Space, Aether and the Dark Energy in the Energy Pairs Theory Framework

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Abstract

The primary aim of this study was to analyze the Energy embedded in electric and magnetic fields, from a new point of view. The study shows that these scenarios manifest energy losses that seem as a violation of the Energy Conservation Principle. This is explained by expanding the Energy Pairs Theory (EPT) to include these scenarios. The EPT was developed to explain the seemingly energy loss that exist when two electromagnetic waves unify and continue to travel together in the same direction. The Energy Pairs resided initially in the photons that these waves carry. However, in the analyzed scenarios there are no photons. So, the question where the Energy Pairs reside in these scenarios remains open. This article presents the assumption that Space contains these Energy Pairs and Space might be equated with Energy because what were assumed as Complete Emptiness in Space are untraceable Energy Pairs. This increases significantly the assumption that untraceable Energy Pairs might be the cause of the mysterious Dark Energy. Because the universe rate of expansion, which is proportional to the total Energy embedded in the universe, is increased now by adding the untraceable Energy Pairs. The unification of Space with Energy complies also with the requirement of the General Relativity Theory which requires some substance, as Aether, to provide physical properties to the Space/Time entity. Thus, the EPT might also turn to be a connecting link between the Electromagnetism and Gravitation.

Key words: Space, Aether, Energy Pairs, Energy, Dark Energy.

1. Introduction

The Energy Pairs Theory (EPT) was already presented in an article titled: "Energy Analysis of a Null Electromagnetic Wave" [1]. That article presented a scenario of two one dimensional electromagnetic traveling waves, which collide, then consolidate and unify and continue to travel together in the same direction. Analysis of that scenario shows that it is possible to create a Null electromagnetic traveling wave which does not contain any electric and magnetic fields, from two normal electromagnetic waves, which do contain electric and magnetic fields and energy. And thus, a violation of the Energy Conservation Principle might seem to occur.

The Energy Pairs Theory (EPT) developed using the Null wave scenario provided a reasonable explanation to that seemingly violation of the Energy Conservation Principle. It does that by introducing the novel construct of "Energy Pair", which is a theoretical construct that represents 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.
The EPT presented the assumption that *Energy Pairs* might be the cause of at least part of the mysterious *Dark Energy*. Since a huge portion of the universe is composed of electromagnetic waves that can be bended, scattered and deflected, there is a high probability that these waves might create a significant amount of Null or partly Null electromagnetic waves, whose energies are *untraceable* or *partly untraceable*. The EPT also showed that such *untraceable Energy Pairs* might convert back to *traceable energy* by analyzing the scenario of a photon that converts to an electron and a positron in appropriate conditions. That supports the assumption that *Energy Pairs* might be the *cause* of at least part of the mysterious *Dark Energy*.

The EPT also presented the surprising conclusion that *Electric Charges* are a form of *Energy*, analogous to the *Mass* being a form of *Energy*, as derived in the *Special Relativity Theory*.

In this article the EPT framework is expanded to additional scenarios where it provides explanations to other *seemingly* energy conservation issues which seem to be ignored today. These scenarios contain electric fields generated by static electric charges, and magnetic fields generated by moving electric charges that move at a constant velocity. This article shows that these scenarios might also manifest *energy losses* that *seem* as a violation of the *energy conservation principle*. This energy loss is again explained using the EPT.

The EPT suggested the claim that the *Energy pairs* in Null or partly Null electromagnetic waves reside in the photons carried by these waves. In the scenarios described in this article there are no photons. Thus, in the scenarios described in this article, the *Energy Pairs* seem to reside in *Space* itself.

This article also shows that the *composition* of the *energies* in *Space* as related to the *mixture of traceable energies* versus *untraceable Energy Pairs* in *Space* is dynamic and is changing continuously. This implies that the *untraceable Energy Pairs* play a role in the *dynamics of Space*. This might indicate also that the untraceable *Energy Pairs* that exist in *Space* are active, even though they are *untraceable* because the fields that created them annihilated each other.

This article also provides several *additional arguments* that indicate that the *untraceable Energy Pairs* in *Space* can generate new activities even though these *Energy Pairs* are *untraceable*.

