Implications if the Electric Field will be recognized as a form of Acceleration

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Abstract

Gravity is already recognized as form of Acceleration, but the nowadays Science of Physics does not recognize (yet) the Electric Field also as a form of Acceleration. However, ***Structural Identities*** between Newton's Universal Gravitational Law and Coulomb's Law, strongly indicate that the Electric Field should be also recognized as a form of Acceleration.

The implications resulting from the realization, that the Electric Field might be also recognized as a form of acceleration, might not seem to be very significant implications, at first glance. However, this paper does present that, the implications resulting from the realization that the Electric Field might be also recognized as a form of acceleration, are indeed very significant.

One immediate implication, from the realization that the Electric Field might be also recognized as a form of acceleration, presented in this paper, is the realization that Newton's Second Law of Motion (F=ma) might not be always valid. Newton's Second Law of Motion is accepted, by the nowadays Science of Physics, as a Universal Law, and as such, it is accepted as being valid for any scenario containing a Force exerted on a massive body. However, as presented in this paper, if the Electric Field might be also recognized as a form of acceleration, then, Newton's Second Law of Motion might not be valid for Electrically Charged bodies attracted or repelled under Coulomb's Law, and, in such a scenario, Newton's Second Law of Motion should be replaced by a different Law.

In addition to the above, additional ***more significant*** and revolutionary implications, regarding how Humans perceive, the very Nature of the entities of Space and Time, also arise, if the Electric Field might be also recognized as a form of acceleration, which also might provide an answer to the question: why Electric Charges attract or repel each other? That question is still a mystery today, although the answer to the question: why Mass bodies attract each other? is already provided by Einstein's General Relativity theory. The above might also provide a lead to achieve a simple Unification between Gravity and Electricity, a quest which the nowadays Science of Physics is still struggling with, without achieving yet satisfactory results.

In addition to presenting very convincing arguments that the Electric Field might be also recognized as a form of acceleration, based on ***Structural Identities*** between Newton's Universal

Gravitational Law and Coulomb's Law, this article also proposes a relatively simple experiment, which if implemented, it might physically prove, that the Electric Field should be also recognized as a form of Acceleration.

Parts of this paper also exist in additional preprints, by the author of this paper, which are already posted on the web. But this paper contains additional materials, relating mainly to additional more significant implications, if the Electric Field will be also recognized as a form of Acceleration.

The discussion, in this paper, starts with an introduction presenting why Gravity is already recognized as a form of acceleration, and then, continues to the arguments why the Electric Field should be also recognized as a form of acceleration.

Introduction

The issue of Mass Bodies attraction was initially investigated by Newton.

Newton's measurements concluded that two Mass Bodies attract each other according to Newton's Universal Gravitational Law, which is formulated as *(1)*:

$F = G\cdot(m_1\cdot m_2)/ r^2$

Where G is the Gravitational Constant and is equal to 6.674×10^{-11} $m^3\cdot kg^{-1}\cdot s^{-2}$, m_1 is the Mass magnitude of the first Mass body, m_2 is the Mass magnitude of the second Mass body and r is the distance between the center of Mass of the two Mass Bodies.

The Universal Gravitational Law, presented above, provides the amount of the Force that attracts these two Mass Bodies.

However, Newton could not provide a complete explanation relating to what causes this force, or what is exactly the ***origin*** of the attraction between Mass Bodies.

Newton tried to explain the ***origin*** of the attraction force between Mass Bodies by introducing the concept of the Gravitational Field.

Newton stated that a Mass Body creates a Gravitational Field around it, which generates the Force presented in the Universal Gravitational Law.

However, Newton could not explain how any Field, including his Gravitational Field, can cause the attraction forces between bodies.

Newton's Gravitational Field is presented by the following equation *(2)*:

$g = G\cdot m/ r^2$

Where g is the Gravitational Field magnitude, G is the Gravitational Constant, which was already presented above in the Universal Gravitational Law, m is the Mass magnitude of the Mass Body

which creates this Gravitational Field g and r is the distance between the center of Mass of this Mass Body, and the point in Space, where this Gravitational Field g is measured.

Thus, the Universal Gravitational Law can be reformulated as:

$F = m \cdot g$

Where m is the magnitude of the Mass Body on which the Gravitational Field g exerts the force F.

However, as already stated above, the notion of a Field, does not provide a complete answer to the question: how can a Field generate the Forces that it is assumed to create?

Thus, the question:

What is the **origin** of the Force presented by the Universal Gravitational Law?

Remained an unanswered question, until the introduction of Einstein's General Relativity Theory (*3*).

Einstein succeeded to explain the ***origin*** of the attraction forces between Mass Bodies by concluding that Newton's Gravitational Field is a form of Acceleration. This conclusion led to the introduction of Einstein's Interwoven Space/Time concept, which succeeded to explain the ***origin*** of the attraction forces between Mass Bodies.

That conclusion can be derived directly from Newton's work.

Newton's Second Law of Motion (*4*) states, that a force F exerted on a Mass Body of Mass magnitude m obeys the following equation:

$F = m \cdot a$

Where a is the Acceleration that this Mass Body of Mass magnitude m acquires because of the force F exerted on it.

However, the above already presented, that a Gravitational Field g exerted on a Mass Body of Mass magnitude m also results in a force F exerted on this Mass Body:

$F = m \cdot g$

Thus, from the above follows that: $g = a$

Thus, the Gravitational Field must also be a form of Acceleration.

