

EINSTEIN'S CONTRIBUTION TO PHYSICS AND HIS ERRORS

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Abstract

In 1905, Einstein published four groundbreaking papers that outlined a theory of photoelectric effects, explained the Brown motion, introduced his special theory of relativity and demonstrated that mass and energy can be equivalent. In 1915, Einstein proposed general relativity. Then, the accurate bending of a light ray was derived. However, Einstein failed to see that the electromagnetic energy is not equivalent to mass. And his derivation on the perihelion of Mercury is not rigorous because the Einstein equation has no bounded dynamic solutions. Although mathematician S. T. Yau and others claimed the existence of dynamic solutions, since this was not true they failed to provide any example to support this claim. Moreover, Einstein falsely demonstrated the curved space with invalid applications of special relativity to measure the circumference of a rotating circle. Also, there is no gravitational wave solution for the Einstein equation. When Einstein was asked about the gravitational wave, his final answer was "I do not know". Einstein claimed that the weight of a piece of metal would increase as its temperature increases. However, experiments show that the weight is

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reduced although there is no loss of energy. If a heated metal is used as a pendulum, its period is lengthened since the gravity is reduced although an electric current can add weight. Thus, *the inert mass and the weight can be different*, and the assumptions for general relativity are not always valid. Einstein failed to distinguish them when the repulsive gravitational force that would make the difference, is not involved. Thus, the proof of Penrose for the existence of black holes is invalid. This shows that a charge not only produces an electromagnetic force but also a repulsive gravitational force. Thus, gravity and electromagnetism are unified. This new force implies also that Galileo's prediction that matter would have the same acceleration in vacuum can fail. Einstein makes the correct assumption that the photons are massless particles, but their energy is not compatible with the energy of an electromagnetic wave. Since a charged particle is always massive, the photonic energy should include also the energy of the gravitational wave. Thus, a modified Einstein equation, with different coupling signs, is obtained for the gravitational wave accompanying the electromagnetic wave. This shows that the unique sign of couplings proposed by Hawking and Penrose for the existence of space-time singularities is incorrect. Also, the gravitation makes the electromagnetic wave energy quantized. Thus, the claim of incompativity between quantum mechanics and general relativity is nonsense. In addition, quantum theory is incomplete since the charge-mass interaction is omitted. It has been verified by Lo as Zhou Pei-Yuan of Peking University pointed out that Einstein's covariance principle is invalid. A new application of the repulsive gravitational theory would be to improve the flying technology.

"Unthinking respect for authority is the greatest enemy of truth."

- A. Einstein

1. Introduction

Einstein is considered as a genius in physics because of his great contributions to physics. However, this does not mean that he made no mistake in physics.

For instance, I failed to find a physicist to do experiments to see whether Einstein had made mistakes. Apparently, the physics community has been deeply misled to believe that Einstein cannot be

wrong in classical physics. Nevertheless, I found experimental evidence that shows Einstein was wrong [1, 2]. This was due to that the experimentalists failed to see that the results are actually against Einstein's theory.⁽¹⁾

The Bible points out that a human being cannot be perfect. The Chinese history also shows this. In fact, we have a smart woman, who has discovered this. Her name is Wu Zetian (武則天), and Zetian (則天) means that she would learn from nature. She is the only one smart enough to see first that a human being cannot be perfect. I also realized this after I found out that Einstein also has many mistakes.

In 1905, Einstein published four groundbreaking papers. These papers outlined a theory of photoelectric effects [3], explained Brown motion [4], introduced his special theory of relativity [5] and demonstrated that the special relativity implies that mass and energy can be equivalent to each other [6]. However, according to the Einstein equation, for the electromagnetic energy E_e , $m = E_e/c^2$ cannot be valid.

In 1915, Einstein proposed a general theory of relativity [7]. For this, the Einstein equation is,

$$G_{ab} = R_{ab} - 1/2 g_{ab}R = -KT_{ab}, \quad K = 8\pi G/c^2, \quad (1.1)$$

where G_{ab} is the Einstein tensor, R_{ab} is the Ricci curvature tensor, g_{ab} is the space-time metric, T_{ab} is a sum of energy-momentum tensors⁽²⁾, $R = R_{ab}g^{ab}$, and G is the Newtonian coupling constant. This extended the system of mechanics to incorporate gravitation. Then, the accurate bending of a light ray was derived.

However, most physicists do not understand pure mathematics, and most mathematicians such as Yau [8] and those from the Fields Medal have been proven also do not understand gravitation well [9]. Thus, theorists often make errors without knowing them.

Einstein was unaware of that this experiment of light bending actually supports his assumption of equivalence of mass and weight only for this case. However, we shall show later that the inert mass is not generally equivalent to weight. Thus, the validity of his assumptions in general relativity is conditional. Einstein's failure to see this leads to his difficulty to deal with other problems in gravity.

2. Some General Errors of Einstein and Modification of the Einstein Equation

Moreover, the physics community even regarded that the Einstein equation and $E = mc^2$ are Einstein's major achievements. Thus, there are monumental buildings for $E = mc^2$ in Beijing, Taipei, Berlin and etc. Note that Einstein proposed $E = mc^2$ in 1912,⁽³⁾ before general relativity was proposed in 1915. However, these two "achievements" are not even consistent with each other for the electromagnetic energy E_e .⁽⁴⁾

Einstein believed that his assumptions are unconditional [7]. Also, since Einstein's predictions are often mixed with errors, people would accept errors as valid physical results. For instance, although Einstein assumes that photons are massless particles, Richard C. Y. Hui and I discovered [10], that he failed to see the photonic energy must include also the related gravitational wave energy. Thus, not only the electromagnetic wave energy E_w is not equivalent to mass, but also not equivalent the energy of the massless particles.

It is crucial to modify the Einstein equation such that an accompanying gravitational wave is obtained [11, 12]. On the other hand, as Infeld [13] pointed out, Einstein's final answer to the question of gravitational wave was "I do not know." Thus, Einstein has never certain the existence of the gravitational wave.

Let us consider the Einstein equation with the electromagnetic wave

energy-momentum tensor $T(w)_{\mu\nu}$,

$$G_{\mu\nu} \equiv R_{\mu\nu} - (1/2)g_{\mu\nu}R = -KT(w)_{\mu\nu}. \quad (2.1)$$

For an electromagnetic “plane wave” Einstein [14] believed that the non-linear Einstein eq. (2.1) with the wave energy-momentum tensor as the source would do. Then, Penrose [15] obtained a solution as follows:

$$ds^2 = dudv + Hdu^2 - dx_idx_i, \quad \text{where} \quad H = h_{ij}(u)x_ix_j,$$

where $u = ct - z$, $v = ct + z$. However, this metric is unbounded, and there are non-physical parameters (the choice of origin) that are unrelated to any physical causes. Moreover, explicit calculation shows that it is also impossible to have a bounded solution for the gravity from this equation. Thus Penrose [15], being primarily a mathematician, overlooked a violation of the principle of causality in physics. Thus, it is clear that the calculation of Penrose on gravitational wave is incorrect and the Einstein equation is questionable.

Experimentally, the photons consist of mostly electromagnetic energy from the photon-electric effects [3]. However, there is no evidence that the photons consist of electromagnetic energy alone. For instance, it would be natural to conjecture that the photons also consist of gravitational wave energy since all the charged particles are massive.

Obviously, the editors of *Annalen der Physik* also do not know that Einstein's assumption of massless particle energy can be derived from the electromagnetism, needs a proof. They also are not aware that the proof of Einstein, as it stands, is inconsistent with Maxwell's electromagnetism.

Moreover, since the energy of an electromagnetic wave E_w and the energy of photons E_p are very different [10], to make them compatible, the addition of another energy E_g is necessary, i.e.,

$$E_p = E_w + E_g. \quad (2.3)$$

Since a charged particle is always massive, E_g should be the gravitational wave energy.

Thus, based on eq. (2.3), we would have an equation as follows:

$$-T(g)_{ab} = T(w)_{ab} - T(p)_{ab}, \quad (2.4)$$

where $T(w)_{ab}$ and $T(p)_{ab}$ are the energy-stress tensors for the electromagnetic wave and the related photons. $T(g)_{ab}$ is the energy-momentum tensor of the gravitational wave.⁽⁵⁾ Then, we have

$$G_{ab} = R_{ab} - (1/2)g_{ab}R = KT(g)_{ab} = -K[T(w)_{ab} - T(p)_{ab}]. \quad (2.5)$$

And an equation for the gravitational wave is obtained in 2006 [16, 17]. Thus, Lo proves that the photons confirm the existence of gravitational waves.⁽⁶⁾ And the existence of the gravitational waves is guaranteed.

Thus, eq. (2.5) is the first shows that the photons and general relativity are intimately related, and the claim of Hawking and Penrose that *quantum theory and general relativity are incompatible is nonsense*.

Note that eq. (2.5) is similar to the modified Einstein equation for massive sources,

$$G_{ab} = R_{ab} - (1/2)g_{ab}R = -K[T(m)_{ab} - T(g)_{ab}], \quad (2.6)$$

which is necessitated by the Hulse-Taylor experiment [16, 17]. Note that $T(g)_{ab}$ has a different coupling sign. The principle of causality requires that $T(g)_{ab}$ is nonzero since a gravitational wave carries energy.

Recently LIGO announced that the gravitational wave has been detected. However, the exact equation that produces the gravitational wave remains to be investigated.⁽⁷⁾ But, we do not have to worry about this since the existence of gravitational wave has already been known in 2006 because of the photons.

Although Einstein's special relativity has no mistakes, Einstein started general relativity with invalid applications of special relativity [5, 7]. Einstein claimed that in a rotating disk, the ratios U/D for the diameter D of a circle and its circumference U is larger than π . Thus, Einstein considered this would mean that the space is curved [5, 7] although this cannot be represented with a picture that the diameter D is in touch with the circumference U . Careful calculation shows, however, that they are the same [18]. This error of Einstein is due to adding up very small pieces of the rotating circumstance measured from different coordinate systems. Thus, Einstein's physical intuition and logic is not always reliable.

General relativity was well-known for its difficulty to understand,⁽⁸⁾ as pointed out by Eddington [19]. In fact, Einstein's error started from the beginning of his general relativity [19]. As pointed out also by A. Gullstrand [20], Einstein's calculation for the perihelion of Mercury is defective since Einstein failed to show that this can be obtained from a perturbation approach.

Einstein's covariance principle is invalid as Prof. Zhou Pei-Yuan [21] of Peking University pointed out in 1983.⁽⁹⁾ However, few were convinced since Einstein proposed the special relativity and no counter example for the covariance principle was provided. In addition, Einstein's view was supported by that very different coordinate systems lead to the same first order approximation for the bending of light. In 2003, even the second order approximation also invariant with respect to different coordinates (different gauges).

