

# A new angle for explaining the Wave-Particle duality of Light

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## Abstract

The Wave-Particle duality of Light should be considered as an unresolved mystery.

Indeed, Light manifests these two *very different* phenomena *simultaneously*.

On one hand Light should be viewed as a stream of Particles. Einstein initially introduced the understanding that Light should be viewed as a stream of Particles (named Photons), to explain the Photoelectric effect.

On the other hand, Light clearly exhibits a Wave facet, dating back to Newton's days, who measured the wavelength of Light with his Newton's rings interference observations.

However, these two *very different* facets of Light, its Particle facet, and its Wave facet, are so *significantly different*, which implies that the Wave-Particle duality of Light still awaits additional clarification and additional explanation, which was not yet provided by mainstream Physics.

Instead, nowadays mainstream Physics *just accepts* the fact that Light embed these two very different facets *simultaneously*, and exhibits each facet in different experiments or situations.

This paper proposes a new angle for explaining the Wave-Particle duality of Light, based on the famous Mutual Annihilation process, in which an Electron and a Positron annihilate each other to create Photons, and on the famous inverse Pair Production process, in which a Photon, in certain conditions, converts back into a pair of an Electron and a Positron.

Actually, the connection between the nature of Photons and the Electron and the Positron is already presented in another paper, namely, the Electron Positron-Photon idea.

The Electron Positron-Photon idea, which is due originally to (the late) Prof. J. P. Wesley, in his paper titled: "Light, a Flux of Electric Dipole Photons" [4], proposed a model of the Photon as an Electric Dipole Photon which might be an Electron-Positron pair separated by a distance  $L$ .

There are two reasons why the Electron Positron-Photon idea, as presented in Prof. J. P. Wesley's paper, cannot be considered a viable concept:

- The science of Physics recognizes Photons as being composed of pure Energy, without any Mass or Electric Charges associated to Photons. However, the Electron and the Positron do embed Mass and Electric Charges, and thus, Photons cannot be composed of pairs of Electrons and Positrons as the Electron Positron-Photon idea presented in Prof. J. P. Wesley's paper, states.
- Photons travel at the velocity of Light, and thus, according to Einstein's Special Relativity Theory, if Photons are composed of pairs of Electrons and Positrons as Prof. J. P. Wesley's Electron Positron-Photon idea states, then, their Masses must increase to virtually an infinite Mass magnitude.

This paper proposes another aspect of the Photon nature, which is also based on the Electron and the Positron, which does not have the limitations which were already presented above, in Prof. J. P. Wesley's Electron Positron-Photon idea.

The proposed aspect of the Photon nature is based on the new Energy Pairs Theory, proposed, in various papers, by the author of this paper.

# 1. Introduction

The Wave-Particle problem of Light “dates back to Newton’s days”. The question of Light being “a flux of particles”, or a “propagated perturbation in a medium or luminiferous ether” resulted in the Science of Physics accepting the conclusion that Light manifests two facet *simultaneously*, a Wave facet and a Particle facet.

The Wave facet or “the periodic nature of Light, was first recognized by Newton, who measured the wavelength of Light with his Newton’s rings interference observations.”

Then, the conclusion derived from Maxwell’s equations, that accelerating Electric Charges emit radiation in the form of Electromagnetic Waves brought about the understanding that Light is just a subset group of frequencies of the broader phenomena of Electromagnetic Waves.

Then, after the Photoelectric Effect was explained by Einstein, the science of Physics concluded that Electromagnetic Waves (including Light), are also streams of Particles, namely the Photons, which established the recognition, that Light, and any other Electromagnetic Wave, have also a Particle facet.

However, although the science of Physics accepts these two *simultaneous* facets of Light, and any other Electromagnetic Waves, this situation, in which Light, and any other Electromagnetic Waves, embeds such *separate* facets *simultaneously*, seems to be an unnatural situation, which seems like an open problem, that should be resolved.

The Electron Positron-Photon idea, which is due originally to (the late) Prof. J. P. Wesley, in his paper titled: “Light, a Flux of Electric Dipole Photons” [4], tried to resolve this problem.

