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The Repulsive Gravitation and Errors of Einstein

By C. Y. Lo
Applied and Pure Research Institute, United States

Abstract- Einstein rejected repulsive gravitation which Galileo and Newton also over-looked although the repulsive gravitation can be identified if one calculates the static Einstein equation for a charged particle carefully. However, Einstein believed incorrectly the speculation of unconditional validity of $E = mc^2$. Because of inadequacy in pure mathematics, Einstein failed to see that the photons have gravitational energy, and his equation has no dynamic solution and that the coupling constants cannot have unique sign. Otherwise, the Einstein equation is in conflict with the notion of photons and violates the principle of causality. Einstein also failed to see a crucial error, the inconsistency between the Einstein equation and $E = mc^2$. Now, experiments have proven that the gravitational force consists of three components: 1) the mass-mass attractive interaction, 2) the repulsive charge-mass interaction, 3) the current-mass attractive interaction. Thus, Einstein's unification is necessary, and would start another revolution in physics. A main problem in physics is, however, the incompetence of APS in pure mathematics.

Keywords: *repulsive gravitation; $E = mc^2$; charge-mass interaction.*

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5. C. Y. Lo, Gravitation, Physics, and Technology, Physics Essays, **25** (4), 553-560 (Dec. 2012).

The Repulsive Gravitation and Errors of Einstein

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I. Introduction

Since the existence of repulsive gravitation was proposed in 1997, it is known that $E = mc^2$ can be invalid [1]. [1)] There are several types of experimental supports for this new physics [2-5]. It is interesting that at the earlier stage, I cannot find a physicist to do the experiment that would show Einstein could be wrong because it was generally believed that Einstein cannot be wrong in classical physics [6].

However, such experiments actually have been done because the meanings of these experiments were not understood [4, 5]. They are: 1) the weight reduction of a charged metal ball done by Tsipenyuk and Andreev [7]; 2) The weight reduction of charged capacitor done by scientists from several countries, including the US, Japan, China, etc. [5]; 3) The weight reduction of heated-up metals done by scientists in Russia and China [3, 4]. Note that the weight reduction of a charged capacitor is proportional to the square of the electric potential [5]. Overlooking the repulsive gravitation led to the failure to show the necessary unification of gravitation and electromagnetism.

Moreover, these experiments can be difficult to understand in a four-dimensional theory, and thus they were either not recognized as due to repulsive gravitation or incorrectly regarded as experimental errors because many theorists failed to explain them [6]. I found out these in the American Physical Society meeting in April 2015.

Some believed that the weight reduction is due to a reduction of mass [4]. However, the pendulum made of charged capacitors or heated-up metals would show

Author: Applied and Pure Research Institute, 15 Walnut Hill Rd., Amherst, NH 03031. e-mail: c_y_lo@yahoo.com

also the extension of period and this also means a reduction of gravitation, because the related mass has not been changed [8].

A common error of Einstein and his followers is that they failed to see the simple fact that the formula $E = mc^2$ is inconsistent with the Einstein equation, $R_{\mu\nu} - (1/2)\, g_{\mu\nu}R = -KT_{\mu\nu}$, where $R_{\mu\nu}$ is the Ricci tensor, $R = R_{\alpha\beta}g^{\alpha\beta} = K\, T_{\alpha\beta}g^{\alpha\beta}$, $g_{\mu\nu}$ is the space-time metric, and $T_{\mu\nu}$ is the sum of energy-momentum tensors. Because the electromagnetic energy-momentum tensor is traceless, the electromagnetic energy cannot affect the Ricci curvature R, but the mass can. Thus, mass and the electromagnetic energy cannot be equivalent if the static Einstein equation is valid.

This error is related to Einstein's inadequate notion of photon which is only a quantization of electromagnetic energy [9]. From this basic error, many subsequent mistakes are derived.

II. The Inappropriate Award of 2016 APS Medal for Exceptional Achievements

For instance, the 2016 APS Medal for exceptional achievement in research was inappropriately awarded to Edward Witten of the Institute for Advanced Study. [2)] The APS President Samuel Aronson even claimed "Witten's achievements in mathematical physics have had profound effects on many areas of active research. This award sets a very high standard for the prestigious new prize." However, in the 2016 APS award, there is no mention of experimental supports for Witten's achievements. Clearly, this "very high standard" has no experimental basis [10]. Thus, this award is against the standard established by Galileo that such an achievement must be supported by experiments.

Note that Witten [11] adapted Yau's erroneous view [12, 13] based on the false assumption on the existence of bounded dynamic solution for the Einstein equation, and "proved" another version of the misleading theorem on energy. However, because of the mathematicians in charge of the Fields Medal did not understand physics [13], Yau and Witten were awarded the Fields Medal in 1982 and 1990. [3)] Consequently, their misleading theorem prevents the progress of general relativity for at least 13 years until 1995 [14] when the non-existence of dynamic solution for Einstein equation is proven [15, 16]. [4)] Note that their theorem and the space-time singularity theorems of Hawking and Penrose have the same implicit assumption that are based on the invalid speculation of $E = mc^2$ [17].