Nevertheless Lo [22] has found in 2010 a counter example that the relation between the shortest distance r_0 from the sun and the impact parameter b is gauge dependent. For the isotopic gauge and the harmonic gauge, they are, respectively, $b \sim m + r_0$ and $b \sim 2m + r_0$, where $m = GM/c^2$ and M is the mass of the sun. Also, Zhou's view was

finally supported by H. W. Peng [23] in China.

However, Nobel Laureate C. N. Yang still believed Einstein. Thus, Yang still follows an authority without a reason although he claimed that he had overcome this. Einstein's error has also been shown by the deficiency of his invalid thought experiments approach for later applications [24]. Apparently, Einstein believed incorrectly that all physics has been discovered. This is also why Einstein failed in his unification conjecture. We have learned from electromagnetism, a unification necessary have new physics.

Based on his conjecture of $E = mc^2$, Einstein also predicted incorrectly in 1946 that the weight of a piece of metal would increase as its temperature increases. Thus, the weight reduction experiments of metal lead to the discovery of the repulsive gravitation and Einstein's errors [25]. This is what students of the Pui-Ching Middle School confirmed with experiments on the North Pole.

A strange fact is that neither Princeton University, Harvard University, MIT, Caltech, Cambridge University, nor the Oxford University, and etc., have shown any interest to test the existence of repulsive gravitation even such experiments are simple. Apparently, they believed that this would be impossible according to Einstein since it is against his notion of gravitational mass. The equivalence of gravitational mass and the inert mass is a basic assumption of general relativity [5, 7]. However, Einstein's notion of gravitational mass is not valid when the repulsive gravitation is present [26].

It seems that there are at least two kinds of scientists. The judgments of first class of scientists are based on experiments, whereas the judgments of the second class of scientists are based on the claims of other scientists. The second class of scientists can make mistakes if the claim of previous scientists is incomplete. In MIT, only the 16th President of MIT Susan Hockfield supports my research on the repulsive

gravitation. This would imply that the MIT Physics Department consists of second kind of scientists. This perhaps is a reason why MIT also made mistakes without knowing them.

Another not well-known error of Einstein is his understanding of energy. In fact, the whole physical society failed to notice Einstein's failure in distinguishing two kinds of energies that are not compatible with each other. Although both the energy of an electromagnetic wave and the energy of massless particles are associated with a traceless energy-momentum tensor, the sum of massless energies can become massive [10] while the sum of electromagnetic wave energy cannot. Thus, Einstein also failed to prove the general validity of $m = E/c^2$ since the electromagnetic energy is not equivalent to mass.

Note that about 2,500 years ago the Chinese philosopher Lao Tze predicted that for any force, there must be another force against it such that matter would not be over concentrated. Thus, the Chinese seem to be designated to find the errors of Einstein.

Einstein's mathematics was inadequate for his theory and thus he failed to obtain a Nobel Prize for general relativity. Since he failed to see his mathematical errors, he also failed to see why the Einstein equation has no bounded dynamic solutions. Thus, Einstein never understood why [27] there is no dynamic solution for the Einstein equation, but it does exist for the linearized equation.

Since the mathematics of many physicists was inadequate, naturally Einstein hoped that mathematicians would help. Unfortunately, the positive mass theorem [8] of Schoen and Yau misled physicists to believe that general relativity was perfect because Yau does not understand gravitation. Witten [28] follows also Yau's erroneous step.

In addition, the Fields Medal awarded a prize to Yau in 1981 and to E. Witten in 1990 because their mathematicians also do not understand

gravitation according to Prof. Peter C. Sarnak of the Institute for Advanced Study [25]. In other words, their work was wrongly regarded by the physics community as correct. Thus, almost everybody made mistakes in general relativity for about 40 years!

If one relies on others to obtain the physical condition, one can easily make the same mistake as Yau if one does not use explicit solutions to check the results. In fact, mathematicians such as M. Atiyah⁽¹⁰⁾ and L. D. Faddeev⁽¹¹⁾ had made such errors. In particular, Faddeev's "natural" definition of energy has no valid basis in physics since no bounded dynamic solution has ever been produced. *They are just too eager to believe that Einstein was right.*

The fundamental error of S. T. Yau and the mathematicians of the Fields Medal, like many other theorists, is that they invalidly assumed that dynamic solutions for the Einstein equation exist. However, they were not able to provide a dynamic solution to support their claim. In addition, they do not know that the Einstein equation, due to a violation on the principle of causality, do not have any dynamic solution [29]. Such a paper was published in 2000.⁽¹²⁾

3. The Errors of the Wheeler School and the Princeton University in General Relativity

Moreover, the Wheeler School [30] have claimed and insisted on that the Einstein equation had bounded dynamic solutions but with invalid examples. They even misinterpreted Einstein's equivalent principle as his 1911 incorrect assumption [31] because they suspect that this principle would obstruct the acceptance of their notion of black holes, according to Ohanian and Ruffini [32]. Thus, the Wheeler School are no longer behaving as normal scientists should.

The Wheeler School do not understand the principle of causality. The equation for the Einstein tensor $G_{\mu\nu} = 0$ violates the principle of

causality as demonstrated by the metric of Bondi, Pirani and Robinson [33],

$$ds^2 = e^{2\varphi}(d\tau^2 - d\xi^2) - u^2 \begin{bmatrix} \cosh 2\beta(d\eta^2 + d\zeta^2) \\ + \sinh 2\beta \cos 2\theta(d\eta^2 - d\zeta^2) \\ - 2 \sinh \beta \sin 2\theta d\eta d\zeta \end{bmatrix}, \quad (3.1a)$$

where φ , β and θ are functions of $u = (\tau - \xi)$. It satisfies the differential equation (i.e., their Eq. [2.8]),

$$2\varphi' = u(\beta'^2 + \theta'^2 \sinh^2 2\beta) \quad (3.1b)$$

which is a special case of $G_{\mu\nu} = 0$. The metric is irreducibly unbounded due to the factor u^2 . Linearization does not make sense since u is not bounded.

When gravity is absent, it is necessary to have $\varphi = \sinh 2\beta = \sin 2\theta = 0$. These reduce (3.1a) to

$$ds^2 = (d\tau^2 - d\xi^2) - u^2(d\eta^2 + d\zeta^2). \quad (3.2)$$

This is incompatible to the flat metric. Thus, the principle of causality is violated.

The Wheeler School also do not understand pure mathematics. They believed that the linearization of an equation always produces a valid approximate solution. Thus, they incorrectly choose their typical solution for $G_{\mu\nu} = 0$ in the form of their metric (35.29).

$$ds^2 = c^2 dt^2 - dx^2 - L^2(e^{2\beta} dy^2 + e^{-2\beta} dz^2), \quad (3.3)$$

where $L = L(u)$, $\beta = \beta(u)$, $u = ct - x$, and c is the light speed. However, the principle of causality requires $G_{\mu\nu} \neq 0$ for a gravitational wave to transfer energy. They failed to see this and derived its equation as

$$R_{uu} = -2L^{-1}[L'' + (\beta')^2 L] = 0 \text{ and thus } [L'' + (\beta')^2 L] = 0. \quad (3.4)$$

Physics requires that the gravitational wave energy-momentum tensor cannot be zero. Although this equation violates the principle of causality, the Wheeler School did not check this out.

The Wheeler School even claimed that (35.29) has an approximate solution, their (35.32), obtained with the linearization of the above metric as follows:

$$ds^2 = c^2 dt^2 - dx^2 - (1 + 2\beta)dy^2 - (1 - 2\beta)dz^2. \quad (3.5)$$

They did not derive (3.5) from (3.3), but believed that the linearization of a metric would always produce a valid approximation. However, I have found that metric (3.5) cannot be derived from metric (3.3) [29].

Due to poor mathematics, the Wheeler School also supported the false claims of Christodoulou and Klainerman [34] on their construction of dynamic solutions. A book review on their claims was written by V. Perlick, originally appeared in ZfM [35] in 1996, and republished again in GRG [36]. Thus, the physical society is not completely blind. Moreover, upon close examination, it is found that they have not constructed any dynamic solution at all [37].

Their main problem is, as also pointed out by Perlick, that they are very confusing on the questions of causality and logic [35]. They even regarded an inaccurately phrased definition as a theorem, but a theorem advertised as a self-evident heuristic principle!

Christodoulou and Klainerman [34] claimed the existence of “dynamic” solutions for the vacuum Einstein equation of 1915. However, their so-called “dynamic” solutions are merely constructed from their presumed strong asymptotically flat (S.A.F.) “initial data sets” without showing the physical relevance [37]. They have not shown the existence of a case other than the static solutions. Moreover, they have not related

any of their “dynamic” solutions with dynamic sources. Thus, their claim has not been proven [37].

4. Weight Reduction of Metals as their Temperature Increased

The experiments on weight reduction were not understood since they actually show Einstein is wrong. They are: 1) the weight reduction of a charged metal ball done by Tsipenyuk and Andreev [38]; 2) The weight reduction of charged capacitor done by scientists from countries, including the US, Japan, China, and etc. [1, 39]; 3) The weight reduction of heated-up metals done by the Russian and the Chinese [1, 2].

However, Einstein did not know these developments because he died in 1955. It takes more than 50 years for the physical community to find out that he can be wrong in classical physics. He conjectured the unification of gravitation and electromagnetism, and *he did not know that his assumption for general relativity is inconsistent with the electromagnetism that produces the repulsive gravitational force* [30, 39].

Here we present the experiments done by Dmitriev, Nikushechenko, and Snegov [1] in 2003 that a piece of heated-up brass has reduced weight. A problem of these experiments is that they were misinterpreted as a reduction of mass although no loss of energy is detected. The results can be shown in the following figures.

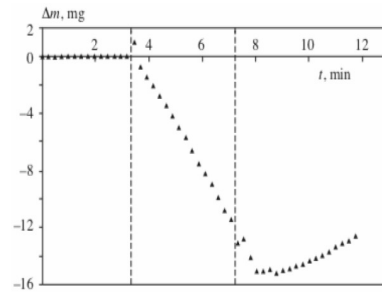


Figure 1. Change in mass of a brass rod mounted in an open holder.

Ultrasound frequency is 131.25 kHz. The dashed lines indicate the moments when the ultrasound was switched on and off.

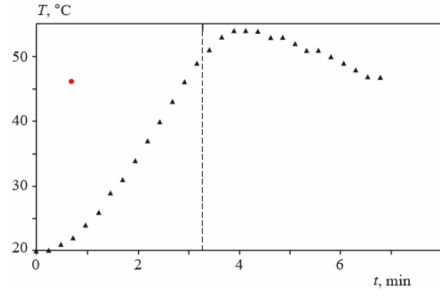


Figure 2. Time dependence of the temperature of a part of the surface of an ultrasonically heated brass rod (open holder). Ultrasound frequency is 131.28 kHz. The dashed line indicates the moment when the ultrasound was switched off.

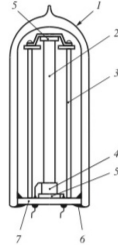


Figure 3. Arrangement of the air tight container: 1) Dewar vessel; 2) metal rod; 3) holder pillar (textolite cloth-based laminate); 4) piezoelectric transducer; 5) foam plastic spacers; 6) cold weld; 7) holder base (ebonite).