It proposes a model of the Photon as an Electric Dipole Photon which might be an Electron-Positron pair separated by a distance  $L$ .

As stated above, in the Abstract Section of this paper, there are two reasons why the Electron Positron-Photon idea, as presented in Prof. J. P. Wesley's paper, cannot be considered a viable concept:

- The science of Physics recognizes Photons as being composed of pure Energy, without any Mass or Electric Charges associated to Photons. However, the Electrons and the Positrons do embed Mass and Electric Charges, and thus, Photons cannot be composed of pairs of Electrons and Positrons as the Electron Positron-Photon idea presented in Prof. J. P. Wesley's paper, states.
- Photons propagate at the velocity of light, and Electrons and Positrons have rest Mass values which are not zero. Then, if Einstein’s Special Relativity Theory conclusion, relating to Mass gain with velocity, is accepted as valid, then, if Photons are Electron-Positron pairs, their Mass must increase to be virtually an infinite Mass value, because Photons travel at the velocity of Light. Thus, if Einstein’s Special Relativity Theory is accepted as a valid theory, Photons cannot be pairs of Electrons and Positrons.

J.P. Wesley did not accept the relativistic Mass gain with velocity as concluded from Einstein’s Special Relativity Theory, and as such, proposed this Photon model.

Thus, since Einstein’s Special Relativity Theory is the acceptable theory by the nowadays science of Physics, and its conclusions, including the conclusion regarding the Mass increase with velocity, is accepted, and its validity was also manifested via observations, then, the proposed model of Photons, brought about by J. P. Wesley’s paper, as Electron-Positron pairs, seems to be a non-viable model.

However, the new Energy Pairs Theory, proposed by the author of this paper, might provide another aspect of the nature of the Photons, based on the famous Mutual Annihilation process, in which an Electron and a Positron annihilate each other to create Photons, and on the famous inverse Pair Production process, in which a Photon, in certain conditions, converts back into a pair of an Electron and a Positron.

The new Energy Pairs Theory predicts, that Electric Charges are also forms of Energy, similarly to Mass being already recognized as a form of Energy following the introduction of Einstein's Special Relativity Theory.

But, contrary to Mass, whose embedded Energy *usually* converts into Traceable Energy, the new Energy Pairs Theory argues, that the Energies embedded in Electric Charges converts only into *Pairs* of Untraceable (or Dark) Energy, as, for example, in the annihilation process occurring when a *Pair* of an Electron and a Positron annihilate each other to produce Photons.

Thus, the new Energy Pairs Theory argues, that Photons embed also Untraceable Energy, in addition to Traceable Energy, and this Untraceable Energy, as argued in a following section of this paper, might manifest the Particle facet *and* the Wave facet of the Photons, even though, these Untraceable (or Dark) Energies are pure Energy, with no Mass associated to them.

Thus, the aspect of the Photon nature, proposed in this paper, agrees with the view that Photons are just pure Energy (although Traceable *and* Untraceable Energies) without any Mass or Electric Charges associated to them, and thus, Photons can also travel at the velocity of light without violating Einstein's Special Relativity Theory, and also retain the possibility to explain the Wave-Particle problem of Electromagnetic waves, and thus, bring about a possible viable explanation to the old Wave-Particle problem of Electromagnetic Waves.

## 2. The new Energy Pairs Theory

The new Energy Pairs Theory, proposed by the author of this paper, was initially introduced to resolve Paradoxes embedded in Consolidating Electromagnetic Waves from Separate Sources.

A paper titled: "Consolidating Electromagnetic Waves from Separate Sources" [6], by the author of this paper, provides *very sound argumentations*, that Electromagnetic Magnetic Waves from separate sources *can and do consolidate*, even though the *acceptable notion today*, by the nowadays science of Physics, is, that this *cannot* occur.

An example of the *acceptable notion* today that this *cannot* occur is presented in a paper by Kirk T. McDonald from Princeton University whose title is: "Does Destructive Interference Destroy Energy?" [5] which states: "A one-dimensional wave moving in one direction can have only one source, and there can be only one such wave at a given point", which implies that Electromagnetic Waves from separate sources *cannot* consolidate.

