

Energy analysis of a Null electromagnetic wave

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Abstract

This article summarizes a research based on a thinking exercise relating to electric charges, electromagnetic traveling waves and energy, which results in surprising, new and important insights into the nature of electric charges, electromagnetic traveling waves, photons, and energy.

This thinking exercise started with the attempt to provide an answer to the following question: is it possible to detect a Null electromagnetic traveling wave, which is a wave that does not contain any electric or magnetic fields?

Analysis of the above question shows that **any answer** to that question provides surprising and **important new insights**.

The article provides a description of how to implement such a Null electromagnetic wave, and it also provides a description of how to carry on a lab experiment which might provide answers to the above question.

As already mentioned above, any answer to the above question results in providing surprising and new insights to issues such as:

Energies embedded in electric charges, electric or magnetic fields and photon, can, in certain circumstances, seem as annihilating each other, but actually exist together as latent potential **Energy Pairs** that only disable each other from operation, which only seemingly, or apparently, looks as annihilating each other.

In addition to their detectable energy, photons might contain latent potential energy pairs that are undetectable.

The Dark Energy might be embedded in consolidating electromagnetic waves which consolidate and continue to travel in the same direction.

The Energy Pairs theory mentioned above provides an explanation to the charge disappearance mystery in electron positron collisions.

The charges of the electron positron pair created when a photon passes near a heavy atom might be created from a latent energy pair embedded in the photon.

Electric Charges are a form of energy as Mass is recognized being a form of energy.

Complete Emptiness might contain Energy Pairs that disable each other, which only seem to be a state that does not contain any energy.

Introduction

The issue of electromagnetic traveling waves interference was already presented and analyzed 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 shows that in these cases, the interference between these waves conserves the wave energy. (Ref 1).

However, the following scenario presents surprising results relating to electric and magnetic fields energies:

A scenario of very focused two source electromagnetic traveling waves, focused such that they can be considered as traveling only in one dimension, which are colliding, and following this collision, the waves consolidate and become unified, and continue to travel in the same direction. If the two waves consolidate when they oscillate at exactly the same frequency, have exactly the same intensities in their electric and magnetic fields, have proper polarization (as is explained later in this article) and are exactly at a phase shift of 180 degrees relative to one another, the resultant electromagnetic wave is a Null wave which does not contain any electric or magnetic fields.

This article presents a description of how to carry on the necessary steps in order to implement the above Null electromagnetic traveling wave.

This article then analyzes the question if it is possible to detect such a Null electromagnetic traveling wave, and shows, that any answer to this question should provide surprising and new insights.

The article also describes how to conduct a lab experiment, using the implementation of this Null electromagnetic wave, to provide an answer to the above question. Then, the article analyzes the possible results of this experiment, and discusses the various

surprising insights provided by each of these possible answers which results in the following findings:

Energies embedded in electric charges, electric or magnetic fields and photon, can, in certain circumstances, seem as annihilating each other, but actually exist together as latent potential **Energy Pairs** that only disable each other from operation, which only seemingly, or apparently, looks as annihilating each other.

In addition to their detectable energy, photons might contain latent potential energy pairs that are undetectable.

The Dark Energy might be embedded in consolidating electromagnetic waves which consolidate and continue to travel in the same direction.

The Energy Pairs theory mentioned above provides an explanation to the charge disappearance mystery in electron positron collisions.

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Electric Charges are a form of energy as Mass is recognized being a form of energy.

