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The Temperature Dependence of Gravitation, and Errors of Einstein and Penrose on Gravitation

C Y Lo

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

ABSTRACT

Newton claimed that gravity is independent of the temperature, and Einstein claimed as the temperature increases, gravity also increases. However, experiments show that the weight of a metal piece is reduced as temperature increases. Thus, it is impossible to obtain an accurate Newtonian coupling constant through direct measurements. Einstein's notion of gravitational mass is invalid due to repulsive gravitation was over-looked. In fact, the attractive current-mass interaction has been verified, and the repulsive charge-mass interaction has been shown by a lifted-up capacitor, charged with very high voltage, hovering on Earth. When E is the electromagnetic energy, E = mc2 is inconsistent with the Einstein equation. Galileo, Newton, Maxwell, and Einstein all over-looked the repulsive gravitation. Both Einstein and Penrose do not understand the principle of causality. Penrose produced an unbounded solution with unphysical parameters for the Einstein equation that also does not have any dynamic solution. The repulsive gravitation implies that general relativity must be extended to a five-dimensional theory. Penrose's proof for the existence of black holes is invalid because he failed to account for the repulsive gravitation, and the five-dimensional theory is still incomplete.

***Corresponding author**

C Y Lo, Applied and Pure Research Institute, 15 Walnut Hill Rd., Amherst, NH 03031, USA. E-mail: c_y_lo@yahoo.com

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Introduction

In Newtonian theory, for two particles m1 and m2 with a distance r in between, the gravitational force F_n is,

$$F_n = G\frac{m_1 m_2}{r^2}, \text{ where G is the Newtonian coupling constant.} \quad (1)$$

It was clear that the gravitational force is independent of temperature. In general relativity, the static force Fs

From the Schwarzschild metric of a spherical distribution mass M to a test particle p with mass mp at r is

$$F_s = G\frac{Mm_p}{r^2}. \quad (2)$$

When the test particle p is heated up, according to the formula $E = mc^2$, the mass of particle p would increase [1]. It follows that the force acting on p would increase. Thus, Einstein predicted that a piece of heated-up metal would increase its weight as its temperature increases. However, few examine Einstein's claim carefully [2]. Many just accepted this thought experiment of Einstein as if it were correct. However, Newton, Einstein and Penrose made mistakes on gravitation, and this is related to some of their fundamental conceptual errors in physics.

Influence of the Temperature of a Body on its Weight

In 2003 Dmitriev, Nikushchenko, & Snegov showed, however, that a brass metal rod heated by ultrasound has a reduced weight as the temperature increases [3]. Their results can be shown in the following figures.

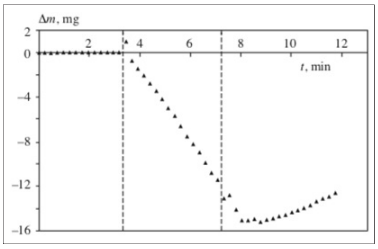

Figure 1: Change in mass of a brass rod mounted in an open holder. Ultrasound frequency 131.25 kHz. The dashed lines indicate the moments when the ultrasound was switched on and off.

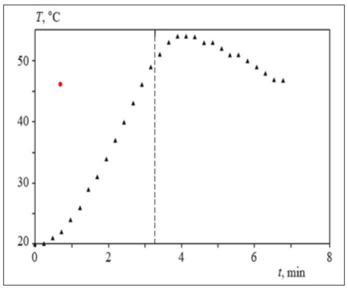

Figure 2: Time dependence of the temperature of a part of the surface of an ultrasonically heated brass rod (open holder). Ultrasound frequency 131.28 kHz. The dashed line indicates the

moment when the ultrasound was switched off.

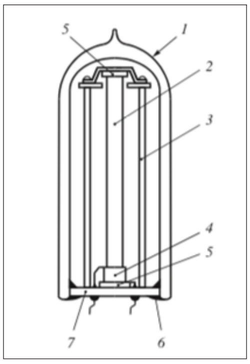

Figure 3: Arrangement of the air-tight container: 1) Dewar vessel; 2) metal rod; 3) holder pillar (textolite loth-based laminate); 4) piezoelectric transducer; 5) foam plastic spacers; 6) cold weld; 7) holder base (ebonite).

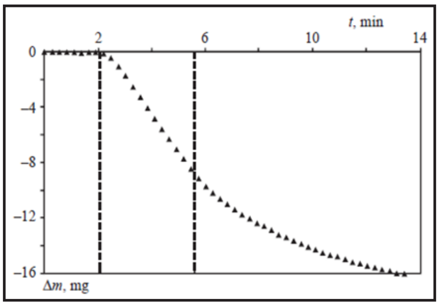

Figure 4: Change in mass of a brass rod mounted in a closed Dewar vessel. Ultrasound frequency 131.27 kHz. The dashed lines indicate the moments when the ultrasound was switched on and off.

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

Dmitriev et al. are confident that their observed results, the reduction of weight as temperature increases, is correct [3]. They point out, "It is well known that the temperature regimes play an important role when weighing with high accuracy. The basic reasons for temperature influencing the results of such 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 quite well known in modern measurement technology and their contribution to the results of measuring the mass of samples can be estimated quantitatively".

It should be noted also that the temperature dependence of gravity also depends on the metal involved. They have measured such dependencies for the lead, Copper, Brass, and Duralumin, and find they are different. It would be interesting to find out the detailed rules on such dependencies.

Moreover, Fan Liangzao, Feng Jinsong, & Liu Wu Qing also show in 2010 that six kinds of metal, after heating-up, all have reduced weight. And the weight reductions also depend on the metal used. However, they incorrectly regard the reduction of weight as a reduction of mass. Apparently, they do not understand that if the repulsive gravitation is present, to measure mass through gravitation is no longer valid [3-5].

It has been firmly established that mass is equivalent to energy from the atomic bomb although energy such as the electric energy may not be equivalent to mass [2]. Therefore, their claim is inconsistent with established experiments. Moreover, they must explain where the loss mass had become. Thus, their results were incorrectly rejected by many as due to errors. Since physics is based on experiments, we must be able to explain the experiments consistently.