Arguments which imply that the Electric Field should be also recognized as a form of Acceleration

As already presented above, Einstein concluded that Newton's Gravitational Field is a form of Acceleration, and it was also showed that this conclusion can be also derived directly from a version of Newton's Universal Gravitational Law, F=mg, and Newton's Second Law of Motion, F=ma.

But this conclusion might be also obvious from analyzing ***only*** Newton's Universal Gravitational Law, $F = G\cdot(m_1\cdot m_2)/ r^2$, without using Newton's Second Law of Motion, F=ma.

During the attraction process between the Mass Bodies the Force F in $F = G\cdot(m_1\cdot m_2)/ r^2$ is dependent only on the distance r between these Mass Bodies, since G is a constant and the Mass magnitudes of the Mass Bodies also do not change, assuming that the velocities in the attraction process are negligible in comparison to the velocity of Light, implying that the Mass increase with velocity, implied from Einstein's Special Relativity Theory, is also negligible.

Thus, during the attraction process, the force F continuously increases, as the distance r between the bodies continuously decreases.

Since this Force F is what causes the attraction between the Mass Bodies, the fact that during this attraction process the Force F continuously increases, this should imply, that during the attraction process, the velocities of the attracting Mass Bodies also continuously increase, which implies that during the attraction process, the Mass Bodies are also Accelerating towards each other.

Since the Gravitational Field is what causes the Force F, and thus, is actually the cause of the attraction between the Mass Bodies which, as concluded above, are Accelerating towards each other, it should be concluded that the Gravitational Field is a form of Acceleration.

And this conclusion is the result from an analysis done ***only*** on Newton's Universal Gravitational Law, $F = G\cdot(m_1\cdot m_2)/ r^2$, without using Newton's Second Law of Motion, F=ma, as presented above.

However, the analysis done only on Newton's Universal Gravitational Law, $F = G\cdot(m_1\cdot m_2)/ r^2$, without using Newton's Second Law of Motion, F=ma, reveals more than what was presented above.

Since the Gravitational Field itself, presented by the equation: $g = G\cdot m/ r^2$, also continuously increases during the attraction process, as the distance r between the bodies continuously decreases, then, the Gravitational Field, which is the cause of the attraction between the Mass Bodies, is not only a form of Acceleration, it is a form of Acceleration which increases continuously, during the attraction process between the Mass Bodies.

The nowadays Science of Physics, does not recognize (yet) the Electric Fields as being also a form of Acceleration, as the Gravitational Field is already recognized as a form of Acceleration.

But, similar to what was presented, that Newton's Gravitational Field is a form of Acceleration, which can be derived ***only*** from analyzing Newton's Universal Gravitational Law, $F = G\cdot(m_1\cdot m_2)/ r^2$, without using Newton's Second Law of Motion, F=ma, similar arguments might apply also to the claim, that Electric Fields might also be concluded to be forms of Acceleration, only by analyzing the Coulomb's Law.

Analogous to Newton's Universal Gravitational Law, which provides the Force of attraction between Mass Bodies, Coulomb's Law provides the Force of the attraction or the repulsion between Electric Charges.

Coulomb's Law is presented by the following formula (5) :

$$F = Ke\cdot(q_1\cdot q_2)/r^2$$

Where Ke represents the Coulomb's Constant and is equal to $8.99\times10^9\ N\cdot m^2\cdot C^{-2}$, q_1 is the amount of Electric Charge in the first Electric Charge, q_2 is the amount of Electric Charge in the second Electric Charge and r is the distance between the center of Mass of the bodies that carry these two Electric Charges.

It should be noticed that the ***structure*** of the Newton's Universal Gravitational Law and the ***structure*** of the Coulomb's Law are ***identical***.

Thus, as already stated above, similarly to the arguments presented above, that Gravity can be recognized as a form of Acceleration ***only*** by analyzing Newton's Universal Gravitational Law, without using also Newton's Second Law of Motion, similar arguments apply which imply the Electric Field should be also recognized as a form of Acceleration, only from analyzing Coulomb's Law.

These arguments are:

During the attraction or the repulsion process between the Electrically Charges Bodies the Force F in $F = Ke\cdot(q_1\cdot q_2)/r^2$ is dependent only on the distance r between these Electrically Charged Bodies, since Ke is a constant and the Electric Charges magnitudes embedded in the Electrically Charged Bodies also do not change.

Thus, during the attraction or the repulsion process, the force F continuously increases or decreases, as the distance r between the Electric Charges continuously decreases or increases (depending if the Electric Charges attract or repel each other).

Since this Force F, presented by Coulomb's Law, is what causes the attraction or the repulsion between the Electrically Charged Bodies, the fact that during this attraction or repulsion process the Force F continuously increases or decreases, (depending if the Electric Charges attract or repel each other), this should imply, that during the attraction or the repulsion process, the velocities of the attracting or repelling Electrically Charged Bodies also continuously increase or decrease, which implies that during the attraction or the repulsion process, the Electrically Charged Bodies are also Accelerating towards each other, or Decelerating from each other.

Since the Electric Fields involved in the above-described process are the cause of the force F and thus, also the cause of the attraction or the repulsion between the Electrically Charged Bodies which, as concluded above, are accelerating towards each other, or decelerating from each other, it should be concluded that these Electric Fields are also forms of Accelerations or Decelerations (depending if the Electrically Charged Bodies attract or repel each other).