The fact is that due to inadequacy in pure mathematics, Witten does not understand Einstein's equivalence principle (see Appendix A), and agrees with the misinterpretation of Wheeler [18, 19]. Witten also incorrectly believed that linearization of the Einstein equation always produces an approximate solution for the Einstein equation. However, for the dynamic case, the Einstein equation and its "linearization" actually are independent equations [20]. In addition, the invalid dynamic Einstein equation was derived again from the current string theory.

In short, the physicists made errors because they do not understand mathematics, and on the other hand the mathematicians proved misleading theorems because they do not understand physics. These combinations of errors of mathematicians and physicists reinforced each other, and formed part of the basis of general relativity [6]. [5)]

III. The Repulsive Gravitation and Invalidity of $E = MC^2$

The discovery of the repulsive gravitation is due to the need to investigate $E = mc^2$ for the electromagnetic energy. In fact, the theoretical existence of the repulsive

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8. C. Y. Lo, Could Galileo Be Wrong?, Phys. Essays, **24** (4), 477-482 (2011).

gravitation actually comes from a solution of the static Einstein equation for a particle Q with charge q and mass M, the Reissner-Nordstrom metric [18] as follows:

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

(with 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 [21]) from the particle center. In metric (1), the gravitational components generated by electricity have not only a very different radial coordinate dependence but also a different sign.

However, owing to the belief that the electric energy had a mass equivalence, theorists including Nobel Laureate t' Hooft [22], consider incorrectly that the mass M would include the electric energy, i.e.

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

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. [6] Thus, in the net effect, there would be no repulsive gravitation since

$$\frac{1}{2}\frac{\partial}{\partial r}\left(1 - \frac{2M}{r} + \frac{q^2}{r^2}\right) = (M - \frac{q^2}{r})\frac{1}{r^2} = \left(m(r_0) + q^2(\frac{1}{r_0} - \frac{1}{r})\right)\frac{1}{r^2} > 0. \quad (3)$$

Nevertheless, Tsipenyuk & Andreev [7] observed a weight reduction of a charged metal ball. [7] Thus, the existence of repulsive gravitation is confirmed by experiments. This mistake in eq. (2) [2] is that the effect of the electric energy has been incorrectly counted twice in the Reissner-Nordstrom metric.

The crucial point is, as shown in metric (1), that the charge would create a 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 [5].

The data of a charged capacitor shows that the repulsive gravitational force is proportional to V^2, where V the electric potential difference of the capacitor [5] (Q = VC, where Q is the charge, and C is the capacity). Also, the capacitor lifter would hover on earth [23, 24] shows that the repulsive force must diminish faster than $1/r^2$. [8] Moreover, the time delay of weight recovery for a discharged capacitor shows that the heat would also reduce gravitation [3].

IV. 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 [25]. It is also necessary to have the current-mass interaction to cancel out the charge-mass interaction. After a capacitor is charged, the only changes are that the motion of some electrons has become static. Thus, the attractive current-mass interaction is necessary to explain such a weight reduction [24].

Moreover, the existence of such a current-mass attractive force has been verified by Martin Tajmar and Clovis de Matos [26]. 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. This interaction would generate a force perpendicular to the current, and such interaction could be identified as the cause for the anomaly of flybys.

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21. C. Y. Lo, Chinese J. of Phys., 41 (4), 233-343 (August 2003).

However, we are not yet ready to derive this current-mass force explicitly. This 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 [27]. This general force is related to the static charge-mass repulsive force similar to the Lorentz force is related to the Coulomb force (see Appendix B).

Nevertheless, we may assume [24] that the force on a charged capacitor is the interaction of net macroscopic charges with the mass. This current-mass interaction also explains the phenomenon that it takes time for a discharged capacitor to recover its weight. A discharged capacitor needs time to dissipate the heat that the motion of its charges would recover to normal. This was observed by Liu because his rolled-up capacitors keep heat better [5].

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. [9] 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 [3] instead of increased weight as Einstein predicted [28].

V. The Torsion Balance Scale and Measurement of Repulsive Gravitation

Thus, measuring the temperature dependence of gravitation would show the existence of repulsive gravitation. Therefore, the experiment used the torsion balance scale to measure gravitation of metal balls provides, by far, the simplest verification of the repulsive gravitation without other complications such as the electric forces. The Torsion Balance Scale consists of four balls. The smaller two balls m are connected with a T bar shown in Figure 1. The T bar is attached with a mirror and hangs on a string which provides the torsion. The two large balls M are fixed and the centers of the balls are in the same plane. The torsion force is observed by a laser bean light spot. The relative distances among the balls are shown in Figure 2.