Although heat would increase energy, the increase of energy need not mean the increase of gravity according to experiments [6]. Thus, E = mc2 is not generally valid. Since David Gross won his Nobel Prize based on the general validity of $E = mc^2$, their proof for asymptotic freedom for the strong interaction is at least incomplete.

The Inertial Mass and Einstein's Invalid Gravitational Mass. In physics, a theoretical conclusion may not be valid unless it is supported by experiments because in physics implicit assumptions could be used without knowing it. On the other hand, an experimental result could be misinterpreted [3,4]. For examples, an implicit assumption in the space-time singularity theorems of Penrose and Hawking is that all the coupling constants have the same sign and Einstein's claim of $E = mc^2$ [7].

As Einstein pointed out, the inertial mass is related to the resistance to acceleration and gravitational mass is related to the attraction to a mass. Thus, acceleration mass and gravitational mass should be distinguishable [8,9]. However, Einstein was able to identify them because *the existence of repulsive gravity has not been recognized* [10]. In short, Einstein's notion of gravitational mass is a misconception created by a failure to recognize repulsive gravity.

Nevertheless, it is possible that the mass and gravity can be distinguished with the first approximation of a formula for the period T of a pendulum as follows [11]:

$$T \approx 2\pi\sqrt{\frac{l}{g}}, \qquad (3)$$

where l is the length of the pendulum and g is the gravitational acceleration. Thus, the change of mass of the pendulum would not change the period of the pendulum, but if the g changes, the period T of the pendulum will be changed. Apparently, Dmitriev et. al and Fan et al did not measure the changes of the period T [3,4].

Since a piece of metal is a solid, a reduction of its mass or gravity can be distinguished by using it as a pendulum. In fact, it has been verified by Liu that the mass is essentially the same as Einstein and Lo predicted, but the period is extended after heating-up. Moreover, it has been verified by Lo with a torsion balance scale that the lead balls have reduced gravitation after heated-up [1,5,12,13].

Thus, measuring the mass through gravity is no longer reliable. It remains to show why gravity reduces as the temperature increases.

The Invalidity of E = mc², an Error of Einstein

Many believed that $E = mc^2$ was unconditional because this formula was derived from special relativity and its application is well-known from the atomic bomb. However, these only mean that mass can be transformed into energy. But, it does not necessarily mean that any energy can be equivalent to mass.

However, this formula was not questioned until 1995 after Lo proved the non-existence of dynamic solutions for the Einstein equation. Then, Lo found that there is no proof for the general validity of $E = mc^2$ and the claims of obtaining dynamic solutions are due to various mistakes in mathematics [14-17]. Moreover, it is also found that the Einstein equation and the formula $E = mc^2$ are not consistent [2]. Therefore, Einstein's theory is also incomplete.

To see the inconsistency of Einstein's theory, we need to do only some simple algebra. From the Einstein equation,

$$G_{\mu\nu} = R_{\mu\nu} - (1/2)g_{\mu\nu}R = -KT_{\mu\nu} \qquad (4)$$

Where $R_{\mu\nu}$ is the Rici curvature tensor, $g_{\mu\nu}$ is the space time metric, and $R = g^{\mu\nu}R_{\mu\nu}$, we have

$$R = Kg^{\mu\nu}T_{\mu\nu}. \text{ because } g^{\mu\nu}g_{\mu\nu} = 4. \qquad (5)$$

Since the electromagnetic energy-momentum tensor $T(E)_{\mu\nu}$ is traceless ($g^{\mu\nu}T(E)_{\mu\nu} = 0$), it cannot affect the Rici curvature R. Thus the electromagnetic energy cannot be equivalent to mass since the mass can affect R. Note that the validity of eq. (5) depends only on the static Einstein equation. Naturally, the problem would only be the inadequately verified formula $E = mc^2$. Since eq. (5) was first derived by Einstein the failure of seeing this inconsistency is his oversight [9]. Thus, from the above experiments the repulsive gravitational force must exist [3,4].

More important, the invalidity of $E = mc^2$ implies that the implicit assumption of the space-time singularity theorems that all the coupling constants must have the same sign, are invalid, and for a dynamic case, a coupling of different sign must be included as the case for the gravity generated by the electromagnetic wave [18,19]. This solved the puzzle that why Hawking's predictions can only be incorrect [7,17]. It is well known that Hawking rejected the existence of the Higgs Boson. Moreover, it has been verified by Tsipenyuk & Andreev that a charged metal ball has reduced weight) and a charged capacitor also has reduced weight [20,21].

The Repulsive Gravitation and the Necessary Extension of General Relativity

In fact, a charge-mass repulsive force has been derived from the Reissner-Nordstrom metric in 1916 for a particle with charge q and mass M as follows [10,22]:

$$ds^2 = \left(1 - \frac{2M}{r} + \frac{q^2}{r^2}\right)dt^2 - \left(1 - \frac{2M}{r} + \frac{q^2}{r^2}\right)^{-1} dr^2 - r^2 d\Omega^2, \qquad (6)$$

(with c = 1) where r is the radial distance (in terms of the Euclidean-like structure) from the particle center [23]. In this metric (6), the gravitational components generated by electricity have not only a very different radial coordinate dependence but also a different sign that makes it a new repulsive gravity [10]. This repulsion implies that the basic assumption for black holes is gravity being always attractive is invalid, and general relativity must be extended [24].

For an elementary charged particle, the repulsive force would be tiny. However, a similar metric can be derived for a charged ball. The only changes are that r becomes R, the distance from the center of the ball and q becomes Q the total charge of the ball [25]. Thus, since the repulsive force is proportional to Q2, for a charged ball with a sufficient large Q, the repulsive gravitational force can be macroscopically observed. 8) However, nothing but errors has been derived from this metric (6) until 1997 because theorists did not accept the repulsive gravitational force [26].

In 2005, Tsipenyuk and Andreev discovered that a charged metal ball becomes lighter in weight, but they did not know why because repulsive gravitation was not included in Einstein's general relativity. Moreover, theorists such as Herrera, Santos, & Skea argued that M in metric (6) involves electric energy [20,27]. Then they obtained a metric that would imply a charged ball would increase its weight as the charge q increased in disagreement with experiments [10,20]. Nevertheless, 't Hooft 9) and Wilczek 10) also have mistaken that $m = E/c^2$ was universally true. Since Wilczek used $E = mc^2$ for the asymptotic freedom without any justification his proof is incomplete [28,29].