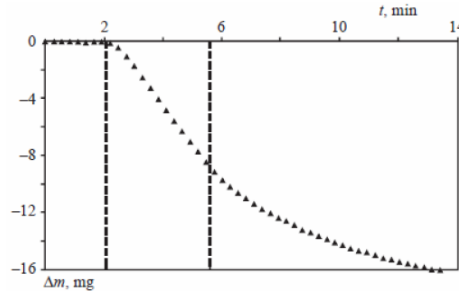


Figure 4. Change in mass of a brass rod mounted in a closed Dewar

vessel. Ultrasound frequency is 131.27 kHz. The dashed lines indicate the moments when the ultrasound was switched on and off.

Figure 1 shows the change of weight for the brass rod mounted in an open holder. Figure 2 shows the time dependence of the temperature of a part of the surface of an ultrasonically heated brass rod (open holder). Figure 3 shows the arrangement in an air-tight container. Figure 4 shows the change of weight for the brass rod in a closed Dewar vessel, which separates the influence of outside heat. The brass rod weighs 58.5 g before heating, with a length of 140.0 mm, and a diameter of 8.0 mm. These figures show that the Dewar vessel is not essential for the weight reduction experiment.

Dmitriev et al. [1] pointed out, “It is well known that the temperature regimes play an important role when weighing with high accuracy. The reasons for temperature influencing the results of measurements are thermal expansion of the bodies, temperature changes in the magnetization of the weighed sample, adsorption of moisture by the surface of the sample (a change in the buoyancy), thermal convection of the air near the surface of the sample, the influence of the heated sample on the balance mechanism (through thermal radiation, heat conduction, or convection). These factors are known in modern measurement technology and their contribution to the results of measuring the mass of samples can be estimated quantitatively.” So, they are confident that their measured result of the reduction of weight is correct.

However, they misinterpreted the reduction of weight as a reduction of mass because there is no repulsive gravitation in Einstein's theory. This implies that the addition of energy leads to a reduction of mass without any rejection of energy. Thus, many believe incorrectly that this is due to an improper operation of experiment. However, it is difficult to regard a continuous reduction of weight during a process of increased temperature as experimental errors. Moreover, the 2010 experimental

results of a set of metals by Fan, Feng and Liu [2] rejected such an idea because as the temperature increases, they obtain also essentially similar results, other reductions of weight.

Moreover, it has been verified by Lo [40] with a torsion balance scale that the lead balls have reduced gravitation after heated-up. However, there is no large loss of energy which would be expected from a loss of mass. H. Y. Woo [41] also has measured heated-up metals, and concludes that the weight reduction does exist.⁽¹³⁾ Thus, the prediction of Einstein on weight increase as temperature increases, is clearly incorrect. Also it is possible the reduction of weight is due to a reduction of gravity, but not mass. We shall show that this is the case of a reduction of gravity due to the existence of the repulsive gravitational force.

5. The Weight Reduction of Metal and the Differences between Mass and Weight

Interestingly, a counter example on the prediction of Einstein is provided by Einstein himself [24]. Based on the unproven speculation $E = mc^2$, Einstein [24] claimed in 1946 that the weight of a metal piece would increase as its temperature increases. Experimentally, however, an increase of temperature for a metal not only did not produce an increase of weight, but on the contrary a measurable reduction of weight [1, 2].

Nevertheless, Einstein did show it with his favorite thought experiment because of technology limitation of his time. Thus, the shortcomings of his thought experiment were exposed later because of incorrect predictions. Thus, Witten's⁽¹⁴⁾ claim that theoretical self-consistent is most important in physics is false. Also, there are other weight reduction due to added energy [42] such as a charged metal ball and a charged capacitor. Thus, $E = mc^2$ has been clearly proven experimentally as not generally valid.

However, since Einstein assumed the inert mass is equivalent to the

gravitational mass [5, 7], in general relativity weight and inert mass are indistinguishable. Nevertheless, Einstein also recognized that since inert mass and gravitational mass are defined very differently they should be distinguishable. Thus, it is a puzzle to Einstein that he was unable to distinguish them.

From $E = mc^2$, we know that a reduction of inert mass would be accompanied with a release of large energy. However, we have measured with a torsion balance scale [40] that a reduction of gravity does not accompany with a release of large energy. Thus, the inert mass and the weight are distinguishable. Moreover, the reduction of weight is due to the existence of repulsive gravitation. Einstein was unable to distinguish them because *the repulsive gravitational force had not been recognized*.

Moreover, we must be able to distinguish mass and gravity with experiments. To prove the existence of such a repulsive force the experiment must involve both mass acceleration and gravitational attraction. For such a purpose, the measurement of the period T of a pendulum would be appropriate. The first approximation of a formula for the period T of a pendulum is as follows [43]:

$$T \approx 2\pi\sqrt{\frac{l}{g}}, \quad (5.1)$$

where l is the length of the pendulum and g is the gravitational acceleration. Thus, the pendulum inert mass change would not change its period T , but if the g changes, the period T of the pendulum will be changed. Thus, a reduction of gravity would have an increase on the period T , but some fail to see this is important.

Hence, a reduction of the mass or gravity can be distinguished by using it as a pendulum. It has been verified by Liu [44] that the mass is essentially the same as Lo [45] predicted since there is no loss of energy, but the period T is extended after heating-up. This is consistent with Lo

[40] who also verified with a torsion balance scale that shows the lead balls have reduced gravitation after being heated-up.

However, Einstein had not aware of a repulsive gravitation. There is no evidence for a loss of energy when the weight is reduced. Since the reduction of gravity is established, the gravitational mass proposed by Einstein [5, 7] is incorrect. *This is due to that the electromagnetism includes also repulsive gravitational force.* Thus, general relativity must be reviewed.

Therefore, based on the invalidly assuming gravity was always attractive, Penrose's 1965 proof [46] for the existence of black holes is invalid. Thus, in 1965 Penrose produced another error in addition of the erroneous gravitational wave equation. Nevertheless, the 2020 Nobel Committee [47] awarded a prize to Penrose because of their knowledge on gravitation was out dated as Einstein did.

6. The Oversight of Einstein on the Repulsive Gravitation and Errors of Nobel Laureate 't Hooft

We have proved that existence of the repulsive gravitational force from experiments but we have not shown how the repulsive gravitational force is generated. We must explain how such a weight reduction would happen and why a charged capacitor or a charged particle would lead to a reduction of weight.

In 1916, a charge-mass repulsive force was derived from the Reissner-Nordstrom metric for a particle with charge q and mass M [30] as follows:

$$ds^2 = \left(1 - \frac{2M}{r} + \frac{q^2}{r^2}\right) dt^2 - \left(1 - \frac{2M}{r} + \frac{q^2}{r^2}\right)^{-1} dr^2 - r^2 d\Omega^2, \quad (6.1)$$

(light speed $c = 1$) where r is the radial distance from the particle center.

In metric (6.1), the gravity components generated by electricity have not only a very different radial coordinate dependence but also a different sign that makes a new repulsive gravitational force [42]. This should be a new contribution.

Thus, $q^2 / 2r^2$ is the *repulsive gravitational potential*. This new force is a big surprise since it means that the charge also additionally provides a repulsive gravitational force. And thus, gravity and electromagnetism are unified. This repulsion implies also that the existence for black holes is questionable because gravity is not always attractive as Penrose incorrectly assumed [46].

However, for a charged particle, the repulsive gravitational force would be very small at a normal distance. This is why Maxwell overlooked the repulsive force. A similar metric can be derived for a charged ball [48]. The changes are that r becomes R the distance from the center of the ball, and q becomes Q the total charge of the ball. Thus, the repulsive gravitational force can be observed.

Now, the existence of repulsive gravitational force is very clear from experiments. It was a puzzle why a charged particle is always massive. Now we start to show some light on this. If a charged particle is not massive, it would not be able to stay with other massive particles. Thus, general relativity has not been fully tested, and supplemental experiments are desired. However, due to the fact that the string theorists cannot explain the repulsive gravitational force, many wrongly take the attitude of ignoring such a subject.

In fact, nothing have been derived from metric (6.1) until 1997 [49] because theorists did not acknowledge the repulsive gravitational force. This is mainly due to that Einstein believed in general validity of $E = mc^2$. Moreover, in 2003 theorists such as Herrera et al. [50] argued that M in metric (6.1) could involve the electric energy. Thus, they

wrongly believed no net repulsive force could be generated.

They considered the mass M would include the electric energy, i.e., $M = m(r_0) + q^2 / r_0$ 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 net effect, there would be no repulsive gravitation since

$$\begin{aligned} \frac{1}{2} \frac{\partial}{\partial r} \left[1 - \frac{2M}{r} + \frac{q^2}{r^2} \right] &= \left(M - \frac{q^2}{r} \right) \frac{1}{r^2} \\ &= \left(m(r_0) + q^2 \left(\frac{1}{r_0} - \frac{1}{r} \right) \right) \frac{1}{r^2} > 0. \end{aligned} \quad (6.2)$$

The attraction would increase as the charge q increased. (What fundamentally wrong is that the electric energy is not equivalent to mass since the electric energy is spread over a large area.) On the other hand, if the M is the inertial mass of the particle, the weight of a charged metal ball would be reduced.

In 2005, Tsipenyuk and Andreev [38] discovered that a charged metal ball becomes lighter in weight, but they did not know why because there is no repulsive gravity in Einstein's theory. However, Lo [39] pointed out that this confirms the existence of repulsive gravitation force Q^2 / r^3 and $E = mc^2$ may not be valid. The charge would create a repulsive gravitational force, is: 1) proportional to the square of the charge Q , and 2) diminished as $1/r^3$. These are supported by Japan, the force from a charged capacitor [51, 52].

Thus, the experiments on two metal balls [38] support the conclusion that the mass M does not include the electric energy since a charged ball has a reduced weight and the *repulsive gravitational potential* $q^2 / 2r^2$ is confirmed. Moreover, as we shall show later, such a force would lead to

the necessity to extend the theoretical framework of general relativity.

Nevertheless, Nobel Laureate 't Hooft [53] has mistakenly assumed that $m = E/c^2$ was universally true due to misunderstanding of Newtonian mechanics and special relativity. Note that if the mass of an electron includes all the electronic energy of an electron, then the Newton's law, $F = m_e a$ (F is the force acting on the electron, m_e is the mass of the electron, and a is the acceleration of the electron) would not be valid.

Moreover, since Nobel Laureate F. Wilczek [54] used $E = mc^2$ for the asymptotic freedom without any justification, his proof is still incomplete. For this, I have asked Prof. Wilczek and he agrees that $E = mc^2$ may not always be valid. Thus, Wilczek has a far better understanding of physics than 't Hooft. However, a basic error of the most theorists is that they invalidly assumed the existence of dynamic solutions for the Einstein equation.

