

Energy Pairs Theory

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Abstract

This study presents a new concept related to *Energy*, the concept of *Energy Pairs*. The study starts by trying to answer the following question: is it possible to detect the energy embedded in a Null electromagnetic wave, which is an electromagnetic wave that does not contain any electric or magnetic fields at all. The article describes how to create such an electromagnetic wave from two normal electromagnetic waves, that 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 a proposed experiment of producing a Null electromagnetic wave, 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 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*.

The *Energy Pair 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 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.

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):

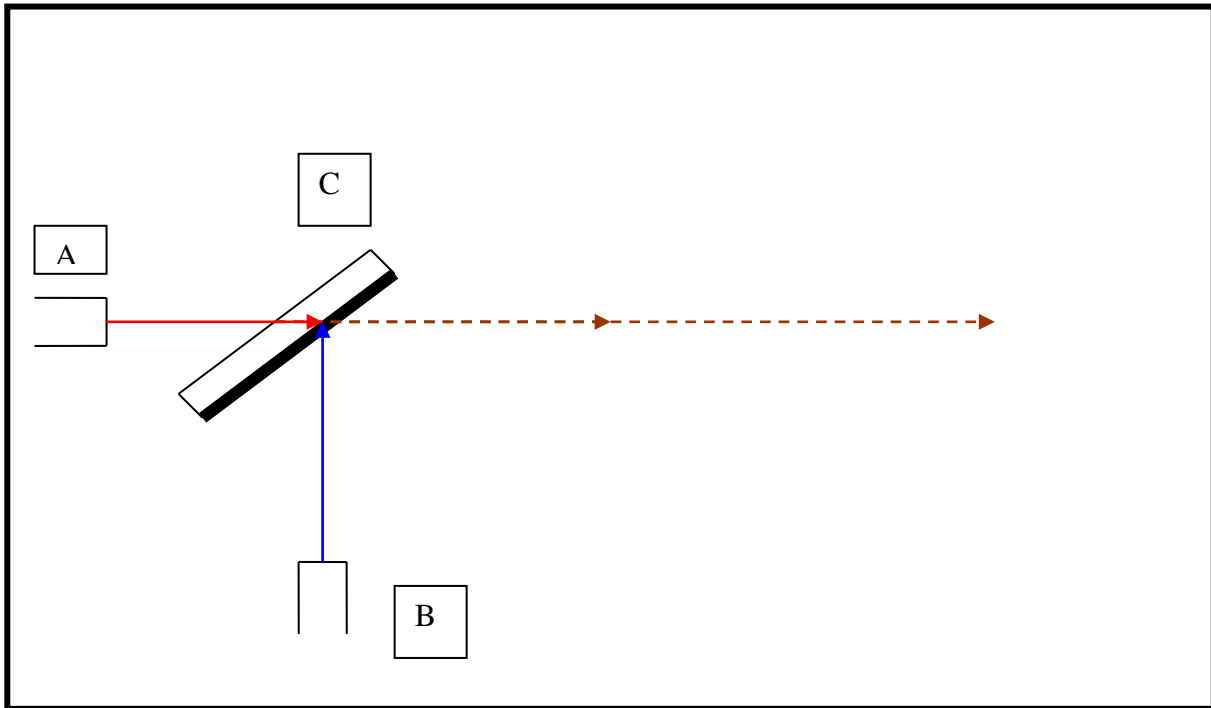
$$E_y = E_0 \cos [2 \pi (x / \lambda) - f t]$$

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

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 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