This article also shows that *Space* contains *some untraceable Energy Pair at each point* of it, and as such *Space* is filled with *untraceable energy*. Thus, this article shows that what was assumed before to be *Nothing or Complete Emptiness* in *Space* is *untraceable energy*. Thus, because *every point* in *Space* contains *Energy*, either *traceable or untraceable*, *Space* might be *equated* with *Energy*.

Thus, this article arrives at an additional surprising conclusion that the *Space* entity itself is not composed out of *Nothing or Complete Emptiness*, but *Space* itself might also be a form of *Energy* which contains *Energy Pairs* that are *untraceable*. This might provide an additional support to the assumption that the *Energy Pairs* might be the *cause* of at least part of the *Dark Energy*. Because the amount of *untraceable energy* generated by *Energy Pairs* increases now significantly the total amount of *Energy* embedded in *Space*. And since this article also claims that these *untraceable Energy Pairs* are also capable of creating new activities, this provides a reasonable explanation to the measured expansion rate of the universe, because that rate should be proportional to the total *Energy* embedded in *Space*. 

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The assumption that *Space* itself might be composed of *untraceable Energy Pairs* also complies with the requirement of the *General Relativity Theory*, that requires some substance, such as *Aether*, to provide physical properties to the *Space/Time* entity, and as such the EPT might turn out to be *also a link* between the *Electromagnetism* and *Gravity*.

**2. Energy Pairs Theory resolves other Energy Conservation Issues**

The *Energy Pairs Theory* can be also used to provide an explanation to an electric field potential energy conservation paradox. This electric field potential energy conservation paradox is described as follows:

When a body is charged with electric positive charges it creates an electric field around it whose embedded energy per unit volume *u* is provided by the following \[ u_e = \varepsilon_0 |E^>|^2/(2) \].

Where \(|E^>|\) is the electric field magnitude in the unit volume, and \(\varepsilon_0\) is the vacuum permittivity and is equal to: \(8.854187817 \times 10^{-12} \text{ F/m}\) (Farad per meter).

While the electric field magnitude \(|E^>|\) is expressed by the following: \(|E^>| = (1/(4\pi \varepsilon_0))(q/r^2)\).

Where \(q\) is the electric charge magnitude that generates that electric field \(E^>|\) and \(r\) is the distance from the electric charge to the point in space where the electric field is generated. The electric field is a radial vector which means that its pointing direction exists on the line that connects the electric charge to the point in space where the electric field exists.

When a second body is charged with an amount of negative charges, it creates an electric field whose polarity is opposite to the polarity of the electric field that the positive electric charge created. But, the embedded energy per unit volume of the electric field created by that second body is still expressed by the *same* formula presented before for energy per unit volume in an electric field.

Figure 1 is a picture representing the electric field intensities in *Space* generated by a positive electric charge. The electric field direction at each point is radial which means that it points to the direction of the line that connects this point to the electric charge, and points *outwards from* the electric charge. The intensity of the electric field at each point in *Space* decreases by a factor of \(1/r^2\) where \(r\) is the distance of the point from the electric charge. Thus, the arrows in the picture decrease in size as they become further away from the electric charge.

Although the picture of Figure 1 is a two-dimensional picture it should be extrapolated to the three-dimensional volume of *Space*. Thus, the picture represents a plane which is a two-dimensional slice of the volume of *Space*. 
Figure 2 is a picture representing the electric field intensities in Space generated by a negative electric charge. It is like Figure 1 with only one change: the polarity (or direction) of the field is opposite to the polarity of the field generated by the positive electric charge. Thus, the arrows point now inwards, towards the electric charge.
When two electric charges, one positive and one negative, exist in Space, none of them is aware that the other electric charge also exists in Space. Thus, each of these charges still generates its own electric field which contains its own energy density. That statement might need some more clarification because it states the reason for the energy issues that exist in static electric fields, as this article claims, energy issues that seem as a violation of the energy conservation principle. Thus, the following explains this in more details:

From the equation $u_e = \varepsilon_0 |E^-|^2/(2)$, that was already presented above, it is clear that whenever there is an electric field $E^-$ at some point in space, with intensity of $|E^-|$, there is also, at that point in space, an energy density whose intensity is proportional to $|E^-|^2$. The intensity of the electric field $|E^-|$ is proportional to the magnitude of the electric charge that generated the electric field $E^-$. Electric field is a vector which might be annihilated, fully or partly, by another electric field of opposite polarity (or direction) that exists at the same point in space where that initial electric field also exists.