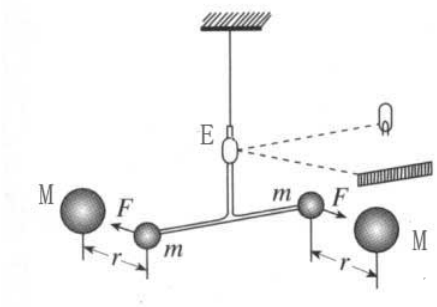

Figure 1: The torsion balance scale

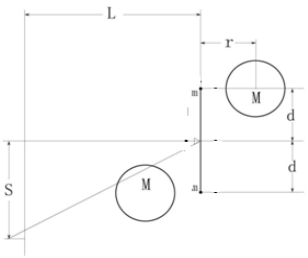

Figure 2: Details of the distances

1. The small brass ball has a mass m = 0.575kg and the large lead ball has a mass M = 1.5kg.
2. The two brass balls are connected with a bar of 2d = 0.40 meter, and suspended from the middle in a horizon orientation by a fine wire ("torsion balance") as shown in Fig. 1 and Fig. 2.
3. A mirror E is attached to the bar to reflect a light beam shined in the mirror.
4. A white board is placed at distance L = 10.3 meter from the mirror as shown in Figure 2.

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28. A. Einstein, 'E = mc²' (Science Illustrated 1946) in *Ideas and Opinions* (Crown, New York, 1954).

5. A light spot is shown in the board at a distance S from the middle (the moving distance of the light spot).
6. The distance between the center of the brass ball and the lead ball is r as shown in Figure 2.
7. The natural period of the torsion balance is T, which depends on the string.

Then, according to Newtonian law, the gravitational force is $F = \pi^2 mdS/T^2L$.[10] Thus, the torsion balance can be very sensitive since the sensitivity will increase with the distance L. At room temperature, the experiment shows that the gravitation decreases as the temperature of the balls increases, but gravitation increases as the temperature reduces. Thus, the existence of repulsive gravitation is clear. However, a short coming of this experiment is that since such a dependence on temperature was not clear, one might over-look the current - mass interaction.

I saw this experiment in a vacuum can in China in 2015 [29] and decided to design a similar experiment without the vacuum can. The experiments done in cooperation with Austin Napier [30] are also successful in showing the existence of repulsive gravitation. Thus, Einstein is clearly wrong in rejecting repulsive gravitation.

VI. The Question of the Photons and the Gravitational Waves

One may argue the equivalent between electromagnetic energy and mass with that the experiment shows that the pi-meson π_0 decays into two photons. However, this only means that the photons include the gravitational wave energy as general relativity requires [31, 32], i.e., the Einstein equation is modified into

$$G_{\mu\nu} \equiv R_{\mu\nu} - (1/2)\, g_{\mu\nu}R = - K[T(E)_{\mu\nu} - T(p)_{\mu\nu}], \qquad (4)$$

where $T(E)_{ab}$ and $T(P)_{ab}$ are the energy-stress tensors for the electromagnetic wave and the related photons. Thus, we have that the photonic energy includes the energy from its gravitational wave component.

However, Einstein [33] believed incorrectly that for this case a valid solution could be obtained by the Einstein equation although he has never tried to obtain the gravity generated by an electromagnetic wave. Because such gravitation is very weak in physics, many journals such as the Chinese Physics B [11] claimed that it could be obtained by perturbation. This is due to an inability to distinct the difference between mathematics and physics. Mathematically, a necessary condition for the application of a perturbation approach is the existence of a bounded solution. However, the evidence is the contrary [31, 32]. Thus, clearly Einstein does not fully understand general relativity.

Then, I proved in 1995 [15, 16] that, if the coupling constants of the Einstein equation have the same sign, the Einstein equation would have no dynamic solution as Gullstrand, Chairman (1922-1929) of the Nobel Committee for Physics suspected [34]. Thus, the space-time singularity theorems of Hawking and Penrose are irrelevant to physics because their assumptions are invalid in physics [17].

