

Consolidating Waves might create the Dark Energy

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Abstract

The primary aim of this article is to evaluate a possible connection between the Dark Energy and electromagnetic traveling waves. The study starts by trying to answer the following question: is it possible to detect the energy embedded in a Null electromagnetic traveling wave, which is an electromagnetic traveling wave that does not contain any electric or magnetic fields at all. The article describes how to create such a Null electromagnetic traveling wave from two normal electromagnetic traveling waves, which do contain electric and magnetic fields, which collide and following their collision consolidate and unify and continue to travel together in the same direction. In three different proposed experiments of producing a Null, or a partly Null electromagnetic traveling waves, examined in the study, energy loss in the process was observed, which seems as a violation of the energy conservation principle.

The main part of this study is the development of the "*Energy Pair Theory*" (*EPT*) that explained the above energy loss by the central idea of this theory that certain energies can be accumulated and stored as "*Energy Pairs*" that *exist* but *disable* each other, and therefore, the energy that is accumulated in the pairs *exists* but is *undetectable* or *untraceable*.

Finally, the article examines the well-known *Dark Energy* untraceable energy in the *EPT* framework, and concludes that this energy might be a space in the universe where *Energy Pairs* reside.

The *Energy Pairs Theory*, developed in this study, puts the concept of "Energy" in a new and an interesting framework that is flexible and convenient to be further used as a framework in studying other physical and natural observations.

Introduction

The issue of electromagnetic traveling wave's interference was already analyzed and presented extensively. Examples of such scenarios might be counter propagating one dimensional two source waves, or a single source wave propagating in two or more dimensions via scattering one portion of the wave into another portion, such as a double slit experiment with a single source. Analysis of these scenarios has shown that the interference between such waves always conserves the waves' energy (Ref. 1).

The research presented in this paper describes a different scenario in which, a two source electromagnetic traveling waves, focused in a way that they can be considered as traveling only in one dimension are colliding, then the two waves unify and continue to travel together in the same direction. If the two waves unify when they oscillate at exactly the same frequencies, have exactly the same intensities in their electric and magnetic fields, are exactly at a phase shift of 180 degrees relative to one another, and have proper polarization (as is explained later in this article), the resultant electromagnetic wave will be a Null wave which does not contain

any electric or magnetic fields. According to our best knowledge, this kind of scenario has not been studied yet.

The present study provides a description of a possible lab experiment targeted to implement a Null Electromagnetic Wave. Then, analysis of possible results of such an experiment is discussed, and a new theoretical framework is developed to explain the results.

The conclusions drawn in this study are innovative and quite surprising, not only relating to the specific process examined, the Null Wave, but also in providing a better understanding of other unresolved scientific problems, as the disappearance of charge in electron positron collision, a possible explanation of the nature of the *Dark Energy* which affects the rate of expansion of the universe, which expands in a rate which is much bigger than the expected rate according to the current state of knowledge, and the surprising conclusions that *Electric Charges* and even the *Space* itself might be forms of *Energy* as *Mass* is a form of *Energy*.

Implementation of a Null electromagnetic wave

Consider a traveling electromagnetic wave propagating along the x-axis. According to Maxwell's equations, the electric and magnetic fields associated with such a wave take the form of (Ref. 2):