7. The Weight Reduction of a Charged Capacitor, and Errors of Galileo on Gravitation

Moreover, experiments show, a capacitor after being charged with a high voltage (about 40 kilovolts), without a continuous supply of electric energy, the lifter (a capacitor) is able to lift its own weight plus a payload hovering over Earth. Also, a lifter could work by charging the wire to either a positive or a negative potential. It has been determined that the lift is not due to ion wind effects [55, 56]. Thus, the lift is generated by changing something inside the lifter with a high voltage.

In a charged capacitor, the only change is the state of motion of some electrons that have become statically concentrated instead of moving in orbits. Since such a repulsive force did not appear before, it is clear that such a force was canceled out by the force created by the motion of the

electrons. Thus, the repulsive force generated by the charges of protons and the electrons was canceled out by the force generated by moving electrons. This attractive new current-mass interaction will be discussed later.

This repulsive force, however, cannot be proportional to the charge density. The equal numbers of negatively charged electrons and positively charged protons with equal charge would lead to the cancellation of the forces so generated. However, if such a force is proportional to the charge density square, these two kinds of forces would be added together instead of canceled out. Moreover, since the lifter has a limited height, one should expect that this repulsive gravitational force would diminish faster.

If the force is proportional to mass, the static charge-mass interaction would be a repulsive force between particles with charge density D_q and another particle of mass m would have the following form,

$$F_r \approx KmD_q^2/r^n \text{ where } n > 2, \quad (7.1)$$

r is the distance between the two particles, and K is the coupling constant. In formula (7.1) the coupling constant K and n the power of r can be determined by experiments. The simplest case would be $n = 3$. The results are that the charged capacitors have reduced weight. If the lift force is large enough, it will hover over the Earth [55, 56] since the repulsive gravitation force reduces faster.

The experiment data of Japanese T. Musha [51, 52] for the charged capacitor show that the repulsive gravitational force would be proportional to the potential square, V^2 where V is the electric potential difference of the capacitor ($Q = CV$, C is the capacitance and Q is the charge). Thus, the charge density square in heuristic eq. (7.1) is correct. Moreover, the lifter's hovering shows that the repulsive force would diminish faster than the gravity. However, even if the $1/r^3$ factor in the

repulsive force is verified, the calculation still depends on detailed modeling [57].

The weight reduction effect for charged capacitors is not directional, because the directional effects have been averaged out. Also, it stays the same if the electric potential is stable. This has been verified by Liu [44] with the rolled-up capacitors.

It was reported by a British reporter that some Buddhist monks can hover on earth. This was considered as a nonsense in the past because it is against Newton's law of gravitation. Now, Newton's observation is clearly incomplete. Their hovering on earth is simply an experimental fact [55, 56]. Thus, the claim of Galileo that all matter falling under gravitation in vacuum would have the same acceleration is incorrect.

8. The Current-Mass Interaction and the Directional Weight of a Magnet

Now, let us discuss the current-mass interaction. According to general relativity, the magnetic energy would lead to an attractive force from a current toward a mass [57]. Due to a charged capacitor having reduced weight, it is necessary to have the attractive current-mass interaction canceled out by the effect of the repulsive charge-mass interaction. This is why a charged capacitor exhibits the repulsive force. This cancellation is also why we can ignore electromagnetism in general relativity. Apparently, Einstein failed to see this.

Such a current-mass attractive force has been discovered by Martin Tajmar and Clovis de Matos [58] of the European Space Agency. Martin et al. found that a spinning ring of superconducting material increases its weight more than expected. According to quantum theory, spinning superconductors should produce a weak magnetic field. Thus, they measured also the attractive current-mass interaction to Earth!

This would generate a force perpendicular to the current. Such a

directional dependence of weight is a new phenomenon that verifies the existence of the current-mass interaction. Since the additional weight from a current-mass interaction is directional, the weight of a magnet would depend on the direction. The difficulty is, however, an accurate electronic scale would be affected by the magnet to be weighted.

To eliminate the influence of the magnet to the electronic scale, we use a long paper tube to raise the scale platform to very high. In our case, a paper tube of two feet long would be sufficient.



We measure each rectangular magnets in 6 positions and our data confirm that the weight of a magnet is indeed directional [59]. Thus, one sees the existence of the current-mass attractive force.

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 from discharging, and the motions of its charges would accordingly recover to the previous state. However, we may also assume that, for a charged capacitor, the resulting force is the interaction of the net macroscopic charges with the mass. Because the atomic electrons are different for different atoms, the weight reduction processes for different metals are also different.

Thus, there are three factors that determine the weight. 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 increases. Hence, a net result is a reduction of weight as its temperature increases [24].

9. The Errors of Penrose and Hawking on Gravitation

A problem in general relativity is that some theorists such as Penrose and Hawking like to speculate opinions without sufficient experimental basis. We shall show that the approach of Hawking and Penrose is wrong. Philosopher Hu Shih once remarked that in sciences, one can have daring assumptions, but one must also be careful in his proof. A problem of Einstein and some physicists is that they often have only the first half. It is hoped that this analysis would stimulate further careful studies on Einstein's theory.

In their well-known spacetime singularity theorems, they have never stated any physical reason for the existence of such spacetime singularities. Also, they have never stated any reason why the couplings have a unique sign. They believe that it is reasonable to assume that all the coupling constants have the same sign, without giving what is being reasonable.

Nevertheless, they have many followers who also believed that general relativity should give strange results due to their ignorance, a surprise seems to be the trade mark of general relativity. But they failed to see that a dynamic solution requires the existence of different signs for coupling constants [12, 17] because the coupling of a gravitational energy requires a different sign.

Unlike mathematics, in which the validity of a reasonable assumption can be rigorously proven, in physics a reasonable assumption can lead to completely wrong results because of some unknown physical reason. It

was conjectured that a “reasonable” assumption of $E = mc^2$ would lead to the increase of weight as the temperature increases [24]. However, experiments show that the result is a reduction of weight [1, 2]. Consequently, the repulsive gravitational force is discovered and the inert mass and weight are different.

E. Witten incorrectly believes that the most important in physics is self-consistent, but not in agreement with experiments. In fact, even Einstein cannot tell the difference between mathematics and physics. Penrose and Hawking did not produce any meaningful verification in physics. They follow the steps of Einstein faithfully because they incorrectly believed that the accurate bending of light would guaranty that general relativity was always correct. Unfortunately, they are wrong. This uncertainty is why an experimental verification is necessary as Galileo advocated.

For example, the singularity theorems lead to the speculation of an expanding universe to interpret Hubble’s law. However, Hubble [60] did not accept such an interpretation because it would be in conflict with the calculation for the bending of light. An alternative interpretation is, as other waves, due to a loss of energy in the long traveling of light [61]. However, such a reasonable theory has not been proposed.

Both quantum theory and relativity are based on the phenomena of light. It is gravity that makes the notion of photons compatible with the electromagnetic wave [11, 12]. Thus, the claim of Hawking and Penrose that quantum mechanics and general relativity are incompatible is completely nonsense. Since Einstein proposed the photons before he conceived general relativity, understandably Einstein failed to include gravitational wave energy in the photons.

The 2020 Nobel Committee for Physics awarded a prize to Penrose for his proof for the existence of black holes. However, Penrose’s proof is based on the invalid assumption that gravity is always attractive [46].

Now, the assumption of Penrose is not just unverifiable, but also wrong. This shows the Nobel Committee for physics is out-dated in their knowledge in gravitation since they cannot accept new physics.

Many incorrectly regard that Hawking and Penrose were great physicists. This is due to the fact that they cannot tell the difference between a theorist, who requires only reasoning in words and a physicist, whose theory requires experimental supports. They are theorists, but not physicists because a physicist must be able to make experimentally confirmed predictions. However, they failed this. In fact, the existence of black holes is based on an invalid assumption that gravity is always attractive, and $E = mc^2$ is not generally valid.

There are some differences between Hawking and Penrose. Penrose is a mathematician as he was trained. Thus, he cannot distinguish physics from mathematics. Hawking's problem is that he had mistaken physics was just the mathematics you can understand. However, although many wrongly regard him as a great physicist, unlike Newton, Hawking has no experimentally confirmed prediction to support his theory.

10. The Necessary Extension to a Five-Dimensional Space

It should be noted that the theory based on the Reissner-Nordstrom Metric is incomplete. It must be extended to a five-dimensional theory.

To see the necessity to extend general relativity, we consider the force on a test particle with mass m ,

$$\frac{d^2x^\mu}{ds^2} + \Gamma^\mu_{\alpha\beta} \frac{dx^\alpha}{ds} \frac{dx^\beta}{ds} = 0, \quad ds^2 = g_{\alpha\beta} dx^\alpha dx^\beta. \quad (10.1)$$

Let us consider only the static case. For a test particle p with mass m at r , the force on p is

$$-m \frac{M}{r^2} + m \frac{q^2}{r^3} \quad (10.2a)$$

in the first-order approximation because of $g^{rr} \approx -1$. Thus, the second term is a repulsive force.

If the particles are at rest, then the force acting on the charged particle P has the same magnitude

$$\left(m \frac{M}{r^2} - m \frac{q^2}{r^3} \right) \hat{r}, \text{ where } \hat{r} \text{ is a unit vector.} \quad (10.2b)$$

Thus, force (10.2b) to particle P is beyond the framework of gravitation + electromagnetism. As predicted by Lo, Goldstein and Napier [62], general relativity would lead to the necessity of its extension.

The repulsive force in metric (10.1) comes from the electric energy. A question would be whether such a charge-mass repulsive force mq^2/r^3 is subjected to electromagnetic screening. This force, being independent of a charge sign, should not be subjected to such screening. This has been verified by experiments. An existence of the repulsive force mq^2/r^3 means that *Maxwell's theory is inadequate*.

Note that this repulsive force can be considered a result of q^2 interacting with a field created by the mass m [62]. Thus, such a field is independent of electromagnetism and is beyond general relativity, and the need for unification is established. To test this, one can measure whether there is such a repulsive force outside a charged capacitor. In other words, general relativity must be extended to a five-dimensional space.

The existence of such a repulsive force has been verified by Japanese weighing charged capacitors since a charged capacitor has been observed to have less weight although the distance dependency cannot be verified

with such experiments [51, 52]. According to Einstein's theory, the capacitor after charging should have become heavier. *Thus, general relativity has not been well understood starting from Einstein.*

11. Einstein's Conjecture of Unification and the Five-dimensional Relativity

In Section 10, the coupling with q^2 leads to a five-dimensional space of Lo et al. [62] since such a coupling does not exist in a four-dimensional theory, the five dimensional theories of Kaluza [63] or Einstein and Pauli [64]. The theory of Lo et al. [62] is a true five-dimensional theory which has five variables. This makes it possible to obtain some additional new results from their extended metric. This theory also has addressed the radiation reaction force in electromagnetism with some success.

