

A Discussion about certain Axioms in Physics

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Abstract:

An Axiom is a statement whose truth or validity is accepted, without providing any additional proof or explanation why this statement is accepted as true or valid

On the other hand, Physics is about providing explanations about the Existence and the Universe, and it is expected that the Physics explanations should be accompanied by reason and proof.

However, Physics does still contain statements which are presented as Axioms, even though, such statements are usually the basis, or the corner stones, of structures, which are built over these statements.

This paper addresses this issue, about some of such statements that Physics presents as Axioms, and this paper also intends to provide an *additional tentative explanation* for one of these statements, which might help in providing *additional validity* to these statements.

1. Three statements that Physics presents as Axioms

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Three of such statements, that Physics presents as Axioms are:

- All Inertial Frames of Reference are equivalent, in the sense that the Laws of Physics appear the same in all Inertial Frames of Reference.

- Energy is always conserved, a statement which is also known as the Energy Conservation Principle, which also implies that no amount of Energy, in the whole Universe, can disappear or be created from nothing.
- The speed of Light in free Space appears the same to all observers, independent of their Inertial Frame of Reference.

An additional paper, by the author of this paper, titled: "Energy Relativity and its Implications on the Energy Conservation Principle" (1), elaborates on the fact that Physics presents the Energy Conservation Principle as an Axiom.

That paper states that Humans have difficulties in *exact* evaluations of Energy amounts because:

- Humans cannot arrive at an *exact* amount of the Energy embedded in the whole Universe, in order to state with *complete validity* that Energy is always conserved, as the Energy Conservation Principle implies.
- Humans recognize that most of the Energy embedded in the Universe might be *Dark Energy*, which Humans might not be able to detect or evaluate *exactly* its amount.
- Humans might not be able to evaluate *exactly* the velocity of massive bodies, and thus, Humans might not be able to evaluate *exactly* the amount of the *Kinetic Energy* embedded in massive bodies, which implies that Humans might not be able to evaluate *exactly* the *Total Energy* embedded in massive bodies.
- In certain special scenarios, the evaluations of Energy amounts by Humans might be also relative to the Human who evaluated these Energy amounts.

Thus, that paper (1) concludes, that although the above *does not provide* a conclusive proof that the Energy Conservation Principle might not be a viable principle, it still implies that Humans should view the Energy Conservation Principle *as an Axiom*, because Humans do have difficulties in *exact* evaluations of Energy amounts, and Humans are not able to provide a *conclusive proof* for the Energy Conservation Principle.

Physics does consider the Energy Conservation Principle as one of its bases, or one of its corner stones, mainly because a Human does detect Energy Conservation in evaluations of Energy amounts related to *this Human Inertial Frame of Reference*, and because, as stated above, Physics states that all Inertial Frames of Reference are equivalent.

This might provide some general validity also to the Energy Conservation Principle, in being valid in all Inertial Frames of Reference.

But, as also stated above, because *also the statement* that all Inertial Frames of Reference are equivalent, *is stated as an Axiom*, then, this still does not remove the necessity to recognize the Energy Conservation Principle as being presented only *as an Axioms*, without any *conclusive proof* presented about its validity over the *entire Universe*, as presented above and elaborated in the paper (1).

As related to the third Axiom mentioned above, relating to the speed of Light, Maxwell's Equations, which relate to the Free Space, did predict that the speed of Light in Free Space is a

constant value which is equal to $1/\sqrt{\epsilon_0 * \mu_0}$ where ϵ_0 is the permittivity of Free Space and μ_0 is the permeability of Free Space.

And according to the first Axiom, presented above, that all Inertial Frames of Reference are equivalent, Maxwell's Equations are assumed to be valid in all Inertial Frames of Reference, thus, this also implies that the speed of Light should be viewed as a constant value to all observers, regardless of their Inertial Frame of Reference.

But, similarly to what was stated above, relating to the Energy Conservation Principle, because **also the statement** that all Inertial Frames of Reference are equivalent, **is stated as an Axiom**, then, this still does not remove the necessity to recognize the Speed of Light as being presented only **as an Axiom**, without any **conclusive proof** presented about the validity that the speed of Light appears the same to all observers, and not only to observers in the Inertial Frame of Reference equated with the Free Space, which is the Inertial Frame of Reference that Maxwell's Equations address.

Moreover, Maxwell's Equations address only one facet of Light, the Wave facet of Light.

But Light has an additional facet, the Particle facet of Light, which is also known as Photons, which is not addressed at all by Maxwell's Equations.

And, if the statement that the speed of Light in Free Space appears the same to all observers, independent of their Inertial Frame of Reference, is based only what Maxwell's Equations predicts about the speed of Light, since Maxwell's Equations does not address at all the Photons facet of Light, then, this still might also not remove the necessity to recognize the Speed of Light as being presented only as an Axioms, without any **conclusive proof** presented about the validity.

Thus, because of what was just presented above, Einstein in his Special Relativity Theory (2) does postulate that the Light always travels at the same speed for every observer, regardless of this observer's Inertial Frame of Reference, and Einstein presented this as a postulate, or as an Axiom, and did not base this postulate on what Maxwell's Equations predicted about the speed of Light, and even without mentioning the prediction related to the speed of Light provided by Maxwell's Equations, which implies that Einstein also referred to the speed of Light appearing the same to all observers as a postulate, or as an Axiom.

