# Consolidating Electromagnetic waves might embed more traceable Energy than the sum of the traceable Energies embedded in the waves before consolidation.

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## Abstract

The common notion is that Electromagnetic (EM) waves cannot consolidate. Contrary to that, an article [2] published by the author of this article, presented a scenario which argues that EM waves can and do consolidate. Another article [1] published by the author of this article presented one such scenario, in which consolidating EM waves generate an EM Null wave without any electric and magnetic fields, which **seems** to violate the Energy Conservation Principle. That article [1] resolves this paradox by introducing the novel Energy Pairs Theory, which implies that this Null wave conserves the energy as **untraceable** energy. This article presents another paradox manifested by another scenario of consolidating EM waves, in which the resultant EM wave contains **more** traceable energy than the sum of the traceable energies embedded in the consolidating waves. This scenario also **seems** to violate the Energy Conservation Principle, because energy **seems** to be created out of nothing. The Energy Pairs Theory resolves this paradox, which also significantly enhances the hypothesis presented in article [1], that the energies embedded in photons and EM waves are composed of **traceable and untraceable** energies.

## 1. Introduction

The author of this article published an article: "A Discussion relating to the feasibility of a Null Electromagnetic Wave" [2] which also referenced another article by this author: "Energy Analysis of a Null Electromagnetic Wave" [1]. These two articles conclude that EM waves can consolidate, and in certain conditions the resultant EM wave might be an EM Null wave without any electric or magnetic fields. However, the combined traceable energies embedded in the original consolidating waves are still conserved as **untraceable** energy in the photons of this resultant wave and can convert back to traceable energy under certain conditions.

These conclusions are clearly contradictory to the common notion held by physicists that such a Null wave cannot be created. An example to this notion might be the Article: "Does Destructive Interference Destroy Energy?" By Kirk T. McDonald [3] which implies that EM waves cannot consolidate because it states that "A one-dimensional wave moving in one direction can have only one source, and there can be only one such wave at a given point".

The conclusions in articles [1] and [2], are based on two argumentations:

1. Article [1] presents a scenario of how to implement a consolidation of EM waves, by describing how two EM waves can meet on a half transparent mirror, consolidate, and continue to travel together as an EM Null wave. One wave comes from the transparent side of the mirror and passes the mirror. The second wave comes from another direction and is deflected by the deflecting side of the mirror, and in certain conditions, the two waves consolidate to one EM Null wave.

2. the above scenario which contains a half transparent mirror is a linear constellation. Such linear apparatuses are widely used, for example in applications such as beam splitters. Because the scenario is linear and because this scenario can be described as a combination of two separate scenarios, one containing only the EM wave that passes the mirror and the other only the EM wave that hits the deflecting side of the mirror, then, from the Superposition Principle [4] which states that: "for all linear systems, the net response caused by two or more stimuli is the sum of the responses that would have been caused by each stimulus individually", it turns out that the result of the combination of these scenarios, would produce a consolidated EM Null wave.

## 2. Consolidating EM waves might also <u>create</u> traceable Energy

If the consolidation of EM waves relies on sound argumentations, the creation of an EM Null wave must also be recognized as a reasonable result of consolidating EM waves.

However, the creation of the EM Null wave is not the only outstanding outcome of consolidating EM waves. Following is a description of consolidating EM waves that might **<u>create</u>** traceable energy.

The creation of the EM Null wave occurred when the two EM waves consolidated in certain conditions, as described in article [1], of which, two of these conditions were, that these EM waves consolidated when they were exactly at anti-phase (180 degrees phase shift) and had the same polarization.

However, if these consolidating EM waves will consolidate when they are exactly at phase (0 degrees phase shift) and have the same polarization, the resultant EM wave will contain **<u>more</u>** traceable energy than the combined traceable energies embedded in the two original EM waves. This is also an outstanding outcome! it **<u>seems</u>** that energy is created out of nothing, and this also violates the Energy Conservation Principle.

How is the extra traceable energy created in this case?

The two EM waves were in phase when they consolidated, and thus, the intensity of the electric field of the consolidated wave is the sum of the intensities of the electric fields of the two consolidating waves. Since the traceable energy in an electric field is proportional to the **<u>square</u>** of the field's intensity, the traceable energy embedded in the electric field of the consolidated wave is bigger than the sum of the traceable energies embedded in the electric fields of the two consolidating waves. The following simple example can clarify this result:

If x is the intensity of the electric field of one of the consolidating EM waves, and y is the intensity of the electric field of the second wave, then, x+y is the intensity of the electric field of the resultant EM wave, $(x+y)^2$ is proportional to

the traceable energy embedded in the resultant EM wave, and this is bigger than $x^2+y^2$, which is proportional to the combined traceable energies embedded in the two consolidating waves.