On the other hand, if the mass M is the inertial mass of the particle, the weight of a charged metal ball would be reduced [10]. Thus, experiments on two metal balls supports that the mass M does not include electric energy since a charged ball has a reduced weight [20]. It will be shown, based on the principle of causality (see Appendix A) that such a force leads to the necessity to extend the theoretical framework of general relativity.

To see the necessity of extending general relativity, we consider the force on a test particle with mass m, and

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

$$\Gamma^\mu{}_{\alpha\beta} = (\partial_\alpha g_{\nu\beta} + \partial_\beta g_{\nu\alpha} - \partial_\nu g_{\alpha\beta})g^{\mu\nu}/2 \qquad (7)$$

and $ds^2 = g_{\mu\nu}dx^\mu dx^\nu$ according to Einstein. Note, the gauge affects only the second order approximation of gt t [30].

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

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

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

Thus, the second term is a repulsive force.

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

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

Because the action and reaction forces are equal and in the opposite directions. However, for the motion of the charged particle with mass M, if one calculates the metric according to the particle p of mass m, only the first term is obtained.

Then, it is necessary to have a repulsive force with the coupling q^2 to the charged particle *P* in a gravitational field generated by mass m. Thus, force (8b) to particle *P* is beyond the framework of gravitation + electromagnetism. As predicted by Lo, Goldstein,

& Napier this would lead to the necessity of its extension to a five-dimensional theory [31].

The repulsive force in metric (6) comes from the electric energy [10]. An immediate 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 a screening.

Note that this force can be considered as a result of q^2 interacting with a field created by the mass m. Thus such a field is independent of electromagnetism and is beyond general relativity, and the need of unification is established. To test such a possibility, one can measure whether there is such a repulsive force outside a charged capacitor.

The Weight Reduction of a Charged Capacitor

The study of charging a capacitor was initiated by Thomas T. Brown and later was joined by Paul A. Biefeld [32,33]. Since the B-B effects cannot be explained with current theories, many regarded such effects just experimental errors.

For instance, it is known that a charged capacitor has reduced weight. Moreover, after being charged with a high voltage (about 40 kilovolts), but without continuous supply of electric energy, the lifter (a light capacitor) is able to lift its own weight plus a payload hovering on earth. Also a lifter could get to 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 [32]. Thus, the lift is generated by changing something inside the lifter with a high voltage charge.

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. Then, a repulsive force appears. Since such a force did not appear before, it is clear that such a force was cancelled out by the force created by the motion of the electrons. In other words, the repulsive force generated by the charges of protons and the electrons was cancelled by the force generated by the motion of the initially moving charges of the electrons.

However, this repulsive force cannot be proportional to the charge density. We have equal numbers of negatively charged electrons and positively charged protons with equal charge. This would lead to the cancellation of the forces generated by particles charges. However, if such a force is proportional to the charge density square, then these two kinds of forces would be added up, instead of cancelled out. Moreover, since the lifter has a limited height, one should expect that this repulsive gravitational force would diminish faster than the attractive gravitational force. Thus, if we assume that the force is proportional to mass as usual, the static charge-mass interaction would be a repulsive force between particles with charge density Dq and another particle of mass m would have the following form,

$$F_r \approx KmD_q^2/r^n \text{ where } n > 2 \qquad (9)$$

r is the distance between the two particles, and K is the coupling constant. In formula (9), the coupling constant K and n the power of r can be determined by experiments. The simplest case would be n = 3.

Formula (9) is derived from the observations with common physical sense. The experimental results are that the charged capacitors have reduced weight. If the lift force is large enough, it will hover over the earth [32,33].

According to general relativity, if the electric energy leads to a repulsive force toward a mass, the magnetic energy would lead to an attractive force from a current toward a mass [24]. Due to a charged capacitor having a reduced weight, it is necessary to have the current-mass interaction to be cancelled out by the effect of the charge-mass interaction. *Thus, the existence of the current-mass attractive force would solve a puzzle*, i.e., why a charged capacitor exhibits the charge-mass repulsive force since a charged capacitor has no additional electric charges. In fact, the charge-mass repulsive force would be cancelled by the current-mass force as Galileo, Newton and Einstein implicitly assumed.

The existence of such a current-mass attractive force has been discovered by Martin Tajmar and Clovis de Matos from the European Space Agency [34]. Martin et al found that a spinning ring of superconducting material increases its weight more than expected. Thus, they believed that general relativity was wrong. However, according to quantum theory, spinning super-conductors should produce a weak magnetic field. Thus, they also measured the current-mass interaction to the earth! The current-mass interaction would generate a force which is perpendicular to the current.

Since the additional weight from a current-mass interaction is directional, the weight of a magnet is directional dependent as our experiment verified [35]. *This directional dependence of weight is a completely new phenomena that verify the existence of the current-mass interaction*.

One may ask what the formula for the current-mass force is. Unlike the charge-mass repulsive force, which can be derived from general relativity; this general force would be beyond general relativity since a current-mass interaction would involve the acceleration of a charge, this force would be time-dependent and generate electromagnetic radiation. Moreover, when the radiation is involved, the radiation reaction force and the variable of the fifth dimension must be considered [31]. Thus, we are not yet ready to derive the current-mass interaction. Nevertheless, we may assume that, for a charged capacitor, the resulting force is the interaction of net macroscopic charges with the mass [21].

Experimentally, the repulsive 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). This has been verified by the experiments of Musha [36,37]. Thus, the factor of charge density square in heuristic Eq. (9) is correct. Moreover, the hovering of the lifter shows that the repulsive force would diminish faster than the gravitational force. However, even the 1/r3 factor in the repulsive force is verified, the calculation would still depend on the detailed modeling [38]. Although the initial thrust due to the electric field is directional, the weight reduction effect for charged capacitors is not directional and it stays if the potential does not change. This is verified by Liu with the roll-up capacitors [12]. Thus, the repulsive force on the charged capacitor is the same force that derived from general relativity [22].

One may ask, what would the weight of the charged capacitor be after it is discharged? It takes time for a capacitor to recover its weight after being discharged [39]. A discharged capacitor needs time to dissipate the heat generated by discharging, and the motions of its charges would accordingly recover to the previous state. This was observed because the rolled-up capacitors keep heat better. Thus, this explains also the weight reduction of a piece of heat-up metal [3,4].