And this conclusion is the result from an analysis done ***only*** on Coulomb's Law, $F = Ke \cdot (q_1 \cdot q_2)/r^2$, as presented above.

However, the analyzing done only on Coulomb's Law, $F = Ke \cdot (q_1 \cdot q_2)/r^2$, reveals more than what was presented above.

Since the Electric Fields involved, presented by the equation: $e = Ke \cdot q/r^2$, also continuously increase or decrease during the attraction or the repulsion process, as the distance r between the Electrically Charged Bodies continuously decreases or increases, then, the Electric Fields, which are the cause of the attraction or the repulsion between the Electrically Charged Bodies, are not only forms of acceleration or deceleration, these Electric Fields are forms of acceleration or deceleration which increases continuously, during the attraction or the repulsion process between the Electrically Charged Bodies.

But since Coulomb's Law ***does not*** contain any Mass component in its equation, it is reasonable to conclude that the above-described Acceleration or Deceleration property, derived from analyzing ***only*** the Coulomb's Law, is caused ***only*** by the Electric Fields created by Electric Charges embedded in the Electrically Charged Bodies presented in the Coulomb's Laws, which implies that Electric Fields are also forms of Acceleration.

A simpler presentation that the Electric Field should be also recognized as a form of Acceleration

In the previous chapter of this paper, detailed arguments were provided, which result in the conclusion that the Electric Field should be also recognized as a form of Acceleration.

This presentation was provided in order to point out all the details which are required to arrive at the conclusion that the Electric Field should be also recognized as a form of Acceleration.

But the ***obvious structural identities*** between Newton's Universal Gravitational Law, $F = G \cdot (m_1 \cdot m_2)/ r^2$ and Coulomb's Law, $F = Ke \cdot (q_1 \cdot q_2)/r^2$ can be used to provide a somewhat simpler presentation of the claim that the Electric Field should be also recognized as a form of Acceleration.

Because the Gravitational Field, is already recognized, by the nowadays Science of Physics as a form of Acceleration, and because this Gravitation Field, presented in Newton's Universal Gravitational Law, is the cause of the attraction between the Mass bodies, then, the following can be concluded:

Because the ***structure*** of the Coulomb's Law is ***identical*** to the ***structure*** of Newton's Universal Gravitational Law, and the Electric Field is the cause of the attraction or the repulsion of the

Electrically Charged bodies presented in the Coulomb's Law, then, it should be concluded, that like the Gravitational Field in Newton's Universal Gravitational Law, which is already recognized by the nowadays Science of Physics as a form of Acceleration, also the Electric Field, in Coulomb's Law, should be also concluded to be a form of Acceleration.

A proposed experiment for validating (or disproving) the statement that the Electric Field should be also recognized as a form of Acceleration

This paper also suggests a physical experiment that might prove (or disprove) the prediction that the Electric Field should be also recognized as a form of Acceleration.

Electrically Charged Bodies always embed Electric Charge ***and*** Mass. However, the Coulomb's Force is much more ***potent*** than the Gravitational Force.

This can be demonstrated by the following:

The Gravitational Force between two 1-kg Mass Objects that are 1 meter apart is $6.67 \cdot 10^{-11}$ (6) Newtons, while the Attraction or the Repulsion Force caused by the Coulomb's Law, between two 1 Coulomb Electrically Charged Bodies, held 1 meter apart, is $9 \cdot 10^{9}$ (7) Newtons.

The above clearly indicates that the Coulomb's Force might be more ***potent***, as compared to the Gravitational Force, by a magnitude factor of $1.35 \cdot 10^{20}$!

Thus, if Electric Fields are also forms of Accelerations, the Acceleration between Electrically Charged Bodies, attracted to, or repelled from each other, because of Coulomb's Law, should be dependent mainly on the amount of the Electric Charge that these bodies carry and not on the Mass magnitudes of these bodies, as Newton's Second Law of Motion states.

Thus, this paper proposes a relatively simple experiment which might check if the Acceleration between Electrically Charged Bodies, attracted to, or repelled from each other, because of Coulomb's Law, is dependent mainly on the amount of the Electric Charge that these bodies carry and not on the magnitudes of the Mass that these bodies embed, as Newton's Second Law of Motion (F=ma) states.

That experiment suggests letting two Electrically Charged Bodies, at a specific distant L apart, being attracted to each other under Coulomb's Law.

In the first phase of the experiment the bodies should be of equal Mass magnitudes, embedding equal amounts of Electric Charges, each of a different polarity, to enable the attraction between the bodies under the Coulomb's Force. The experiment should measure the time it takes for these bodies to collide.

Then, the experiment is repeated with two additional Electrically Charged Bodies with the same amount of Electric Charge but with a much bigger Mass magnitude (for example, twice the Mass magnitude that the Electrically Charged Bodies had in the first phase of the experiment).

Newton’s Second Law of Motion predicts that the time to collision, in that second phase of the experiment, would be different (bigger), because the Forces exerted on the bodies will be the same, as in the first phase of the experiment, because the Electric Charges are the same in both phases of the experiment, (and thus, the Coulomb's Force will be the same, and the Gravitational Force is negligible in comparison with Coulomb's Force), but the Mass magnitudes of the bodies are bigger in the second phase of the experiment, which will result in a smaller Acceleration.

This paper, on the other hand, predicts that the time to collision in both phases of the experiment would be virtually the same, because the Acceleration between Electrically Charged Bodies, attracted to, or repelled from each other under the Coulomb’s Law, is dependent mainly on the amount of the Electric Charge that these bodies carry and not on the Mass magnitudes of these bodies, as Newton’s Second Law of Motion (F=ma) states.