If there are several charges in space, anyone of these charges is, of course, not aware of the existence of the other charges, so anyone of these electric charges will generate its own electric field, at any point in space, with its full electric field intensity $|E^-|$ that is proportional to the magnitude of that electric charge. And the field that each
electric charge will generate at each point in space, will contain embedded energy density proportional to the full magnitude of \(|E|\) that that electric charge generated, even if another charge that exists in space will generate at that point in space an inverse electric field that will annihilate partially or fully the electric field that the first electric charge generated at that point in space. In other words, even if some of the electric field that the first electric charge generated at some point in space is annihilated by an inverse electric field that another electric charge also generate at that point in space, not any portion of the energy density that the first electric charge generated at that point in space will be annihilated because energies are not supposed to be destroyed.

This is in complete analogy to the situation described in a creation of a Null electromagnetic wave that was presented in the article titled: "Energy Analysis of a Null Electromagnetic Wave" [1], mentioned before in this article. In that scenario the electric (and magnetic) fields of both colliding and unifying electromagnetic waves, that continue to travel together in the same direction, annihilated each other completely, which resulted in a seemingly energy conservation principle violation, because seemingly the energies embedded in the two unifying waves seem also to disappear. This seemingly energy conservation violation was explained by the Energy Pairs Theory, that claimed that the waves energies did not disappear, instead, they were accumulated and stored in an Energy Pair that continued to exist but was untraceable.

Thus, analogous to that scenario, when two electric (or magnetic) fields annihilate each other fully or partially at any point in Space, the initial energy that existed in each of these fields is not annihilated. Instead, what seems as energy that was annihilated or disappeared is also stored into an untraceable Energy Pair that, at this scenario, resides in Space itself.

Figure 3 is a picture of two electric charges of equal magnitude in Space and the electric fields they generate at point A in Space. Because point A is closer to the positive electric charge the electric field that the positive electric charge generates at point A is represented by the black arrow which points outward from the positive electric charge, and the red arrow, which is smaller than the black arrow, represents the electric field intensity that the negative electric charge generates at point A. Also, that red arrow is pointing inward, towards the negative electric charge. Because these two arrows are vectors which represent intensities of electric fields at point A, the resultant electric field at point A is represented by the subtraction of these two arrows, which is the blue arrow, and its direction is outwards from the positive electric charge.

Thus, the net traceable electric field that exists at point A is represented by the size of the blue arrow, and the size of this arrow also represents the intensity of the traceable electric field energy density at point A.
Fig 3 | Electric fields at point A generated by a negative electric charge and a positive electric charge

However, the positive electric charge does not "know" that a second, negative electric charge also exists. Thus, the positive electric charge still generates its own electric field at point A, which is represented by the black arrow. This electric field embeds energy per unit volume described by the formula above with intensity equal to its full intensity represented by the size of the black arrow. However, the traceable energy density at point A has the intensity represented by the size of the blue arrow, which is smaller than the energy density embedded in the field that the positive electric charge generates at point A. Thus, the fact that some of the electric field generated at point A by the positive electric charge (the black arrow) was annihilated by the electric field generated at point A by the negative electric charge (the red arrow) seems to violate the energy conservation principle. Because, some of the energy density generated by the positive electric charge at point A seems to disappear or is also annihilated.

A logical explanation to that paradox might be provided by the Energy Pairs Theory which states that certain energies, such as electric fields embedded energies, come in an Energy Pairs form. And, energies belonging to Energy Pairs might still exist but disable each other in certain conditions.

Thus, the explanation that the Energy Pairs Theory provides to this paradox is as follows:

At point A there is a traceable electric field that is represented by the blue arrow, whose size also represents the traceable energy density at point A.

In addition to that, at point A there is an untraceable Energy Pair that contains two energies. The energy density of each of these two energies is represented by the size of the red arrow, which annihilated part of the electric field that the positive electric charge generated at point A.
That untraceable Energy Pair accumulate and store the energy density that the negative charge generated at point A and part of the energy density that the positive electric charge generated at point A, the part which seem to be annihilated and disappear.