It follows that there are three factors that determine the weight of matter. They are; 1) the mass-mass interaction; 2) the charge-mass repulsive force; and 3) the attractive current-mass force. For a piece of a heated-up metal, the current-mass attractive force due to orbital electrons is reduced, but the charge-mass repulsive force would increase. Therefore, a net result is a reduction of weight instead of increased weight as Einstein predicted [10]. Thus, to test the inverse square law accurately, one must know exactly how temperature affects the weight.

Problems in Newtonian Gravity and the Repulsive Gravitation

Experimental tests of gravity's distance-dependence define a frontier between our understanding of gravity and many proposed forms of new physics. As gravity is ~ 1040 times weaker than electromagnetism, gravity remains hidden by experimental backgrounds at distances smaller than the diameter of a fine human hair. The recent talk of Charles Hagedorn surveys the past, present, and near-future of the experimental field, with emphasis on precision sub-millimeter laboratory experiments [40]. However, Hagedorn did not know that gravity depends also on its temperature [13].

Although Faller is aware that error budgets in the measurements of the Newtonian coupling constant are fundamentally flawed because they cannot make allowances for error sources that have not been thought of [41]. However, he did not know that the measurements to obtain the Big G coupling constant could not be accurate due to ignorance on the influence of heat to weight [13]. Thus, the Newtonian coupling obtained by J. Luo (罗俊) is questionable [42].

Einstein did not see that for the dynamic case, the Einstein equation does not have any bounded solution [43]. He was confident because he got the remaining perihelion of Mercury right. He neglected that he cannot justify his calculation with the necessary perturbation approach. In fact, for the dynamic case, the "linearized" equation is an independent equation [44]. *Therefore, the Newtonian gravity has not been superseded yet*. Einstein was puzzled why his equation does not produce the gravitational wave solution [45].

Since the measured Newtonian gravity is actually temperature dependent in principle, the temperature dependence must be understood before an accurate test of Newton's inverse square law [13]. One might argue that the temperature dependence of gravity is expected since an increase of temperature means the increase of energy. The problem is, however, that an increase of temperature leads to a reduction of weight [13].

What we measured is actually a combination of Newtonian gravity and a much weaker repulsive force [6], i. e.

$$\mathrm{F} = G\frac{m_1 m_2}{r^2} - k_2\frac{m_1}{r^3} - k_1\frac{m_2}{r^3} \qquad (10)$$

where k_1 and k_2 are functions of temperature, depending on the matter used to construct m_1 and m_2. The increment of gravitational reduction is due to the increment of the number of random electrons as the temperature increases [13]. However, we have not been able to establish details of the temperature dependence of k_1 and k_2.

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

The coupling with q^2 leads to a five-dimensional space of Lo et al. since such a coupling does not exist in a four-dimensional theory, the five dimensional theories of Kaluza or Einstein & Pauli [31,46,47].

Now let us give a brief introduction of the five-dimensional relativity. The five dimensional geodesic of a particle is

$$\frac{d}{ds}\left(g_{ik}\frac{dx^k}{ds}\right) = \frac{1}{2}\frac{\partial g_{kl}}{\partial x^i}\frac{dx^k}{ds}\frac{dx^l}{ds} + \left(\frac{\partial g_{5k}}{\partial x^i} - \frac{\partial g_{5i}}{\partial x^k}\right)\frac{dx^5}{ds}\frac{dx^k}{ds} - \Gamma_{i,55}\frac{dx^5}{ds}\frac{dx^5}{ds} - g_{i5}\frac{d^2x^5}{ds^2}\ , \qquad (11a)$$

$$\frac{d}{ds}\left(g_{5k}\frac{dx^k}{ds} + \frac{1}{2}g_{55}\frac{dx^5}{ds}\right) = \Gamma_{k,55}\frac{dx^5}{ds}\frac{dx^k}{ds} - \frac{1}{2}g_{55}\frac{d^2x^5}{ds^2} + \frac{1}{2}\frac{\partial g_{kl}}{\partial x^5}\frac{dx^l}{ds}\frac{dx^k}{ds}, \qquad (11b)$$

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

If instead of ds, dt is used in (11), for a test particle with charge q and mass M, the Lorentz force suggests

$$\frac{q}{Mc^2}\left(\frac{\partial A_i}{\partial x^k} - \frac{\partial A_k}{\partial x^i}\right) = \left(\frac{\partial g_{i5}}{\partial x^k} - \frac{\partial g_{k5}}{\partial x^i}\right)\frac{dx^5}{d\tau}\ . \qquad (12a)$$

Thus,

$$\frac{dx^5}{d\tau} = \frac{q}{Mc^2}\frac{1}{K},\quad K\left(\frac{\partial A_i}{\partial x^k} - \frac{\partial A_k}{\partial x^i}\right) = \left(\frac{\partial g_{i5}}{\partial x^k} - \frac{\partial g_{k5}}{\partial x^i}\right) \text{ and } \frac{d^2x^5}{d\tau^2} = 0 \qquad (12b)$$

where K is a constant. It thus follows that (11) is reduced to

$$\frac{d}{d\tau}\left(g_{ik}\frac{dx^k}{d\tau}\right) = \frac{1}{2}\frac{\partial g_{kl}}{\partial x^i}\frac{dx^k}{d\tau}\frac{dx^l}{d\tau} + \left(\frac{\partial A_k}{\partial x^i} - \frac{\partial A_i}{\partial x^k}\right)\frac{q}{Mc^2}\frac{dx^k}{d\tau} - \Gamma_{i,55}\left(\frac{q}{Mc^2}\right)^2\frac{1}{K^2}\ , \qquad (13a)$$

$$\frac{d}{d\tau}\left(g_{5k}\frac{dx^k}{d\tau} + \frac{1}{2}g_{55}\frac{q}{KMc^2}\right) = \Gamma_{k,55}\frac{q}{KMc^2}\frac{dx^k}{d\tau} + \frac{1}{2}\frac{\partial g_{kl}}{\partial x^5}\frac{dx^l}{d\tau}\frac{dx^k}{d\tau}. \qquad (13b)$$