However, as stated above, the paper already mentioned above [6], and proposed by the author of this paper, provides *sound argumentations* that Electromagnetic Waves from separate sources *can and do consolidate*.

That paper [6], also presents a scenario, that *anybody* can experience, *everyday*, which does imply, that Electromagnetic Waves from separate sources *can and do consolidate*, even though, such consolidations embed Paradoxes, because such consolidations *seem* to violate the Energy Conservation Principle.

One such paradox, in consolidations of Electromagnetic Waves from separate sources, is the creation of a *Null Electromagnetic wave*, which contains *no Electric and Magnetic fields at all*, and thus, *seem* to embed *no Energy at all*, even though, that *Null Electromagnetic wave*, was created from two Electromagnetic Waves which embedded Energy, and, in certain conditions, as described in that paper, consolidated to create this *Null Electromagnetic Wave*, which *seem* to embed *no Energy at all*.

Thus, in such a scenario, *Energy seems to disappear*, which is a clear violation of the Energy Conservation Principle.

That scenario is also described in the following papers published by the author of this paper: "Energy Analysis of a Null Electromagnetic Wave" [1], and "A Discussion relating to the feasibility of a Null Electromagnetic Wave" [2].

However, the creation of the *Null Electromagnetic wave* is not the only surprising and astonishing scenario occurring in situations of consolidations of Electromagnetic Waves from separate sources, which seem to violate the Energy Conservation Principle.

The following paper, also published by the author of this paper, "Consolidating Electromagnetic waves might embed more traceable Energy than the sum of the traceable Energies embedded in the waves before consolidation"

[3], presents an additional scenario in which two Electromagnetic Waves, from separate sources, consolidate to create a consolidated Electromagnetic Wave that embeds **more Energy** as compared to the combined Energies embedded in the two Electromagnetic Waves that created it.

Thus, in the above-described scenario **Energy seems to be created out of nothing**, which is also a clear violation of the Energy Conservation Principle.

Thus, as stated above, The Energy Pairs Theory, was developed to resolve the Paradoxes embedded in Electromagnetic waves consolidations from separate sources, which **seem** to violate the Energy Conservation Principle.

The main premise of the new Energy Pairs Theory is as follows:

Energies embedded in Electromagnetic Waves (or related directly or indirectly to an Electric Charge) can accumulate and be stored together in **pairs**, while **disabling** each other from **being detected**, such that the Energies **Exist** but are **Untraceable (or Latent Energy)** or Exist as Untraceable or **Dark Energy**.

Thus, the new Energy Pairs Theory brings about a new Facet of Energy which is Untraceable Energy that is also stored as Energy Pairs.

So, the new Energy Pairs Theory Elements are:

- It expands the Energy notion to contain two Facets of Energies:
- A Detectable or Traceable Energy
- An Untraceable or Dark Energy
- The Untraceable Energy is Untraceable because it is accumulated in **Pairs** which **Disable** each other from **being Detected**
- The new Energy Pairs Theory also predicts that Photons can carry both, Traceable and Untraceable Energies.

More on the Energy Pairs Theory can be found in the papers mentioned above, [1], [2], [3], [6], by the author of this paper.

### **3. The new Energy Pairs Theory resolves Paradoxes embedded in Scenarios of Consolidations of Electromagnetic Waves from Separate Sources**

The new Energy Pairs Theory resolves the Paradoxes embedded in the scenarios of Consolidations of Electromagnetic Waves from separate sources as follows:

The new Energy Pairs Theory predicts that in the scenario of the creation of the Null Electromagnetic Wave the Energy did not Disappear. It was Converted into Untraceable, or Dark Energy, embedded into the Photons of the created Null Electromagnetic Wave.

The new Energy Pairs Theory also predicts, that in scenarios of consolidations of Electromagnetic Waves that seem to create Energy out of nothing, that created Energy is Untraceable, or Dark Energy, embedded in the created consolidated Electromagnetic Wave, which Converted back, into Traceable Energy.

However, the Paradoxes in scenarios of consolidations of Electromagnetic Waves from separate sources which **seem** to violate the Energy Conservation Principle, are not the only Paradoxes that get resolved or explained by the new Energy Pairs Theory.

