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Comments on "Unification of Gravity and Electromagnetism by Mohammed A. El-Lakany" & Einstein's Unification

C. Y. Lo

Applied and Pure Research Institute, 15 Walnut Hill Rd., Amherst, NH 03031, USA

Abstract: The unification of gravity and electromagnetism is a conjecture of Einstein although he failed to show it because Einstein did not realize that this unification requires a new charge-mass interaction. Moreover, the existence of such an interaction has been verified by experiments. Apparently M. A. El-Lakany also fails to see the need of such a new interaction. Moreover, he also has no experiment predictions that can be used to support his theory. It will be shown that Einstein's conjecture is valid.

Key words: Gravity, electromagnetism, general theory of relativity.

1. Introduction

It is well-known that Einstein conjectured the unification of gravity and electromagnetism. However, he failed to show this because he did not see that the unification requires a new charge-mass interaction [1]. Apparently El-Lakany [2] has made the same mistake.

The charge-mass interaction is responsible to the repulsive gravitation that Galileo, Newton, and Einstein did not know. It is interesting that the repulsive gravitation actually was first discovered from a solution of the static Einstein equation for the case of a charged particle. In this paper, we shall discuss the charge-mass interaction and the unification of electromagnetism and gravitation.

2. The Reissner-Nordstrom Metric

For a particle with mass M and charge q, the solution of the static Einstein equation is the Reissner-Nordstrom metric [3] as follows:

$$ds^2 = \left[1 - \frac{2M}{r} + \frac{q^2}{r^2}\right]dt^2 - \left[1 - \frac{2M}{r} + \frac{q^2}{r^2}\right]^{-1} dr^2 - r^2 d\Omega^2 \qquad (1)$$

(with light speed c = 1) where q and M are the charge and mass of a particle, and r is the radial distance (in terms of the Euclidean-like structure [4]) from the particle center. In metric from Eq. (1), the gravitational components generated by electricity have not only a very different radial coordinate dependence but also a different sign.

Some argued that the effective mass could be considered as:

$$M - q^2/2r \qquad (2)$$

Because the total electric energy outside a sphere of radius r is q^2/r, and thus Eq. (2) could be interpreted as supporting $m = E/c^2$ for the electric energy. However, the gravitational forces would be different from the force created by the "effective mass" $M - q^2/2r$ because:

$$-\frac{1}{2}\frac{\partial}{\partial r}\left(1 - \frac{2M}{r} + \frac{q^2}{r^2}\right) =$$

Corresponding author: C. Y. Lo, Ph.D. in mathematics from Queen's University, D.Sc. in physics from MIT, research field: theoretical physics.

$$-\left(\frac{M}{r^2}-\frac{q^2}{r^3}\right) > -\frac{1}{r^2}\left(M-\frac{q^2}{2r}\right) \qquad (3)$$

Thus, the Reissner-Nordstrom metric would imply $E = mc^2$ is invalid for the electric energy.

3. Misinterpretations of the Reissner-Nordstrom Metric

Owing to the belief that the electric energy had a mass equivalence ($E = mc^2$), theorists [5] including Nobel Laureate t' Hooft [6], consider incorrectly that the mass M would include the electric energy, i.e.,

$$M = m(r_0) + q^2/r_0 \qquad (4)$$

where $m(r_0)$ is the mass of the particle and q^2/r_0 is the electric energy of the particle outside the radius r_0 of the particle. Thus, in the net effect, there would be no repulsive gravitation since:

$$-\frac{1}{2}\frac{\partial}{\partial r}\left(1-\frac{2M}{r}+\frac{q^2}{r^2}\right) = -\left(\frac{M}{r^2}-\frac{q^2}{r^3}\right) =$$

$$-\frac{1}{r^2}\left(m(r_0)+\frac{q^2}{r_0}-\frac{q^2}{r}\right) \qquad (5)$$

However, the experiment of Tsipenyuk & Andreev [7] showed the weight of a charged metal ball is reduced. Thus, the existence of the repulsive force is verified. This theoretical mistake in Eq. (4) [1] is due to the fact that the effect of the electric energy has been incorrectly counted twice in the Reissner-Nordstrom metric.

4. The Necessary Extension of General Relativity

Note that, due to failure, many theorists believed Einstein's conjecture of unification of gravitation and electromagnetism was not valid. The reason is that Einstein and his followers do not understand that the unification requires new interactions as Maxwell demonstrated.[1] Moreover, due to not understanding non-linear mathematics, they have accumulated errors in mathematics and physics [8, 9]. In particular, the string theorists such as Witten have further confirmed errors in general relativity since the invalid dynamic Einstein equation was derived again [10]. The charge-mass interaction, however, implies the need of extending general relativity with anti-gravity coupling to the charge square.

