

# 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*.

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 [2]:  $u_e = \epsilon_0 |E^>|^2 / (2)$ .

Where  $|E^>|$  is the electric field magnitude in the unit volume, and  $\epsilon_0$  is the vacuum permittivity and is equal to:  $8.854187817 \dots \times 10^{-12}$  F/m (Farad per meter).

While the electric field magnitude  $|E^>|$  is expressed by the following:  $|E^>| = (1 / (4\pi \epsilon_0))(q / r^2)$  [3]

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.

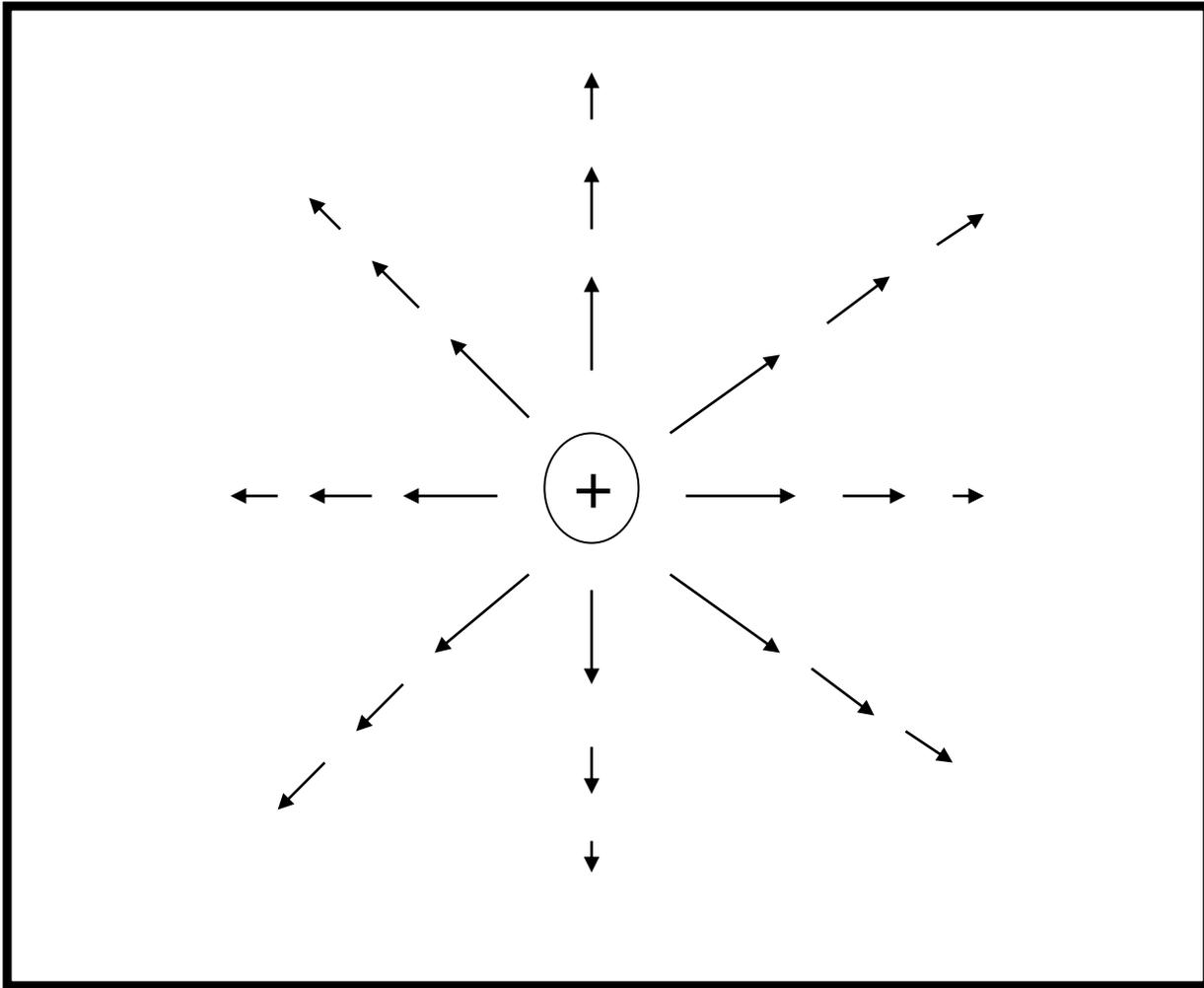


Fig 1 | Electric field intensities in Space generated by a positive Electric Charge

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.