It turns out also the claim of Christodoulou and Klainerman [35] on their construction of dynamic solutions is also due to elementary mathematical errors [36] that they overlooked the need to prove the set of dynamic solutions is non-empty. Although Christodoulou got his Ph. D. degree from Princeton University, it should be noted that his thesis adviser is J. A. Wheeler, who has been known to make crucial mathematical errors at the undergraduate level [19] in their well-known book "Gravitation". [12]

To have a dynamic solution, it is necessary to add an additional gravitational energy-stress tensor $t(g)_{\mu\nu}$ with an anti-gravitational coupling to the Einstein equation [16], i.e.,

Ref

30. A. Napier and C. Y. Lo, Measurements of the temperature dependence of gravitation, to be published.

$$G_{\mu\nu} \equiv R_{\mu\nu} - \tfrac{1}{2} g_{\mu\nu} R = - K[T_{\mu\nu} - t(g)_{\mu\nu}], \qquad (5)$$

which is the Lorentz-Levi-Einstein equation because it was first proposed by Lorentz [37] and later by Levi-Civita [38]. It is eq. (5), but not the Einstein equation, $R_{\mu\nu} - (1/2)\ g_{\mu\nu} R = - KT_{\mu\nu}$, that is consistent with the linearized equation for the massive case [20]. [13] However, Einstein [39] objected to eq. (5) on the ground that $t(g)_{\mu\nu}$ is zero in his equation. Einstein was wrong since his equation is proven invalid for the dynamic case. A remaining problem is that the exact form of $t(g)_{\mu\nu}$ is still not known [6].

For the non-existence of dynamic solutions, Professor P. Morrison of MIT went to Princeton University to ask Professor J. A. Taylor, a Nobel Laureate for his work on gravitational radiation, about the justification of their calculation on gravitational radiation. However, Taylor failed to give a justification. Therefore, Morrison advised me to write a book on this, but I believe that this problem should not be addressed alone then [40]. Now, clearly Einstein's theory has at least three serious mistakes that failed his unification [6].

VII. The Unification of Gravitation and Electromagnetism

Note that currently many theorists believed Einstein's conjecture of unification of gravitation and electromagnetism is not valid because they also failed to show this. The reason is that Einstein and his followers do not understand that the unification requires new interactions as Maxwell demonstrated. Moreover, due to not understanding non-linear mathematics, they have accumulated errors in mathematics and physics [40, 41]. In particular, the string theorists such as Witten have further confirmed errors in general relativity since the invalid dynamic equation was derived again [14]. The charge-mass interaction, however, provides a necessary new interaction for this unification.

a) The Charge-Mass Repulsive Force and Unification

The existence of the repulsive gravitation in the Reissner-Nordstrom metric makes clear that general relativity is incomplete. To show the static repulsive effect of a charged particle, one needs to consider only g_{tt} in metric (1).
According to Einstein [42], the equation of motion is

$$\frac{d^2x^\mu}{ds^2} + \Gamma^\mu{}_{\alpha\beta} \frac{dx^\mu}{ds} \frac{dx^\nu}{ds} = 0, \qquad \text{where} \qquad \Gamma^\mu{}_{\alpha\beta} = (\partial_\alpha g_{\nu\beta} + \partial_\beta g_{\nu\alpha} - \partial_\nu g_{\alpha\beta}) g^{\mu\nu}/2 \qquad (6)$$

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

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 $g_{t\ t}$ [43].) For a test particle P with mass m at $\mathbf{r}$, the force on P is

$$(-m\frac{M}{r^2} + m\frac{q^2}{r^3})\,\hat{r} \qquad \text{where } \hat{r} \text{ is a unit vector} \qquad (7)$$

in the first order approximation because $g^{r\ r} \cong -1$. 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

$$(m\frac{M}{r^2} - m\frac{q^2}{r^3})\,\hat{r}, \qquad \text{where } \hat{r} \text{ is a unit vector,} \qquad (8)$$

Ref
38. T. Levi-Civita, R. C. Accad Lincei (5), vol. 26, p. 381 (1917).

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 (8) to particle Q is beyond current theoretical framework of gravitation + electromagnetism. As predicted by Lo, Goldstein, & Napier [27], 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 [24].

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.

b) Extension of Einstein's Equivalence Principle and the Five-Dimensional Relativity

If we consider the need for coupling with q^2, this naturally leads to a five-dimensional space [27]. To maintain the theory, i.e., reproducing the Einstein equation and the Maxwell equation, Kaluza [44] proposed his cylindrical condition to reduce the five variables to four. Subsequently, Einstein and Pauli [45] 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 [27].

In the theory of Lo et al. [27], 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. Currently, the meaning of the fifth dimension is given by the equation,

$$dx^5/d\tau = q/Mc^2\kappa \tag{9a}$$

where M and q are respectively the mass and charge of a test particle, and κ is a constant.