Two additional puzzling questions are also resolved by the new Energy Pairs Theory.

These two additional puzzling questions are:

- Why in the famous Mutual Annihilation scenario, Electric Charges Disappear?
- How come that Electric Charges are created from nothing in the famous inverse Pair Production scenario?

In the Mutual Annihilation scenario an Electron and a Positron annihilate each other to create Photons.

But because Electric Charges are not recognized (yet) as a form of Energy, then, according to the Energy Conservation Principle, the Energies embedded in the Masses of the annihilating Electron and Positron are Fully embedded in the Energies embedded in the created Photons, and the Electric Charges of the annihilating Electron and Positron, just Disappear.

Where these Electric Charges went?

How can Basic Elements such as Electric Charges Disappear, without leaving any trace of their prior existence?

And, in the inverse Pair Production scenario, a Photon, in certain conditions, converts back into an Electron and a Positron.

But because Electric Charges are not recognized (yet) as a form of Energy, then, according to the Energy Conservation Principle, the Energy embedded in the Photon is Fully embedded only in the Masses of the created Electron and Positron, and the Electric Charges of the created Electron and Positron are created out of nothing.

How can this happen?

The new Energy Pairs Theory resolves also these two new puzzles:

It predicts that in the Mutual Annihilation scenario the Electric Charges did not Disappear.

The new Energy Pairs Theory argues, that in the Mutual Annihilation scenario, the Energies embedded in the Masses of the annihilating Electron and Positron are embedded in the Traceable Energy embedded in the created Photons and the Energies embedded in the Electric Charges of the annihilating Electron and Positron are converted into the Untraceable (or Dark) Energy embedded in the created Photons. Similarly, to how the new Energy Pairs Theory predicts that the Null Electromagnetic Wave embeds the Energy that seemed to Disappear as Untraceable Energy in its Photons.

And in the inverse Pair Production Scenario, in which a Photon, in certain conditions, converts back into an Electron and a Positron, the new Energy Pairs Theory predicts, that the created Electric Charges, embedded in the created Electron and the created Positron, were not created out of nothing.

The new Energy Pairs Theory predicts that the Traceable Energy embedded in the Photon is converted into the Masses of the created Electron and Positron, and the created Electric Charges, embedded in the created Electron and Positron, were Untraceable (or Dark) Energy, embedded in the Photon, which Converts to Traceable Energy embedded in the Electric Charges of the created Electron and Positron.

Thus, another significant conclusion, or prediction, of the new Energy Pairs Theory is:

Electric Charges are just forms of Energy.

However, Mass was already recognized as a form of Energy by Einstein's Special Relativity Theory, and now, the new Energy Pairs Theory adds to this the conclusion that Mass, Electric Charges and Energy, might be the exact same Entity.

This also can be concluded from the following:

Since in the Mutual Annihilation scenario, Electric Charges in the Electron and the Positron converts to Photons, which are pure Energy, without any Mass or Electric Charge, and since, in the inverse, Pair Production scenario, a Photon, which is just pure Energy without any Mass or Electric Charge, converts into Mass and Electric Charges embedded in the created Electron and Positron, this might also imply, that Electric Charges are also just forms of Energy, as Mass is a form of Energy.

And, another important conclusion, or prediction, of the new Energy Pairs Theory might be:

Most of the Dark Energy, whose origin is still a mystery, might originate from Electromagnetism!

More on the above can be found in additional papers by the author of this paper.

#### 4. A tentative explanation relating to the Wave-Particle problem a Light beam

The famous Mutual Annihilation process and the famous Pair Production process already indicate that there is an intimate relationship between the nature of Photons and Electrons and Positrons.

If in the Mutual Annihilation process a pair of an Electron and a Positron meet and annihilate each other to create Photons, and if in the inverse Pair Production process, a Photon, in certain conditions, converts back into a pair of an Electron and a Positron, then, these processes might provide a reasonable basis to the assumption, that Photons are actually composed of pairs of Electrons and Positrons.