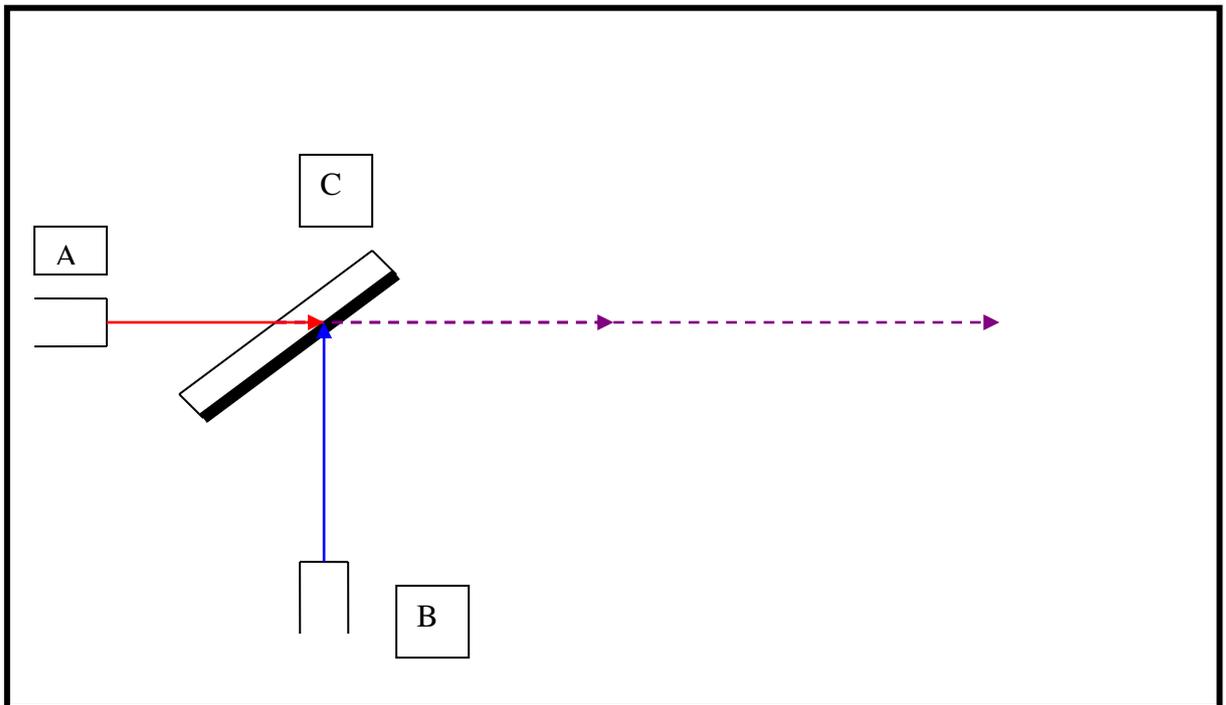
Complete Emptiness might contain Energy Pairs that disable each other, which only seem to be a state that does not contain any energy.

Actually, the analysis offered in this article, provides a deep and surprising view, not only on the specific process examined, but also in better understanding of the biggest unresolved problems of the science of Physics today, the "expansion of the universe" and the "dark energy" issue.

Description of an implementation of a Null electromagnetic traveling wave

The above described scenario of two one dimensional electromagnetic waves which consolidate and become unified, and continue to travel together in the same direction can be implemented as shown by Fig. 1 below:

Fig 1

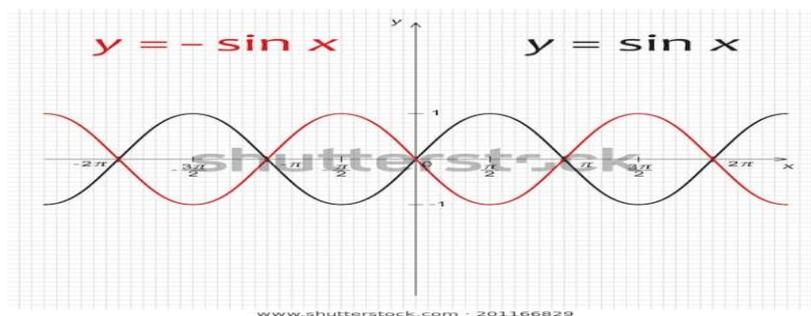


An electromagnetic wave source A generates the very focused first (red) one dimensional electromagnetic traveling wave , which passes through the half transparent mirror C, and is supposed to continue, after it passes the half transparent mirror C (as the dotted line indicates).

A second electromagnetic wave source B generates the very focused second (blue) one dimensional electromagnetic traveling wave, which is deflected by the mirror C, such that it is supposed to continue on exactly the same line as the first wave (as the dotted line indicates).

If the two waves consolidate when they oscillate at exactly the same frequency, have exactly the same intensities in their electric and magnetic fields, have proper polarization (as will be explained in the next paragraph) and are exactly at a phase shift of 180 degrees relative to one another, 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 below:

Fig. 2



This figure shows, for example, the electric fields intensities of the two consolidated waves after the consolidation, and also the magnetic fields intensities of these two waves (but the y-axis replaced by z-axis, because the electric and magnetic fields are perpendicular to each other). It is clear from this figure that the electric and magnetic fields of both waves will disappear after their consolidation, because each field cancels the respective field in the other wave, completely and continuously.