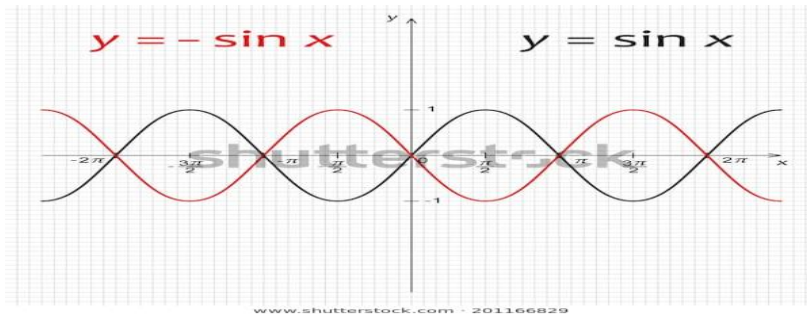


Fig 2 shows the electric fields intensities of the two waves after their unification. Clearly, the electric fields of both waves will disappear after their unification, because each field cancels the respective field in the other wave, completely and continuously. The same applies for the magnetic fields 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 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 magnetic field generated by *moving positive charge*, and energy embedded in magnetic field generated by *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, 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 applied for the energies embedded in the electric and magnetic components of the Null Wave. 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 is, of course, 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 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 be manifested as *Energy Pairs* that are capable of disabling each other and therefore, being undetectable.

More on the Energy Pairs Theory

The *Energy Pairs Theory* describes energies that *exist* but can *disable* each other.

The assumption that certain energies can cancel each other is not a new concept in physics. According to Ref. 5, the energy embedded in the gravitational fields, in the **whole universe**, is now considered to be a negative energy, such that it offsets completely the energies embedded in the masses, in the **whole universe**, such that the net energy of the universe which relates to masses and gravitational fields is zero.

This fits with the assumption that the energies embedded in charges belong to one set of *Energy Pairs*, and, if the charge conservation principle holds, the net energy embedded in charges, in the *whole universe*, is again zero.

On the other hand, Ref. 4 defines an equation for the energy density in the gravitational field. If we adopt the idea presented in Ref. 5 that this energy density is a negative energy, then, we should conclude also that the energy embedded in the masses in the *whole universe* and the energy embedded in the gravitational field in the *whole universe* belong also to an Energy Pair.

The concept of *Energy Pairs* that applies only to the set of *all* the masses in the universe does not apply to a single mass and its gravitational field.

Because, the energy embedded in the mass is proportional to the mass magnitude, and the energy embedded in the gravitational field is proportional to the square of the mass magnitude.

Only when we consider *all* the masses in the universe and assume that the masses are spread, on the average, uniformly in the universe, we can derive the conclusion that the energy embedded in all the masses in the whole universe might cancel the energy embedded in the gravitational field of the whole universe.

Analogous to the above, if we adopt the assumption that the charge is energy, then, the energy embedded in the positive charges in the *whole universe* and the Energy in the electric fields and the magnetic fields of positive charges in the *whole universe* should also belong to an Energy Pair.

And, the energy embedded in the negative charges in the *whole universe* and the energy in the electric fields and the magnetic fields of negative charges in the *whole universe* should also belong to an Energy Pair.

The above described Energy Pairs *must* contain elements from the *whole universe*. On the other hand, this article assumes that if charge is considered energy, then, the energy embedded in any positive charge and the energy embedded in any negative charge, belong to an *Energy Pair*.

Also, energy belonging to any electric field generated by positive charges, and energy belonging to any electric field generated by negative charges, belong to an *Energy Pair*.

Also, energy belonging to any magnetic field generated by positive charges, and energy belonging to any magnetic field generated by negative charges, belong to an *Energy Pair*.

Also, as Ref. 6 implies, modern physics is evaluating the concept of *Negative Mass*. Ref. 7 even informs that it may be that physicists created "*negative mass*". If the notion of *negative mass* is found to be a viable concept, it further increases the similarities between *Mass* and *Charge*, as related to *Energy*. Then, since *Mass* is already recognized as a special form of *Energy*, this also increases the possibility that *Charge* should also be recognized as a special form of *Energy*.

Summary and Conclusions

Summary of this Study

This study introduces a new concept related to *Energy*, the concept of *Energy Pairs*. This study starts by analyzing Null Electromagnetic (EM) Waves that are created by consolidation of unified EM waves that continue to travel together in the same direction.

The study shows that in 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". This *seemingly* "Energy Conservation Principle" violation 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 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.

Conclusions of this Study

First, This study contributes to the energy entity a new "state of energy": "**Energy Pair**" that establishes a theoretical framework to study untraceable energies like the Dark Energy and the Complete Emptiness entities. This is further elaborated in other articles related to this subject.

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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