One may ask what the physical meaning of the fifth dimension is. Our position is that the physical meaning of the fifth dimension is not yet very clear except some physical meaning is given in the equation, $dx^5/d\tau = q/Mc^2K$ where M and q are respectively the mass and charge of a test particle, and *K* is a constant [31]. 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 *p*-direction

$$-\frac{mM}{\rho^2} \approx \frac{Mc^2}{2}\frac{\partial g_{tt}}{\partial \rho}\frac{dct}{d\tau}\frac{dct}{d\tau} g^{\rho\rho}, \quad \text{and} \quad \frac{mq^2}{\rho^3} \approx -\Gamma_{\rho,55}\frac{1}{K^2}\frac{q^2}{Mc^2}\, g^{\rho\rho} \qquad (14a)$$

and

$$\Gamma_{k,55}\frac{q}{KMc^2}\frac{dx^k}{d\tau} = 0, \ \text{where}\ \Gamma_{k,55} \equiv \frac{\partial g_{k5}}{\partial x^5} - \frac{1}{2}\frac{\partial g_{55}}{\partial x^k} = -\frac{1}{2}\frac{\partial g_{55}}{\partial x^k} \qquad (14b)$$

in the (-*r*)-direction. The meaning of (14b) is the energy momentum conservation. Thus,

$$g_{tt} = 1 - \frac{2m}{\rho c^2}, \text{and}\ g_{55} = \frac{mMc^2}{\rho^2}K^2 + \text{constant (or}\ \frac{1}{MK^2c^2}g_{55} = \frac{m}{\rho^2} + \text{constant.)} \qquad (15)$$

In other words, g_{55} is a repulsive potential, and g_{55} /M is also a function of a distance mass m. Because g_{55} is independent of q, this force would penetrate electromagnetic screening.

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. the charge-mass interaction would penetrate a charged capacitor [31]. To verify the five-dimensional theory, one can simply test the repulsive force on a charged capacitor. This has been experimentally confirmed [10]. However, because *p* is neutral, there is no charge-mass repulsion force on p.

However, journals such as the Physical Review D and Proceedings of the Royal Society A, still have not recognized these important experiments due to inadequacy in nonlinear mathematics and blind faith toward Einstein. They all, like Hawking, incorrectly believed, without sufficient evidence, in the invalid speculation $E = mc^2$.

The Gravity Generated by an Electromagnetic Wave

The verification of the bending of light rays made Einstein famous. Most of Einstein's followers, however, were not aware that the bending of light also exposed necessary modifications.

Einstein's calculation of the bending of light implicitly assumes that the gravity created by an electromagnetic wave is negligible. Einstein also claimed that any energy-momentum tensor could be the source of his equation; one should be able to obtain a gravitational solution for the electromagnetic wave. Since such gravity is physically very weak, many were in agreement with Einstein, and believed that such gravity could be calculated with the perturbation approach (although they did not do it).

Mathematically, for a perturbation approach to be valid, a necessary condition is, however, that this problem has a bounded solution. This compatibility between mathematics and physics is crucial for the validity of a theory in physics. Thus, it was natural for Einstein to believe that his equation could be used for such a case [48]. Although Einstein claimed that his equation was valid for any energy-momentum tensor, he solved only a few cases [22].

Einstein claimed also the energy of an electromagnetic wave are the photons, and Einstein proved that the energy of photons is equivalent to mass [49]. This does not mean, however, that electromagnetic energy is equivalent to mass, since it is actually based on Einstein's unproven assumption that photons are massless particles.

Note that the energy-momentum tensor of the massless particles is incompatible with the electromagnetic energy-momentum tensor because a sum of electromagnetic energy-momentum tensors is always traceless, but a sum of the energy-momentum of massless particles can become massive. In fact, to derive the photonic energy-momentum tensor, general relativity must be used [2].

Now, consider a source of electromagnetic "plane wave." Einstein believed that the Einstein eq. (4) can be used for this case However, explicit calculation shows that it is impossible to have bounded solutions for an electromagnetic wave's gravity [9]. For instance, Penrose obtain a solution metric for the Einstein equation as follows [50]:

$$ds^2 = dudv + Hdu^2 - dx_i dx_i, \ \text{where}\ H = h_{ij}(u)x_i x_j, \qquad (16)$$

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. Thus Penrose being primarily a mathematician, over-looked a violation of the principle of causality (Appendix A) in physics [39,50].

Nevertheless, Einstein insisted only on his Einstein tensor G_{ab} in eq. (4), but otherwise allowed modifications. In order for Einstein's theory of general relativity to make sense, the related Einstein equation, with an electromagnetic wave as the source, must include a photonic energy-stress tensor with the anti-gravity coupling [18,19]. For this case, the related modified Einstein equation is the following:

$$G_{ab} \equiv R_{ab} - (1/2)g_{ab}R = -K[T(w)_{ab} - T(p)_{ab}], \qquad (17)$$

$$T_{ab} = -T(g)_{ab} = T(w)_{ab} - T(p)_{ab}, \qquad (18)$$

where $T(w)$ and $T(p)_{ab}$ are the energy-stress tensors for the electromagnetic wave and the related photons, which are massless particles. Thus, the photonic energy must also include the energy of its gravitational-wave component. The energy, related to the photons, is clearly beyond special relativity. Further, the implicit assumption of a unique sign for all coupling constants in space-time singularity theorems is invalid. Thus, the claim of Hawking and Penrose that general relativity is not suitable for microscopic phenomena is simply incorrect.

Note that for a massive source to have a dynamic solution the modified Einstein equation is as follows [14]:

$$G_{\mu\nu} \equiv R_{\mu\nu} - (1/2)g_{\mu\nu}R = -K[T_{\mu\nu}(m) - t_{\mu\nu}(g)], \qquad (19)$$

where $t_{\mu\nu}(g)$ is the gravitational field. This equation was first obtained by Lorentz and Levi but Einstein objected to it on the mistaken grounds that his field equation implies However, eq. (19) was recovered by Lo with the support of Einstein's radiation formula [14,51,52]. Thus, there are three important conclusions: (1) The antigravity coupling is necessary for a dynamic case, (2) For the dynamic case, the Einstein equation has no bounded solution, and (3) The space-time singularity theorems, which requires a unique sign for coupling constants, are invalid for physics.