Now let us give a brief description of their theory [62]. The five dimensional geodesic of a particle is

$$\begin{aligned} \frac{d}{ds} \left(g_{ik} \frac{dx^k}{ds} \right) &= \frac{1}{2} \frac{\partial g_{kl}}{\partial x^i} \frac{dx^k}{ds} \frac{dx^l}{ds} + \left(\frac{\partial g_{5k}}{\partial x^i} - \frac{\partial g_{5i}}{\partial x^k} \right) \frac{dx^5}{ds} \frac{dx^k}{ds} \\ &\quad - \Gamma_{i,55} \frac{dx^5}{ds} \frac{dx^5}{ds} - g_{i5} \frac{d^2 x^5}{ds^2}, \end{aligned} \quad (11.1a)$$

$$\begin{aligned} \frac{d}{ds} \left(g_{5k} \frac{dx^k}{ds} + \frac{1}{2} g_{55} \frac{dx^5}{ds} \right) &= \Gamma_{k,55} \frac{dx^5}{ds} \frac{dx^k}{ds} - \frac{1}{2} g_{55} \frac{d^2 x^5}{ds^2} \\ &\quad + \frac{1}{2} \frac{\partial g_{kl}}{\partial x^5} \frac{dx^l}{ds} \frac{dx^k}{ds}, \end{aligned} \quad (11.1b)$$

where $ds^2 = g_{\mu\nu} dx^\mu dx^\nu$, $\mu, \nu = 0, 1, 2, 3, 5$ ($d\tau^2 = g_{kl} dx^k dx^l$; $k, l = 0, 1, 2, 3$).

If instead of ds , $d\tau$ is used in (11.1), for a test particle with charge q

and mass M , the force suggests

$$\frac{q}{Mc^2} \left(\frac{\partial A_i}{\partial x^k} - \frac{\partial A_k}{\partial x^i} \right) = \left(\frac{\partial g_{i5}}{\partial x^k} - \frac{\partial g_{k5}}{\partial x^i} \right) \frac{dx^5}{d\tau}. \quad (11.2a)$$

Thus,

$$\frac{dx^5}{d\tau} = \frac{q}{Mc^2} \frac{1}{K}, \quad K \left(\frac{\partial A_i}{\partial x^k} - \frac{\partial A_k}{\partial x^i} \right) = \left(\frac{\partial g_{i5}}{\partial x^k} - \frac{\partial g_{k5}}{\partial x^i} \right) \text{ and } \frac{d^2 x^5}{d\tau^2} = 0 \quad (11.2b)$$

where K is a constant. It thus follows that (11.1) is reduced to

$$\begin{aligned} \frac{d}{d\tau} \left(g_{ik} \frac{dx^k}{d\tau} \right) &= \frac{1}{2} \frac{\partial g_{kl}}{\partial x^i} \frac{dx^k}{d\tau} \frac{dx^l}{d\tau} + \left(\frac{\partial A_k}{\partial x^i} - \frac{\partial A_i}{\partial x^k} \right) \frac{q}{Mc^2} \frac{dx^k}{d\tau} \\ &\quad - \Gamma_{i,55} \left(\frac{q}{Mc^2} \right)^2 \frac{1}{K^2}, \end{aligned} \quad (11.3a)$$

$$\begin{aligned} \frac{d}{d\tau} \left(g_{5k} \frac{dx^k}{d\tau} + \frac{1}{2} g_{55} \frac{q}{KMc^2} \right) &= \Gamma_{k,55} \frac{q}{KMc^2} \frac{dx^k}{d\tau} \\ &\quad + \frac{1}{2} \frac{\partial g_{kl}}{\partial x^5} \frac{dx^l}{d\tau} \frac{dx^k}{d\tau}. \end{aligned} \quad (11.3b)$$

One may ask what is the physical meaning of the fifth dimension. Our position is that the meaning of the fifth dimension is not yet very clear [62] except some physical meaning is given in the equation, $dx^5/d\tau = q/Mc^2 K$ where M and q are, respectively, the mass and charge of a test particle, and K is a constant. We shall denote the fifth axis as the w -axis. Our approach is to find out the full physical meaning of the w -axis as our understanding gets deeper.

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

$$-\frac{mM}{\rho^2} \approx \frac{M}{2} \frac{\partial g_{tt}}{\partial \rho} \frac{dct}{d\tau} \frac{dct}{d\tau}, \quad \frac{mq^2}{\rho^3} \approx -\Gamma_{\rho,55} \frac{1}{K^2} \frac{q^2}{Mc^4} \quad (11.4a)$$

and also

$$\Gamma_{k,55} \frac{q}{KMc^2} \frac{dx^k}{d\tau} = 0, \text{ where } \Gamma_{k,55} \equiv \frac{\partial g_{k5}}{\partial x^5} - \frac{1}{2} \frac{\partial g_{55}}{\partial x^k} = -\frac{1}{2} \frac{\partial g_{55}}{\partial x^k}. \quad (11.4b)$$

The meaning of (11.4b) is the energy momentum conservation.

Thus, from first part of (11.4a), in agreement with the potential generated by m , we have

$$g_{tt} \approx 1 - \frac{2m}{\rho}. \quad (11.5)$$

And since the second part has the q^2 coupling, then we would have the second equation

$$\text{if } g_{55} = \frac{mMc^4}{\rho^2} K^2 + \text{constant (or } \frac{1}{MK^2c^4} g_{55} = \frac{m}{\rho^2} + \text{constant.)} \quad (11.6)$$

In other words, g_{55} is a repulsive potential, and g_{55}/M is also a function of ρ^{-2} and mass m . Because g_{55} is independent of q , this force would penetrate electromagnetic screening. Then, we would have the consistency of the action and reaction forces are opposite to each other.

Thus, general relativity must be extended to accommodate the charge-mass interaction. For this, a five-dimensional relativity is a natural candidate. According to Lo et al. [42, 62], the charge-mass interaction would penetrate a charged capacitor. To verify the five-dimensional theory, one can simply test the repulsive force on a charged capacitor. This has been experimentally confirmed.

However, journals such as the Physical Review D and Proceedings of the Royal Society A, still have not recognized these important new

findings due to their blind faith toward Einstein. A main problem is that many do not know the difference between mathematics and physics, which depends on experiments.

Moreover, although we have established the framework of a five-dimensional theory, we still have a long way to go since the fifth dimension remains to be clarified and details of the five-dimensional theory remain to be clarified. Nevertheless, it is clear that Einstein's dream of unification is valid. A Nobel Prize awarded to Roger Penrose indicates the current "experts" for general relativity are completely incompetent in physics since Penrose used an invalid assumption for his proof and does not understand the principle of causality [15]. Note that this is not the first time the Nobel Committee made mistakes on gravitation [65].

12. Some Remarks on Gravitation

There are attractive and repulsive electromagnetic forces, and there is a strong attractive force among nucleons and also the weak decay force. But, the gravitational force seems always attractive.

The repulsive gravitational is very weak at normal distance. At Newton's time, it is not possible to detect such a weak force. Nevertheless, philosopher Lao Tze predicted that for any force, there must be another force against it. Then, matter would not be over concentrated. Thus, the existence of a repulsive gravitational force would be expected. However, it takes more than 2,500 years to recognize his wisdom.

The repulsive gravitational force was first discovered from the Reissner-Nordstrom Metric, which is a solution of the Einstein equation. However, Einstein and his followers failed to recognize this important discovery because this would be against Einstein's notion of gravitational mass, which actually is a problem in general relativity. The notion of gravitational mass is valid only if the electromagnetism is not fully

involved. This is why Einstein failed to show the unification of gravitation and electromagnetism.

Galileo was the first to study the acceleration under the influence of gravitation. He managed to slow down the acceleration by reducing the decline angle. This helped Newton to formulate his second law of mechanics, $F = ma$, where F is the force, m is the initial mass, and a is the acceleration.

The first big step on the attractive gravitational force F_g is Newton's formula,

$$F_g = G \frac{m_1 m_2}{r^2}, \quad (12.1)$$

where m_1 and m_2 are the masses of particles, r is the distance between them, and G is the Newtonian coupling. In equation (12.1), the inert mass and weight are indistinguishable since the charge-mass repulsive force and the current-mass attractive force are neglected because they cancel each other for most matters.

Einstein also overlooked these two forces. Thus, it is impossible to distinguish the mass and the weight in Einstein's theory. Newton got his inspiration from the sky, the Kepler's third law of planetary motion and his own second law of motion. Unlike Einstein, Newton was a mathematician, who invented calculus. Thus, he was able to derive from Kepler's law to eq. (12.1).

However, Newton still did not understand what makes action at a distance work and why gravitational force has no opposite force. The first question was answered by Einstein with general relativity in which gravity is a field.⁽¹⁵⁾ And the second question is clarified by the discovery of the repulsive gravitational force and thus the force in eq. (12.1) must be extended to include also the weak repulsive force.

Thus, the wisdom of Lao Tze is finally recognized. However, the string theory seems to have reached its end since it cannot accommodate the existence of a repulsive gravitational force.

However, due to the incompetence of the Nobel Committee for Physics, Penrose was still awarded a Nobel Prize even he used an invalid assumption for his proof [46] and also cannot tell the difference between mathematics and physics [15].

In the past, a discovery of a new force inevitably leads to new developments of technology because the detection method has been improved. However, Einstein's general relativity seems to have little direct influence on modern technology because his theory does not provide an improved means for the creation and the detection of phenomena related to gravity although the theory can have useful results. Nevertheless, such a problem will be changed with the discovery of the charge-mass interaction also called the fifth force.

We found the repulsive gravitational force due to the charge of electrons. However, since different atoms have different electrons, we still do not clearly know how the weight reduction is related to different temperature for different atoms. Thus, we still have a long way to find out how weight reduction work.

13. Discussions and Conclusions

The weight reduction experiments of metal, as temperature increases, are important because this shows that Einstein can be definitely wrong and general relativity is far from being perfect. This also makes it possible to show a unification of gravitation and electromagnetism. It should be noted that Einstein failed to show the unification because he assumed incorrectly that the inert mass is always equivalent to the weight.

Since this fifth force is related to the local concentration of charges

Q ; the sensitivity of mass detection can be manipulated with an improved charged-capacitor. Moreover, since this force cannot be screened, it would be a powerful tool for the detection of structures of massive and less massive objects in the industry such as mining. This repulsive gravity has a very different dependence to the distance. Thus, it would be a very useful additional tool for passive detections and also for space traveling.

General relativity is distinct from other theories because everybody, including Einstein made basic mistakes. This is due to assuming that the inert mass is equivalent to the weight is not unconditionally valid. Unlike Newton, Einstein was not a mathematician. Thus, he made mistakes in mathematics without even knowing them. For instance, Einstein was unaware of that his equation has no bounded dynamic solution. However, mathematician D. Hilbert seems to be the only one to notice this. *Moreover, a surprise is that a charge not only generates the electromagnetic force, but also the repulsive gravitational force.*

In addition, Einstein's habit of over relying on his intuitions leads to new errors that prevent further development of gravitation. For instance, he started general relativity with special relativity and the lack of bounded dynamic solutions is due to that the Einstein equation violates the principle of causality. In fact, the space-time singularity theorems reflect that the assumption of unique coupling sign is invalid.