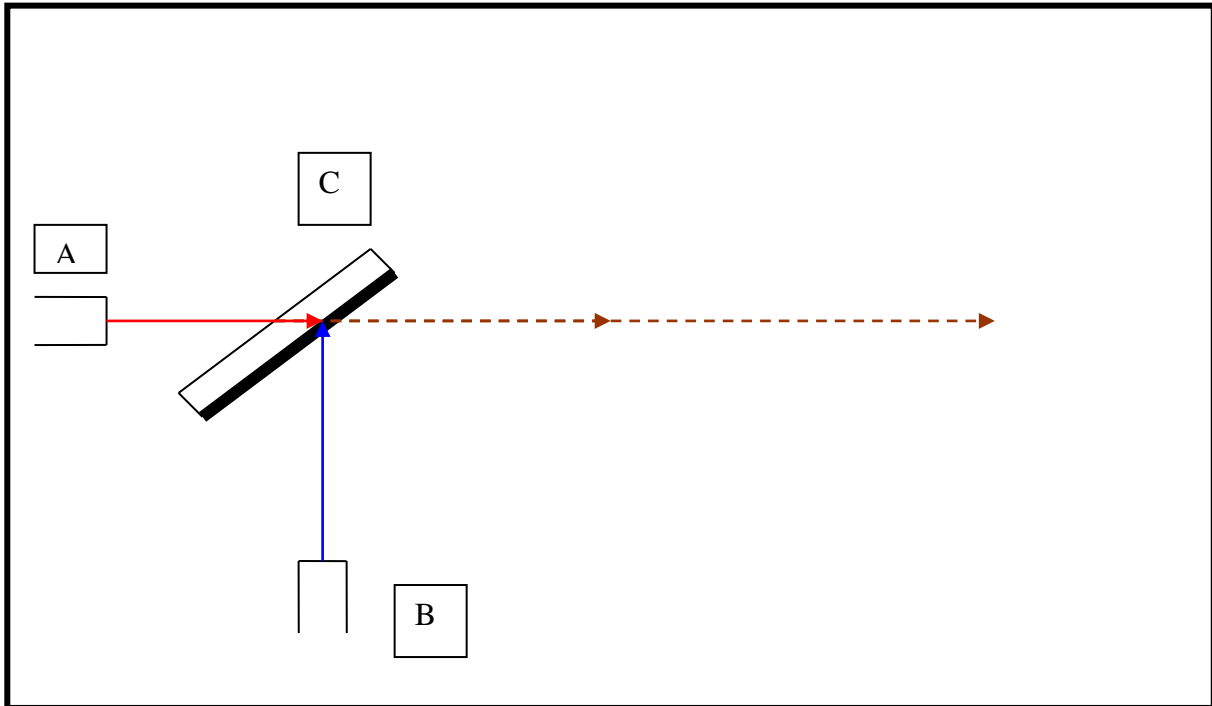
$$E_y = E_0 \cos [2 \pi (x / \lambda) - f t]$$

$$B_z = B_0 \cos [2 \pi (x / \lambda) - f t]$$

Thus, an electromagnetic wave contains two synchronized oscillating fields, an electric and a magnetic field, where each field oscillation occur at a line in space which is perpendicular to the line of the oscillation of the other field, and both these oscillation lines are perpendicular to the line of traveling of this wave. All electromagnetic waves travel at the velocity of the speed of light.

The scenario of two one dimensional electromagnetic waves which unify, and continue to travel together in the same direction can be described and implemented as shown in Fig. 1.

Fig 1



An Electromagnetic Wave source A generates a much focused one dimensional electromagnetic traveling wave (red), that passes through a half transparent mirror C, and continues to travel, as indicated by the dotted line. Another Electromagnetic Wave source B generates a much focused, one dimensional electromagnetic traveling wave (blue), that is deflected by the mirror C, such that it continues to travel on exactly the same line as the first wave A, as indicated by the dotted line.

From a Technical point of view, it might be difficult to implement such an experiment because of the requirement that the blue wave should arrive at the mirror C at a time and at an angle that it will be deflected such as to consolidate completely with the red wave A. This might be difficult to achieve. Moreover, the waves should be much focused and one dimensional, which might present an additional difficulty in arranging the equipment needed. However, thinking about the above scenario and trying to analyze it theoretically (like a thought exercise), provides the following possible result: If the two waves A and B unify when they oscillate at exactly the same frequencies, have exactly the same intensities in their electric and magnetic fields, are exactly at a phase shift of 180 degrees relative to one another, and have proper

polarization (as is explained later in this article), the resultant electromagnetic wave is a Null Wave which does not contain any electric or magnetic fields. Such a wave is described by Fig. 2.

