Are all photon frequencies a result of Doppler Effect?

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Abstract

In the paper with title "matter light duality and speed greater than light" we demonstrated that there exists a duality of matter and light. As per a of theorem in that paper, a photon can be represented by one particle going below the speed of light and another particle above the speed of light. In this article we conjecture that every photon is composed of an electron with speed less than light and an electron with speed greater than light (positron as per the matter-duality paper). We validate this prediction with the equations and further conjecture that all the frequency shifts of photons are due to Doppler Effect of the source. Then we take a case of zero energy vacuum where we show that the vacuum is composed of pair of electrons with first electron approaching speed of light from below *c* and the second electron from above *c*. We further demonstrate that the speed of an electron out of electron pair with respect to the other electron is infinite. We call them as **"blind pairs"** because one cannot see the other.

Keywords: Doppler Effect, Matter light duality, speed greater than light, Positron, Blind Pairs

1. Introduction

We demonstrated in article with title "matter light duality and speed greater than light" any photon can be represented by a non-zero mass particle with one going below the speed of light and another going above the speed of light [1]. In this paper we further propose that every photon is actually composed of an electron at a speed less than light and another electron with speed greater than light (a positron).

In the section 2 we formulate and validate the photon as a pair of electron and positron and also counter-validate it as an interference between matter waves of the electron pair. We look at the case of zero energy photons, which is vacuum and the full energy photons and the conditions under which they exist.

2. Photon as an electron and positron pair with Doppler shift

As we demonstrated in [1] that a photon is composed of a particle with speed greater than light and another particle with speed less that light. We formulated the energy and momentum of particle with speed greater than light in that paper. We also formulated that a particle with speed greater than light will have dual measurements, one of which is positive and another one which is negative.

Let us take an electron moving with speed 'u' in the direction of –ive x axis and another one moving at a speed $v = c^2 / u$ in -ive x direction. Taking the negative observation of energy and momentum of electron with the speed of light we have following for the photon [2]:

Energy and momentum of electron going above speed of light ($v = c^2 / u > c$):

$$E_{v>c} = -\frac{m_e c^2}{\sqrt{v^2 / c^2 - 1}} \quad \ldots (1)$$

$$P_{v>c} = -\frac{m_e v}{\sqrt{v^2 / c^2 - 1}} \quad \ldots (2)$$

For the speed below c, the energy and momentum are [2]:

$$E_{u<c} = \frac{m_e c^2}{\sqrt{1 - u^2 / c^2}} \quad \ldots (3)$$

$$P_{u<c} = \frac{m_e u}{\sqrt{1-u^2/c^2}} \quad \ldots (4)$$

So the sum of the energy and momentum is

$$E = m_e c^2 \left(\frac{1}{\sqrt{1-u^2/c^2}} - \frac{1}{\sqrt{v^2/c^2-1}} \right)$$

$$\Rightarrow E = m_e c^2 \left(\frac{1}{\sqrt{1-u^2/c^2}} - \frac{1}{\sqrt{c^4/u^2c^2-1}} \right)$$

$$\Rightarrow E = m_e c^2 \left(\sqrt{\frac{1-u/c}{1+u/c}} \right) \quad \ldots (5)$$

Similarly

$$P = m_e \left(\frac{-u}{\sqrt{1-u^2/c^2}} + \frac{c^2/u}{\sqrt{v^2/c^2-1}} \right)$$

$$\Rightarrow P = m_e \left(\frac{-u}{\sqrt{1-u^2/c^2}} + \frac{c^2/u}{\sqrt{c^4/u^2c^2-1}} \right)$$

$$\Rightarrow P = -m_e c \left(\frac{-u/c+1}{\sqrt{1-u^2/c^2}} \right)$$

$$\Rightarrow P = m_e c \left(\sqrt{\frac{1-u/c}{1+u/c}} \right) \quad \ldots (6)$$

As per another result in [1], the relation between frequency and mass of the particle is $m_e c^2 = 2\hbar\omega_e$

So the equation (5) and (6) can be simplified to:

$$E = 2\hbar\omega\sqrt{(1-u/c)/(1+u/c)} \quad \ldots (7)$$

$$P = 2\hbar\omega/c\sqrt{(1-u/c)/(1+u/c)} \quad \ldots (8)$$

In the above equations (7) & (8), we can see that the energy and momentum are come out to be that of a photon generated from a source with speed '*u*'

2.1 Validation of the frequency as interference of matter waves

As per [1] the 2 components of any matter wave with speed less than c are given by:

$$\omega_{1(u<c)} = 2\omega/\sqrt{1-u^2/c^2} \quad \ldots (9)$$

$$\omega_{2(u<c)} = 2\omega / \sqrt{1-u^2/c^2} \times u/c \qquad \ldots (10)$$

In the case of speed greater than the speed of light the Doppler Effect is formulated as:

$D_{v>c(towards)} = -\sqrt{(v/c+1)/(v/c-1)}$ and $D_{v>c(away)} = \sqrt{(v/c-1)/(v/c+1)}$. Using $v = c^2/u$ the means the frequency of 2 photons making a particle with speed greater than light are:

$$-\omega\sqrt{\frac{1+u/c}{1-u/c}} \text{ and } \omega\sqrt{\frac{1-u/c}{1+u/c}}$$

Thus the two interference frequencies for speed greater than light are:

$$\omega_{1(v>c)} = \omega\left(-\sqrt{\frac{1+u/c}{1-u/c}} + \sqrt{\frac{1-u/c}{1+u/c}}\right) = -2\omega / \sqrt{1-u^2/c^2} \times u/c \qquad \ldots (11)$$

$$\omega_{2(v>c)} = \omega\left(-\sqrt{\frac{1+u/c}{1-u/c}} - \sqrt{\frac{1-u/c}{1+u/c}}\right) = -2\omega / \sqrt{1-u^2/c^2} \qquad \ldots (12)$$

For the photon generated by these matter waves the components combine as follows:

$$\omega_{1p} = \omega_{1(u<c)} + \omega_{1(v>c)} = 2\omega / \sqrt{1-u^2/c^2} - 2\omega / \sqrt{1-u^2/c^2} \times u/c$$

$$\Rightarrow \omega_{1p} = 2\omega / \sqrt{1-u^2/c^2}(1-u/c) = 2\omega\sqrt{(1-u/c)/(1+u/c)} \qquad \ldots (13)$$

$$\omega_{2p} = \omega_{2(u<c)} + \omega_{2(v>c)} = 2\omega / \sqrt{1-u^2/c^2} \times u/c - 2\omega / \sqrt{1-u^2/c^2}$$

$$\Rightarrow \omega_{2p} = -2\omega / \sqrt{1-u^2/c^2}(1-u/c) = -2\omega\sqrt{(1-u/c)/(1+u/c)} \qquad \ldots (14)$$

From the (13) and (14) we conclude that the matter wave interference results are also consistent with the prediction.

2.2 Case of zero energy and full energy

Let us look 2 important cases for the results (7) & (8)

Zero Energy (*E = P = 0):*

Energy in will be zero if $u = c$, which means both electron and positron are going with a speed of light. This is a special case of vacuum. In this case first electron is approaching the speed of light from below the speed light and the second one approaching the speed of light from above the speed of light.

Full Energy:

In the full energy case, $u = 0$, which means electron is at speed 0 and positron at infinite speed. A special characteristic of infinite speed particle is:

$$E_\infty = \lim_{v\to\infty} mc^2 / \sqrt{v^2/c^2 - 1} = 0$$

$$P_\infty = \lim_{v\to\infty} mv / \sqrt{v^2/c^2 - 1} = mc$$

Which means zero energy, finite momentum.

2.3 Further shift*:*

From equations (7) & (8) the frequency of the photon is:

$$\omega_p = 2\omega\sqrt{(1-u/c)/(1+u/c)}$$

If this is seen from another frame of reference which has a speed of ' *s* 'coming towards it, the total frequency becomes:

$$\omega_s = 2\omega\sqrt{(1-u/c)/(1+u/c)}\sqrt{(1+s/c)/(1-s/c)}$$

Let us consider the 2 electrons individually:

For electron with speed less than light, the resultant speed u' as per Lorentz velocity addition law is:

$$u' = (u-s)/(1-us/c^2) \qquad \ldots (15)$$

For electron with speed greater than light, the resultant speed v' as per Lorentz velocity addition law is:

$$v' = (c^2/u - s)/(1 - c^2 s/c^2 u) = c^2(1-us/c^2)/(u-s) \qquad \ldots (16)$$

From (15) & (16) we see that the electrons still remain with the relation $u'v' = c^2$

2.4 Inter particle speed of the electron pair

As we have proven in section 2.3, the speed of the electron pair forming a photon always follow the rule $uv = c^2$. Thus inter-particle speed between them given by $s = (u-v)/(1-uv/c^2) = \infty$, which means that the 2 electrons are always at infinite speed with each other. We call them as "***blind pairs***."

3. Conclusion and Results

1. Conjecture: All photons can be represented by an electron and a positron. Any frequency change is due to Doppler Effect from the source.

2. Vacuum is formed by 2 electrons approaching c from above the speed of light and below the speed of light.

3. The electrons pair defining a photon exists as a "blind pair", which means at infinite speed w.r.t. to the other.

References

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