Thus, indeed, as already presented, in this paper, the Electron Positron-Photon idea, which is due originally to (the late) Prof. J. P. Wesley, in his paper titled: "Light, a Flux of Electric Dipole Photons" [4], proposed a model of the Photon as an Electric Dipole Photon which might be an Electron-Positron pair separated by a distance  $L$ .

However, as also presented already, in this paper, Prof. J. P. Wesley's Electron Positron-Photon idea cannot be accepted as a viable idea, and the reasons why this idea cannot be accepted as a viable idea were also presented already, in this paper.

But, as mentioned already, in this paper, the new Energy Pairs Theory, proposed by the author of this paper, and several other papers, might provide a reasonable explanation to the Wave-Particle problem of Light, which is also related to the intimate relationship between the natures of Photons and Electrons and Positrons.

Prof. J. P. Wesley's Electron Positron-Photon idea explained the Wave-Particle problem of Light by assuming that Photons are actually composed of pairs of Electrons and Positrons. The new Energy Pairs Theory also explains the Wave-Particle problem of Light by assuming that Photons are actually composed of pairs of Electrons and Positrons, but it argues, that the Electron and the Positron are not embedded in the Photons as physical particles which are composed of Mass and Electric Charges.

Instead, the new Energy Pairs Theory argues that the Electron and the Positron are embedded in the Photon as pure Energy, which is a result of the annihilation process that occurred between the Electron and the Positron.

This eliminates the limitations presented above in the original Prof. J. P. Wesley's Electron Positron-Photon idea, but can still explain the Wave-Particle problem of Light by arguing that this pure Energy, embedded in the Photon, which is a result of the annihilation process that occurred between the Electron and the Positron, is still able to retain *some abilities* which existed in the Electron and the Positron before they annihilated each other.

Because, as presented already, in this paper, Photons can embed both, Traceable Energy and Untraceable Energy Pairs, and because this Untraceable Energy Pairs originate from physical Electric Charges and converts back into physical Electric Charges, and because these Untraceable Energy Pairs are accumulated in *Pairs* of Energies, which render these *Energy Pairs* as Undetectable (or Dark) Energies, it might be argued, that this Untraceable Energy Pairs might also retain *some abilities* which existed in the Electron and the Positron before they annihilated each other.

The Electric Dipoles, embedded in an Electron-Positron pair separated by a distance  $L$ , are the result of *Pairs* of coupled Electric Charges of equal Charge magnitudes and opposite polarity, and also of *Pairs* of equal Mass magnitudes.

And, the Untraceable Energies Pairs, mentioned above, are also composed of *Energy Pairs*.

Thus, the fact that both, the Energy embedded in a *Pair* of an Electron and a Positron and the Energies embedded in the Untraceable Energy Pairs of the above-mentioned *Energy Pairs*, are composed of coupled

*Pairs*, might be used to provide a tentative explanation to the Wave-Particle problem of Light, as presented in the following chapters of this paper.

## 5. A tentative explanation relating to what generates the Wave Facet of a Light beam

The following focuses first on a tentative explanation as related to what creates the Wave Facet of a Light beam.

A Light beam manifests a Wave Facet which is manifested in two propagating and synchronized Energy Fields, an Electric and a Magnetic Field, which are both perpendicular to the direction of travel of this Light beam, and are also perpendicular to each other and are traveling at the velocity of Light.

Prof. J. P. Wesley's Electron Positron-Photon idea presents the thesis that an immense number of Electron-Positron pairs, each separated by a distance  $L$ , might be generating the pattern of the above mentioned two Energy Fields, the Electric and the Magnetic Fields, which manifest the Wave Facet of a Light beam.

Thus, as the original physical Energy embedded in a **Pair** of an Electron and a Positron, held at a distant  $L$  apart, can act as Electric Dipoles, and as proposed in Prof. J. P. Wesley's Electron Positron-Photon idea, an immense number of these Electric Dipoles might generate the Electric and Magnetic Fields which *might explain* the **Wave facet** of a Light beam, also the Energy embedded in **Pairs** of Untraceable **Energy Pairs**, embedded in the created Photons of this Light beam, which might be the result of such Electron-Positron annihilation processes, might be also able to behave as Electric Dipoles, even though they are embedded in the Photons as pure Untraceable Energy, without any Mass or Electric Charges associated to them, and not as physical Electric Charges.