Thus, point A contains both, traceable energy and an untraceable Energy Pair.

If the two electric charges in Figure 3 move and turn to exist very close to each other such that they can be considered that they virtually reside at the same point in Space, the electric field that the positive electric charge generates in Space annihilates almost completely the electric field that the negative electric charge generates in Space. This results in virtually zero traceable electric field generated in Space by these two electric charges that are now so close to each other.

However, as argued above, the positive electric charge does not "know" that a second, inverse electric field is created, and it still creates its own electric field. This electric field embeds energy per unit volume described by the formula above. The same is true for the negative electric charge. So, the fact that each field virtually cancels the other, violates the energy conservation principle, since the energies of both fields also seem to disappear.

Thus, in this case the Space is filled virtually only with untraceable Energy Pairs, which store both the energy densities in the field generated by the positive electric charge, and the energy densities of the field generated by the negative electric charge, and there is virtually no traceable energy at all in Space in this case.

This situation in which the two electric charges of equal magnitude are so close to each other is a complete analogy to the Null electromagnetic Wave created which was mentioned before, which also contains only untraceable Energy Pairs.

Thus, the Mutual Annihilation of energies belonging to Energy Pairs can be also viewed not as Mutual Annihilation but as Mutual Disabling, if the energies exist as Energy Pairs and their Mutual Disabling are only seen as Annihilation.

The Energy Pairs Theory provides a similar explanation to a similar magnetic field energy conservation paradox. This magnetic field energy conservation paradox is very similar to the electric field energy conservation paradox described above. Thus, it will be described here more briefly, since its description is very similar to the description of the electric field energy conservation paradox.

When a body is charged with electric charges of a certain polarity (such as positive electric charges) and a certain amount of charge, and the body is moved at a specific constant speed in a certain direction, it creates a magnetic field $B^\to$ around it whose embedded energy per unit volume $u$ is provided by the following formula:

$$u_m = \frac{|B^\to|^2}{2\mu_0}$$

Where $\mu_0$ is the vacuum magnetic permeability and is equal to: $4\pi10^{-7}$ H/m (Henry per meter). While the magnetic field $B^\to$ is described by:

$$B^\to = \frac{\mu_0}{4\pi}(q( v \times r)/r^3)$$

Where $q$ is the magnitude of the electric charge generating that magnetic field, $r$ is the distance from the electric charge to the point in space where the magnetic field is generated, $v \times r$ is the velocity vector of the electric charge, $r \to$
is a unit vector pointing in the direction of the line connecting the electric charge to the point in space where the magnetic field is generated and $\mathbf{X}$ denotes vector multiplication.

When a second body is charged with electric charges of the opposite polarity (negative electric charges) but with the same amount of charge, and that body is also moved at the same constant speed in the same direction, it creates a magnetic field in the same space volume, whose magnitude is still expressed by the same formula that describes the magnetic field $\mathbf{B}^->$ created by the first body when it was moved, but its direction (or polarity) is inverse to the polarity of the magnetic field $\mathbf{B}^->$ that the first body created when it was moved. But, the embedded energy per unit volume of the magnetic field created by that second body is still expressed by the same formula presented before for energy per unit volume in a magnetic field.

When both bodies are tied to an apparatus that keeps them very close to each other, (but inhibits them from being attracted completely to each other), and both bodies are moved together, at the same speed, in the same direction, virtually no magnetic field is created around them (or a negligible magnetic field, because the bodies are not exactly at the same point in space).

As before, the paradox is, again, the fact that the energies also seem to disappear, although, each charge is not "aware" of the other charge, and, thus, is supposed to create still its own magnetic field with its own embedded energy.

### 3. The composition of Energy in Space, as related to the mixture of traceable and untraceable energies, is dynamic, and changes continuously.

The untraceable Energy Pairs that exist in Space as discussed above do not exist in Space as a stable constellation. The scenario described in the previous section of this article of two equal magnitude electric charges, one positive and one negative which get close to each other is only one of an infinite number of possible situations. As described, that scenario creates around it mainly untraceable Energy Pairs because both fields cancel each other. But charges in the universe are in continuous movement and change location relative to each other.