Fig. 2

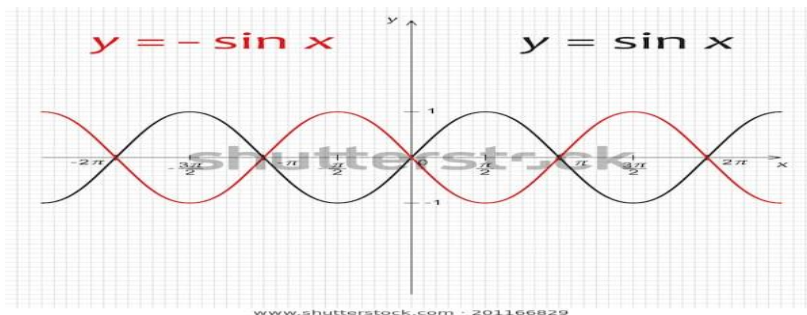


Fig 2 shows the electric fields intensities of the two waves after their unification. Clearly, the electric fields of both waves will disappear after their unification, because each field cancels the respective field in the other wave, completely and continuously. The same applies for the magnetic fields of both waves. The magnetic fields intensities of these two waves can be described also by Fig. 2, only the y-axis should be replaced by the z-axis, because the electric and magnetic fields are perpendicular to each other. So, the magnetic fields of both waves will disappear after their unification exactly as in the case of the electric fields.

It's important to add that the ***original polarization of wave A*** (the red wave) and the ***original polarization of wave B*** (the blue wave), should be such as to achieve the following result: the oscillations of the electric fields, of both waves A and B, after they pass the half transparent mirror C, must occur exactly on the same line in space. And also the oscillations of the magnetic fields, of both waves A and B, after they pass the half transparent mirror C, must also occur exactly on the same line in space (which, of course, is perpendicular to the line of oscillation of the electric fields). This polarization demand of waves A and B validates that each field cancels the respective field in the other wave, completely and continuously, after the unification of the two waves.

As already mentioned, the requirement that the waves unify when they oscillate at exactly the same frequency, have exactly the same intensities in their electric and magnetic fields, are

exactly at a phase shift of 180 degrees relative to one another, and have proper polarization (as described above), might create an extra complication in carrying out such a lab experiment.

However, this experiment can also be examined also by reasoning only, or as a "thinking exercise".

The main question we want to answer relating to this experiment is:

"Is it possible to detect a Null Electromagnetic traveling wave, which is a wave that does not contain any electric or magnetic fields?"

In order to answer this question, more experimental tools should be utilized in the described experiment: A tool that can be inserted at the wave's propagation line and is able to measure the energy embedded in each electromagnetic wave. For example, since electric charges are affected by electric and magnetic fields, inserting a detector that its measurements are based on the interactions between charges and electromagnetic fields might be appropriate. Any other technically suitable detector tool can also be devised and inserted in the propagation line of the two original electromagnetic waves A and B (Fig. 1), and then in the Null Wave's propagation line (Fig. 2) and provide an indication whether the fields in the Null Wave exist, or whether the Null wave is detected via some other features it might have (for example, its energy). Actually, there are only two possible results: One, if the inserted tool will be affected by waves A and B, but will not be affected by the Null Wave, it will be an indication that the fields in the Null Wave, as shown in Fig 2, really do not exist and the Null wave energy is undetectable. Two, if the inserted tool will be affected by waves A and B, and also by the Null Wave, then, some new conclusions about the characteristics of electromagnetic waves should be drawn. These two possible scenarios are analyzed in the following section.

Analysis of Two Possible Experiment's Results

Scenario (2) - A scenario in which a Null Wave is detected in the experiment

It is accepted by the science of Physics that the energy in an electromagnetic wave is embedded in the electric and magnetic fields it carries (Ref. 3). Since these fields do not exist in the Null Wave, but the lab-detector still measured energy according to scenario-2 of the experiment, it must be concluded that *the energy in electromagnetic traveling*

waves is not necessarily embedded in the electric and magnetic fields it carries. If scenario-2 is really the case, this conclusion is surprising, and raises some questions: In what, then, the energy of an electromagnetic wave is embedded? Could it be that it is embedded in the photons existing in such a wave? And if so, is it possible that these photons remained intact when the electric and magnetic fields of the wave do not exist? It might be that there are more questions that should be asked and studied if a Null Wave can really be detected as scenario-2 of the lab-experiment shows.

In our view, the assumption that the energy of an Electromagnetic Null wave is embedded in its photons, and can be detected when the electric and magnetic fields of the wave do not exist, is unacceptable. The current scientific knowledge indicates that both manifestations of a traveling electromagnetic wave, its wave and its photons or particles, are two manifestations of a single phenomenon. Thus, one cannot exist without the other. Photons are both manifestation of energy and particles, which are believed to carry the electromagnetic field force. As such, photons can't exist in the absence of an electromagnetic field. Moreover, if photons are the particles that carry the electromagnetic fields, then, their energy patterns should coincide with the energy patterns that these fields carry. But since the fields in the Null Wave disappeared and their energy cannot be detected, it is reasonable to assume, that the energy of the photons will not be detected either.