If the experiment will prove that the time to collision will be virtually the same, in both phases of the experiment, this will provide validity to what is presented in this paper.

Additional comments related to the proposed experiment

If the experiment will be conducted in a laboratory residing on our planet, Earth, then, in each of the two phases of the proposed experiment, Vertical ***and*** Horizontal Forces will be exerted on the Electrically Charged bodies under test.

The experiment intends to prove that in the Horizontal axis, the Acceleration of the Electrically Charged bodies is affected mainly by their Electric Charge magnitudes and not by their Mass magnitudes.

In addition to the Horizontal Forces, exerted on the Ellectrically Charged bodies under test, an additional Vertical Force will be exerted on the Electrically Charged bodies under test, if the experiment will be conducted in a laboratory residing on our planet, Earth, attracting the bodies towards the center of our planet, Earth. This is the Gravitational Force acting between the bodies and the Earth Mass.

Because this experiment aim is to check what happens only in the Horizontal axis, the above-mentioned Vertical Force should not affect the experiment results.

But, an additional Horizontal Force, affected by the attraction Gravitational Force between the bodies and the Earth Mass, might have significant effect on the experiment. This additional Horizontal Force is the Friction between the bodies and the surface on which the bodies reside.

The size of this Friction Force is affected by the bodies Mass and the Friction Coefficient of the Horizontal surface on which the bodies reside.

Thus, the bodies should be kept as Light as possible, and the Horizontal surface should have a remarkably small Friction Coefficient.

Actually, the best environment for conducting the proposed experiment, might be a laboratory in a Space Station, because in such an environment, it might be possible to conduct the experiment

without any surface under the bodies, because, the Earth Gravitational Force will be virtually absent in such an environment.

An immediate implication if the Electric Field will be recognized as a form of Acceleration.

Thus, as presented in the previous chapter of this paper, if Electric Fields are also forms of Accelerations, the Acceleration between Electrically Charged Bodies, attracted to, or repelled from each other, because of Coulomb's Law, should be dependent mainly on the amount of the Electric Charge that these bodies carry and not on the Mass magnitudes of these bodies, as Newton's Second Law of Motion states.

The above also implies that Newton's Second Law of Motion, F=ma, should undergo a suitable modification, in scenarios relating to Electrically Charged Bodies, attracting or repelling each other, under Coulomb's Law, which implies that in such scenarios Newton's F=ma Law should be replaced with a different Law, namely, F=kqa, as is presented below:

An Electric Field e, generated by an Electric Charge q, is defined by:

$e = Ke \cdot q/r^2$

Where e is the Electric Field magnitude, Ke is the Coulomb's Constant, already presented in a previous chapter of this paper, q is the magnitude of the Electric Charge generating this Electric Field e and r is the distance between the center of Mass, of the body which embeds this Electric Charge, and the point in Space where this Electric Field e is measured.

Thus, Coulomb's Law can be reformulated as:

$F = q \cdot e$

Where F is the Coulomb's Force exerted on an Electric Charge q by an Electric Field e.

The above is similar to:

$F = m \cdot g$,

Where m (Mass) is replaced by q (Electric Charge),
g (the Gravitational Field) is replaced by e (the Electric Field),
and F (the attraction Gravitational Force) is replaced by F (the attraction or repulsion Force under Coulomb's Law).

Thus, as g, the Gravitational Field, is already recognized as a form of Acceleration, if e, the Electric Field, is also found to be a form of Acceleration, as predicted in this paper, then,

$F = q \cdot e$ can be also presented as:

$F = q \cdot ka$

Where a is the Acceleration exerted on an Electric Charge q under Coulomb's Law, which also implies, as stated above, that for Electrically Charged Bodies, attracted or repelled under Coulomb's Law, F = ma should be replaced by F = kqa.

It should be also emphasized, that although the Gravitational Field g is equated exactly with the Acceleration a, in case of the Electric Field, it is not possible, at this stage, to completely equate the Electric Field e with the Acceleration a, and all that can be established, at this stage, is that the Electric Field e is equal to the Acceleration multiplied by a certain factor k, or, as stated above: e=ka. This is because of the following:

The conclusion that the Gravitational Field g is also a form of Acceleration, derived from an analysis performed ***only*** on Newton's Universal Gravitation Law without using Newton's Second Law of Motion (F=ma), does imply that the Gravitational Field g is a form of Acceleration, but does not establish yet that the Gravitational Field g is equal exactly to the Acceleration a.

Only by using also Newton's Second Law of Motion (F=ma), the equation g=a can be established.

Similarly, in case of the Electric Field, the conclusion that the Electric Field e is a form of Acceleration, derived from analysis performed on the Coulomb's Law, is not sufficient to establish that e=a, and all it can be established, at this stage, is that e is equal to the Acceleration a multiplied by a certain factor k, which must be established, by further experimentation, or as stated already above, e=ka.

Additional, more significant implications, if the Electric Field will be recognized as a form of Acceleration

As already presented, in the Abstract section of this paper, in addition to the immediate implication presented above, additional ***more significant*** and revolutionary implications will result, if the Electric Field will be recognized as a form of Acceleration.

These additional ***more significant*** and revolutionary implications relate to how should Humans perceive the very Nature of the entities of Space and Time.

This might also provide an answer to the question: why Electric Charges attract or repel each other?