For a static case, we have the forces on the charged particle Q in the ρ-direction

$$-\frac{mM}{\rho^2} \approx \frac{Mc^2}{2}\frac{\partial g_{tt}}{\partial \rho}\frac{dct}{d\tau}\frac{dct}{d\tau}g^{\rho\rho}, \qquad \text{and} \qquad \frac{mq^2}{\rho^3} \approx -\Gamma_{\rho,55}\frac{1}{\kappa^2}\frac{q^2}{Mc^2}g^{\rho\rho} \tag{9b}$$

and

$$\Gamma_{k,55}\frac{q}{\kappa Mc^2}\frac{dx^k}{d\tau} = 0, \qquad \text{where} \qquad \Gamma_{k,55} \equiv \frac{\partial g_{k5}}{\partial x^5} - \frac{1}{2}\frac{\partial g_{55}}{\partial x^k} = -\frac{1}{2}\frac{\partial g_{55}}{\partial x^k} \tag{9c}$$

in the $(-r)$-direction. The meaning of (9c) is the energy momentum conservation. It is interesting that the same force would come from a different type of metric element depending on the test particle used. Thus,

45. A. Einstein & W. Pauli, Ann. Math. **44**, 133 (1943).

$$g_{tt} = 1 - \frac{2m}{\rho c^2}, \qquad \text{and} \qquad g_{55} = \frac{mMc^2}{\rho^2}\kappa^2 + \text{constant}。 \tag{10}$$

In other words, g_{55} is a repulsive potential. Because g_{55} depends on M, it is a function of local property, and this is different from the metric element $g_{t\,t}$ that depends on a distant source of mass m.

That the repulsive gravitational potential can be generated from a mass, would explain the fact that a charged capacitor can also have the repulsive force [24], 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 are so involved in current theoretical considerations that they seem to forget that physics is based on experiments. Thus, Einstein's status as a leading theorist is enhanced because unification is proven necessary.

VIII. Repulsive Gravitation and Astrophysics

Einstein's theory was questioned because of the pioneer anomaly discovered by NASA. [14] This discovery of the Pioneer anomaly gives strong supports to the $1/r^3$ factor in eq. (19).

The charge-mass interaction is a long-range one, and thus should have some consequences in astrophysics. An example would be the Space-Probe Pioneer Anomaly [46]. Based on the charge-mass repulsive force, it is conjectured that the anomaly would be due to an effective charge-mass repulsive force from the sun,

$$F_{ps} = \frac{P_s m_p}{R^3}, \tag{11}$$

where P_s is a parameter due to the sun, m_p is the mass of the Space-Probe, and R is the distance from the sun.

However, the charge term is not clear since for the sun we do not know what should correspond to the term q^2. Nevertheless, since such forces act essentially in the same direction, we could use a parameter P_s to represent the collective effect of the charges. The neutral sun has many locally charged particles, and thus P_s is not negligible. If the data fits well with an appropriate parameter P_s, then this is another confirmation of the charge-mass interaction.

Since this force is much smaller than the gravitational force from the sun, in practice the existence of such a repulsive force would result in a very slightly smaller mass M_s for the sun, i.e.

$$F = \frac{M_s m_p}{R^2} - \frac{P_s m_p}{R^3} \tag{12a}$$

and

$$\frac{M_s m_p}{{R_0}^2} - \frac{P_s m_p}{{R_0}^3} = \frac{M_{ss} m_p}{R_0^2} \tag{12b}$$

for R_0, which is the distance of the earth from the sun. Then, we have

$$F = \frac{M_{ss} m_p}{R^2} + \frac{P_s m_p}{R^2}\left(\frac{1}{R_0} - \frac{1}{R}\right). \tag{12c}$$

Thus, there is an additional attractive force for $R > R_0$. This explains the unsolved puzzle of more than 15 years. Note that such a force would not be noticeable from a closed orbit since the variation of the distance from the sun is small.

Ref
46. Charles Q. Choi, NASA Baffled by Unexplained Force Acting on Space Probes, SPACE.com, 3 March 2008.

However, for open orbits of the pioneers, there are great variations. When the distance is very large, the repulsive force becomes negligible, and thus an additional attractive force would appear as the anomaly. Such a force would appear as a constant over a not too long distance. Thus, the force (11) satisfies the overall requirements [47]. Currently, the repulsive force (11) F_{ps} is a candidate that would give a qualitative explanation of the data [48, 49]. [15)]

Therefore, there are two forces acting on a planet, one attractive and another repulsive with different strengths and distance dependences. It is possible that these forces would have an effect on the spins of the planets. Another speculation is that such a coupling would supply the energy that heats up planets internally. Current explanations for such heat that causes the explosion of the volcanoes, as being due to radiation decay are not satisfactory since there has been no radioactive material discovered from volcanoes. Thus, a new area for experimental and theoretical development of the charge-mass interaction and higher dimensional unification are opened for physicists to explore. Now, fundamental physics will be more alive again.

IX. Conclusions and Discussions

The bending of light marks the success of general relativity. However, such calculations also lead to discovering problems in general relativity. First, in such calculations, the gravitational effect of an electromagnetic wave is assumed to be negligible. However, there is no bounded solution for such a gravitational effect. Thus, it is necessary to modify the Einstein equation by adding the photonic energy-stress tensor with an anti-gravity coupling [31, 32]. Therefore, the notion of photons is actually a consequence of general relativity. This also solves a problem that the energy of photons can be equivalent to mass [42] although the electromagnetic energy cannot [2].