This might provide a tentative explanation to why Photons embed a Wave facet, as proposed in the Electron Positron-Photon idea, as presented in J. P. Wesley's paper, without the limitations presented already in the original J. P. Wesley's paper.

Because the above-mentioned Untraceable Energy Pairs, which, according to the above argumentation generate the Wave Facet of a Light beam, are just pure Energies (although Dark Energies), without any Mass or Electric Charge, and thus, can travel at the velocity of Light, without violating Einstein's Mass increase predicted by Einstein's Special Relativity Theory.

## 6. A tentative modification, to what was presented earlier in this paper, relating to the Energy compositions embedded in Photons.

The above also might imply that a modification might be required relating to what might be the origins of the **Traceable** Energy *and* the **Untraceable Energy Pairs**, embedded in the created Photon, in a Mutual Annihilation process, a modification to what was presented before in this paper and papers [1], [2], [3], by the author of this paper.

*All* the **Traceable** Energy embedded in Photons is *manifested* via the Wave facet of the Photon, which is manifested via the synchronized, oscillating and propagating Electric and Magnetic Fields associated with the Photon, which were already presented above.

Thus, the above might also imply that the **Traceable** Energy embedded in the created Photons, in a Mutual Annihilation process, is a result of the **Electric and Magnetic Fields** generated by the Electric Dipole mentioned above, of the Electron and the Positron, which annihilated each other, (which, as argued in a previous

chapter of this paper, is also manifested, after the annihilation occurred, by the ability of the Untraceable Energy Pairs to act also as Electric Dipoles.)

The above **is a modification to** what was presented before in this paper and papers [1], [2], [3], that the **Traceable** Energy embedded in the created Photons, in a Mutual Annihilation process, is a result of the conversion of the Energies embedded in the **Masses** of the Electron and the Positron which annihilated each other.

In addition to the modification presented above, relating to the **nature** of the **Traceable** Energy embedded in a Photon, a tentative modification might be also required, relating to the **composition** of the **Energies** which are embedded in the above-mentioned **Untraceable Energy Pairs**.

This is presented in the following argumentation:

Previously in this paper, and in the papers [1], [2], [3], a proposal was presented, that the above-mentioned Untraceable Energy Pairs are composed **only** of the Energies embedded in the Electric Charges of the Electron and the Positron which annihilated each other to create Photons.

This assumption, as already presented before in this paper and papers [1], [2], [3], is based on the fact that the nowadays Science of Physics assumes that the Energy embedded in the created Photon originated **only** from the Energies embedded in the Masses of the Electron and the Positron, which annihilated each other, because, as also already presented before, in this paper, the nowadays Science of Physics does not considers (yet), as Energy, the Electric Charges embedded in Electron and the Positron, which annihilated each other, and thus, the nowadays Science of Physics assumes that the Electric Charges embedded in the Electron and the Positron just disappeared, which seem as an unreasonable conclusion.

However, a closer evaluation of the Energies existing in this annihilation process reveals the following:

The Energies embedded in the annihilating Electron and the Positron, before they annihilated each other, included the following Energy elements:

- The Energies embedded in the Masses of the Electron and the Positron, which annihilated each other.
- The Energies embedded in the Electric Charges of the Electron and the Positron, which annihilated each other.
- The Energies embedded in the Electric and Magnetic Fields which were induced by the Electric Charges embedded in the Electron and the Positron, which annihilated each other.
- The Energies embedded in the Gravitational Fields which were induced by the Masses embedded in the Electron and the Positron, which annihilated each other.

Thus, in this annihilation process, the nowadays Science of Physics seems to ignore not only the Energies embedded in the Electric Charges embedded in the Electron and the Positron, which annihilated each other, as already presented before in this paper, the nowadays Science of Physics seems to ignore also the Energies embedded in the Electric and Magnetic Fields which were induced by the Electric Charges embedded in the Electron and the Positron, which annihilated each other, and also the Energies embedded in the Gravitational Fields which were induced by the Masses embedded in the Electron and the Positron, which annihilated each other.