That question is still a mystery today, although the answer to the question: why Mass bodies attract each other? is already provided by Einstein's General Relativity theory.

The above might also provide a lead to achieve a simple Unification between Gravity and Electricity, a quest which the nowadays Science of Physics is still struggling with, without achieving yet satisfactory results.

Because these additional more significant implications are closely related to Einstein's Interwoven Space/Time concept, introduced in Eistein's General Relativity theory, the following first elaborates briefly on the subject of Einstein's Interwoven Space/Time concept.

As presented already in this paper, Einstein succeeded to explain the ***origin*** of the attraction force between Mass bodies, by realizing that Newton's Gravitational Field is a form of Acceleration, which led Einstein to introduce his Interwoven Space/Time concept, which succeeded to explain the ***origin*** of the attraction force between Mass bodies.

Einstein's General Relativity Theory explains the ***origin*** of the attraction force between Mass bodies by using the following arguments:

Acceleration is the second derivative of Space as related to Time:

$a = d2\ s/dt2$

Where s is the Space point at which the Acceleration a is measured, and t is the Time moment at which the Acceleration a is measured.

Space is a three-dimensional entity, while Time is a one-dimensional entity.

From the above Einstein concluded that if it can be assumed, that Space and Time ***are not*** independent entities, and they are ***always*** interweaved into a four-dimensional construct, which replaces the three-dimensional Space entity, then, this four-dimensional Interwoven Space/Time construct already embeds an Acceleration at each point of it, because the second derivate of Space in relation to Time can be calculated at each point of it, because this four-dimensional Interwoven Space/Time construct already embeds the Space and the Time entities at each point of it.

Thus, Einstein concluded, that if a form of this four-dimensional Interwoven Space/Time entity can be assumed to be Newton's Gravitational Field, then, this form of Interwoven Space/Time entity, will exert an Acceleration, on any Mass Body, residing in it, which is the Acceleration embedded in the point of this form of Interwoven Space/Time entity, where this Mass Body resides.

Following is an additional, very brief, explanation of what was just presented above:

Actually, Einstein's General Relativity theory states, that any Mass body induces a deformation in the above-mentioned Einstein's Interwoven Space/Time structure, such that, this Interwoven Space/Time structure embeds now an Acceleration, at each point of it, which is equal to the value of the Acceleration embedded in the Gravitational Field generated by this Mass body.

Thus, the above implies that the above-mentioned deformation, induced in the above-mentioned Einstein's Interwoven Space/Time structure, will cause any ***other*** Mass body to be attracted to the Mass body which induced this deformation, in a motion containing the Acceleration embedded in this deformed Einstein's Interwoven Space/Time entity, which is also this Gravitational Field and, thus, this motion, then, would also comply to how Newton's Universal Gravitational Law describes this motion.

More details on what exactly is this form of this four-dimensional Interwoven Space/Time entity, and how a Mass Body deforms this form of this four-dimensional Interwoven Space/Time entity, can be found in Einstein's General Relativity Theory (*3*).

The brief elaboration presented above, relating to Eistein's Interwoven Space/Time entity related only to how this concept explains the attraction between Mass bodies.

But this concept should have wider implications, affecting also any other Energy Fields, for example, Electric Fields, and not only the Gravitation Field, because of the following:

Einstein assumed that the Universe embeds only ***one, single*** three-dimensional Space entity, and also only ***one, single*** one-dimensional Time entity, resulting in only ***one, single*** four-dimensional Interwoven Space/Time entity.

This implies that Einstein's Interwoven Space/Time entity, should be the ***only*** entity which dictates Accelerations, because the Acceleration is defined as the second derivate of Space in relation to Time, and if Einstein's Interwoven Space/Time entity is the ***only*** entity in the Universe which ***embeds*** the Space and the Time entities, it is, thus, also the ***only*** entity which is able to dictate the Accelerations in the Universe, especially Accelerations embedded in motions which are the result of activities originating by all Energy Fields in the Universe, for example, Gravity ***and*** Electric Fields.

Thus, if the Electric Field might be also recognized as a form of Acceleration, as this paper suggests, then, because the Electric Field might exist together with the Gravitational Field, in the same locations defined by Einstein's Interwoven Space/Time entity, then, the Acceleration embedded in that Electric Field, should be also dictated by the **one, single** Interwoven Space/Time entity, just described above.

However, as will be immediately present in the following, if the Acceleration embedded in Electric Fields, must be also dictated by the ***one single*** Interwoven Space/Time entity just described above, this might pose a severe difficulty, relating to the concept of Einstein's Interwoven Space/Time concept, as described in the following paragraphs:

It was already presented above, that according to Einstein's General Relativity theory, Mass bodies, which are the cause of Newton's Gravitational Field, are able to induce a deformation into Einstein's Interwoven Space/Time entity, which ***causes*** the attraction between Mass bodies.

Thus, if the Electric Field might be also recognized as a form of Acceleration, as this paper suggests, then, also Electric Charges, which are the cause of the Electric Fields, ***must also be able*** to induce a deformation into Einstein's Interwoven Space/Time entity, in order to cause the Acceleration embedded in the Electric Fields, as this paper suggests, because, as just presented above, Einstein's Interwoven Space/Time entity, is the ***only entity*** which causes Accelerations, because it is the ***only entity*** which embeds the Space and the Time entities.