For the sake of simplicity, again, only two electric charges, one positive and one negative will be analyzed, but these electric charges are assumed to be in continuous movement relative to each other.

At a specific instant in time, the fields they generate in Space are such that at certain locations in Space the field generated by the positive electric charge has higher intensity than the field generated by the negative electric charge. Thus, in such locations the Space contains traceable energy embedded in the residual field created by the positive electric charge whose intensity is the intensity of the field created by the positive electric charge if the negative electric charge does not exist at all, subtracted by field created by the negative electric charge. Also, in such locations the Space contains an untraceable Energy Pair that contains two energies. The intensity of each of these two energies is equal to the energy intensity embedded in the field generated by the negative electric charge. So, in such locations the Space contains both traceable energy and untraceable Energy Pairs.
At other locations in Space the field generated by the negative electric charge has higher intensity than the field generated by the positive electric charge. Thus, in such locations the Space contains traceable energy embedded in the residual field created by the negative electric charge whose intensity is the intensity of the field created by the negative electric charge if the positive electric charge does not exist at all, subtracted by field created by the positive electric charge. Also, in such locations the Space contains an untraceable Energy Pair that contains two energies. The intensity of each of these two energies is equal to the energy intensity embedded in the field generated by the positive electric charge. So, in such locations the Space contains again both traceable energy and untraceable Energy Pairs.

At still other locations in Space the field generated by the negative electric charge has equal intensity to the field generated by the positive electric charge. Thus, in such locations the Space contains only an untraceable Energy Pair which contains the energy embedded in the field created by the negative electric charge and in the field created by the positive electric charge. So, in such locations the Space contains only untraceable energy embedded in the Energy Pair, and no traceable Energy at all.

Since the electric charges are at continuous movement relative to each other, the above described locations will change continuously in Space, which means that the Composition of the Energy in Space as related to the mixture of traceable energy and untraceable energy at each point in Space is dynamic and changes continuously.

Also, all points in Space contain some untraceable Energy Pairs (or, in other words, some untraceable energy) this can be seen from the following argumentation: Because the number of electric charges in Space is virtually unlimited, there is virtually complete certainty that at each point in Space some electric charge generates a field at that point that annihilates fully or partially the field that another electric charge generates at this point. Thus, Space is filled completely with untraceable Energy Pairs at any point of it.

Figure 4 provides some visualization of a Space volume that might contain traceable energies and untraceable Energy Pairs. If the yellow colored sections represent portions of space where most of the energy in these portions belongs to the energy embedded in one member of an Energy Pair, and the dark blue sections represent portions of space where most of the energy in these portions belongs to the energy embedded in the second member of this Energy Pair, then, these sections contain mainly traceable energies., but, as argued above, also small intensities of untraceable energy Pairs. The sections that are colored with other shades and colors represent sections of space which contain a more balanced mixture of traceable energies and untraceable Energy Pairs. And, the white portions contain only untraceable Energy Pairs and no traceable energy. This picture might represent a snapshot in time of this Space volume, because the situation described is dynamic and is changing continuously in time.
4. Space and the Dark Energy

The EPT answer to the question where the Energy Pairs reside in Null or partly Null electromagnetic waves was that the Energy Pairs in such waves are embedded in the photons that these waves carry.

However, since the Energy Pairs Theory was used above to explain energy conservation issues in static electric fields, and in magnetic fields generated by moving electric charges which move at a constant velocity, the question of where the Energy Pairs reside in these scenarios might be also asked.

In these cases, it seems that the Energy Pairs reside simply in the space volume where the two opposing fields exist. Then, this article claims that the Space volume should be equated with Energy which is also manifested as untraceable Energy Pairs in certain portions of Space that are viewed as Complete Emptiness. This might mean that the Space itself might be a form of Energy.

This article claims that Space should be equated with Energy not only because the untraceable Energy Pairs described in this article are assumed to exist in Space. After all, the traceable energies of electric and magnetic fields also exist in Space, and this did not generate a claim that Space is equated with Energy. As claimed in the previous section of this article, Space is filled with untraceable Energy Pairs at each point of it. Thus, what was before assumed to be Nothing, or Complete Emptiness in Space are these untraceable Energy Pairs. As such, it is reasonable to assume that Space can be equated with Energy, because at any point of it, it contains Energy, either traceable or untraceable.