It should be added that the polarization of the red wave and the polarization of the blue waves should be such as to achieve the following: the polarization of the blue wave after it is deflected by the half transparent mirror should be exactly the same as the polarization of the red wave that passes through the half transparent mirror. This means, that the oscillations of the electric fields of both waves (after the half transparent mirror) occur on exactly the same line in space. And also, the oscillations of the magnetic fields of both waves (after the half transparent mirror) occur on exactly the same line in space, (which is, of course, perpendicular to the other line, the line on which the electric fields oscillate). This polarization validates that each field

cancels the respective field in the other wave, completely and continuously, after the consolidation moment.

It might be difficult, technologically, to arrange such an experiment, because the requirement is that the blue wave should arrive at the half transparent mirror C such that it will be deflected in exactly the right angle, in order to consolidate completely with the red wave. And, because the waves are supposed to be very focused and, actually, almost one dimensional, this might be a difficult task to achieve. Also the requirements that the waves consolidate when they oscillate at exactly the same frequency, have exactly the same intensities in their electric and magnetic fields, have proper polarization and are exactly at a phase shift of 180 degrees relative to one another might provide significantly extra complications in carrying on this implementation. But, in principle, this is only a technology issue.

Analysis of new insights if such a Null wave can be detected

In order to answer the question if such a Null wave can be detected, means must be devised, which will be inserted in the line of propagation of the wave, and these means should be designed such that they are expected to be affected by this Null wave.

One such means might be electric charges. Since electric charges are affected by electric and magnetic fields, inserting charges in the line of propagation of the Null wave might provide the answer if the Null wave really does not contain any electric and magnetic fields. If the inserted charges will not be affected, it will be an indication that these fields in the Null wave really do not exist. It will also provide the understanding that the Null wave cannot be detected by such charges.

Then, if inserted charges cannot be used to detect the Null wave, another type of detector should be devised (of any sort), and inserted in the propagation line of the Null wave, and the output of this detector should be examined, to see if this detector does detect anything.

If such a detector will be devised, and it will detect the Null wave, the following new and important conclusions must be drawn:

The energy in electromagnetic traveling waves is not necessarily embedded in the electric and magnetic fields it carries. This is a surprising new insight, since it is common knowledge that the energy in an electromagnetic wave **is** embedded in the electric and magnetic fields it carries. But this Null wave does not contain any such fields, and the above mentioned detector still detected it, so it cannot be that the wave energy is embedded in such fields. This should raise other questions: In what, then, the energy of an electromagnetic wave is embedded? Maybe, in the photons existing in such a wave? And, do these photons remain intact when the electric and magnetic fields of the wave do not exist? The current common knowledge today is that both manifestations of a traveling electromagnetic wave, its wave manifestation and its

photons, or particles manifestation, are two manifestations of a single phenomenon. Thus, one manifestation cannot exist without the other. Photons are also particles which are believed to carry the electromagnetic field force. As such, Photons can't exist in the absence of an electromagnetic field.

Also, 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 also the energy of the photons will not be detected.

So, if the Null wave will be detected despite the fact that it has no fields, and thus, its wave manifestation does not exist, and this detection will be decided **to be** because of the photons that still exist without the fields, this will also be an important new and surprising insight, which will have to change or alter our understanding of what photons really are.

And, if the Null wave will be detected despite the fact that it has no fields, and thus, its wave manifestation does not exist, and this detection will be decided **not to be** because of the photons, the question of where the energy in electromagnetic waves is embedded will remain an open question.

Thus, all the results from the finding that the Null wave can be detected are important new and surprising insights, and, in this case, important new questions will be raised.

Analysis of new insights if such a Null wave cannot be detected

Actually, the article assumes that the attempt to detect the above described Null wave will fail, and it will not be possible to devise any detector which will be able to detect the above described Null wave. In this case the following discussion applies:

If we conclude that the Null wave is really null and does not contain any energy, and because of this it cannot be detected, then, this **violates the Energy Conservation principle**. Because, this Null wave was created from two separate waves that contained energy. Thus, the assumption that the Null wave is really null and does not contain any energy seems as an assumption that is not viable.