The assumption made by Einstein, that there is ***only one, single*** entity of Einstein's Interwoven Space/Time entity, ***enabled*** Einstein to develop his General Relativity theory, because it is possible to envision, how a proper deformation into that ***one, single*** Einstein's Interwoven Space/Time

entity, can generate the required Acceleration, at each point of it, for explaining the ***origin***, of Mass bodies attraction.

However, Electric Charge might attract ***or*** repel each other, and it seems ***impossible*** to envision a proper deformation, induced into a ***single*** Einstein's Interwoven Space/Time entity, composed of only a ***single*** Space entity and a ***single*** Time entity, which will be able to generate the proper Accelerations which will be able to explain the ***origin*** of Electric Charges attractions, ***and***, also to explain the ***origin*** of Electric Charges repulsions.

Thus, since Einstein's Interwoven Space/Time entity is the ***only entity*** that can generate Accelerations, because it is the ***only entity*** that embeds the Space and the Time entities, if Electric Fields might be also recognized as a form of Acceleration, that Acceleration seems to be ***problematic***, because it cannot be related to Einstein's Interwoven Space/Time entity, as presented above, although, as also presented above, this Acceleration ***must*** be related to Einstein's Interwoven Space/Time entity.

The resolution of the above presented difficulty, is presented in the next chapters of this paper, which relate to additional important implications resulting from Einstein's Interwoven Space/Time concept, which seem to be yet ignored or overlooked.

The resolution of the above presented difficulty will result in the additional more significant implications, mentioned at the beginning of this chapter, if the Electric Fields will be also recognized as a form of Acceleration.

Important Implications as related to Einstein's Interwoven Space/Time concept.

Einstein's four-dimensional ***Interwoven Space/Time*** notion does succeed to explain the ***origin*** of the attraction between Mass bodies, as presented already above. However, that notion embeds also an important additional implication.

By stating that the Space and the Time notions are ***always*** interweaved into one four-dimensional entity, this also implies that the Space and the Time notions, are not independent notions, as Humans perceive such notions.

Moreover, because Einstein's four-dimensional Interwoven Space/Time notion replaces the Newton's Gravitational Field, which should be recognized as a form of Energy, then, the Space and the Time notion, are not only not independent notions, but they are also just attributes (or facets) of a form of Energy.

In a speech, in the University of Leiden on May 5th, 1920, (8), Einstein claimed that the Ether should exist to provide physical properties to his Space/Time entity, which implies, that Einstein also agreed that his Space/Time Entity is a form of Energy.

Thus, Einstein's four-dimensional Interwoven Space/Time notion also implies that the Space and the Time notions are not independent notions, are just attributes (or facets) of a form of Energy, which also implies that the Space and the Time notions, as Humans perceive such notions, do not really exist.

The statement that Space and Time do not really exist sounds as an extraordinary, unbelievable, and out of line statement, at first.

This is because the notions of Space and Time are crucial notions, which Humans need them, to perceive, understand and calculate Motions and Changes.

However, in view of the arguments above, if Space and Time cannot be considered any longer as independent entities, and if Space and Time are just embedded in a form of Energy (the Gravitational Field), the statement that Space and Time might not really exist does not sound so detached any more.

Moreover, the above actually indicates that what ***does exist*** are Energies which ***Interact*** with each other, and these ***Interactions*** cause, what Humans perceive as Motions and Changes. For example, the attraction (Motions) between Mass bodies is a result of the ***Way*** a form of Energy (the Gravitational Field) ***Interacts*** with another form of Energy (Mass bodies), which leads Humans to attribute attributes (or facets) of Space and Time to the Gravitational Field Energy.

The understanding that Space and Time might not really exist, and what causes Motions and Changes are the ***Ways*** Energies Interact with each other, will resolve the difficulty presented in the previous chapter of this paper, and is also used to explain the attraction or the repulsion between Electric Charges, in the next chapter of this paper, which also might result in a lead for a proposal for a simple Unification of Gravitation and Electricity.

Since the entities which compose Einstein's Interwoven Space/Time concept are the entities of Space and Time, and since the resolution of the difficulty presented in the previous chapter of this paper depends, relies, on the various aspects of Einstein's Interwoven Space/Time concept, the next chapter of this paper provides additional elaboration on the very Nature of the entities (or concepts) of Space and Time, which will eventually conclude in a resolution of the difficulty presented in the previous chapter of this paper.

A resolution to the difficulty presented in relation to Electric Fields being a form of Acceleration and Einstein's Interwoven Space/Time concept

Humans need the entity of Space to perceive relative positions between objects. Humans also need the entities of Space and Time to calculate values that Humans attribute to Motions, such as Velocity or Acceleration.

The entities of Space and Time are also the entities that compose the four-dimensional Interwoven Space/Time entity, introduced by Einstein’s General Relativity theory, which provided an explanation of the ***origin*** of the attraction between Mass bodies.

This paper presented the following prediction: Electric Fields are forms of Accelerations, like the Gravitational Field, which is already recognized as a form of Acceleration.

And, as presented in a previous chapter of this paper, although the prediction, that Electric Fields should be recognized also as forms of Accelerations, is based on very sound arguments, based on

structural identities between Newton's Universal Gravitational Law and Coulomb's Law, that prediction also presents the following difficulty:

The Acceleration that should be also recognized as embedded in Electric Fields, ***must*** be also manifested by Einstein's Interwoven Space/Time entity, because this is the ***only*** entity that embeds the Space and the Time entities in the Universe, but, on the other hand, as also already presented in a previous chapter of this paper, the Acceleration that should be also recognized as embedded in Electric Fields ***cannot*** be related to Einstein's Interwoven Space/Time entity, because if the Universe embeds only ***one, single*** Interwoven Space/Time entity, this cannot explain why Electric Charges are able to attract ***or*** repel each other.