It should be noted that Einstein's error also influence quantum theory. In quantum electrodynamics (QED), we are taught that the photons are due to only electromagnetic energy without any justification. Another problem is duality, we were taught that light can be considered as a wave classically and particles in quantum mechanics. However, relativity tells us that the electromagnetic wave and light are different.

In addition, as shown, most of physicists have inadequate background in pure mathematics. For instance, the Wheeler School [30] that

dominated the Physics department of Princeton University, were incompetent in pure mathematics and new physics. They incorrectly believed that the linearization would always produce an approximate solution and the equation $G_{\mu\nu} = 0$ would produce wave solutions. However, they were not aware of such errors and thus led to more mistakes in general relativity.

Consequently, Christodoulou and Klainerman [34] invalidly claimed they had constructed the dynamic solutions of the Einstein equation although they cannot have any dynamic solution because of the violation of the principle of causality [29]. As a result, they are the few theorists who had received great honor because of their errors in mathematics and physics. It is a surprise that Princeton can survive this error without being well-known.

Also, S. T. Yau gave the content of their erroneous 1981 paper [27] to honor Prof. Chern in 1980 [66]. Yau received the Fields Medal in 1982, as pointed out by Prof. Peter C. Sarnak, due to her mathematicians also do not understand general relativity [25]. However, after Yau knew that their paper was wrong in 1993 [14], he did not correct it since it was not possible to provide an example to support their theorem. The problem is that Yau did not inform others on the fact that he was wrong.

It is strange that Hawking and Penrose made claims without any usual verification were accepted. Their space-time singularity theorems led to the misinterpretation of Hubble's law as the red shift due to the result of an expanding universe [60]. An alternative interpretation of this law is that light, just as other waves, loses energy during its long traveling. However, such a theory has not yet been proposed for light [61].

In short, since all the errors in general relativity are from the top institutes and top theorists, this is why general relativity has no progress until the repulsive gravity is discovered. Obviously, general relativity needs a complete review since Einstein's notion of gravitational mass is

not always valid. This also led to Einstein's failure to prove his conjecture of unification and he left the world without proving this.

Since the time of Newton, we have succeeded to express physical theories into mathematics. This leads to many failed to see the difference between mathematics and theoretical physics. Hawking and Wheeler are good examples of this extreme. Wheeler failed to see the possibility of new physics. Hawking liked to do mathematics, but this alone does not make him a physicist. We should remember that the basic difference is that physics is based on experiments, but mathematics is based on known logic.

To change the situation, we must do more experiments to check the claims. Note that the existence of the repulsive gravitation was obtained through experiments. We can check whether Galileo's claim is right by testing the down fall of a hot metal with feather in a vacuum chamber! We can also check whether any monk can raise and floating above without supports. Although we had doubt on relativity, we did not have simple clear evidence until experiments show weight reduction as temperature increases.

A reason for Dr. Hockfield's support on my work is that she is a scientist and thus believes in experiments. On the other hand theoreticians often have blind faith on authorities without careful considerations. For example, physicist C. N. Yang made mistakes because he blindly believes in Einstein's covariance principle. Mathematician S. T. Yau claimed to have dynamic solutions, but failed to provide an example to support it. Many believe incorrectly that the inert mass is always equivalent to weight.

Roger Penrose was awarded a Nobel Prize raises the question whether the "experts" in general relativity is competent since Penrose cannot tell the differences between mathematics and physics [15, 39]. The British also gave a very high evaluation to Hawking almost equal to

Newton. However, on this the British is wrong again since Hawking has no verifiable predictions and wrongly believed that physics is a question of understanding the mathematics. He also wrongly considered $E = mc^2$ always valid [67].

A surprise is that many theorists, including Einstein, are often unable to tell the difference between mathematics and physics because Einstein also incorrectly believed all physics has been known. Many admire Einstein's physical intuition. However, we have shown that Einstein's physical intuition is not always reliable. Thus, the prevailing unbounded Einstein worship can prevent the progress of physics and therefore this must be changed.

At MIT, Prof. P. Morrison, being a former student of J. R. Oppenheimer, has a clear mind in gravity. Unfortunately, he passed away in 2005. Then the Wheeler School started to invade MIT to dominate gravity since nobody were able to correct them and understand the principle of causality sufficiently to identify whether errors can occur.

An important problem in the development of gravitation theory is to choose a leader. However, A. J. Wheeler was not a good leader for new physics because he treats new physics as if mathematics. He failed to see the important issue in physics is the possibility to discover unknown new physics. Another problem is that the Wheeler group also does not understand pure mathematics, and the principle of causality in physics. Thus, it is clear that the Wheeler School should be responsible for most of the errors in general relativity.

The Wheeler School seem to be a particularly bad example that would show academic errors could be dismissed by academic power. Apparently, this also seems the model that Yau would want to follow. Fortunately, we have shown that academic errors would eventually be discovered although it may be dismissed for a while.

There are two types of errors in general relativity. First type is that,

people made mistakes due to inadequate training in mathematics. For instance, they failed to see there is no dynamic solution for the Einstein equation [29]. The second type is that they forget the differences between mathematics and physics. Thus, general relativity remains to be completed. MIT is often number one because we have outstanding scientists such as Phillip Morrison and Susan Hockfield, who believe in experiments.

In Einstein's theory, light and the electromagnetic wave were the same. However, they are different because the energy of an electromagnetic wave is different from the energy of light. Our new conclusion is that the light is a combination of the electromagnetic wave and the related gravitational wave. Moreover, gravitation is the reason that the electromagnetic wave is quantized.

In Einstein's theory, gravitational force is always attractive. However, we find the new repulsive gravitational force. Since the inert mass is not always equivalent to the weight, Einstein's equivalent principle may not be unconditionally valid. Thus, a complete review of general relativity is necessary.

In China, there was a tradition of accepting foreign authorities as Mao [68] pointed out, and that to criticize a scientific theory with another theory without any base from experiments. Then, unverifiable conclusions were obtained. General relativity is a difficult theory, since nobody including Einstein fully understood it. Without verifications, it is also difficult to consider Hawking and Penrose as physicists.

We have also identified that the Physical Review D and the Proceedings of the Royal Society A are mainly responsible to the spreading of errors of general relativity. We still agree that Einstein was a great physicist. However, obviously he and his general relativity are wrongly over evaluated. In particular, Einstein failed to see that his assumptions in general relativity are only conditionally valid.

We believe that the criticism toward a scientific theory must be based on experiments and valid mathematics such as the repulsive gravitation is obtained. Moreover, the principle of causality would give useful guidance as shown in obtaining the modified Einstein equation for the accompanying gravitational wave. Thus, we can hope to improve sciences, and avoid mistakes like our ancestors to have useful results. A new application of the repulsive gravitational theory would be to improve the flying technology.

Acknowledgments

The author is grateful to Dr. S. Hockfield, the 16th President of MIT, for her support and encouragement. I would like to thank Prof. S. Weinberg, who taught us general relativity at MIT, and Prof. I. Halperin, who taught me mathematics at Queen's University, Canada. Special thanks are to Prof. P. Morrison of MIT for his guidance on gravitation theory, A. Napier of Tufts University for stimulating discussions on repulsive gravitation, and to the Physics Department of Tufts University for their generous assistance in conducting the experiments on the weight reduction of heated-up metals. Above all, I am grateful to Prof. J. E. Hogarth for the scholarship from Queen's University, which enabled me to have a research career in North America. The author is grateful to G. P. Wood for her valuable suggestions and comments. The author is also grateful to the support of Innotec Design Inc., USA, the Chan Foundation, and the Szecheon Co., Hong Kong, China.

Appendix A: The Principle of Causality in Physics

Physics is essentially a science for causality. There are two aspects in causality: its relevance and its time ordering. In time ordering, a cause event must happen before its effects. This is further restricted by relativistic causality that no cause event can propagate faster than the light speed in the vacuum. The time-tested assumption that phenomena

can be explained in terms of identifiable causes will be called the principle of causality. This is the basis of relevance for all scientific investigations.

Causality means causes will lead to consequences. It should be emphasized that the principle assumed:

(1) From the consequences that causes must exist even we do not know what they are.

(2) The partial consequences of the cause are identified even its full consequences remain to be known.

Then, we can use such partial consequences as requirements to decide whether a solution or even an equation is valid in physics. This might provide crucial steps to solve a problem correctly. For instance, this is how the Einstein equation has no bounded dynamic solution is determined. Thus, the consideration of this principle can be the most important step for a successful or a failure in theory.

Thus, this principle implies that any parameter in a solution for physics must be related to some physical causes. Moreover, the principle of causality implies that a weak source would produce a weak gravity. Here this principle will be elucidated first in connection with symmetries of a field, and the boundedness of a field solution. Thus, it can help to determine whether a field equation or its solutions are valid in physics.

This can make a difference between a successful or a failure in theoretical considerations. For instance, the equation for the accompanying gravitational wave of an electromagnetic wave was started from the discovery of Lo and Hui [10] that the energy of massless particles is the sum of the energies of the accompanying gravitational wave and the electromagnetic wave.

In practice, when the considered field is absent, physical properties are ascribed as in a “normal” state. Then, any deviation from the normal

state must have physically identifiable causes. Thus, the principle of causality implies that the symmetry must be preserved if no cause breaks it. The causality to symmetry has been used in deriving the inverse square law from Gauss's law.

Thus, if a metric does not possess a symmetry, then there must be a physical cause(s) which has broken such a symmetry. For a spherically symmetric mass, causality requires that the metric is spherically symmetric and asymptotically flat. Also, a weak cause can lead to only weak gravity.

The principle of causality is important because it would determine a successful or a failure for a theoretical consideration. This is also how the Einstein equation for the electromagnetic wave as a source was modified to obtain the equation for the accompanying gravitational wave [11, 12]. This principle is also overlooked by Einstein. His major failure is that he assumed that all the physical causes are known.

It is Einstein's major error that he assumed the repulsive gravitation does not exist. His assumptions in general relativity are only conditionally valid. His idea of thought experiment was an evidence that he believed incorrectly that all the causes of physics had been known. He also invalidly assumed that the inert mass is always equivalent the weight, This is why he would never succeed in proving his conjecture on the unification of gravitation and electromagnetism.

Thus, it is important to allow the possibility of unknown physical cause. This would mean that experimental verification is necessary. Einstein's notion of thought experiment is clearly misleading. Only if we recognize this, we can claim that we understand the differences between mathematics and physics.

Appendix B: Perlick's Review "The Global Nonlinear Stability of the Minkowski Space"

This book review by Volker Perlick originally appeared in ZfM [35] in 1996; and, with the permission of its Editor, B. Uegner, will be republished in the journal, GRG [36] again with the editorial note, "One may extract two messages: on the one hand, (by seeing, e.g., how often this book has been cited), the result is in fact interesting even today, and on the other hand: There exists, up to now no generally understandable proof of it." Thus, it is clear that the physical society is not completely blind.