The claim that Space can be equated with Energy might be also supported by the findings of the General Relativity Theory that the cause of the Gravitation Force Field around a Mass is the distortion of the Space around the Mass that creates this Gravitation Field. And since a Gravitation Field is a form of Energy, then the Space itself, which causes this Gravitation Field to occur by being distorted by the Mass, might be a form of Energy.

The conclusion that Space itself is a form of Energy that might also be untraceable increases significantly the claim that the mysterious Dark Energy is composed, at least partly, of Energy Pairs. Because the amount of untraceable energy generated by Energy Pairs increases now significantly the total amount of Energy in Space. Despite the fact that Null or partly Null electromagnetic waves might compose a significant portion of the universe, the fact that the whole
Space itself might contain Energy Pairs, might provide a reasonable explanation to why the Dark Energy is assumed to be most of the Energy (about 70%) of the universe.

Because this article claims that Space can be equated with Energy, the following should be also taken into consideration:

According to the Energy Conservation Principle Energies are not supposed to be annihilated or destroyed. Thus, the total amount of Energy in Space (or the universe for that matter) should be constant. This includes all the Energies in Space, traceable and untraceable, at any instant of Time. The fact that part of the Energies in the universe are untraceable and cannot be detected at some instant of Time, does not mean that the untraceable Energies do not exist at that instant of Time, and their contribution to the total amount of Energy in the universe, at that instant of Time is zero. What the Energy Pairs Theory claims is as follows: all Energies in the universe, traceable and untraceable, have positive Energy values. Any point in Space (or the universe, for that matter) that contains an untraceable Energy Pair does not contain zero Energy because the untraceable Energy Pair is untraceable. On the contrary, it contains more Energy compared to the situation in which this point in Space would contain only the traceable Energy equal to the Energy embedded in only one member of this Energy Pair. Because it contains twice that amount of Energy, because it contains both members of this Energy Pair. Thus, the locations in Space containing untraceable Energy Pairs contribute to the total amount of Energy of the universe an amount of positive Energy which is bigger in size as compared to the amount of Energy contributed by the points that contain traceable energies.

Although the untraceable Energy Pairs are untraceable because they seem to be latent and not active, this article claims that the Energy Pairs can create new activities, even though the fields that created them annihilated each other. The claim that the untraceable Energy Pairs that exist in Space are active is supported by the following:

The process of a photon converting to an electron and a positron, which was mentioned in a previous section of the article and analyzed in the article titled: "Energy Analysis of a Null Electromagnetic Wave" [1], is one example of such activity created by an Energy Pair. In this process the Energy Pair embedded in the photon created two new electric charges that did not exist before, which implies clearly that the Energy Pair can create new activity. Although that Energy Pair resided in photons and not at a point in Space, it is still of the same nature of the Energy Pairs that exist in Space because both these Energy Pairs contain energies that were generated from fields that annihilated each other. So, if the Energy Pair embedded in a photon is capable of creating new activities, it is reasonable to assume that also the Energy Pairs that exist in Space, and are described in this article, are also capable of creating new activities.

Also, following is a quote which expresses what some physicists predict today:

"Pairs of particles are constantly popping into existence throughout the universe. These "virtual pairs" consist of one particle with a negative charge and one with a positive charge. They exist for only a tiny fraction of a second before they collide and annihilate each other in a tiny burst of energy. This energy may be pushing outward on space itself, causing the universe to accelerate faster." [6].
These particles popped from *Complete Emptiness*. But this article already demonstrated that there is no point in *Space* that contains *Complete Emptiness, and each point in space does contain some untraceable Energy Pair* with some intensity. Thus, if these particles popped from what is assumed to be the *Complete Emptiness*, according to what this article claims, it is reasonable to assume that they actually popped from the *untraceable Energy Pairs* in *Space*, which means that these *untraceable Energy Pairs* converted to *traceable* energy, which might be a facet of *untraceable Energy Pairs* activity.

