = E_M (motional energy) (see Section 2.2, [2] for detail information), and the orbiting electrons possess energy $= E_K + E_S +$ P.E. (potential energy) $= E_M$ + P.E. Therefore, when the radiation energy is emitted from an orbiting electron in the form of a bundle (i.e. photon), the amount of radiation energy contained in that photon happens to be $\equiv$ P.E. of the orbiting electron at its energy state E_f - P.E. of the orbiting electron at its energy state E_i (see Section III F, [3] for detail), and the energy = E_M of the orbiting electron at its energy state E_f - E_M of the orbiting electron at its energy state E_i is imparted to the photon as its energy E_M $(= h\nu)$ {see Section III E, [3] for detail}. The energy $h\nu$ enables the photon to travel with velocity c, spin with frequency ν, scatter electron in Compton scattering, and eject electron penetrating into metals in photoelectric effect.

Therefore, the photon should be interpreted as follows:

a photon = a quantum of radiation energy + energy $h\nu$, where

● **Quantum of radiation energy:** It constitutes the photon and provides the particle like physical existence and rest mass $m_{ph}(\approx 3.38\times 10^{-36}Kg)$ to photon. (For mathematical proof of $m_{ph}\approx 3.38\times 10^{-36}Kg$, see Section IV B, [3], and for confirmation that the photons possess rest mass (m_{ph}), see Ref. 4.] It provides intensity, in accordance as the amount of radiation energy contained in quantum, to the spectral lines (see Section III F, [3]), and the fine lines of the fine structure of spectral lines (see Section III K, [3]) in the spectroscopic phenomena, and to the bright interference fringes (see Section 3.2, [1]) and bright diffraction bands (see Section 3.3, [1]) in the phenomena of interference and diffraction respectively.

● **ν :** It is frequency of spin motion of the photon. As the photon is emitted from the orbiting electron (which possesses spin motion), the photon derives spin motion from that orbiting electron (see Section I A, [3] for verification of its truth). The frequencies of spectral lines (see Section III E, [3]), fine lines of the fine structures of the spectral lines (see Sections III K, [3]), and interference fringes (see Sections 3.2.1, and 3.2.3, [1]) are happened to be the frequencies of spin motion of the photons, due to which the spectral lines, fine lines of the fine structures of the spectral lines, and interference fringes are produced.

● **h** : It is plank's constant.

● **hν :** It is motional energy E_M $(=E_K+E_S)$ of photon (see Section III E, [3]). It enables the photon to travel with velocity c, spin with frequency ν, scatter electron in Compton scattering and eject electron in Photoelectric effect penetrating into metals, and so forth.

● **a quantum of radiation energy + energy hν :** It is total energy of photon (see Section III G, [3]).

Moreover,

● **hν/c, which is associated with photons:** It is spin momentum (p_S) of photon, but not the linear momentum of photon (p_{LIN}), because, the spinning particles possess p_S (for confirmation of its truth, see Sections I C, and I D, [3]). Further, as photons possess spin motion, and the momentum $h\nu / c$ varies as ν of photon varies, $h\nu / c$ should be the p_S of photon. However, in all the phenomena, $h\nu / c$ is used as the linear momentum of photon and it succeeds to explain all the phenomena. Why and how, that is as follows:

As the photons possess spin motion, because of the first property generated in them due to their spin motion, they travel always along the directions of their respective spin angular momentum (L_S **)** (see Section 2.1, [2]), and because of the second property generated in them due to their spin motion, they possess always the motional energy E_M (= $E_K + E_S$) and the motional momentum p_M (= $p_{LIN} + p_S$) (see Section 2.2, [2]). However, as the photon moves always with constant velocity c (according to the postulate of the theory of relativity), the E_K and p_{LIN} of photon become constant, and further, as the rest mass of photon (m_{ph}) happens to be extremely small, and the frequency of its spin motion (ν) increases very rapidly as its energy increases, in p_M (= $p_{LIN} + p_S$) of photon, the p_{LIN} (= $m_{ph}\, c$) of photon probably becomes negligibly small as compared to its p_S. Consequently, wherever the momentum of photon is needed to use, $h\nu / c$ (i.e. p_S of photon) succeeds to explain all the phenomena.

However, in E_M (= $E_K + E_S$) of photon, the E_K (= $m_{ph}\, c^2 / 2$) of photon probably does not become negligibly small as compared to E_S of photon because of having c^2 in $m_{ph}\, c^2 / 2$. Hence, wherever the energy of photon is needed to use, $h\nu$ is used.

3. Importance of the present interpretation of photon

The present interpretation of photons enables to provide very clear and complete explanation of all the phenomena related to them. Below is a list of some of the related important phenomena included in this study: 1) Phenomena of interference and diffraction (see Section 3.1, [5]); 2) Phenomenon of spectroscopy (see Section 3.2, [5]).

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