Eq. (19) also explains that, for a dynamic case, the linearized equation does not have a compatible solution from the nonlinear Einstein equation. The linear equation is a valid linearization for eq. (19), but an invalid linearization of the Einstein equation. Thus, Einstein failed to see the need for an anti-gravity coupling for a dynamic solution.

Note that Einstein uses massless particles to represent photons but from eq. (17) and eq. (18) it is clear that this cannot be done without the gravitational wave [4,5,18,19,49]. Thus, Einstein failed to recognize that this energy problem is beyond special relativity.

Between 1905-1909, Einstein also failed to show the general validity of [1]. This failure to see the need for the anti-gravity coupling provides the basis for the space-time singularity theorems, which are based on the implicit assumption of a unique coupling sign. If photons consist only of electromagnetic energy, then there is a conflict, since photonic energy can be equivalent to mass, but electromagnetic energy is not [2]. This conflict has now been resolved, since the photonic energy is the sum of electromagnetic energy and gravitational energy, and this confirms that $E=mc^2$ can be invalid.

The proof of photonic energy consisting of massless particles is a remarkable achievement of general relativity. This also shows an important example of the Einstein equation where a valid physical solution may not satisfy it. Thus, one cannot just conjecture a solution based only on "reasonable" physical considerations alone, without an explicit example as shown in the "Proof of the Positive Mass Theorem. II", of Schoen and Yau.

Based on this theorem, Schoen and Yau claimed that Einstein's theory is consistent and stable, and Yau was incorrectly awarded a Fields Medal in 1982. The boundary condition to be imposed in the Positive Mass Theorem of Schoen and Yau, is that it is asymptotically flat, i.e. [53].

$$g_{ij} = \delta_{ij} + O(r^{-1}), \qquad (20)$$

However, due to the Einstein equation's deficiency, the requirement of asymptotically flat (20) just cannot be satisfied since the Einstein equation actually has no dynamic solutions [14,54].

The net result is that even the solution to a two-body problem is excluded. Thus, what remain are the gravity of a single mass such as the Schwarzschild solution, the harmonic solution, the Kerr solution, etc. are stable. Had they tried to obtain a solution for a two-body problem, they would have found that it is impossible to satisfy condition (20) for the Einstein equation. In effect, the boundary conditions excluded an important class of problems, and then claim the result for remaining trivial problems as a general result [55]. E. Witten also failed to see this crucial error of Yau [56].

Thus, the positive mass theorem of Schoen and Yau is misleading [57]. Since their misleading theorem had made the belief that general relativity is perfect and thus prevents the necessary progress [55]. Their errors were discovered because detailed calculations exposed them. Their errors escaped the detection because nobody openly asked Schoen and Yau to produce explicit examples to support their theorem.

Applications of the Charge-Mass Repulsive Force and Anomaly of the Space Probes

The Reissner-Nordstrom metric was first published in 1916, the same year that first paper on general relativity was published. Thus, the repulsive charge-mass interaction should have been discovered shortly afterward. However, this was not recognized until 1997 [26]. Moreover, general relativity was based on the equivalence of inertial mass and gravitational mass, and thus Einstein cannot accept the repulsive gravitation.

However, the existence of repulsive gravitation was inadvertently verified by the charged metal ball experiment in 2005 [20]. One may ask whether the repulsive gravitation has some effects on astrophysics. In addition to the temperature and the composition of the test particle, the gravity also has some issues related to the sun. Note that, the calculation of metric (6) is essentially based on general relativity. However, it is important to see this is crucial to establish a charge-mass repulsive force, which is independent of electromagnetism.

Then, the charge-mass repulsive force between a point charge q and a point mass m is

$$F = \frac{q^2 m}{r^3} \qquad (21)$$

in the r-direction. The five-dimensional theory supports that it is not subjected to electromagnetic screening, and this is supported by the experiment of weighing charged capacitors because a concentration of charges would provide such repulsion [21]. This new force is different from Newtonian attractive force, which is inversely proportional to the square of the distance. Thus such a repulsive force would become weaker faster than gravity at long distance.

Due to such a force, a capacitor lifter hovers on earth only in a limited height [32,33]. Note that the lifter does not need a continuation of power supply, and it is essentially due to the positive and negative static charges. This provides a theoretical basis for the reported phenomena that some monks can hover above the earth. Similarly, in the Chinese martial arts, there are speculations of the exceptional ability of high jump and walking on top of water and snow. Now, these are possible in terms of the law of repulsive gravity although how these could be done is not yet clear. Previ-ously, such exceptional abilities were simply disregarded as a miracle since it would be against the "law of physics".

The space probes also give a good opportunity to check the mass-charge interaction. If the repulsive force comes from the sun, then m in (20) would be m_p the mass of the pioneer, and distance r would be R the distance between the sun and the space probe. However, the charge term is not clear since for the sun we do not know what the non-linear term for the charge square should be.

Nevertheless, since such forces act essentially in the same direction, we could use a parameter P_s to represent the collective effect of the charges. Then, the effective repulsive force F_p would be

$$F_p = \frac{P_s m_p}{R^3}\ . \qquad (22)$$

Since the neutral sun emits light and is in an excited state, the sun has many locally charged particles, whose effect exceed the attractive effects of motion of charge and thus is not negligible. If the data fits well with a parameter P_s, then this would be another confirmation of the charge-mass interaction.

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

$$F = \frac{M_s m_p}{R^2} - \frac{P_s m_p}{R^3} \qquad (23a)$$

and

$$\frac{M_s m_p}{{R_0}^2} - \frac{P_s m_p}{{R_0}^3} = \frac{M_{ss} m_p}{R_0^2} \qquad (23b)$$

where R_0 is the distance from earth to the sun. Then, we have

$$F = \frac{M_{ss} m_p}{R^2} + \frac{P_s m_p}{R^2}\left(\frac{1}{R_0} - \frac{1}{R}\right) \qquad (24)$$

Thus, it appears that there is an additional attractive force for $R >> R_0$.

Moreover, such a force would not be noticeable from a closed orbit since the variation of the distance from the sun is small. However, for open orbits of the pioneers, there are great variations. When the distance is very large, the repulsive force becomes negligible, and thus an additional attractive force would appear as the anomaly. Such a force would appear as a constant over a not too long distance. Thus, the repulsive fifth force seems to be the only force that satisfies the overall requirements from the data. However, this problem does not affect the gravity of the moon.