For this static force, one needs to consider only g_{tt} in metric Eq. (1). According to general relativity [11, 12], the equation of motion is the geodesic equation.

$$\frac{d^2x^\mu}{ds^2} + \Gamma^\mu{}_{\alpha\beta}\frac{dx^\mu}{ds}\frac{dx^\nu}{ds} = 0,$$

where $\Gamma^\mu{}_{\alpha\beta} = (\partial_\alpha g_{\nu\beta} + \partial_\beta g_{\nu\alpha} - \partial_\nu g_{\alpha\beta})g^{\mu\nu}/2 \qquad (6)$

and $ds^2 = g_{\mu\nu}dx^\mu dx^\nu$.

Let us consider the static case (One need not worry whether the gauge is physically valid because the gauge affects only the second order approximation of g_{tt} [13]). For a test particle P with mass m at r, the force on P is:

$$(-m\frac{M}{r^2} + m\frac{q^2}{r^3})\,\hat{r} \qquad (7)$$

where $\hat{r}$ is a unit vector in the first order approximation because $g^{rr} \cong -1$. Thus, the second term is a repulsive force.

If the particles are at rest, then the force generated by p acting on the charged particle Q would be:

$$(m\frac{M}{r^2} - m\frac{q^2}{r^3})\,\hat{r} \qquad (8)$$

where $\hat{r}$ is a unit vector, because the action and reaction forces are equal and in the opposite directions. However, for the motion of particle Q, if one calculates the metric according to the particle P of mass m, only the first term is obtained.

Thus, it is necessary to have a repulsive force with the coupling q^2 to the charged particle Q in a gravitational field generated by masses. It thus follows that, force in Eq. (8) to particle Q is beyond current theoretical framework of gravitation + electromagnetism. As predicted by Lo, Goldstein, and Napier [14], general relativity leads to a realization of its inadequacy, just as electricity and magnetism lead to the exposition of their shortcomings.

The charge-mass repulsive force mq^2/r^3 for two point-like particles is inversely proportional to the cube power of the distances between the two particles. Thus, it diminishes faster than the attractive gravitational force. Moreover, this force is proportional to the square of the charge q, and thus is independent of the charge sign. Such characteristics would make the repulsive effects verifiable [15].

The term of repulsive force in metric (1) comes from the electric energy [2]. An immediate question would be whether such a charge-mass repulsive force mq^2/r^3 is subjected to electromagnetic screening. It is conjectured that this force, being independent of a charge sign, should not be subjected to such a screening. Moreover, from the viewpoint of physics, this force can be considered as a result of a field created by the mass *m* and the field interacts with the q^2. Thus such a field is independent of the electromagnetic field.

5. A Five-Dimensional Space

If we consider the need for coupling with q^2, this naturally leads to a five-dimensional space [16]. To reproduce the Einstein equation and the Maxwell equation, Kaluza [17] proposed his cylindrical condition to reduce the five variables to four. Subsequently, Einstein and Pauli [18] wrote a paper to continue the work of Kaluza. However, their five-dimensional relativity does not have the coupling with the square of a charge since the "extra" metric elements other than those relating to the electromagnetic potentials, are neglected [18].

In the theory of Lo et al. [14], the fifth dimension is assumed as part of the physical reality. They denote the fifth axis as the w-axis (w stands for "wunderbar", in memorial of Kaluza), and thus the coordinates are (t, w, x, y, z). Our approach is to find out the full physical meaning of the w-axis as our understanding gets deeper.

That the repulsive gravitational potential can be generated from a mass, would explain that a charged capacitor can have the repulsive force [15], but such a force is absent from the current four-dimensional theory. This is why many theorists would not accept the existence of the repulsive gravitation. They seem to forget that physics is based on experiments. Thus, Einstein's status as a theorist is enhanced because unification is proven necessary.

6. The Attractive Current-Mass Interaction

While the electric energy leads to a repulsive force from a charge to a mass, the magnetic energy would lead to an attractive force from a current toward a mass [19]. Also, for a normal situation, it is necessary to have the current-mass interaction to cancel out the charge-mass interaction as Galileo, Newton and Einstein implicitly assumed. Note that a charged capacitor has the same number of charged particles, and the only changes, after being charged, are the motions of some electrons and have become static. Thus, the attractive current-mass interaction is necessary for the weight reduction of a charged capacitor [15].