Actually, we believe that any experimental attempt to detect the Null Wave will fail, because according to the basic physical laws, it is really impossible to detect energy in a wave that doesn't have electric or magnetic fields. A new theoretical approach that explains this assumption is discussed in the following section.

Scenario (1) - A scenario in which a Null Wave is not detected in the experiment

According to scenario-1 of the experiment, the Null Wave is not detected. If we conclude that the Null Wave does not contain energy, we clearly face a violation of the ***Energy Conservation principle***: Since the Null wave was created from two electromagnetic waves, A and B, that unified and each contained energy, the accumulated energy of these two waves should be manifested in the Null Wave. If this doesn't happen, then, it is

simply a violation of the energy conservation principle. Thus, a conclusion that the Null wave is really "Null" and does not contain energy seems as an unacceptable conclusion.

In the following section we introduce a *new theory* relating the energies embedded in electromagnetic fields that will provide an appropriate explanation to the results obtained in scenario-1 of the experiment.

The "Energy Pairs Theory"

"Energy Pair" is a novel theoretical construct representing a physical state in which certain energies can be accumulated and stored together, and at the same time disable each other in a way that these energies exist but are untraceable.

To resolve what seems as a violation of the *energy conservation principle* discussed above, and to show that energy conservation in the creation of a Null Wave still exists, we'll introduce the *"Energy Pairs Theory"* and the novel construct of *Energy Pair* to explain the experimental results obtained in scenario-1 above. Accordingly, the energies in the Null Wave are not annihilated; they still *exist* together after the unification of waves A and B as *"energy pairs" that disable each other*, such that it only appears that the Null Wave does not have any energy and the energy conservation principle is violated. The Null Wave's embedded energies disable each other and therefore this energy is untraceable.

What is this *"Energy Pair"* and how do the energies accumulated in it disable each other?

Following is a detailed description of *"The Energy Pairs Theory"*:

The energy embedded in an electric field generated by a *positive charge*, and the energy embedded in an electric field generated by a *negative charge*, are assigned to one set of "Energy Pairs". The same is applied for the energies embedded in magnetic fields generated by moving charges: The energy embedded in a magnetic field generated by a *moving positive charge*, and the energy embedded in a magnetic field generated by a *moving negative charge*, are assigned to another set of "Energy Pairs". And, energies belonging to an *Energy Pair* that

exist together in the same location in space and have equal intensities can still *exist* together but disable each other, a disabling that *seems* as a violation of the *energy conservation principle*.

In each set of "*Energy Pairs*" the energies of the electromagnetic waves that unified and created the Null Wave, were accumulated and continued to be stored into that *Energy Pair*. The mutual annihilation of the fields or the waves that was seen and measured as a mutual annihilation of energies belonging to these fields, and a violation of the energy conservation principle, can be viewed now as *mutual disabling of the energies* that continue to be stored into each *Energy Pair*.

The idea of "*Energy Pairs*", can be better understood by examining an analogue situation: *A rope in a rope pulling game (tug-of-war)*: Two people pull a rope each holding one edge of the rope and each in a direction exactly opposite to the other; if their pulling force is exactly equal, the rope does not move; this does not mean that the pulling energies that are exerted on the rope annihilate each other or disappear; The energies are accumulated and stored as a potential latent energy in the rope tension. The fact that the rope does not move, does not mean that the energies disappeared; they seem to be undetectable. The same applies when two electric or magnetic fields' forces of exactly the same intensity but *opposite polarity* annihilate each other. The energies of these fields are not annihilated or disappear; they are accumulated and stored into two sets of "*Energy Pairs*", one that was created by the unification of the electric component of the waves, and the other by the unification of the magnetic component of the waves. The energies in each set of these "*Energy Pairs*" disable each other; as a result, the Null Wave cannot be detected.