Some claimed that the Pioneer Space-Probe Anomaly has been resolved by a heat-radiation model. However, a discoverer of the anomaly, Erik Anderson commented, "Science will have suffered the worst sort of dysfunction if the Pioneer Anomaly gets swept under the convenient rug of 'the plausible.' Even so, we will still have the Earth flyby anomalies and the so-called 'A.U.' anomaly left uncovered. All three anomalies seem to be manifestations of a singular phenomenon the latter two cannot be dismissed as heat radiation. Heat-radiation models, like string theory, can be customized to fit any set of observational parameters. There is no limit on sophistication. We should not be so easily impressed. Nothing has been resolved." I would like or add also that there is no evidence that can justify a heat-radiation model. It seems such modeling reflects only a blind faith of Einstein.

Moreover, when the four planetary probes experienced unaccountable changes in velocity as they passed Earth, they experienced an additional repulsive force from the Earth because the core of the globe has charged currents. Moreover, depending on the way of approaching the globe, a planetary probe would also experience an additional attractive force due to current-mass interaction. Thus, a planetary probe would have an additional acceleration or de-acceleration. These cannot be modeled with a heat-radiation model.

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

Discussions and Conclusions

Einstein's general relativity is only preliminary in nature. As a theory, it is not self-consistent, and thus must be rectified. It is also incomplete because the repulsive gravitation must be included. Moreover, the space must be extended to a five-dimensional space because the four-dimensional space cannot accommodate the repulsive gravitation [17]. Clearly some fundamental notions in general relativity such as the equivalence between the gravitational mass and the inertial mass, and general E= mc2 are wrong which are inconsistent with the Einstein equation. It is also known that. the Einstein equation has no bounded dynamic solution and gravitational energy cannot be localized [17].

Moreover, because the crucial experiment shows a piece of heat-up metal having a reduced weight and thus proves Einstein was incorrect. Such an experiment is so simple and inexpensive that almost any physicists can do it by using a scale with an accuracy of 10-4 gram at home. Thus, this makes it easier for many to verify Einstein's errors.

Thus, we solved at least three puzzles 1) Why Hawking has no verified predictions in spite of that he follows Einstein faithfully. 2) How the increase of repulsive force on an object is related to its temperature. 3) Would the lack of breakthrough in physics imply there is no longer any genius? For the first question, it is simply that Hawking follows Einstein's major error such as E = mc2 that Einstein had mistaken as valid. Hawking's space-time singularity theorems were mistaken as correct [7]. But, now it is clear that the formula E = mc2 is invalid in theory as well as incorrect that have been proven by three types of experiments [6]. For the second question, why the gravity is reduced as the temperature increases. This implies that the repulsive gravitational force increases as the temperature increases.

For the third question, we do not need a genius, but only careful derivations and examinations that will discover the existing errors and eventually lead us to a break through. In fact, too many have overlooked obvious errors, but attempted to be a genius already.For example, the Einstein equation cannot generate the gravitational waves as Einstein found out but the Nobel Committee thought it could [38]. Many fail to see that for a dynamic case the non-linear equation and the linearized equation are unrelated equations [44].

Moreover, string theorists such as Witten also failed to see that the Einstein equation has no dynamic solutions and they cannot explain the existence of repulsive gravitation [56]. In addition, they never explain how strings are formed, but they jumped into a very high dimensional space without any evidence from physics just to achieve consistency. Some even claimed only the string theory has the hope of solving everything although they have solved nothing so far.

Moreover, while the physicists are inadequate in mathematics, mathematicians such as S. T. Yau [53]. Michael F. Atiyah and Ludwig D. Faddeev made mistakes because they do not understand physics. In the "Proof of the Positive Mass Theorem II", Schoen and Yau made an error of incorrectly assuming that all the physical solutions satisfy their asymptotically flat condition, yet again failed to support their results with an example [17]. Had they tried, they could have found their errors.

Nevertheless, Yau and Witten were incorrectly awarded a Fields Medal in 1982 and 1990 for the misleading theorem [57]. The erroneous positive mass theorem of Schoen and Yau prevents the necessary rectifications of general relativity for about 38 years [53]. Also few can stand up alone to point out the errors of Einstein as Zhou did [58]. However, we have found examples that show Einstein's covariance principle is incorrect [59]. These show that an award cannot made an error right, and a correct statement in physics will eventually be recognized.

Many regarded a Nobel Prize as a certificate for correctness, and thus failed to see that it could mean only partially correct. For instance, Einstein's proposal of photons actually include a gravitational wave component. Some physicists even incorrectly regarded errors in physics such as the space-time singularity theorems as new achievements [7]. They also did not see that not all the neutral objects fall with the same acceleration as Galileo said [5].

Based on the misleading space-time singularity theorems, Hawking and Penrose claimed that general relativity cannot deal with microscopic problems. This is completely nonsense since one must use general relativity to prove the existence of photons [19,20]. Moreover, Einstein's 1905 claim that the photons are massless particles also need to use general relativity to prove [2,49]. These details expose also that Einstein and his followers did not fully under-stand Maxwell's theory as well as the special relativity [2].

Moreover, Misner, Thorne and Wheeler incorrectly referred it to Pauli and the 1911 invalid assumption for Einstein's equivalence principle, and Wald abandoned it but accepted the invalid covariance principle [22,60-62]. It is amazing that the physics community had regarded them as authorities. This resulted in many relativists become very confused, and actually do not understand general relativity.

For a long time, nobody tested Einstein's claim of weight increment of a metal piece after being heated-up [1]. Moreover, many failed to see that, for the electromagnetic energy, $E= mc^2$ is inconsistent with the Einstein equation. Einstein's habit of using thought experiments instead of real experiments to check his results allows unverified claims to be implicitly used without being detected. Thus, he failed to see is the repulsive gravitation. Note that the possibility of a repulsive force related to an attractive force, actually appeared at the time of Lao Tze, about 3000 years ago.

Moreover, some editors of APS are against experiments to test Einstein's claims such as E = mc2 because of their blind. An important question is whether there is a unification of gravitation and electromagnetism. This issue was conjectured first by Einstein. However, Einstein failed to confirm it because he did not recognize the repulsive gravitational force, which would lead to the confirmation of Einstein's conjecture.