Moreover, this also means that the implicit assumption of Hawking and Penrose [50] on the unique sign for all the coupling constants is invalid. Since the unique sign was thought to be implied by $E = mc^2$, this formula of Einstein is now questionable. In fact, there are three types of experiments that shows $E = mc^2$ is not valid [3-5]. In particular the electromagnetic energy is not equivalent to mass [31, 32]. Theoretically, $E = mc^2$ is inconsistent with the Einstein equation [6]. Thus, the gravity generated by the electromagnetic energy should be different.

According to calculations of the bending of light, adaptation of the notion of distance in Riemannian is inconsistent [21], but a Euclidean-like theoretical framework is necessary. Thus, regarding the Hubble's redshifts as due to the receding velocities of the stars would be invalid [51], and then there is inadequate evidence for the expanding universe. Second, there is a need to add the gravitational radiation reaction force, which is absent from the geodesic equation [6], and thus gravity is clearly not just the Riemannian geometry.

Moreover, the charge-mass interaction (the fifth force [16)]) 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 [27]. 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. [9)] 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 [27], Einstein's conjecture of unification of electromagnetism and gravitation is

Ref

42. A. Einstein, H. A. Lorentz, H. Minkowski, H. Weyl, *The Principle of Relativity* (Dover, New York, 1923).

proven necessary and valid. Consequently, new phenomena can be explained and long time errors can be identified.

It was a puzzle that a successful theory could be so difficult to understand. Now, we know that a successful theory may still have some errors. For, instance, a problem is Einstein's adaptation of the length measurement in Riemannian geometry. As Whitehead [52] pointed out, "By identifying the potential mass impetus of a kinematics element with a spatio-temporal measurement Einstein, in my opinion, leaves the whole antecedent theory of measurement in confusion, when it is confronted with the actual conditions of our perceptual knowledge." As Einstein pointed out, "Unthinking respect for authority is the greatest enemy of truth."

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 [53] that leads to the theory of black holes is not valid. Moreover, Einstein's covariance principle is invalid as Zhou [54] pointed out. In fact, there are explicit examples that illustrate the covariance principle to be invalid have been found [55], and thus Zhou's view is confirmed. [17)]

Due to inadequacy in mathematics, Einstein failed to see that his equation does not have any dynamic solution [15, 16] as Gullstrand, the Chairman (1922-1929) of the Nobel Prize Committee suspected. It is ironic that Einstein's confidence of his general relativity is based on his calculation result on the remaining perihelion of Mercury [56]. Einstein also did not see that linearization of his equation is invalid for the dynamic case [20]. Due to the general inadequacy of mathematics, physicists not only follow Einstein's errors, but also physicists such as Pauli [57], the Wheeler School, and Eric J. Weinberg, [18)] misinterpreted Einstein's equivalence principle to become impossible [19].

Since many physicists are incompetent in pure mathematics, [2)] D. Christodoulou had received many honors for his errors on general relativity [35, 36]. Moreover, errors in mathematics misled the physics community to the wrong direction. In addition, mathematicians who do not understand physics have made the situation worse. Thus, physicists must improve your mathematics that such errors of self-deception will not happen again.

An example is mathematician Roger Penrose. His inadequacy in physics misled him to believe that all the coupling of energy-momentum tensors must have the same sign. Then his talent in mathematic comes up with the space-time singularity theorems without realizing such an assumption is invalid in physics [17]. Worse, his victory over physicist Lifshitz on mathematical arguments had convinced many to believe that he was correct. Apparently, few realized the crucial fact is that the physical assumptions are invalid [17]. Thus, he has never looked for a dynamic solution, but simply believed the invalid claim of Einstein.

Yau [12] did not realize that the assumption of asymptotically flat implies that the solution is a stable solution such as the Schwarzschild and the Kerr solutions, etc. Therefore, Schoen and Yau actually prove a trivial result that the total mass of a stable solution is positive [13]. Since their misleading theorem is responsible for the false confidence on subsequent errors, the International Mathematics Union should rectify her awards to Yau and Witten [14].

Because of inadequacy in nonlinear mathematics, the top research institutes such as Princeton [18, 19], Harvard [12] and the Royal Society (London) [50] are the main sources of current errors [13, 36]. Moreover, because of the blind faith on Einstein, the mistakes are not discovered for a long time [19, 13, 41]. These lead to invalid

Ref

53. K. S. Thorne, ***Black Holes and Time Warps*** (Norton, New York, 1994).

speculations and misinterpretations on experiments. However, in sciences errors cannot be covered up forever [10]. [19)]

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 [3, 5].