However, for the Editorial Board of Classical & Quantum Gravity, their strong faith on this book, in particular their claimed proof on the existence of radiative bounded solutions, remains unchanged although they cannot give a good reason for it. This shows that a blind faith is at work.

The review by Perlick on "Global Nonlinear Stability of the Minkowski Space" is as follows:

"For Einstein's vacuum field equation, it is a difficult task to investigate the existence of solutions with prescribed global properties. A very interesting result on that score is the topic of the book under review. The authors prove the existence of globally hyperbolic, geodesically complete, and asymptotically flat solutions that are close to (but different from) Minkowski space. These solutions are constructed by solving the initial value problem associated with Einstein's vacuum field equation. More precisely, the main theorem of the book says that any initial data, given on R_3 , that are asymptotically flat and sufficiently close to the data for Minkowski space give rise to a solution with the desired properties. In physical terms, these solutions can be interpreted as spacetimes filled with source-free gravitational radiation. Geodesic completeness means that there are no singularities. At first sight, this theorem might appear

intuitively obvious and the enormous amount of work necessary for the proof might come as a surprise. The following two facts, however, should caution everyone against such an attitude. First, it is known that there are nonlinear hyperbolic partial differential equations (e.g., the equation of motion for waves in non-linear elastic media) for which even arbitrarily small localized initial data lead to singularities. Second, all earlier attempts to find geodesically complete and asymptotically flat solutions of Einstein's vacuum equation other than Minkowski space had failed. In the class of spherically symmetric spacetime and in the class of static spacetimes the existence of such solutions is even excluded by classical theorems. These facts indicate that the theorem is, indeed, highly non-trivial. Yet even in the light of these facts it is still amazing that the proof of the theorem fills a book of about 500 pages. To a large part, the methods needed for the proof are rather elementary; abstract methods from functional analysis are used only in so far as a lot of L_2 norms have to be estimated. What makes the proof involved and difficult to follow is that the authors introduce many special mathematical constructions, involving long calculations, without giving a clear idea of how these building-blocks will go together to eventually prove the theorem. The introduction, almost 30 pages long, is of little help in this respect. Whereas giving a good idea of the problems to be faced and of the basic tools necessary to overcome each problem, the introduction sheds no light on the line of thought along which the proof will proceed for mathematical details without seeing the thread of the story. This is exactly what happened to the reviewer."

"To give at least a vague idea of how the desired solutions of Einstein's vacuum equation are constructed, let us mention that each solution comes with the following: (a) a maximal spacelike foliation generalizing the standard foliation into surfaces $t = \text{const.}$ in Minkowski space; (b) a so-called optical function u , i.e., a solution u of the eikonal equation that generalizes the outgoing null function $u = r - t$ on

Minkowski space; (c) a family of “almost conformal killing vector fields on Minkowski space. The construction of these objects and the study of their properties require a lot of technicalities. Another important tool is the study of “Bianchi equations” for “Weyl tensor fields”. By definition, a Weyl tensor field is a fourth rank tensor field that satisfies the algebraic identities of the conformal curvature tensor, and Bianchi equations are generalizations of the differential Bianchi identities.”

“In addition to the difficulties that are in the nature of the matter the reader has to struggle with a lot of unnecessary problems caused by inaccurate formulations and misprints, e.g., “Theorem 1.0.2” is not a theorem but rather an inaccurately phrased definition. The principle of conservation of signature” presented on p. 148 looks like a mathematical theorem that should be proved; instead, it is advertised as an “heuristic principle which is essentially self-evident.” For all these reasons, reading this book is not exactly great fun. Probably only very few readers are willing to struggle through these 500 pages to verify the proof of just one single theorem, however interesting.”

“Before this book appeared in 1993 its content was already circulating in the relativity community in form of a preprint that gained some notoriety for being extremely voluminous and extremely hard to read. Unfortunately, any hope that final version would be easier to digest is now disappointed. Nonetheless, it is to be emphasized that the result presented in this book is very important. Therefore, any one interested in relativity and/or in nonlinear partial differential equations is recommended to read at least the introduction.

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Author’s note. This review actually suggests that problems would be identified in the introduction of the book. Moreover, the possible nonexistence of their dynamic solutions and its incompatibility with the

radiation formula can be discovered in their introduction. He is also too polite to tell the whole truth directly. However, he did not do as shown by Lo [37] in 2000, their construction of “dynamic” solutions actually has been found to be invalid.⁽¹⁶⁾ Christodoulou and Klainerman [34] provided a classical example of how to fool others with invalid mathematics. Now, it is clear why their book is difficult to read. This is simply because their book is wrong. Nevertheless, their book should be kept to remind how Princeton can make big mistakes.

Appendix C: The Torsion Balance Scale and Measurement of Repulsive Gravitation

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.

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 beam light spot. The relative distances among the balls are shown in Figure 2.

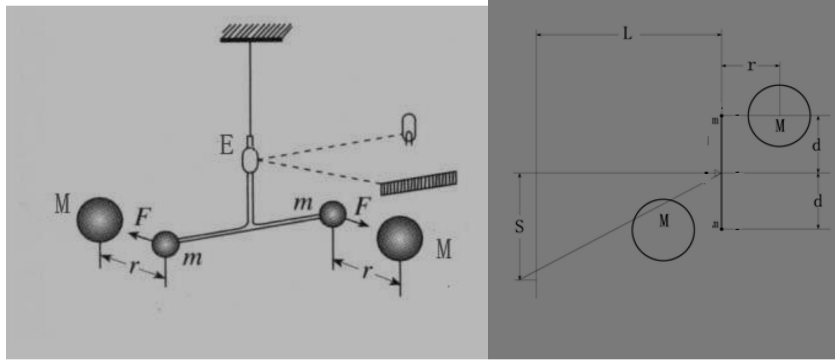


Figure 1. The torsion balance scale. **Figure 2.** Details of the distances.

These figures show:

1. The small brass ball has a mass $m = 0.575$ kg and the large lead ball has a mass $M = 1.5$ g.
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 Figure 1 and Figure 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.
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 the gravitational force is $F = \pi^2 m d S / T^2 L$. Thus, the torsion balance can be very sensitive since the sensitivity will increase with the distance L . However, one might ask how about the influence of the current mass interaction? However, one need not worry about this problem since its influence is negligible. 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. I saw this experiment in China last year and decided to design a similar experiment for the Physics Dept. of the Tufts University. This experiment has the merit of eliminating other undesirable complications.

The experiments done in cooperation with Prof. Austin Napier of Tufts University are also successful in showing the existence of repulsive gravitation. This experiment is clean because it does not have the complication of measuring the weight on earth. Thus, Einstein is clearly wrong in the repulsive gravitation and his notion of gravitational mass is invalid.

Endnotes

(1) They have mistaken that the reduction of weight is due to the loss of mass, instead of a reduction of gravity.

(2) Einstein [7] did not include the gravitational energy-momentum tensor $T_{\mu\nu}$. However, it turns out that for a dynamic solution, this tensor must have a different coupling constant sign.

(3) In 1912, Einstein changed $L = mc^2$ where L is the radiation energy to $E = mc^2$. Thus he changed an incomplete proof to an invalid formula.

(4) According to the Einstein equation, the electromagnetic energy is not equivalent to mass.

(5) On the modified Einstein equation for the gravitational waves;

Since photons travel in the speed of light, there should not be any interaction among them [11]. Thus, the photonic energy tensor $T_{ab}(P)$ should be dust-like with the momentum of the photon P_a as follows:

$$T_{ab}(P) = \rho P_a P_b,$$

where ρ is a scalar and is a function of u . In the units $c = h = 1$, $P_t = \omega$. It has been obtained that

$$\rho(u) = -A_m g^{mn} A_n > 0,$$

where A_m ($m = 0, 1, 2, 3$) are the components of the electromagnetic wave, and $\rho(u)$ is related to gravity through g^{mn} . Since light intensity is proportion to the square of the wave amplitude, ρ can be considered as the density function of photons, Then

$$T_{ab} = -T(g)_{ab} = T(E)_{ab} - T(P)_{ab} = T(E)_{ab} + A_m g^{mn} A_n P_a P_b.$$

Thus, $T_{ab}(P)$ has been derived completely from the electromagnetic wave A_k and g_{ab} .

For an electromagnetic plane wave α of circular polarization, propagating to the z -direction,

$$A_x = \frac{1}{\sqrt{2}} A_0 \cos \omega u, \quad \text{and} \quad A_y = \frac{1}{\sqrt{2}} A_0 \sin \omega u,$$

where $u = ct - z$. The solution is

$$g_{xx} = -1 - C + B_\alpha \cos(\omega_1 u + \alpha), \quad g_{yy} = -1 - C - B_\alpha \cos(\omega_1 u + \alpha),$$

$$\text{and } g_{xy} = \pm B_\alpha \sin(\omega_1 u + \alpha),$$

where $B_\alpha = (K/2)(A_0)^2 \cos \alpha$, C is a constant, and $\omega_1 = 2\omega$.

For a wave linearly polarized in the x -direction,

$$A_x = A_0 \cos \omega(ct - z).$$

Then the solution is

$$g_{xy} = 0, \quad g_{yy} = -1, \quad -g_{xx} = 1 + C_1 - (K/2)A_0^2 \cos[2\omega(ct - z)],$$

$$\text{and } g_{tt} = -g_{zz} = \sqrt{g/g_{xx}},$$

where C_1 is a constant and g is the determinant of the metric g_{ab} . Note that the frequency ratio is the same as that of a circular polarization.

(6) Although Zhou published his paper in 1983, his idea was formed in 1937 when he met Einstein in Caltech. Nevertheless, at his late old age, Zhou also mistaken that the Einstein equation had bounded dynamic solutions [69, 70].

(7) Some theorists claim that based on computer calculation, they have identified the equation that produced the gravitational wave. However, computer calculations are known to be unreliable because the points chosen are generally quite arbitrary although it is fast. The non-existence of gravitational wave solution was first discovered by Einstein and Rosen [71] in 1937. This is further confirmed by Lo in his 2000 paper [29].

(8) I never met Zhou Pei-Yuan personally. I learned Zhou's work through our mutual friend H. Yilmaz with the help from the library of Peking University. Then, I know that I am more than ten years behind.

(9) C. N. Yang, unlike Zhou Pei-Yuan, has never in conflict with the main stream of the theorists alone. This is why he follows Einstein's error, but against the correct view of Zhou Pei-Yuan. Moreover, his interpretation of Yang-Mills theory is not completely valid as pointed out by S. Weinberg [72].

(10) Michael F. Atiyah has been a leader of the Royal Society (1990-1995). However, Prof. Peter C. Sarnak, Chairman of the 2011 Shaw Prize Committee for mathematics found out that Aityah does not understand general relativity [25].

(11) Ludwig D. Faddeev is the Chairman of the Fields Medal Committee. Faddeev failed to see that the so-called natural definition of energy is invalid. Thus, he failed to see that Yau's theory exclude all the two-body problems. Yau failed to provide an example to support their misleading theorem.