The "Energy Pairs Theory" Related to Photons

The novel idea of "*Energy Pairs*" that exists in a Null Electromagnetic Wave is actually a new concept related to accumulation and storage of energy that *can not* be detected because its components disable each other. This new concept should be expanded to the particle manifestation of an Electromagnetic Wave, namely, the Photon.

If a Null Wave cannot be detected, then the energies embedded in the photons that are carried by the Null Wave, *continue to exist but should be disabled* in a way that the wave cannot be detected, exactly as the energies embedded in the electric and magnetic components of the Null Wave cannot be detected. How can such a state of photons be explained, or how can photons continue to exist in a disabled state? We offer an explanation related to the "*Energy Pairs Theory*"; Photons should be capable of being in two different states in order to disable each other. When the wave's electric and magnetic *fields' polarity is positive*, photons exist in one state (state-1). When the wave's electric and magnetic *fields' polarity is negative*, photons exist in a second state (state-2). State-1 and state-2 are opposing each other. So, two photons that *exist together* in the same place in space but are at *opposite states* as related to one another *disable each other*. This, of course, is analogous to the conclusions derived relating the energies embedded in the electric and magnetic fields carried by the Null Wave. Photons can exist in two opposing states only if they have the capability to oscillate between these two states (1 and 2) synchronized with the oscillation frequency of the wave that carries them. So, photons should be always *physically oscillating* between two states. Since the two photons' states are synchronized with the frequency of oscillation of the wave that carry them, and the two unified waves that created the Null Wave are at a phase shift of 180 degrees as related to one another, then photons in the Null Wave *exist but all the time disable each other* such that the Null Wave cannot be detected.

The assumption that a photon physically oscillate also explains why the energy embedded in each photon is proportional to the frequency of oscillation of the electromagnetic wave that carries this photon. Because photons are particles, and if they oscillate between two states, the frequency of this oscillation must be proportional to the energy embedded in them.

Thus, photons in the "*Energy Pairs Theory*" framework can also be manifested as *Energy Pairs* that are capable of disabling each other and therefore, being undetectable.

Expansion of the Experimental Implementation of a Null Wave

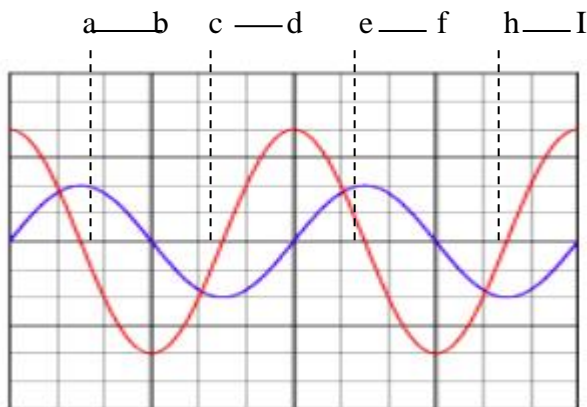
The Null wave experimental implementation described in Fig. 1 is now expanded to two more scenarios: One in which two electromagnetic waves unified, and continue to travel together in

the same direction, but they have *a phase shift relative to one another* before the unification, and a second in which the two waves have *different frequency of oscillation* before the unification.

(1) The two electromagnetic waves have a phase shift before their unification

Fig. 3 represents two electric fields waves' oscillations, as a function of time, which has a phase shift relative to one another before their unification. After their unification, they still have a phase shift relative to one another. However, there are portions of time such as: a-b, c-d, e-f and h-I, in each oscillating cycle, where one wave has opposite polarity relative to the other wave. In these portions of the oscillating cycle, *one wave will annihilate part of the other wave*, which will result in reducing both the electric field's intensity and *the energy* of the unified wave in these portions of the oscillation cycle. This result may *seem* again as an energy loss after the unification of the two waves; more than that, because all waves have the same velocity along the one dimensional x-axis (that represents time), this *seemingly energy loss* will occur continuously. In this case the unified wave is a Partly Null Wave.