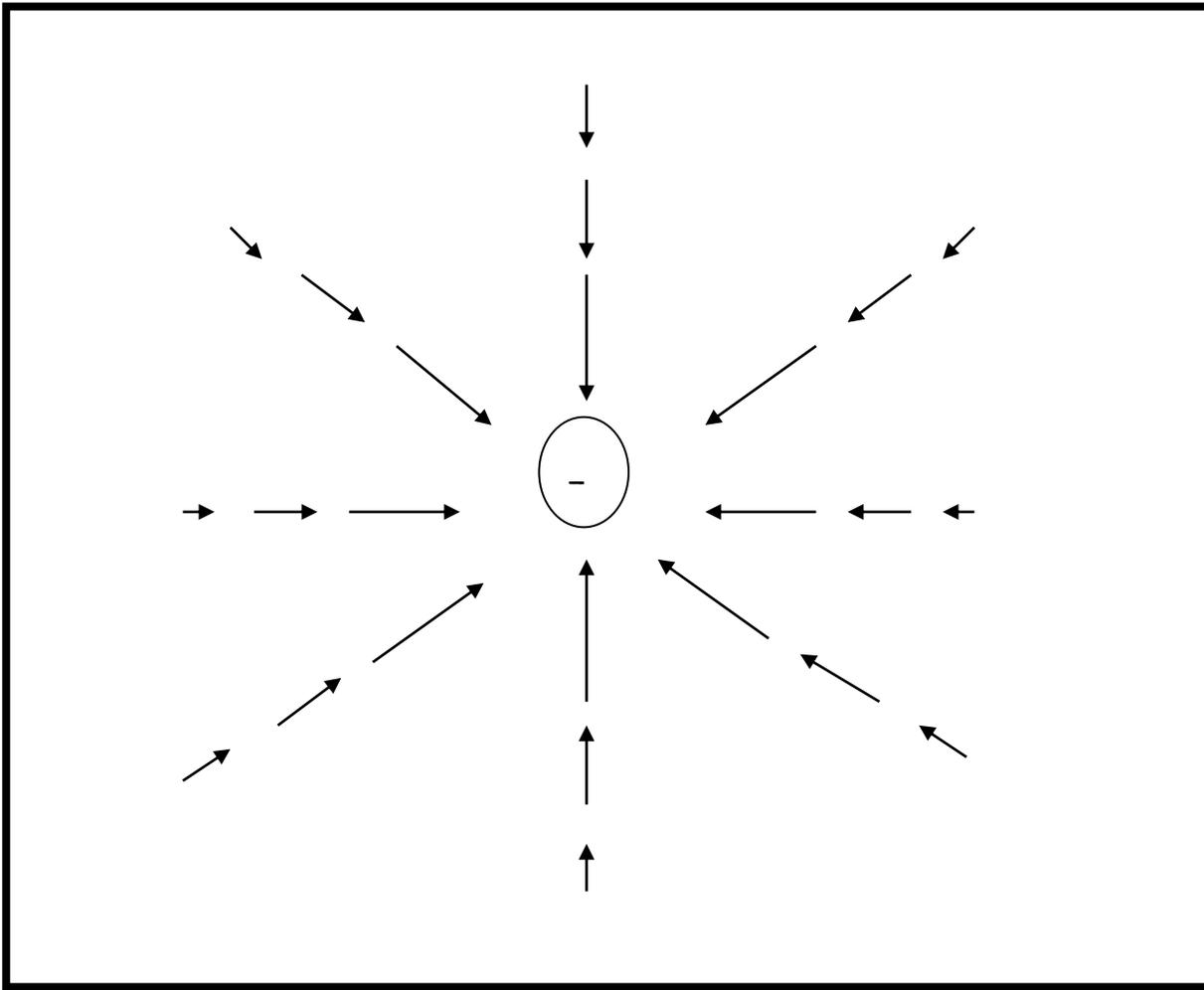


Fig 2 | Electric field intensities in Space generated by a negative Electric Charge

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  $u_e = \epsilon_0 |E^>|^2 / (2)$ , 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  $|E \rightarrow|^2$  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.