Because Energies cannot just disappear, none of the above-mentioned Energies should be ignored.

Thus, this might imply that a modification might be also required relating to the composition, presented previously in this paper, and in the papers [1], [2], [3], relating to the Energies embedded in the Untraceable Energy Pairs embedded in the created Photons, as is presented in the following argumentation:

It should be emphasized again, that **all** the **Traceable Energy** embedded in Photons is associated to the Energies embedded in the Electric and Magnetic Fields of the Wave facet of the Photons.

Thus, because, as already presented above, the Energies embedded in the Electric and Magnetic Fields which were induced by the Electric Charges embedded in the Electron and the Positron, which annihilated each other, might be the explanation of the Wave facet of the created Photons, and because the Energies embedded in the



Electric and Magnetic Fields of the Wave facet of the created Photons is ***all the Traceable Energy*** embedded in the created Photons, then, the Untraceable Energy Pairs, mentioned above, embedded in the created Photons, should contain ***all the other***, Energy Elements, mentioned above, which are:

- The Energies embedded in the Masses of the Electron and the Positron, which annihilated each other.
- The Energies embedded in the Electric Charges of the Electron and the Positron, which annihilated each other, created.
- The Energies embedded in the Gravitational Fields which were induced by the Masses embedded in the Electron and the Positron, which annihilated each other.

And ***not only*** the Energies embedded in the Electric Charges of the Electron and the Positron, which annihilated each other, as presented before, in this paper, and papers [1], [2], [3].

## 7. A tentative explanation also to the Particle Facet of a Light beam.

The Wave Facet of Photons was tentatively explained in a previous chapter of this paper, by arguing that the Untraceable Energy Pairs, embedded in the Photons, might act as the Electric Dipoles embedded in the Electron and the Positron, before they annihilated each other.

However, the Untraceable Energy Pairs, mentioned above, which are embedded in the created Photons, might also provide a tentative explanation to the Particle facet of the Photons, because of the following argumentation:

As argued in the previous chapter of this paper the Energies embedded in the Untraceable Energy Pairs, mentioned above might embed the Energies embedded in the Electric Charges ***and*** the Masses of the annihilating Electron and Positron, before they annihilated each other.

Actually, ***most*** of the Energy elements that existed in the Electron and the Positron, before they annihilated each other, including the Energies embedded in their Electric Charges ***and*** Masses are embedded in the Untraceable Energy Pairs mentioned above and embedded in the created Photon (which is a modification to what was presented already before in this paper and papers [1], [2], [3]).

And because the Electron and the Positron manifested, before they annihilated each other, a Particle facet, mainly because of the Energies embedded in their Masses and Electric Charges, this might imply that these Untraceable Energy Pairs might be able to also manifest a Particle facet, as the Electron and the Positron manifested, before they annihilated each other, ***in addition***, to the ability of these Untraceable Energy Pairs to also behave, as proposed above, as an Electric Dipole, which might also provide an explanation to the Wave facet of the created Photons.

Thus, this might provide a tentative explanation to ***both***, the Wave facet and the Particle facet of the created Photons, which, as just argued, should be related to the Untraceable Energy Pairs, embedded in the created Photons.

And if the Untraceable Energy Pair embedded in the Photon are just pure Energy (although Untraceable Energy) without any Mass or Electric Charges associated to them, Photons can still travel at the velocity of Light, without violating Einstein's Special Relativity Theory.

## 8. Summary and Conclusions

Prof. J. P. Wesley, in his paper titled: "Light, a Flux of Electric Dipole Photons" [4], tries to explain the Wave-Particle problem of Electromagnetic Waves by proposing a model of the Photon as an Electric Dipole Photon which might be an Electron-Positron pair separated by a distance L.

However, Photons are recognized as pure Energy without any Mass or Electric Charge, and, as such cannot be composed of physical particles, such as Electrons and Positrons, which do embed Mass and Electric Charge.

In addition to the above, because Electrons and Positrons have rest Mass, which is not zero, this violates Einstein's Special Relativity Theory conclusion of Mass increase with velocity, because if Photons are Electron Positron pairs, and because Photons travel at the velocity of light, the Masses of these Electron Positron pairs must increase to be virtually of infinite magnitude.