The resolution to the above presented difficulty might exist in the conclusion that Space and Time might not be entities that really exist, as also presented in the previous chapter of this paper.

And, as already presented in the previous chapter of this paper, this paper predicts that what ***does exist*** are Energies which ***Interact*** with each other, and these ***Interactions*** cause, what Humans perceive as Motions and Changes.

For example, the attraction (Motions) between Mass bodies is a result of the ***Way*** a form of Energy (the Gravitational Field) ***Interacts*** with another form of Energy (Mass bodies), which leads Humans to attribute attributes (or facets) of Space and Time to the Gravitational Field Energy.

By abandoning the conclusion that the entities of Space and Time exist, and by concluding that Changes and Motions are only the results of ***Interactions*** between Energies, the ***origin*** of attraction or repulsion between Electrically Charged bodies can be explained, in addition to the explanation, already provided by Einstein's General Relativity theory, relating to the ***origin*** of the attraction between Mass bodies.

Thus, abandoning the conclusion that the entities of Space and Time exist, enables the prediction that there might be other Energies, for example, the Energies embedded in Electric Fields, which might be also attributed with attributes (or facets) of Space and Time, in order to explain the activities related to these forms of Energies.

These additional attributes (or facets), presented above, of Space and Time, attributed to these additional forms of Energies, might be also manifested as two ***additional separate*** four-dimensional Interwoven Space/Time entities, in addition to Einstein's four-dimensional Interwoven Space/Time entity, attributed to the Energy embedded in the Gravitational Field.

One of these ***additional*** four-dimensional Interwoven Space/Time entity might replace the Electric (or Magnetic) Fields generated by the Positive Electric Charges.

The second of these ***additional*** four-dimensional Interwoven Space/Time entity might replace the Electric (or Magnetic) Fields generated by the Negative Electric Charges.

Thus, the two ***additional*** four-dimensional Interwoven Space/Time entities, presented above, together with Einstein's Interwoven Space/Time entity, present three entities of Interwoven Space/Time entities, ***separated*** from each other.

And thus, these three ***separate*** four-dimensional Interwoven Space/Time entities are all forms of Energies, and each of these three ***separate*** four-dimensional Interwoven Space/Time entities embeds ***its own separate*** Space and ***its own separate*** Time attributes (or facets).

Actually, this paper predicts, that different sets of Interactions between Energies, should be assigned ***separate and independent*** attributes of Space and Time, ***different and independent*** from the Space and the Time attributes, assigned to other sets of Interactions between Energies, to provide an explanation for the ***origin*** of motions which are yet unexplained, such as: what is the ***origin*** of the attraction or the repulsion between Electrically Charged bodies?

Because ***different and independent*** Space and Time attributes should be assigned to different sets of ***Interactions*** between Energies, then, Space and Time, as Humans perceive these notions, cannot exist, because the above implies, that there should be ***multiple, independent*** notions of Space, and ***multiple, independent*** notions of Time, and not just one universal Space entity, and just one universal Time entity, as Humans perceive the Space and the Time entities.

An additional paper, by the author of this paper titled "A Discussion Related to The Existence of The Entities of Space and Time" (9), also elaborates on what was just presented above.

Based on the above, the author of this paper published an additional paper titled "A New Theory Expands Einstein's General Relativity Theory to Include Both Electric Charge and Mass Entities" (10) which explains the ***origin*** of the attraction or the repulsion between Electrically Charged bodies like Einstein's General Relativity explains the ***origin*** of the attraction between Mass bodies.

The paper (10) provides detailed explanations of the above, which also results in supplying a lead to achieve a Simple Unification of Gravity and Electricity, because, if the materials presented in the paper (10) will be found valid, then, Gravity and Electricity operations are governed by similar processes.

Unification of Gravity and Electricity is an endeavor which the Science of Physics pursues for a long time, without significant success.

Unifications in Physics are significant steps forward because such unifications provide new insights and explanations to yet unanswered questions, and new predictions.

This paper argues, that if the notions (entities) of Space and Time, will be proven to be entities that do not exist, as this paper predicts, then, the fact that the endeavors to unify the Gravitation with Electricity ***were based*** on the assumption that the entities of Space and Time ***do exist*** as a ***single*** Space entity and as a ***single*** Time entity, might be ***the reason***, why such endeavors ***were not yet successful***.

Summary and Conclusions

This paper presents the prediction that Electric Fields are also forms of Acceleration, as the Newton's Gravitational Field is already recognized as a form of Acceleration.

The prediction that Electric Fields are also forms of Acceleration, is supported by arguments relying on the ***structural identities*** between Newton's Universal Gravitational Law and Coulomb's Law.

However, the prediction that Electric Fields are also forms of Acceleration also implies that the Acceleration between Electrically Charged Bodies, attracted to, or repelled from each other, because of Coulomb's Law, should be dependent mainly on the amount of the Electric Charge that these bodies carry and not on the magnitudes of the Mass embedded in these bodies, as Newton's Second Law of Motion (F=ma) states.

Actually, this paper assumes that Newton's Second Law of motion (F=ma) was never checked to see if it complies with the Acceleration in scenarios of attraction or repulsion between Electrically Charged bodies.