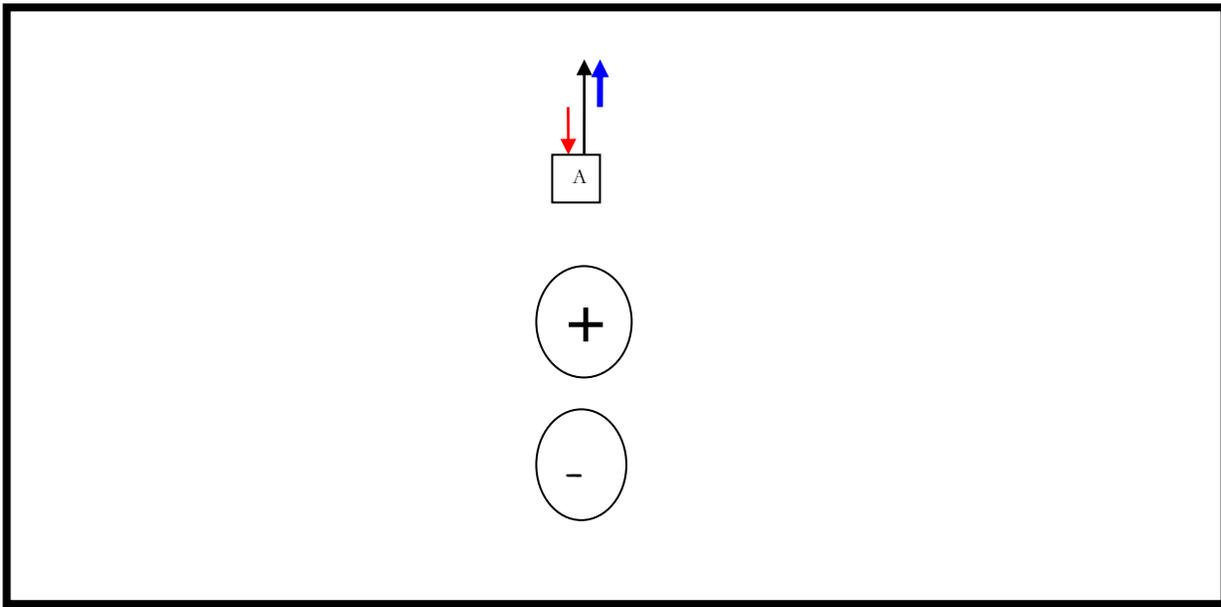


Fig 3 | Electric fields at point A generated by a negative electric charge and a positive electric charge

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  $B \rightarrow$  around it whose embedded energy per unit volume  $u$  is provided by the following formula:

$u_m = |B \rightarrow|^2 / (2 \mu_0)$  [4] Where  $\mu_0$  is the vacuum magnetic permeability and is equal to:  $4\pi 10^{-7}$  H/m (Henry per meter). While the magnetic field  $B \rightarrow$  is described by:  $B \rightarrow = (\mu_0 / (4\pi)) (q (v \rightarrow \times r \rightarrow) / r^2)$  [5]

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,  $v \rightarrow$  is the velocity vector of the electric charge,  $r \rightarrow$

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  $\times$  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  $B \rightarrow$  created by the first body when it was moved, but its direction (or polarity) is inverse to the polarity of the magnetic field  $B \rightarrow$  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.

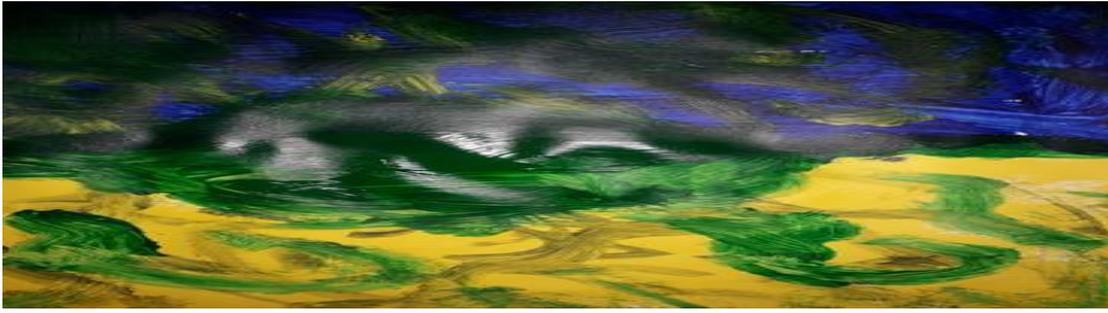


Fig 4 | A visualization of a Space volume with traceable energies and untraceable Energy Pairs

## 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. [7-8]. 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 5<sup>th</sup>, 1920, he explained the difference between the *aether* theory before the Michelson-Morley experiment [9] and the fact that his *General Relativity Theory* requires *aether* like medium. [10-11].

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* [12]. 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 [13] :

"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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