The existence of a current-mass attractive force has been verified by Martin Tajmar and Clovis de Matos [20]. It is found that a spinning ring of superconducting material increases its weight much more than expected. According to quantum theory, spinning super-conductors should produce a weak magnetic field. Thus, they are measuring also the interaction between an electric current and the earth. The current-mass interaction would generate a force which is perpendicular to the current.

However, we are not yet ready to derive this current-mass force explicitly. Unlike the static charge-mass repulsive force, this general force would be beyond general relativity since a current-mass interaction would involve the acceleration of a charge that would generate electromagnetic radiation. Then, the variable of the fifth dimension must be considered [14]. Note that the general force is related to the static charge-mass repulsive force similar to how the Lorentz force is related to the Coulomb force.

Nevertheless, we may assume [15] that, for a charged capacitor, the resulting force is the interaction of net macroscopic charges with the mass. This current-mass interaction also explains that it takes time for a capacitor to recover its weight after being discharged. This was observed by Liu since his rolled-up capacitors keep heat better [16]. A discharged capacitor needs time to dissipate the heat that the motions of its charges recover to normal.

Thus, there are three factors that determine the weight of matter. They are: (1) the mass of the matter; (2) the charge-mass repulsive force; and (3) the attractive current-mass force. For a piece of a heated-up metal, the current-mass attractive force due to orbital electrons is reduced, but the charge-mass repulsive force would increase. Therefore, a net result is a reduction of weight [21] instead of what Einstein predicted [22].

7. Conclusions and Discussions

As shown in metric from Eq. (1), the charge would create repulsive gravitational force, which is: (1) proportional to the square of the particle charge and (2) diminished as $1/r^3$. These two characteristics are supported by the repulsive gravitational force generated by a charge capacitor [23]. The data of the charged capacitor show that the repulsive gravitational force is proportional to the square of electric potential difference V of the capacitor [16] (Note that $Q = VC$, where Q is the charge of the capacitor, and C is the capacity). Moreover, the capacitor lifter would hover on earth [23] shows that the repulsive force must be diminishing faster than $1/r^2$.

Moreover, the time delay of weight recovery for a discharged capacitor shows that the motions of the electrons in the capacitor have to be changed back to normal as before [16]. Thus, the heat would also reduce gravitation.

Moreover, the charge-mass interaction (the fifth force[1]) is discovered, and this implies that the theoretical framework of general relativity must be extended to a five-dimensional relativity of Lo, Goldstein and Napier [14]. Moreover, since a capacitor does not generate repulsive gravitation in a normal situation, it is necessary to have an attractive current-mass interaction to cancel out the repulsive force generated by the charges.[2] Then, the repulsive force from a charged capacitor can be understood, and is definitely not due to experimental errors.

Now, because such a force can be explained in terms of the five-dimensional theory [16], Einstein’s conjecture of unification of electromagnetism and gravitation is proven necessary and valid. Consequently, new phenomena can be explained and long-time errors can be identified. The existence of the repulsive gravitation implies that the physical picture provided by Galileo, Newton and Einstein is too simple for the complicated gravitation. Since gravitation is not always attractive to mass, the basic assumption for the simulation of Wheeler [19] that leads to the theory of black holes is not valid.

Gravitation was considered as producing only attractive force. The physical picture provided by Galileo, Newton and Einstein is just too simple for the complicated gravitation. As expected, Einstein does not fully understand general relativity. Here we promote a deeper understanding of gravitational phenomena, and in particular Einstein's unification, will find useful applications in various parts of physics, astrophysics in particular [15, 16].

One may expect that the charge-mass interaction would be important in physics. Not only that it leads to the new repulsive gravitation, but also it would explain the space-probe pioneer anomaly [16]. Moreover, it implies that current quantum theory is not a final theory since the charge-mass interaction is not included in quantum mechanics. This may also show the need of renormalization in quantum field theories. A lesson to be learned is that experimentally partially supported unconditional $E = mc^2$ and the old notion of photon are actually incomplete.

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Endnotes

(1) Currently, there are four forces: (a) the electromagnetic force; (b) the gravitational attractive force; (c) the strong nuclear force; (d) the weak interaction force. The repulsive force is additionally the fifth force.

(2) The relation between the charge-mass interaction and the current-mass interaction is similar to the relation between the Coulomb force and Lorentz force.

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