When an *untraceable Energy Pair* existing at a point in *Space* converts, at a specific instance of *Time*, to any entity that contains *traceable Energy*, the balance of the Energies in the universe does not change, because the *traceable Energy* embedded in that entity is equal to the amount of *Energy* that this *untraceable Energy Pair* contained before it converted to that entity. At the next instant of *Time*, after that *untraceable Energy Pair* converted to *traceable Energy*, the point in *Space* where that *untraceable Energy Pair* resided before it executed that conversion might contain a new *Energy* value, either *traceable* or, again, *untraceable*, but the total *amount* of *Energy* in the universe remains the same as it was at the instant of *Time* that that conversion was executed, and at the instant of *Time* before that conversion was executed.

Each *untraceable Energy Pair* in *Space* originated from a *field* generated by an electric charge. As already argued, in this article, that electric charge was not *aware* of other electric charges that might generate other fields which annihilate the field that this electric charge generated at the point where this *untraceable Energy Pair* reside. Thus, this electric charge generated that field which contained also embedded *Energy* in it. And since energies are not supposed to be destroyed or annihilated, it is that *Energy* that this *untraceable Energy Pair* contains. *Energy* is the capability to do work or create activity. As such, the *untraceable Energy Pair* should have the capability to create activity, even though the fields that generated it were annihilated and it is *untraceable*.

Also, the *dynamic composition* of the *Energy* in *Space*, as related to the *mixture* of *traceable* and *untraceable Energies* in *Space*, which was already described above, might also be a manifestation of the activity occurring in *Space* which involves all its content, the *traceable* and the *untraceable* energies embedded in *Space*. That, together with the activity examples described above, might be manifestations of the ability of the *untraceable Energy Pairs* in *Space* to create activity. Further investigations into the issue of the new construct of *Energy Pairs*, as described in the EPT framework, might disclose, in the future, other facets and activities related to the *untraceable Energy Pairs*.

Thus, this article claims that the amount of existing *Energy* in the universe is much greater than the amount that was assumed before, because before only the *traceable* energy was counted and this article added to the *traceable* energy the *untraceable Energy Pairs*.

This article also argues that the *untraceable Energy Pairs*, being a form of *Energy*, are also capable of creating activities, as described above.
Because the rate of expansion of the universe is proportional to the amount of Energy in it, and this article increase that amount significantly, this might explain why the universe is expanding at a rate which is much faster than the expected rate according to the current state of knowledge.

And because the Dark Energy is the Energy that was introduced to explain that rate of expansion of the universe, then, the added Energy which are the untraceable Energy Pairs, according to what this article claims, might compose, at least part of that Dark Energy.

5. Space, Aether and the Dark Energy

Aether theory is a theory that claimed the existence of an elastic mass less medium, or a space-filling substance or field, which fills all the empty volumes in Nature. It was introduced initially to claim that Nature is revolted or should shy away from complete emptiness (horror vacci), by claiming that emptiness contains this aether medium. It was also believed that it was necessary as a transmission medium for the propagation of the electromagnetic or gravitational forces and the electromagnetic waves. The aether concept became obsolete in 1905 by Einstein’s Special Relativity Theory, which stated that the speed of light is a constant value and there is no need for a transmission medium for electromagnetic waves.

The assumption (or claim) presented above in this article, that the Space itself might be a form of Energy, resembles this aether theory, and seems to bring it back.

However, one should discern or distinguish between aether that was introduced as a transmission medium for the propagation of electromagnetic waves, which the Special Relativity Theory shows that such a medium is not required, and aether as a medium which is required, according to the General Relativity Theory.

Albert Einstein himself returned to the aether theory and saw it as a necessary medium that provides physical properties to his Space/Time entity. In his speech in the University of Leiden in May 5th, 1920, he explained the difference between the aether theory before the Michelson-Morley experiment and the fact that his General Relativity Theory requires aether like medium.

Thus, the assumption presented in this article, that the Space itself might be a form of Energy containing untraceable Energy Pairs, fits with the requirements of the General Relativity Theory, and the claim that the Space itself might be the cause for at least part of the Dark Energy.