Some physicists [4, 58] have mistaken the weight reduction from the charge-mass interaction as due to a mass reduction. However, this can be clarified by measuring the acceleration [8]. A myth generated by Einstein is that sciences can progress just by some ingenious imaginations without the assistance of experiments. Now, a thorough review in terms of experiments can find out what are invalid and what are needed to be completed. [20)]

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. 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.

Appendix A: Mathematical Foundation of Einstein's Equivalence Principle

Pauli's invalid version [57] has been mistaken as Einstein's equivalence principle although Einstein has made clear it is a misinterpretation [59]. In "Gravitation" [18] of Misner et al, there is no reference to Einstein's equivalence principle. Instead, they misleadingly refer to Einstein's invalid 1911 assumption [60] and Pauli's version [57]. In addition, in their Eq. (40.14) Misner et al. [18] even failed to understand the local time of a particle at free fall.

The mathematical theorems [61] related to Einstein's equivalence principle are as follows:

Theorem 1. Given any point P in any Lorentz manifold (whose metric signature is the same as a Minkowski space) there always exist coordinate systems (x^{μ}) in which $\partial g_{\mu\nu}/\partial x^{\lambda} = 0$ at P.

Theorem 2. Given any time-like geodesic curve Γ there always exists a coordinate system (the so-called Fermi coordinates) (x^{μ}) in which $\partial g_{\mu\nu}/\partial x^{\lambda} = 0$ along Γ.

In these theorems, the local space of a particle is locally constant, but not necessarily Minkowski.

However, after some algebra, a local Minkowski metric exists at any given point and along any time-like geodesic curve Γ. In a uniformly accelerated frame, the local space in a free fall is a Minkowski space according to special relativity. What Einstein added is that such a locally constant metric must be Minkowski. This is the basis of the Einstein-Minkowski condition that Einstein uses to derive the gravitational redshifts [42].

Note that, Pauli's version [57] is a simplified but corrupted version of these theorems as follows:

"For every infinitely small world region (i.e. a world region which is so small that the space- and time-variation of gravity can be neglected in it) there always exists a

8. C. Y. Lo, Could Galileo Be Wrong?, Phys. Essays, **24** (4), 477-482 (2011).

coordinate system K_0 (X_1, X_2, X_3, X_4) in which gravitation has no influence either in the motion of particles or any physical process."

Pauli regards the equivalence principle as merely the existence of locally constant spaces. Moreover, a local Minkowski space at a point does not mean the existence of local Minkowski spaces at a small world region.

An error is that Pauli extended the removal of uniform gravity to the removal of gravity in a small region. This becomes simply incorrect and even impossible in mathematics, but he does not see the difference because of inadequacy in mathematical analysis. He did not recognize that the removal of gravity in a small region, no matter how small, would be very different from a removal of gravity at one point. Apparently, Pauli [57], Witten [21)], the Wheeler School [18], and the British Encyclopedia did not understand the mathematics of the above theorems [61].

Appendix B: Some Remarks on Characteristics of the Current-Mass Interaction

The current-mass attractive interaction [19, 5] would be related to the velocity of the charge and sinθ where θ is the angle between a current element and the line joining the fixed mass point and current element. This attractive force is maximum when the angle is 90^0, but zero when the angle is 0^0 or 180^0.

Thus, the current-mass interact would be responsible for the weight changes of magnets. For instance, theoretically the weight of a magnetic rod would be maximum when the magnetic rod (in the direction of N-S) is perpendicular, and its weight would be minimum when the magnetic rod is horizontal. Moreover, the weight of a magnet changes when the angle of the magnet to earth changes. In the horizontal position of a magnet, its weight would be smaller than the weight before this piece of metal is magnetized. Thus, magnetism can increase or reduce weight. These can be checked with experiments.

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Endnotes

1. Einstein failed to prove $E = mc^2$ (1905-1909) [62], but his invalid speculation was spread by the media [28].
2. However, theorists such as Witten cannot see even errors of Wheeler [18] at the undergraduate level [19]. This is due to that most physicists do not have adequate training in pure mathematics.
3. Recently, Yau claimed that he can withstand all the attacks because he is a recipient of the Fields Medal. Thus, it is fortunate for Yau that those mathematicians do not understand general relativity.
4. An indirect proof has been given by Hu, Zhang, & Ding [63] that the radiation depends on the approach used.
5. The 1993 Nobel Committee for Physics even abandoned Einstein's equivalence principle [64].