Then, the next possible assumption should be the following assumption:

The energies in the Null wave are not really annihilated, they still **exist** together, but disable each other, such that it only appears that the Null wave does not have any energy, but because its embedded energies disable each other, it cannot be detected.

An analogy to the above might be the description of what happens to the energy in a rope in a rope pulling game. When two people pull a rope, each in a direction opposite to the other, if their pulling force is exactly equal, the rope does not move. However, this does not mean that the pulling energies that are exerted on the rope really annihilate each other or disappear. These energies are accumulated or amassed in the rope tension.

The same should occur when two electric fields forces (or magnetic fields forces) of exactly the same intensity and opposite polarity **seem to** annihilate each other. The energies of these electric (or magnetic) fields are not annihilated or disappear, they are accumulated or amassed, but they cannot express themselves. They only disable each other. One possibility where these energies are accumulated might be the photons, as will be further elaborated in a following section of this article.

Also, important new insights relating to this possibility will be further discussed in the following section of this article.

Thus, it was shown that any answer to the question if such a Null wave can be detected, will provide surprising **new and important insights**. Thus, this article states that generating such a Null wave, and answering the question if such a Null wave can be detected, might be an important mission.

The Energy Pairs Theory

If the above described experiment to try and detect the above described Null wave could not end in detecting this Null wave, then, the following additional conclusion should also be derived:

Electric fields energies or magnetic fields energies, which are dependent on the existence of a force field (electric or magnetic) in order to exist, seem to annihilate each other, in certain situations, an annihilation that **seems** to violate the Energy Conservation Principle. And thus, the article assigns such energies to pairs of **Energy Pairs**.

In light of the above described scenario, this article assigns the energy embedded in electric fields generated by positive charges, and energy embedded in electric fields generated by negative charges to one set of energy pairs. And, this article also assigns the energy embedded in magnetic fields generated by moving positive charges, and energy embedded in magnetic fields generated by moving negative charges to another set of energy pairs.

However, as already mentioned in a previous section of this article, this seemingly mutual annihilation of the fields is not really a violation of the Energy Conservation Principle.

The seemingly mutual annihilation of energies belonging to these fields can be viewed not as mutual annihilation but as mutual disabling, assuming that the energies **exist** as Energy Pairs and their mutual disabling is only seen as annihilation.

More on the implications that the energies exist but disable each other, will be further elaborated in a following section of this article.

Photons might turn into undetectable Energy Pairs

In the previous section of this article a conclusion was presented which states that energies embedded in electric fields can exist together as energy pairs but disable each other, such that it appears that no energy exists at all. And, the same conclusion was presented also about the energies embedded in magnetic fields.

However, since the energies embedded in electromagnetic traveling waves are manifested not only in the electric and magnetic fields that the waves carry, but are also in the alternative presentation of these waves, namely the photons, a surprising, new and important conclusion should be derived regarding these photons, which is presented as follows:

If we adopt the assumption that the Null electromagnetic wave described in the previous sections of this article cannot be detected, then, the conclusions regarding the energies embedded in its electric and magnetic fields should be translated to an analogous conclusion regarding the photons, since the photons are the particles that carry these energies.

Then, the assumption that the Null wave cannot be detected should result in concluding that the energies embedded in the photons **also exist but are disabled** such that the wave cannot be detected. This might be translated to the following:

Because photons are the particles that carry the electromagnetic fields, it might be reasonable to conclude that photons should be **physically** oscillating between two **opposing energy** states, as the electromagnetic fields in an electromagnetic traveling wave do. The oscillation of the photons should be synchronized with the oscillation frequency of the wave that carries these photons and should coincide with the oscillation pattern of the electric and magnetic fields of the electromagnetic wave that carry these photons. Thus, when the wave electric and magnetic fields polarity is positive the photons are at one energy state. When the wave electric and magnetic fields polarity is negative the photons are at the opposite energy state. And, two photons that exist together at the same place in space which are at opposite states, as related to one another, still **exist together**

but their energies disable each other energy in the same way as the electric or magnetic fields disable each other energy, such that the portion of the energies that are disabled remain as latent potential energy pairs accumulated in the photons, and only the net energy of the photons which is not disabled, remain as energy that can be detected. This is analogous to the conclusions derived relating to the energies embedded in the electric and magnetic fields carried by the wave.

