Like Gravity, the Electric Field should be also recognized as a form of Acceleration

Moshe Segal[1][*][†][‡]

[1]Independent Researcher.

[*]Email: moshe_segal@yahoo.com

[†]Moshe Segal's address is: Ravutzky st. #78 Ra'anana ISRAEL 4322141
[‡] Moshe has a B.Sc Graduated with distinction (Cum Laude) and a M.Sc in Electronics and
Electrical Engineering from the Technion, Haifa, Israel.

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.

Based on *structural identities* between Newton's Universal Gravitational Law and Coulomb's Law, this paper provides argumentations which indicate that the Electric Field should be also recognized as a form of Acceleration.

This paper also proposes a relatively simple experiment, which if implemented, it might prove, (or disprove), the above presented statement that the Electric Field should be also recognized as a form of Acceleration.

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, which will be presented in additional papers, by the author if this paper.

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·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·g

Thus, from the above follows that: g = a

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

Argumentations 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, $F = G·(m_1·m_2)/ r^2$, without using Newton's Second Law of Motion, F=ma.

During the attraction process between the Mass Bodies the Force F in $F = G·(m_1·m_2)/ r^2$ 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 argumentations 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 8.99×10^9 N·m^2·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 argumentations 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 argumentations apply which

imply the Electric Field should be also recognized as a form of Acceleration, only from analyzing Coulomb's Law.

These argumentations 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 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.

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 argumentations 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, 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, as Newton's Second Law of Motion (F=ma) states.

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, which will be presented in additional papers, by the author if 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)