Thus, the above renders the original form of Prof. J. P. Wesley's Electron Positron-Photon idea to be considered as a non-viable idea.

The new Energy Pairs Theory, provided by the author of this paper, might be used to provide another model of the Photon, which is also based on the intimacy found in the structures of Photons and Electron and Positrons, that can be deduced from the famous Mutual Annihilation and the Pair Production processes, in which **Pairs** of Electrons and Positrons convert into Photons, and Photons convert back into **pairs** of Electrons and Positrons, which, contrary to J. P. Wesley's paper, this proposed model can still explain the Wave Particle problem of Electromagnetic Waves, and also do not violate any conclusions of Einstein's Special Relativity Theory.

The new Energy Pairs Theory predicts that Photons can embed two types of Energies, Traceable and Untraceable Energy Pairs, which are accumulated in **Pairs** which disable each other from being detected.

And the Untraceable Energy Pairs embedded in Photons might also originate from Electron Positron annihilations, because the new Energy Pairs Theory predicts that in such annihilation scenarios the Electric Charges of the annihilating Electron and Positron do not disappear (as it is assumed today), these Electric Charges are embedded as Untraceable Energy, embedded into these Untraceable Energy Pairs, embedded in the Photon.

The new Energy Pairs Theory also predicts, that in the inverse, Pair Production scenario, in which a Photon, in certain conditions, converts back into an Electron and Positron, the Electric Charges of these Electron and Positron are not created from nothing (as it is assumed today), they emerge from the Untraceable Energy Pairs embedded in the Photon, which converted back into the Electric Charges embedded in the created Electron and Positron.

And, because these Untraceable Energy Pairs originate from physical Electric Charges and convert back to physical Electric Charges, and also because these Untraceable Energy Pairs are accumulated in **Pairs** of Energies, similar to how an Electron-Positron **Pair** which annihilate each other are accumulated in **Pairs**, it might be argued, that these Untraceable Energy Pairs might also retain their ability to function as an Electric Dipole, as the original physical Electric Charges, embedded in the annihilating Electron and Positron, could act as Electric Dipoles before being converted into Untraceable Energy.

Thus, the new Energy Pairs Theory argues that the Untraceable Energy Pairs embedded in Photons can behave as Electric Dipoles even though they are embedded in the Photon as pure Untraceable Energy, without any Mass or Electric Charge associated to them, and not as physical Electric Charges.

And thus, the argued ability of these Untraceable Energy Pairs, embedded in Photons, to act as Electric Dipoles, might tentatively explain what causes the Wave Facet of Light beams, similar to the explanation provided for the Wave Facet of Light beams, brought about in Prof. J. P. Wesley's Electron Positron-Photon idea.

Also, this paper argues, that the above mentioned Untraceable Energy Pairs embed not only the Energies embedded in the Electric Charges of the Electron and the Positron that annihilated each other, this paper argues, that these Untraceable Energy Pairs, embedded in the created Photons, embed **most** of the Energies embedded in the annihilating Electron and Positron, including the Energies embedded in the Masses **and** the Electric Charges, embedded in the Electron and the Positron, before they annihilated each other, which might indicate, that these Untraceable Energy Pairs might also manifest a Particle facet, as the annihilating Electron and Positron manifested, before, they annihilated each other, because they embed Mass and Electric Charges.

Thus, if the Untraceable Energy Pairs embedded in the Photon, can retain its ability to act as Electric Dipoles this might, as already argued above, explain the Wave Facet of Electromagnetic Waves, as J.P. Wesley's paper explains this problem, on one hand.

And, on the other hand, as presented above, these Untraceable Energy Pairs might also manifest a Particle facet.

This might provide a tentative explanation to **both** the Wave and the Particle facets of the created Photons.

And if these Untraceable Energy Pair embedded in the Photon are just pure Energy (although Untraceable Energy) without any Mass associated to them, Photons can still travel at the velocity of light, without violating Einstein's Special Relativity Theory.

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That paper was also published by Physics Tomorrow Letters (PTL) in the Theoretical Physics Journal. The link to that publication is:

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