Ref

18. C. W. Misner, K. S. Thorne, & J. A. Wheeler, ***Gravitation*** (W. H. Freeman, San Francisco, 1973).

6. t' Hooft [22] claimed, in violation of special relativity, that the electron inertial mass includes the electric energy.
7. However, when the charge of a ball is large, the repulsive force is observable [7, 65].
8. Many did not recognize that the observed repulsive force toward mass is related to general relativity [5, 23].
9. The current-mass interaction is also crucial for the unification. This interaction shows also [26] that electromagnetic energy does not necessarily lead to a reduction of weight as some believed [4, 58].
10. This formula is only approximately valid because gravity is temperature dependent.
11. The Chinese Physics B is also inadequate in pure mathematics, and thus failed to maintain the independent tradition of Zhou Pei-Yuan [54] and Hu Ning [63]. Instead, it accepted the invalid views advocated by British Encyclopedia. As Mao [66] pointed out, some Chinese have the tendency of believing more in non-Chinese.
12. For those who cannot argue rationally on scientific issues, what can be expected from them on other issues?
13. Their errors were not discovered because most relativists do not understand mathematics adequately. Moreover, without careful examination, many are very happy to see such a difficulty in general relativity was removed.
14. Einstein, nevertheless, discovered that his Einstein equation does not have a gravitational wave solution although the linearized equation does [67]. However, he did not see the root of his errors is due to his unverified speculation that $E = mc^2$ is generally valid [2]. A major problem of Einstein and his followers is that they do not have adequate background in mathematics [15], and consequently also made errors in physics.
15. Some claimed that there is no anomaly on the space-probe since the anomaly can be explained with a model of heat radiation. However, the discoverer of anomaly pointed out that such a model is so flexible that it can fit almost any situation and thus is not meaningful. Moreover, the question of flybys has not been able to explain.
16. Currently, there are four known forces. They are: 1) the gravitational force, 2) the electromagnetic force, 3) the strong force, and 4) the weak force. Thus, the new charge-mass interaction is called the fifth force [5, 68].
17. On the other hand, C. N. Yang incorrectly claimed that the covariance principle is valid because he misunderstood the notion of gauge invariance as Weinberg [69] pointed out.
18. Eric J. Weinberg, editor of Physical Review D, still does not accept the weight reduction of heat-up metal. Moreover, he considered Einstein's equivalence principle and Pauli's version are the same [16]. Weinberg believed [20] that the linearization would always produce an approximate solution for the Einstein equation. He is unable to understand the charge-mass interaction. He also accepts the unbounded solution because of inadequate understanding the principle of causality [15]. Eric J. Weinberg is probably responsible for erroneous papers published in the Physical Review D, because of his inadequacy in both mathematics and physics.
19. Prof. S. Weinberg taught us that general relativity must be understood in terms of physics. This MIT tradition has a long history, starting from Rosen and Einstein's paper of 1937, followed by Yilmaz, advocated by Weisskopf and Morrison, and so on. We believe that experiments will be properly understood at the end.
20. Although some journals disagree with this paper, they will change their mind after understanding the non-linear mathematics and the related experiments.

Ref

22. G. 't Hooft, "A Confrontation with Infinity", Nobel Lecture, December, 1999.

21. Witten was graduated in history, and his understanding of pure mathematics is at most half-baked. Witten has attended the Economic Dept., Applied Mathematics Dept. and Physics Dept. of Princeton University. However, he did not have any formal training in pure mathematics. Due to inadequacy in pure mathematics like many physicists such as Pauli [57], Witten also does not understand Einstein's equivalence principle, and thus agrees with the misinterpretation of Wheeler [18, 19]. He also does not know that the Einstein equation does not have any dynamic solution [15, 16, 70] because he believed incorrectly that linearization of the Einstein equation always produces an approximate solution for the Einstein equation [20]. Thus, he also failed to see that there is no bounded two-body solution in general relativity [71]. Unfortunately, the errors of Witten were over-looked because the non-linear mathematics are new to physicists and the blind faith on Einstein. To rectify this error, I have written a letter on his errors to the International Mathematics Union that issued the Fields Medal [14]. In my opinion, the award of the 2016 APS Medal for exceptional achievement in research to Witten is a good indication on the incompetence in pure mathematics of APS.

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Notes

爱因斯坦的一個主要错误是拒絶了加里略和牛顿所错过了的反引力。对一個带电粒子,反引力存在於爱因斯坦静态方程导出的度规中。但是爱因斯坦拒绝了反引力，因为他相信無條件的，但不正確的质能互换公式 $E = mc^2$。此外， 由於数学的不足， 爱因斯坦没有看到，光子也具有引力能， 但爱因斯坦方程却没有动力解。而且，偶合常数不能都是同符号。否则，动力性的爱因斯坦方程便会与光子概念产生矛盾， 而且也违反了因果原理。爱因斯坦另一个基本的错误是没有看到爱因斯坦方程和 $E = mc^2$之间的矛盾。现在，实验证明引力具有三种情况: 1) 质量与质量间的吸引力，2) 电荷与质量间的排斥力，3) 电流与质量间的吸引力。因此，引力与电磁力的统一是必要的， 而且这也将在物理学中产生革新。现在物理学上，一个主要的问题是美国物理学会普遍地不懂纯数学。

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