In recent years there is a new interest in the Aether, especially to go back to what Einstein argued about it and its necessity by the General Relativity Theory. Some also connect it also to the Dark Energy. But none of these connect the Aether with a theory like the Energy Pairs Theory (EPT) or the Energy Pairs as this article does. The following is a quote from such a publication:

"In an astonishing twist of fate, the key to relativity’s salvation could lie in the aether. Since the early 2000s, a small group of researchers have claimed that this invisible, space-filling substance could have the power to unify physics. Then, in late 2018, two independent groups suggested that the similarity between the aether and the shadowy..."
powers that populate our cosmos may not be mere coincidence. For one team, the aether is a dead ringer for dark matter. For another, it could explain away dark energy. For others still, it might even be both.

Thus, the EPT might be also an important connecting link between the Electromagnetism and Gravity, which is also an important issue pursued by the science of Physics. Because, as this article claims, the Energy Pairs created by Electromagnetism might be related to the Dark Energy and Aether, and this same Dark Energy and Aether might be connected to the gravitational energy manifested by the distortion of Space by Mass.

This implies that the activities that the untraceable Energy Pairs can manifest might extend to new areas and might be also connected to gravitation.

6. Summary and Conclusions

This study was aimed to analyze and explain some energy conservation issues which seem to be ignored today. These energy conservation issues relate to energy conservation issues in the field of energies embedded in static electric fields and in magnetic fields generated by moving electric charges which move at a constant velocity.

These energy conservation issues occur when static electric fields generated by opposite polarity electric charges exist in the same space volume and thus seem to annihilate each other. This creates an energy conservation issue because each electric charge does not "know" about the existence of the other electric charge, and thus, still generates its own electric field, which contains energy. Thus, the annihilation of the fields annihilates also the energies embedded in the fields, which might seem as a violation of the Energy Conservation Principle.

A similar energy conservation issue occurs when magnetic fields generated by opposite polarity moving electric charges exist in the same space volume.

These energy conservation issues are explained by the Energy Pairs Theory whose central idea 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 cannot be detected.

The EPT answer to the question where the Energy Pairs reside in Null or partly Null electromagnetic waves was that the Energy Pairs in such waves are embedded in the photons that these waves carry.

However, since the Energy Pairs Theory was also used above to explain energy conservation issues in static electric fields, and in magnetic fields generated by moving electric charges which move at a constant velocity, the question of where the Energy Pairs reside in these scenarios remains open.

In these cases, it seems that the Energy Pairs reside simply in the space volume where the two opposing fields exist.

This article also shows that the composition of the energies in Space as related to the mixture of traceable energies versus untraceable Energy Pairs in Space is dynamic and is changing continuously. This implies that the untraceable Energy Pairs play a role in the dynamics of Space. This might indicate also that the untraceable Energy Pairs that exist in Space are active, even though they are untraceable because the fields that created them annihilated each other. This article
also provides several additional arguments that indicate that the untraceable Energy Pairs in Space can generate new activities.

This article also shows that Space contains some untraceable Energy Pair at each point of it, and as such Space is filled with untraceable energy. Thus, because every point in Space contains Energy, either traceable or untraceable, Space might be equated with Energy.

Thus, this article claims that the Space entity itself is not composed out of Nothing or Complete Emptiness, but Space itself might also be a form of Energy which contains untraceable Energy Pairs. This might support the claim that these Energy Pairs might be the cause of at least part of the Dark Energy because this increases now significantly the total amount of the Energy embedded in Space. And if the untraceable Energy Pairs are also active, it provides a reasonable explanation to the rate of expansion of the universe which should be proportional to the total amount of Energy embedded in Space.

The claim that Space is a form of Energy might be also supported by the General Relativity Theory. Since the Gravitational Force Field around a Mass is the distortion of the Space around that Mass, and since a Gravitational Field is a form of Energy, then the Space itself, which causes this Gravitational Field to occur, might be a form of Energy.

The assumption (or claim) presented in this article, that the Space itself might be a form of Energy, resembles also the old Aether theory, and seems to bring it back. That Aether theory might also be needed to supply physical properties to the Space/Time entity of the General Relativity Theory. Thus, the Energy Pairs Theory (EPT) might be also a connecting link between the Electromagnetism and Gravity, which is also an important issue pursued by the science of Physics. This might imply that the activities that the untraceable Energy Pairs can manifest might extend to new areas and might be also connected to gravitation.

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