This paper presents an **additional tentative explanation** related to the speed of Light appearing the same to all observers.

And, even though the **additional explanation** presented in this paper, relating to the speed of Light, **cannot** still be considered as a **conclusive proof** that the speed of Light does appear the same to all observers, this explanation, together with the prediction related to the speed of Light by Maxwell's Equations, might provide **an additional validity** to the statement that the speed of Light appears the same to all observers, which in turn, might also provide **an additional validity** also to the additional Physics Axioms, presented above.

2. Significant connections between the three Physics Axioms presented above

It turns out, that there is a significant connection between the above presented Axioms.

It turns out that in order for the Laws of Physics to be equivalent in any Inertial Frame of Reference, there must be a speed which appears the same to all observers, regardless of their Inertial frame of Reference (4).

Thus, if an additional explanation can be provided to the statement that the speed of Light should appear the same to all observers, an explanation from a different angle as related to the prediction provided to this statement by Maxwell's Equations, this might *increase the validity* of this statement, which will also provide *additional validity* to the statements that all Inertial Frames of Reference are equivalent and the statement about the Energy Conservation Principle.

But even if the *additional validity*, mentioned above, that might be provided to the statement, that the Laws of Physics are equivalent, still, the Energy Conservation Principle should be still regarded, even then, as being presented as an Axiom, when it is presented as being valid across the *whole Universe*, and not just in measurements related to any specific Inertial Frame of Reference, because, as presented already above, the paper (1) still presents that Humans still have difficulties in *exact* evaluations of Energy amounts over the *entire Universe*.

3. An additional tentative explanation for the speed of Light appearing the same to all observers

An additional paper, by the author of this paper, titled: "Implications if the Electric Field will be recognized as a form of Acceleration" (5) presents arguments which imply that the Electric Field should be also recognized as a form of Acceleration, similar to the Gravitational Field, which is already recognized as a form of Acceleration.

That paper (5) also proposes an experiment, which might either provide validity, or disprove, the statement, that the Electric Field should be also recognized as a form of Acceleration.

That paper (5) also presents the implications if the Electric Field should be also recognized as a form of Acceleration, which one of these implications should be the recognition that the entities of Space and Time might not be entities which really exist.

That paper (5) presents arguments that if the Electric Field should be also recognized as a form of Acceleration, then, the entities of Space and Time should be regarded only as *facets*, or *attributes*, of *certain forms of Energy*.

An additional paper, by the author of this paper, titled: "An Explanation to why the Light velocity is the maximum attainable velocity value" (6) presents a tentative explanation why the Light velocity appears the same to all observers and is the maximum attainable velocity value of any moving body.

This additional explanation, mentioned above, is also based on the recognition, presented above, that the Space and the Time might not be entities which really exist, and as such, this explanation

is provided from a completely different angle, compared to the prediction about the Light speed provided by Maxwell's Equations, and as such, might be a more comprehensive explanation because it might apply to the *whole Universe*, and not just to sections of the Universe, such as, the Inertial Frames of Reference.

The explanation, presented above, intends to provide a *tentative explanation* why the speed of Light is a constant value for all observers and also, why the speed of Light is the maximum attainable speed for any moving object, and thus, *along with* the prediction about the Light speed provided by Maxwell's Equations, which *does predict* the actual *value of the speed of Light*, all these might provide *additional validity* to the statement that the Light speed appears the same to all observers, (but still *not a conclusive proof*), and this might provide, as already stated above, *additional validity* to the statement that all Inertial Frames of Reference are equivalent, which, in turn, might provide some *additional validity* also to the statement about the Energy Conservation Principle (but still *not a conclusive proof*).

The author of this paper published also an additional paper titled: " Energy Might be the Only Unique, Distinct and Independent Entity in Nature." (3).

This paper (3) presents the possibility that the Universe is composed of only one distinct and independent entity, Energy, and this conclusion is also based on the statement, presented already above, that the Space and the Time entities might not be entities which really exist.

Thus if the experiment proposed in the paper (5) will be executed, and its results will be successful, such that it will provide validity to the statement that the Electric Field should be also recognized as a form of Acceleration, then, this might also generate an additional *tentative explanation* to why the speed of Light appears the same to all observers, as already presented above and presented in details in the paper (6), which might, in turn, provide an additional *tentative explanation* to why the Laws of Physics are equivalent in any Inertial Frame of Reference, and that might, in turn, provide *additional validity* also to the Energy Conservation Principle.

4. Summary and Conclusions

The paper states the following:

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However, Physics does still contain statements which are presented as Axioms, even though, such statements are usually the basis, or the corner stones, of structures, which are built over these statements.

Three of such statements, that Physics presents as Axioms are:

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- Energy is always conserved, a statement which is also known as the Energy Conservation Principle, which also implies that no amount of Energy, in the whole Universe, can disappear or be created from nothing.
- The speed of Light in vacuum appears the same to all Human observers, independent of their Inertial Frame of Reference.

The paper provides an additional *tentative explanation* to the statement that the speed of Light in Free Space appears the same to all Human observers, independent of their Inertial Frame of Reference, which in turn might provide an additional *validity* to the statement that all Inertial Frames of Reference are equivalent, which in turn might provide an additional *validity* to the Energy Conservation Principle.

References

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