Fig. 3



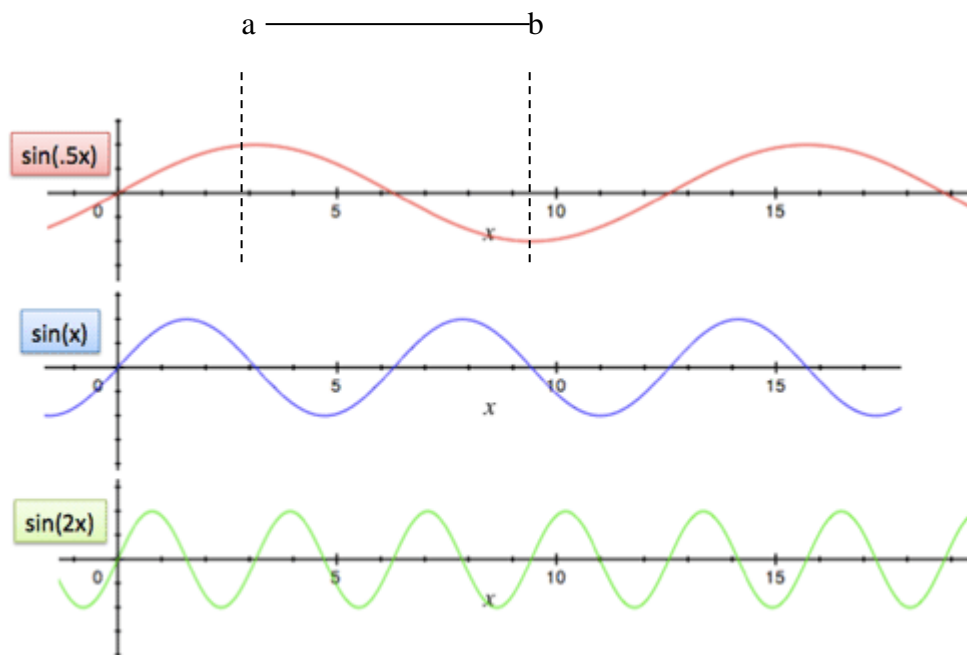
(2) The two waves have different frequency of oscillation before their unification

Fig. 4 shows the electric fields of three waves that have different frequency of oscillation before their unification. We'll examine unification between the first two waves in Fig. 4: Wave

A - the red, and wave B - the blue. After their unification they still have different frequency of oscillation.

Because waves A and B oscillate at different frequencies, after unification between these two waves, there are portions of time, such as a-b, in each oscillating cycle of the unified wave, in which one wave has opposite polarity relative to the other wave. In these portions of the oscillating cycle, one wave will annihilate only *part* of the other wave, which will result in reducing both the electric field's intensity and the energy carried by the unified wave in this portion of the oscillation cycle. This result may *seem again as an energy loss* following the unification. This *seemingly* energy loss will occur continuously, because all electromagnetic waves have the same velocity along the one dimensional x-axis that represents time. In this case, again, the unified wave is a Partly Null Wave.

Fig. 4



We conclude at this point that for electromagnetic waves that consolidate and become unified, and continue to travel together in the same direction, the *Energy Conservation Principle* *seems* to be violated almost always and almost in any constellation.

It should be noted that the polarization conditions of the two unified waves, that was necessary to create a *completely* Null Wave, is not required for the Partly Null Wave which will manifest a *seemingly* energy loss after unification, in any case of the polarization of the original waves, because now the two unified waves do not have to turn completely into a Null Wave. If the polarization of the two unified waves is arbitrary, then, the electric or magnetic fields of one wave, which are vectors, can always be considered as being composed of two perpendicular vector components. And then, one of these components can be a component who is aligned on the same line in space with the component of the other wave. Then, according to the above discussions, this will, almost always, generate *some seemingly energy loss*, when the two waves unify, and continue to travel together in the same direction.

Thus, as stated above, for electromagnetic waves that consolidate and become unified, and continue to travel together in the same direction, the Energy Conservation Principle *seems* to be violated almost always, and almost in any constellation; even if the waves oscillate at different frequencies, have some phases shift as related to one another, have different field's intensities and also *arbitrary polarization*.

According to the *Energy Pairs Theory* described above, portions of the energy that *seem* to be lost actually exist as latent potential *energy pairs* in the photons that are the particle manifestation of these electromagnetic waves, which actually produce a Partly Null Wave.

Unified Electromagnetic Waves and the Entities of Dark Energy and Complete Emptiness

"*Dark Energy*" is a theoretical energy component that is assumed to exist in the universe and is supported by several cosmology observations. The nature of this energy is unknown, but it is used to provide an explanation to the rate of the universe expansion. The "*Dark Energy*" is untraceable but cosmology observations have shown that it makes up about 70% of the energy in the Universe (Ref. 4).