Then, since the oscillation of the photons is synchronized with the frequency of oscillation of the wave that carry these photons, and the two consolidating waves in the Null wave are at a phase shift of 180 degrees, as related to one another, the photons in the two consolidating waves **exist but always disable each other** such that the Null wave cannot be detected.

This conclusion relating the photons, is a surprising and new conclusion, which assigns new features to the photons which states that photon **physically oscillate** between two opposing energy states, **might turn completely into undetectable energy pairs**, and when photons have detectable energy, they **might also contain additional undetectable energy pairs**, in addition to their detectable energy.

This 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.

Consolidating Waves and a possible connection to the issue of the Dark Energy

If the energies do exist but disable each other, which is a possibility that was already described in the previous section, an extrapolation of this assumption can state, that the energies in an Energy Pairs can evolve together again and become detectable again.

Then, by combining the following: the findings about energies converted to Energy Pairs that disable each other in case of electromagnetic waves which consolidate and become unified and continue to travel together in the same direction, and the assumption that such disabling energies can evolve together again and become detectable, 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 the **Dark Energy** which might also look like the **complete emptiness**.

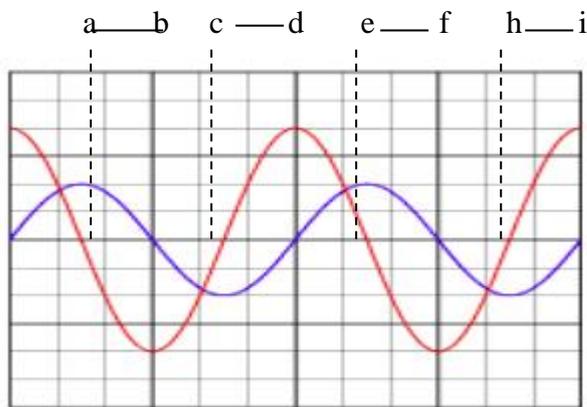
Because, the assumption that the complete emptiness actually contains energy pairs that disable each other, makes it containing energies that are untraceable, as the Dark Energy is. And, the assumption that energy can emerge from what looks like nothing (or complete emptiness) might explain how this Dark Energy is able to enter into activity, in certain conditions.

However, in a scenario were two waves **consolidate and become unified, and continue to travel together in the same direction**, even if they have **any phase shift relative to one another**, or have **different frequency of oscillation**, some of the energy they initially contained will usually **seem** to disappear.

Because, if Fig. 3, for example, represents the oscillation of the electric fields of the two waves at an instant of time, say $t=0$, because these oscillations have a phase shift relative to one another, there are portions, such as a-b, c-d, e-f and h-i, in each oscillating cycle, where one wave have opposite polarity relative to the other wave.

And, in these portions of the oscillating cycle, portions of one wave will annihilate these portions in the other wave, which will result in reducing the electric field intensity in these portions in the oscillation cycle. This results in what seems as an energy loss. And this seemingly energy loss will occur continuously, because Fig. 3 represents the waves along their entire journey, following their consolidation, because they travel at the same speed along the one dimensional x-axis.