Simple calculation also shows that the maximum traceable energy creation will occur when x=y. In such cases the traceable energy embedded in the resultant EM wave will be twice as big as compared to the sum of the traceable energies embedded in the original consolidating waves.

Similar argumentations apply also to the magnetic field of the resultant EM wave.

Thus, the resultant EM wave will embed more traceable energy than the combined traceable energies in the two consolidating EM waves.

## 3.The creation of traceable Energy in consolidating EM waves, in the framework of the Energy Pairs Theory

In article [1] the **seemingly** disappearance of energy in the creation of the EM Null wave was explained by introducing the novel Energy Pairs Theory (EPT), which presented the hypothesis that the EM Null wave still conserves the combined traceable energies embedded in the consolidating waves, but this energy is conserved as **untraceable** energy in the photons of the resultant EM Null wave.

The Energy Pairs Theory also explains other paradoxes and provides new insight into the nature of the Electric Charge and suggested a new explanation to the character of the Dark Energy. All this is presented in article [1].

The Energy Pairs Theory also provides an appropriate framework to understand the **seemingly** creation of traceable energy in other cases of consolidating EM waves, such as the one described above. the EPT states that the energy of the EM Null wave is embedded in photons and photons always contain **traceable and untraceable** energies. Thus, the **extra traceable** energy existing in certain cases of consolidating EM waves is a result of the conversion of the **untraceable energy** embedded in the photons into **traceable Energy**, analogically to the conversion of the traceable energy embedded in the photons to untraceable Energy in the creation of the EM Null wave.

This strengthens the hypothesis that the **Dark Energy** might be of electromagnetic nature, and the **Dark Energy** might be **converted** into **traceable energy**. This last conclusion might have significant **technological** implications.

## 4. Summary and Conclusions

In two previous articles [1], [2], by the author of this article, sound argumentations were provided which indicate that EM waves can consolidate, contrary to the common notion [3] that such consolidation cannot occur.

In article [1] one outstanding outcome from such a consolidation was presented, which was the creation of an EM Null wave. The **seemingly** disappearance of energy in this EM Null wave was explained by introducing the novel Energy Pairs Theory which stated that the energy in the EM Null wave is still conserved, but as **untraceable energy**, in its photons.

This article presents another outstanding outcome of such consolidations, the **creation** of **extra traceable** energy in the resultant EM wave when the two EM wave are in phase when they consolidated, because the traceable energy embedded in the resultant EM wave is bigger than the sum of the traceable energies embedded in the original consolidating waves.

This paradox is explained by the novel Energy Pairs Theory, presenting the hypothesis that photon always contain both **traceable and untraceable** energies. In this case, the **extra traceable** energy embedded in the resultant EM wave, might be a result of a conversion of the **untraceable** energy embedded in the photons, into traceable energy.

This article concludes that when EM waves consolidate, when they have the same polarization, the resultant EM wave **usually** embeds **more traceable energy or less traceable energy** than the sum of the traceable energies embedded in the original waves before their consolidation. This might significantly help the validation, that EM waves **can** consolidate.

Thus, an implementation of the scenario described in article [1], and the validation that EM waves can and do consolidate, might be an important endeavor.

## 5. References


[1] Energy Analysis of a Null Electromagnetic Wave. Moshe Segal. Theoretical Physics Journal by Physics Tomorrow Letters (PTL). https://2edd239a-21aa-41cc-a45e-84832f36b982.filesusr.com/ugd/04176b_f8d75fc7c61d455d8bda102055d6b92d.pdf

[2] A Discussion relating to the feasibility of a Null Electromagnetic Wave. Moshe Segal. Academia Letters, Article 3600. http://doi.org/10.20935/AL3600

[3] Does Destructive Interference Destroy Energy? Kirk T. McDonald Joseph Henry Laboratories, Princeton University. http://www.physics.princeton.edu/~mcdonald/examples/destructive.pdf

[4] The Superpositions Principle. https://en.wikipedia.org/wiki/Superposition_principle.


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