In all the scenarios described above (Fig. 1, 2, 3, 4), where two electromagnetic waves consolidate and become unified, and continue to travel together in the same direction, in case they have a phase shift relative to one another, different frequency of oscillation, different intensities of their electric and magnetic fields, or arbitrary polarity, all or some of the energy

they initially carried, will *seem* to disappear after the consolidation. If such scenarios occur in outer space, at least some of the produced waves will be Null or Partly Null, and, at least part of their energy would not be traceable. According to the "**Energy Pairs Theory**" developed in this study, Null and Partly Null Electromagnetic Waves are composed of "**Energy Pairs**" that are packed up in the Wave's photons, disable each other, and cause the waves' energy to be untraceable or partly untraceable. It is possible then, that the "**Dark Energy**" might be composed of a significant amount of Null or Partly Null waves. Since a huge portion of the energy in the universe is composed of electromagnetic waves that might be bended, scattered and deflected, the probability that scenarios of unification of electromagnetic waves, like those described in Fig. 1, 2, 3, 4 occur in the universe, is high. Therefore, it is probable that many undetectable Null or Partly Null electromagnetic waves are traveling in the universe. Such waves might compose at least part of the "**Dark Energy**". And, since the *Dark Energy* is undetectable, it can be also assumed that it is actually also the "**Complete Emptiness**".

If we assume that after some time that the Null Wave or the Partly Null Wave is traveling in the outer space, for some reason that might occur in the universe, this wave might be able to undergo the reversed process of *energy pairs*, and this process will cause a split of the energies embedded in the *energy pairs* such that the energies become separated again and become traceable energy, it will seem as if energy is generated out of nothing. The concept of "**Nothing**" might be named in Physics: "**complete emptiness**". Such a split of the energies embedded in an **Energy Pair**, which results in these energies to be separated and become traceable again, will be discussed in a separate article titled: "Energy Analysis of a Null Electromagnetic Wave" (that can be found at: <http://viXra.org/abs/1911.0176>), (Ref. 5), which analyzes the phenomena of a photon converting to a pair of electron and positron when passing near a heavy atom.

Since "**Energy Pairs**" of equal intensities residing in the same space volume and carried by photons disable each other, which seems to the observer as **Complete Emptiness**, the reversed process of *Energy Pairs* split and evolving again into detectable energy might seem to evolve out of *nothing* or out of "**Complete Emptiness**". The view that "**Complete Emptiness**" might be a combination of *Energy Pairs* that disable each other, attributes to the "nothing" or "**Complete Emptiness**" concept, the same validity as the validity attributed to the "existence" or "substance" concept.

It can be concluded that electromagnetic waves which consolidate and become unified, and continue to travel together in the same direction, can be seen as a possible source of both the *Dark Energy* and the *Complete Emptiness*. In other words, these entities might be a space in the universe in which *Energy Pairs* reside, but because they disable each other the energy embedded in them can't be traced. Actually, the concept of *Energy Pairs* might view the state of *Complete Emptiness* as containing combinations of *Energy Pairs* that disable each other, and as the steady state of the existence that was, is and will be eternal, and, might transform into a different state of existence, in which energy is created out of nothing, or converted to nothing.

Summary and Conclusions

Summary of this Study

This study was aimed to evaluate a possible connection between the *Dark Energy* and electromagnetic waves. The study starts with the analysis of a Null Electromagnetic (EM) Wave, which is an electromagnetic wave that does not contain any electric or magnetic fields. The article shows how such Null waves can be created by consolidation of unified EM waves that continue to travel together in the same direction.

The study shows that in several measurable cases where Electromagnetic Waves unify and continue to travel together in the same direction, the process is bound to energy loss that *seems* as contradicting the "*Energy Conservation Principle*". In one case the *seemingly* energy loss is total and a Null Electromagnetic Wave is produced, and in other cases the *seemingly* energy loss is partial, so that the produced unified wave *seems* to carry less energy than the two Electromagnetic Waves carried separately before their consolidation, so that a Partial Null Wave is produced. In all cases we've noticed a *seemingly* "*Energy Conservation Principle*" violation, which was our initial reason to think about a resolution to this problem and to develop a new theoretical framework - the "**Energy Pair Theory**" (EPT), which might provide an explanation to these results.