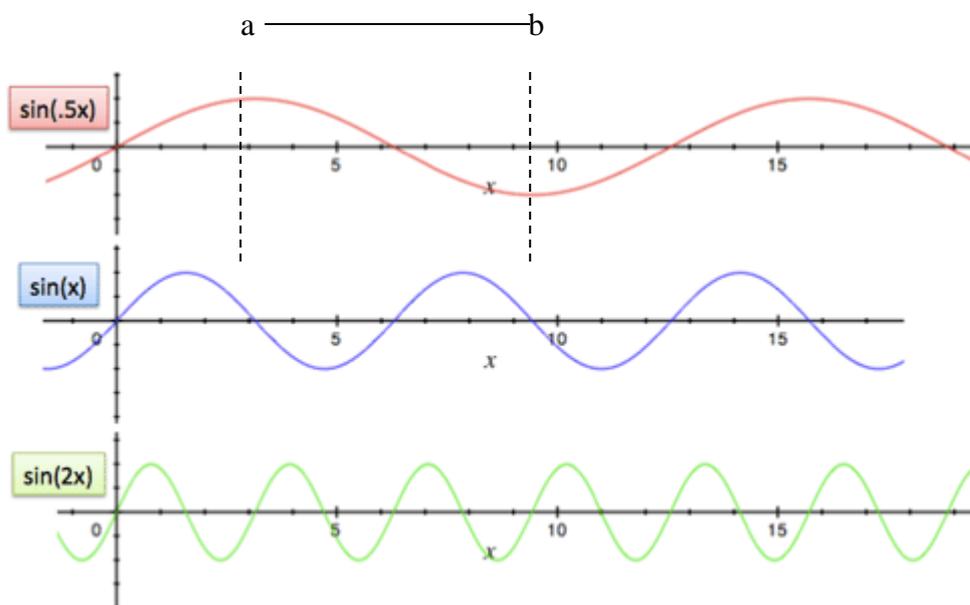
Fig. 3



A similar argument applies to the case of waves which oscillate with different frequencies.

Fig. 4 below shows 3 such waves:

Fig. 4



If the first two waves in Fig. 4 ($\sin(.5x)$ and $\sin(x)$), for example, represent the oscillation of the electric fields of the two waves at an instant of time, say $t=0$, because these oscillations oscillate at different frequencies, there are portions, such as a-b, in each oscillating cycle of the wave $\sin(.5x)$, where one wave have opposite polarity relative to the other wave, which results in what **seems** as an energy loss. And this **seemingly** energy loss will occur continuously, because Fig. 4 represents the waves along **their entire** journey, following their consolidation, because they travel at the same speed along the one dimensional x-axis.

So, for 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**. And, this occurs without any connection to the polarization conditions of the two consolidated waves. Because, in order to achieve some **seemingly** energy loss, the two consolidated waves do not have to turn completely into a null wave. If the polarization of the two consolidated waves is not the same, then, the electric or magnetic fields of one wave always have a component whose polarization is aligned with the polarization of the component of the other wave. And, according to what was shown above, this component, almost always, will generate some **seemingly** energy loss, when the two waves consolidate, and continue

to travel in the same direction. Thus, as stated above, for 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 intensities and also different polarization. And, as mentioned in a previous section of this article, the portions of the energy that **seem** to be lost, might be accumulated as latent potential energy pairs in the photons that are the particles manifestation of these electromagnetic waves.

If the above scenario occurs in outer space, such that the two waves consolidate and become unified, and continue to travel together in the same direction, for a very long journey together, and possibly even a very long time (although they travel at the speed of light), throughout this all long journey, and this all long time, the waves, and their energy cannot be traced. And, even if we assume that after this long journey the waves, for some reason, become separated again, and they, and their energies become traceable, it will seem as waves and energy are generated out of complete emptiness.

It was also shown before that in the case of 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**.

Thus, since a huge portion of the energy in the universe is composed of electromagnetic waves, and these waves might be bended and deflected, the probability that such scenarios occur in the whole universe is big, increasing significantly the possibility that this might **provide some explanation to the issue of Dark Energy**, which is a mystery that the science of physics seeks an explanation to it.

Complete Emptiness and the Dark Energy state

Since the Energy Pairs Theory states, that Energy Pairs of equal intensities residing in the same space volume might disable each other, which seems as complete emptiness, then, the Energy Pairs concept can be extrapolated to predict that energy embedded in Energy Pairs can be also generated out of nothing.

This view attributes to the nothing (or complete emptiness) concept the same validity as the validity attributed to the existence (or substance) concept, assuming that the complete emptiness might contain energy pairs that disable each other, and might be related to the Dark Energy, since it does contain energies that cannot be traced.

Actually, this concept might view the state of complete emptiness (or combinations of energy pairs that disable each other) 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 pairs are created out of **what looks like nothing**, or converted to **what looks like nothing**.

Energy Pairs might explain Charge disappearance in electron positron collisions

When an electron and a positron collide they annihilate each other and gamma ray photons are emitted, with energy equal to the sum of the energies embedded in the masses of the electron and the positron. However, the charges of the electron and the positron are not converted to any new substance (such as energy) and they simply disappear without leaving any trace of their previous existence. This charge disappearance seem to be an unusual, strange and unexpected mystery, although this charge disappearance obey the charge conservation principle. This charge disappearance is strange, because charge seems to be a basic element in physics, and such basic elements should not disappear.