Instead, this paper assumes that Newton developed his Second Law of motion based on the trajectories existing in the Solar System (11), (12), (13). Newton used these trajectories to prove that his laws are valid, by showing that his laws of motion forecasted these trajectories.

Thus, this paper predicts that Newton's Second Law of motion (F=ma) is valid only for very massive bodies (such as planets) or Electrically Uncharged bodies, or Forces exerted on Electrically Charged bodies which are not Forces resulting from Coulomb's Law.

And for the scenario of Electrically Charged bodies attracted or repelled under Coulomb's Law, this paper predicts that Newton's Second Law of motion should undergo a suitable modification.

This paper also proposes a physical experiment to validate (or disprove) the prediction that the Acceleration between Electrically Charged Bodies, attracted to, or repelled from each other, because of Coulomb's Law, is dependent mainly on the amount of the Electric Charge that these bodies carry and not on the magnitudes of the Mass embedded in these bodies.

This experiment is relatively simple to implement, but still requires means and funds which are beyond the reach of the author of this paper, thus, the author of this paper hopes, that this paper will bring about the execution of this experiment, and, hopefully, the validation of what is presented in this paper.

If this experiment will be implemented, and its results will be successful, such that the Electric Field will be also recognized as a form of Acceleration, this will also result in significant implications.

One immediate implication would be the realization, that for Electrically Charged bodies, attracted or repelled under Coulomb's Law, F=ma should be replaced by F=kqa, as described in the body of this paper.

Also, additional, more significant implications, will result if the Electric Field will be recognized as a form of Acceleration.

These additional more significant implications, relates to how Humans can perceive the very Nature of the entities of Space and Time. As already mentioned before in this paper, more on that issue can be found in the preprint titled:

" A Discussion Related to The Existence of The Entities of Space and Time " (9),

by the author of this paper, whose link appears in the references section of this paper.

These additional more significant implications also explain why Electric Charges attract or repel each other, a question which is still a mystery today.
As already mentioned before in this paper, more on that issue can be found in the preprint titled:

"A New Theory Expands Einstein's General Relativity Theory to Include Both Electric Charge and Mass Entities" (10),

by the author of this paper, whose link appears in the references section of this paper.

These additional more significant implications might also provide a lead for a simple Unification between Gravity and Electricity, a quest that the Science of Physics still struggles to achieve a proper resolution to it. more on that issue can be found in the preprint titled:

"A Simple Unification of Gravitation and Electricity" (14),

by the author of this paper, whose link appears in the references section of this paper.

Also, more details relating to how Humans can perceive the very Nature of the entities of Space and Time and its implications to a possible need to update Newton's Second Law of Motion (F=ma) in certain scenarios can be found in the preprint titled:

"For Electrically Charged Bodies, Attracted or Repelled under Coulomb's Law, F=ma should be replaced with F=qa" (15),

by the author of this paper, whose link appears in the references section of this paper.

References

(*1*). Newton's Law of Universal Gravitation. Wikipedia.
https://en.wikipedia.org/wiki/Newton%27s_law_of_universal_gravitation

(*2*). Gravitational Field formula
Gravitational Field Formula: Concept, Important Formulas, Examples (toppr.com)

(*3*). Einstein's Theory of General Relativity. Space.com site.
https://www.space.com/17661-theory-general-relativity.html

(*4*). Newton's Laws of Motion. Wikipedia.
https://en.wikipedia.org/wiki/Newton%27s_laws_of_motion

(*5*). Coulomb's Law, Wikipedia. https://en.wikipedia.org/wiki/Coulomb%27s_law

(*6*). Mass Attraction Forces. ER. services. University Physics Volume 1.
Newton's Law of Universal (lumenlearning.com)

(*7*). Attraction Force Between Charges 1 meter Apart. The Physics Classroom.
Physics Tutorial: Coulomb's Law (physicsclassroom.com)

(8) Einstein: Ether and Relativity. http://mathshistory.st-andrews.ac.uk/Extras/Einstein_ether.html

(9) Segal, Moshe, A Discussion Related to The Existence of The Entities of Space and Time (January 21, 2023). Available at SSRN: https://ssrn.com/abstract=4332823 or http://dx.doi.org/10.2139/ssrn.4332823

(10). A New Theory Expands Einstein's General Relativity Theory to Include Both Electric Charge and Mass Entities. Moshe Segal, Theoretical Physics Letters (PTL). That paper is under PTL copyright and consent form, signed by the author Moshe Segal with PTL.
https://2edd239a-21aa-41cc-a45e-84832f36b982.filesusr.com/ugd/04176b_5399eb07c7334d9d965cc3685558dea1.pdf

(11) Kepler's Laws and Newton's Laws. mtholyoke.edu.
http://www.pas.rochester.edu/~blackman/ast104/newtonkepler.html

(12) The Science: Orbital Mechanics. earthobservatory.nasa.gov.
https://earthobservatory.nasa.gov/features/OrbitsHistory/page2.php

(13) Newtonian Gravitation and the Laws of Kepler. pas.rochester.edu.
http://www.pas.rochester.edu/~blackman/ast104/newtonkepler.html

(14) Moshe Segal, A Simple Unification of Gravitation and Electricity.
10.5281/ZENODO.7414503

(15) Segal, Moshe, For Electrically Charged Bodies, Attracted or Repelled under Coulomb's Law,F=ma should be replaced with F=qa (October 7, 2023). https://ssrn.com/abstract=4595668