The central idea in the EPT is that certain energies can be accumulated and stored together in a state called: "**Energy Pair**" (EP), and at the same time disable each other so that the energies *exist* but can not be *detected*. According to this new theoretical framework, the energy that was seemingly lost in Null waves creation is actually conserved into an "*Energy Pair*" that exists as

latent energy in the Null wave because its two components disable each other. Thus, the energy is conserved into an "*Energy Pair*" though it can't be detected.

A further step in the EPT development was to create a basic understanding of the manifestation of these EP, or to answer the question: Where do the *Energy Pairs* reside in a Null wave? In the EPT framework *Photons of energy might exist as Energy Pairs* based on their feature to oscillate between two opposing states. In addition, *Photons might also carry Energy Pairs*, in the case of a partial Null wave, where a photon has its own *traceable energy* and **in addition** it also carries the *untraceable Energy Pair* of the partial Null wave. These two "kinds" of energy that are embedded in a photon, implies that in a process that a partly Null wave is produced, the energy is conserved. In the case of a Null wave, photons exist as *Energy Pairs only*, that disable each other and therefore a Null wave's energy is totally undetectable.

A further assumption made in the EPT, was that an *Energy Pair*, in appropriate conditions, might split into detectable energy, and its untraceable energy becomes detectable again. This assumption is supported by the well-known Pair Production phenomena in which a photon converts to a pair of electron and positron, which is further elaborated in a separate article titled: "Energy Analysis of a Null Electromagnetic Wave" (that can be found at: <http://vixra.org/abs/1911.0176>), (Ref. 5).

At this point of the study, an attempt to examine other well-known undetectable energies, such as the "*Dark Energy*" and "*The Complete Emptiness*", in the "*Energy Pairs*" theoretical framework, was made. As far as the universe consists of a huge amount of electromagnetic waves that can be bended, scattered and deflected, there exists a high probability that some of these waves might unify and continued to travel together in the same direction after their consolidation, to create Null and partly Null waves that are untraceable or partly untraceable. These untraceable waves or *Energy Pairs* might compose, at least, part of both the *Dark Energy* and *The Complete Emptiness* entities that are untraceable but the science of Physics acknowledges their existence. A further assumption made at this point was that in suitable conditions, that might occur in the Universe, the reversed process might take place and the Null or Partly Null waves that compose both the *Dark Energy* and *The Complete Emptiness*, might split into traceable energy, a process that seems as if energy is evolved out of nothing.

A final and important comment: The fact that a Gamma photon was actually observed to produce electron and positron in appropriate conditions (as when passing near a heavy atom), is a manifestation of a splitting of an *Energy Pair*, and conversion of the untraceable energy of the *Energy Pair* back into traceable energy. This provides further basis to the assumption made before that undetectable *Energy Pairs* in Null or Partly Null waves might compose at least part of the *Dark Energy* or the *Complete Emptiness*, and, such *Energy Pairs* (or *Dark Energy*) might split back and produce traceable energy.

Conclusions of this Study

First, This study contributes to the energy entity a new "state of energy": the "*Energy Pair*" that establishes a theoretical framework to study untraceable energies like the *Dark Energy* and the *Complete Emptiness* entities. Following are two important features of *Energy Pairs* as shown in the *Energy Pairs Theory* developed in this study:

1. *Energy pairs* are built out of two components that disable each other and therefore the energy *exists* but is undetectable.
2. *Energy pair* might be created and might split again into traceable energy. In Gamma photon it splits into a negative charged electron and a positive charged positron as elaborated in a separate article titled: "Energy Analysis of a Null Electromagnetic Wave" (that can be found at: <http://viXra.org/abs/1911.0176>), (Ref. 5)

Thus, *Energy Pair* is a flexible theoretical construct that might be useful in better understanding other lab experiments and scientific observations. The *Energy Pairs Theory* as shown in this study has the right components to establish a robust theoretical framework for other natural and lab observations that are not resolved yet.

Second : Following the present study, it is highly recommended carrying out lab experiments that can produce Null waves or partly Null waves as those described in this study, in order to establish a stronger and solid base for the theory developed in this study.

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