The Energy Pairs mentioned above provides a reasonable and logic explanation also to this charge disappearance mystery. This is done by assuming that charge is energy and energy embedded in positive charge and energy embedded in negative charge belong to one set of Energy Pairs that might disable each other.

Actually, this charge disappearance can also be described **the other way around**, as providing **extra support** to the **assumption that charge is energy**.

Because, as electric and magnetic fields energies are shown to disable each other and disappear, and in order not to violate the energy conservation principle, the assumption that these energies still exist as energy pairs but disable each other, was provided, this assumption should also apply to other elements that disappear, when their disappearance seem as unusual and strange event.

As already stated, the disappearance of the charges of the electron and the positron in their collision, seem as a surprising and strange event, because they are not noticed to be converted to anything else, including energy.

Thus, the fact that positive and negative charges also do annihilate each other in electron positron collisions, provides support to the assumption that electric

charges are also a form of energy which might, in certain circumstances convert to untraceable energy pairs.

In a previous section of this article the assumption that photons oscillate between two opposing energy states was presented. Also, the following assumption was also presented there: photons existing in the same space location and being at two different states might manifest themselves as an energy pair that exist but cannot be detected. Then, it might be reasonable to assume that as photons oscillate between the two energy states of an energy pair, and as photons can become a pair of undetected energy pair, that photons might also **contain** energy pairs.

Then, the photons which are the result of an electron positron collision can be the particles that embed the energy pair that contain the energies that existed in the charges of the electron and the positron before their collision.

The above argumentation is further supported from the fact that the opposite event, namely, the creation of a pair of electron and positron from a photon also occurs, as will be further elaborated in the following section of this article.

Electric charge might be a form of Energy

In the previous section the claim that electric charge might be a form of energy was presented, as mass turned to be after the presentation of the special relativity theory.

In that section, the explanation of the charge disappearance in electron positron collisions was based on assuming that charge is energy, and positive and negative charges belong to one set of Energy Pairs which can disable each other, in certain situations.

In addition to the above, the phenomena in which a photon can be converted back into a pair of electron and positron while it passes near a heavy atom can also be an extra support to the above conclusion that charge is energy. Since the photon does not contain mass or charge and, thus, is **composed only from energy**, and **it is converted** to a pair of particles **that do contain charges**. Then, this implies that charge is also energy, because it evolved from energies that existed as Energy Pairs in the photon, and were converted back to a pair of electric charges. In the previous section the possibility that photons might **contain** also energy pairs was presented. Thus, the charges of the electron and the positron that were generated from a photon passing near an heavy atom might be the result of the energy pair embedded in the photon being converted back to a pair of charges, the charges of the electron and the positron.

Moreover, the fact that this pair of charges evolved from latent potential energy pairs that existed in the photon, (or, in other words, the Dark Energy existed in the photon), is a manifestation that Dark Energy can, in certain circumstances, become active again, as was already assumed in a previous section of this article.

Summary, Results and Conclusions

This article presents a scenario, of a collision, followed by a consolidation, between two one dimensional electromagnetic waves, which continue to travel together in the same direction, after that consolidation.

The article shows that in the above described scenario a Null electromagnetic wave can be created which contains no electric or magnetic fields.

The article shows how to carry on what is necessary in order to implement such a Null wave and how to conduct an experiment to answer the question if such a Null wave can be detected.

The article analyzes all the possible answers to the above question, and shows that every answer to that question provides surprising new and important insights to issues such as:

Energy in general, especially energy embedded in electromagnetic waves and energy embedded in electric and magnetic fields, and even to issues such as new surprising insight into possible new features of electric charges, photons, charge disappearance in electron positron collisions and even some possible leads related to the Dark Energy issue and a connection between the Complete Emptiness and the Dark Energy state.

Actually, the following new insights that the article provides should be emphasized:

The conclusion that energies of electric or magnetic fields which cancel each other and remain as latent, potential energies, that exist but disable each other. The ability of photons to exist as latent potential energy. The ability of photons to carry undetectable energy pairs in addition to their detectable energy. The possible explanation about the origin of the Dark Energy. The explanation of the charge disappearance in an electron positron collision. The possibility that complete emptiness might contain latent energy pairs and the possibility that electric charges are also a form of energy. All these seem to be new insights.

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