(12) The nonexistence of dynamic solution was first obtained by

Einstein and Rosen in 1937 [71]. However, this conclusion was not accepted due conceptual and mathematical errors. The proof for the nonexistence of a bounded dynamic solution was published in 2000 [29] about 20 years later. Thus, there is a conflict between S. T. Yau and Einstein & Rosen [71]; and Yau was wrong. Thus, general relativity is still far from being completed.

(13) Woo did not show that the weight reduction is due to a reduction of gravity. He also had mistaken that the photons had mass but attributed this mistake to Einstein. Fortunately, in my joint paper with Reichard C. Y. Hui [10], we have made clear that Einstein assumes the photons are massless.

(14) This shows that Witten is essentially only a mathematician but not a physicist.

(15) Some regard that gravity is not a force. However, with the discovery of repulsive gravitation, it is difficult to consider that gravity and repulsive gravity are not forces since the repulsive gravity reduces the gravity. Consequently, Einstein's notion of gravitation mass is no longer valid.

(16) In the past, the conflict is between different theories. Now the conflict is between the theory of Einstein and experiments. Thus, it is important to do the experiments of weight reduction.

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Comments on the Chinese Academy of Sciences

The Chinese Academy of Sciences, usually accepts almost all errors from the foreign authorities, but failed to appreciate Chinese authors such as Zhou Pei-Yuan. This deficiency of Chinese scholars was pointed out by Mao [68] in his famous article, "Reform our Studies". However, the Chinese Academy of Sciences seems to still fail on this even until now! For instance, China also accepts the erroneous conclusion of S. T. Yau on Einstein's equation that it has dynamic solutions, but failed to provide an

example. However, it is hoped that the Chinese Academy of Sciences would do better for verifiable problems. I am waiting for the day that this academy would be the first to discover theoretical scientific talents.

Attachment 1: An open letter to MIT President

Dear President Sally Kornbluth:

I read your inaugural address of May 1, 2023. I totally agree with you that curiosity, particularly unbounded curiosity is the key for people to solve problems. In your words, curiosity can give us the hope and courage to do what needs to be done. Moreover, my own research experience also supports your view. It is my curiosity that leads to my discovery of the repulsive gravitation, which started from my curiosity on the question of $E = mc^2$ can be invalid.

In fact, Einstein claimed that he has no special talent, but is intensive curious about things. It is unfortunate that Einstein's curiosity is not unbounded. He failed to ask why gravity was always attractive. Thus, he did not see the existence of repulsive gravitation and $E = mc^2$ is not always correct. Consequently, he also failed to see the non-existence of black holes. Einstein also failed to pursue his curiosity on the question of equivalence between inert mass and gravitational mass although he was aware of their different definitions. It turns out that mass and weight are different if the electric-mass interaction is completely applied. Einstein also failed to recognize this.

I have graduated from the Physics Department of MIT in 1977. However, before I was admitted by MIT, I have already earned a Ph. D. in pure mathematics. The reason is that I know, from my undergraduate studies, that physics students are incompetent in pure mathematics. I have determined to change this.

In my MIT years, I was well-known for doing lengthy calculations

without any mistake. In our field, even Harvard Professor T. T. Wu had made mistakes. I also corrected some errors from physics textbooks. Now you can see why I was able to identify and correct errors in general relativity.

Surprisingly Einstein actually made serious errors, as pointed out by my book draft, without being discovered by the physics community. Currently, the most popular book "Gravitation" is by the Wheeler School. However, these three authors actually do not understand pure mathematics and thus they make errors without knowing them. They just as made as Harvard Prof. S. T. Yau, who based on their erroneous positive mass theorem, misled the physics community to believe that general relativity was perfect.

The Wheeler School seems to be a particularly bad example that would show that academic errors could be dismissed by academic power. Apparently, this also seems to be the model that Yau would want to follow. However, we shall show that academic errors would eventually be discovered although it could be dismissed for a while. In addition, Nobel Laureate C. N. Yang also made a mistake in recognizing Einstein's invalid covariance principle. Thus, the physics of Yang would be questionable. For example, his interpretation of the Yang-Mill theory is only partially valid as S. Weinberg pointed out.

I believe that MIT had been misled to believe that Wheeler, Yau, Yang and Einstein were correct. Such wrong evaluations must be corrected so that physics and sciences can progress.

My curiosity started from questioning whether $E = mc^2$ is always true. The most obvious mistake is that Einstein predicted that a piece of heated-up metal would have increased weight. However, experiments show that they actually have reduced weight. This disagreement between Einstein's theory and experiments is very important because it actually tells that there is something wrong in Einstein's theory. This is why the

high school, Pui-ching in Hong Kong organized a trip to North pole to test whether the weight is increased or decreased. *They said since Harvard and MIT know nothing about this error of Einstein, it is worthwhile to do the same experiment in North Pole.*⁽¹⁾

You may wonder how does a high school Pui-Ching have the accurate electronic scale machine with the accuracy of 10^{-4} gm? I would like to tell you that to encourage Mr. Woo and the students of Pui-Ching to do the experiments, as their alumnus, I have donated two such accurate electronic scale machines to them.

Surprisingly, Einstein also invalidly used special relativity to justify general relativity. Moreover, his covariance principle has been proven wrong by counter examples and this is pointed out first by Zhou Pei-Yuan of Peking University. Also, the electromagnetic energy is not equivalent to mass. Experiments show that a piece of heated-up metal would have reduced weight instead of increasing weight as Einstein predicted and etc. These have been explained clearly in the table of content of my book draft.

Although my research has not been greatly supported by the Physics Department of MIT, I do get strong support from Dr. Susan Hockfield, the 16th president of MIT. I know that you are interested in making MIT a great research institute. I hope that MIT would take my research seriously. In particular, MIT should recognize the existence of repulsive gravitation, which is confirmed by experiments.

Since none of famous schools or institutes has taken any action for the progress of gravitation, it seems this is the time for MIT to take the leadership on gravitation again as started from Dr. Susan Hockfield. We must also be back to believe in experiments instead of the so called authorities.

It should be noted also that Prof. Peter C. Sarnak of the Institute for

Advanced Study, has pointed out in 2016 that the mathematicians of the Fields Medal, who awarded Yau in 1982 and Witten in 1990 a Fields Medal prize, do not understand general relativity. Only Weinberg⁽²⁾ did not add errors to Einstein's theory.

A problem of Hawking and Penrose is that they cannot tell the difference between mathematics and physics, which depends on experiments. Penrose did not understand that in physics, we must consider the possibility of unknown physics. This is why Galileo considered experimental verification is necessary.

The file of my book-draft is attached for your perusal. Any comments and suggestions you may have will be greatly appreciated. Thank you.

Sincerely yours,

C. Y. Lo

Endnote:

(1) However, The Pui-Ching Middle School in Hong Kong did not do the crucial experiments to determine whether the weight reduction is due to a reduction of gravity or mass. It is essentially based on my research that the reduction of weight is due to a reduction of gravity.

(2) S. Weinberg, Gravitation and Cosmology, John Wiley & Sons, New York, 1972.

Attachment 2: Some Personal Experience in my Research

In 1916 general relativity was considered as few could understand. After more than 100 years, it turns out that nobody, including Einstein, fully understands it. In fact, Einstein made many errors himself. For instance, Einstein and Maxwell overlooked repulsive gravitation. Unfortunately, other theorists, with the exception of Zhou Pei-Yuan, not only failed to improve the theory but also added more errors to it.

For instance, Wald abandoned the equivalence principle but replaced it with the invalid covariance principle. The result is a theory having errors and misleading claims, among the static solutions and the correct results from the linearized equation. In particular, the Wheeler School even added misinterpretation to Einstein's equivalence principle [1]. Nevertheless, many incorrectly regarded that they are authorities. This article is written to help readers to avoid repeating past errors since general relativity is the only theory in physics that almost everybody made mistakes in.

The Einstein equation and the formula $E = mc^2$ are considered as the major achievements of Einstein. The fact is, however, not only do these equations contain errors, but they are also not fully consistent with each other. Nevertheless, Einstein's errors often lead to corrections that greatly improve physics.

I found Einstein's story in my high school Pui-Ching's Library. When I finished his story, I wish that I could take a step forward after him. In my university days, my main interest was in physics and relativity. My interest in relativity finally led to a scholarship from Prof. J. E. Hogarth, Queens' University in Canada. I tried very hard to find a suitable subject to do research, but I make little progress before I graduated from MIT. Then, I find that I often in disagreement with the mainstream in general relativity. Then I joined the Bell Lab., and I was prepared to give up my dream and retired as an engineer.

However, one day my mother asked me what is the goal of my life? And for what I study mathematics and physics? Then, I was not able to give her a good answer but promised her to do the best I could. Then in 1985, I completed for Bell Laboratory a difficult job, which has not been solved for a long time. Nevertheless, my colleagues did not believe me because I do not have an engineering background. This dispute was finally resolved in part because my work was published in AT&T

Technical Journal (May/June 1987). Then my confidence on my ability to do research finally returned.

After my mother, Lung Wing-Yue (龍穎儒) passed away, I made up my mind to do the last attempt on gravitation in 1990. The means that I started my research renew at the age most people would consider retirement. I am very grateful to Bell Laboratory for their encouragements for my research. Moreover, as part of my reward, they also kindly awarded a Scholarship to my Nephew Jason Nieh in MIT.

I was very lucky that I succeeded in the discovery of repulsive gravitation because I identify the errors of Einstein. Needless to say I was very lucky to have a very smart mother, who also sent me to a smart school, the Pui-Ching Middle School. As a result, I did not made serious errors as other well-known theorists do.

References:

[1]. J. Norton, What was Einstein's Principle of Equivalence? in Einstein's Studies, Vol.1: Einstein and the History of General Relativity, D. Howard and J. Stachel, eds., Birkhäuser, Boston, 1989.

Remarks:

Einstein had made crucial limitation on his assumptions. Thus, general relativity could not make further progress and in particular he could not prove his conjecture of unification. It is probably for this reason that Einstein preferred to die instead of curing his disease and live. Some might ask how I consider Einstein's contributions. I was very lucky that I passed Einstein. However, it is because of Einstein we are in the age of modern physics. Also, I was fortunate to be able to use the results of the Japanese and the Russian.

However, Einstein's major problem was that he often could not see his own errors. General relativity is a difficult theory. Nobody, including

Einstein fully understands it.

Einstein failed to see his mistakes because he was old. In fact, he has no positive contribution to general relativity since he came to America. This is not a problem of America, but is a problem of old age. Zhou Pei-Yuan has the same problem. He was the first to discover Einstein's covariance principle is invalid, but he failed to see that the Einstein equation has no dynamic solution when he grew old.

When I was young, I discovered the principle of causality and subsequently discovered the repulsive gravitation. I also derived the accompanying gravitational wave equation and its solutions. Now, I am also getting old, it is the time for the younger generation to take over the task of research. To-day, I make this statement and I hope that I can waken up some of the young minds.

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