Unfortunately, the American Physical Society ignored the existence of the repulsive gravitational force by not doing the experiments that show Einstein's claim of E = mc2 is incorrect.26) Thus, many repeated the error of Einstein on the notion of gravitational mass. The repulsive gravitation also implies that the Nobel Prize Committee for Physics had overlooked that the proof of Wilczek, Gross, & Politzer for asymptotic freedom is actually at least incomplete. Thus, winning a Nobel Prize may not yet be a guarantee for that the theory is correct.

We should have learned from Galileo to support physics with real experiments. Einstein's thought experiments could be unreliable since implicit assumptions could be used without knowing them. Since the repulsive gravity is discovered, the measurement of the mass based on gravitation is unreliable. We must improve our skill in mathematics and be able to identify misconceptions. Above all, as philosopher Hu shih said, we must be careful in our proof although we are allowed to have bold assumptions.

Moreover, as the technology advances, the past experiments such as the tests of Newtonian gravitation can become unsatisfactory. Nevertheless, many still just follow "experts" in the past. Another example is that Penrose proved the existence of black holes in 1963 and 1965 [63,64]. However, the discovery of repulsive in 1997 makes it necessary to rejustify the notion of back holes. Moreover, because the necessary extension to a five-dimensional theory discovered in 1915 we cannot even do the necessary justification [17]. Thus, it is actually groundless for the Nobel Committee to claim that "UK-born Penrose showed that Albert Einstein's general theory of relativity leads to the formation of black holes." It is hoped that this paper would help our colleagues to root out misconceptions in physics better.

It is about time that we should grow up beyond Einstein. It should be noted that since the repulsive gravitation was overlooked by Galileo, Newton, Maxwell, and Einstein, and the charge-mass interaction was not included in quantum mechanics, understandably many physicsits would have difficulty in accepting this new physics. To overcome this, I recommend that they start by doing the weight reduction experiemnt on a metal as the temperature increases.

Many theorists still interpreted general relativity according to Einstein. This must be changed since Einstein does not fully understand general relativity. In particular, he failed in recognizing the repulsive gravitation and invented the invalid notion of gravitational mass. Because of these, Einstein failed to show his conjecture on the unification of electromagnetism and gravitation. Galileo claimed that all neutral mater fall with the same acceleration. However, now we know this is actually not always true because the existence of repulsive gravitation implies that not all neutral objects fall with the same acceleration. Currently, the most urgent task is to develop a field equation that can deal with the dynamic problems and the generation of gravitational waves.

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Appendix A: The Principle of Causality in Physic
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.

Normally 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 often provide crucial steps to solve a problem correctly. For example, this is how the equation (6) for the electromagnetic wave as a source was modified.

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. Although this principle alone cannot derive a field equation or its solution, it can help determine whether they are valid in physics. This has made a difference in the investigation of gravitation [14,16,18,19,50].

In practice, when the considered field is absent, physical properties are ascribed to the space-time as in a "normal" state. For example, the electromagnetic field is zero 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 implication of causality to symmetry has been used in deriving the inverse square law from Gauss's law. The normal state of a space-time metric is the flat metric in special relativity. 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. Thus, Einstein's weak gravity is a consequence of causality.

However, the physical cause(s) should not be confused with the mathematical source term in the field equation. In general relativity, the cause of gravity is the physical matter itself, but not its energy tensors in the source term of Einstein's field equation. The energy-stress tensors (for example, the perfect fluid model) may explicitly depend on the metric. Since nothing should be a cause of itself, such a source tensor does not represent the cause of a metric. For the accompanying gravitational wave of an electromagnetic wave, the physical cause is the electromagnetic wave. Thus, one should not infer the symmetries of the metric based on the source term instead of its causes.

Moreover, inferences based on the source term can be misleading because it may have higher symmetries than those of the cause and the metric. For instance, a transverse electromagnetic plane-wave is not rotationally invariant with respect to the direction of propagation. But the related electromagnetic energy-stress tensor component for a circularly polarized wave is. Such an assumption violates causality and results in theoretical difficulties.

A reason that the Einstein equation did not have a bounded dynamic solution is its violation of causality. In the Einstein equation the left side is the Einstein tensor and the right side are the energy-momentum tensors. For the dynamic case, the energy-momentum tensor of the gravitational waves should have been included. Thus, for the dynamic case, the Einstein equation violates the principle of causality and thus has no bounded dynamic solution. The modified Einstein equation (19) can have a dynamic solution because the missing energy-momentum tensor has been added back. It is surprising that physicists did not find this principle of causality for general relativity earlier.

Classical electrodynamics implies that the flat metric is an accurate approximation, caused by the presence of weak electromagnetic waves. This physical requirement is supported by the principle of causality, which implies such a metric to be a bounded periodic function. However, this required boundedness is not satisfied with many solutions in the literature [50,65,66]. If these authors understood the principle of causality, they would not have produced them. Some solutions also violate causality directly since they involve parameters without any physical cause [50].

Many theorists and journals do not understand the principle of causality adequately. For instance, the Physical Review accepted an unbounded solution as valid in physics. As well, the Royal Society (London) accepted Hawking, even though the space-time singularity theorems violate the principle of causality. A major problem is that the teaching of Galileo on the importance on experimental verification is often forgotten. The fact that in Einstein's theory, gravitational energy cannot be localized is also a violation of the principle of causality.

Appendix B: The International Mathematical Union (IMU) Executives (1979-1990)

Terms	President	Vice-Presidents	Secretary	Members
1987-1990	L.D. Faddeev	W. Feit L. Hörmander	O. Lehto	J. Coates
				H. Komatsu
				L. Lovász
				J. Palis Jr.
				C.S. Seshadri
1983-1986	J. Moser	L.D. Faddeev J-P. Serre	O. Lehto	S. Mizohata
				G.D. Mostow
				M.S. Narasimhan
				C. Olech
				J. Palis Jr.
1979-1982	L. Carleson	M. Nagata J.V. Prohorov	J.L. Lions	E. Bombieri
				J.W.S. Cassels
				M. Kneser
				O. Lehto
				C. Olech

The executives of IMU should provide an explicit example of dynamic solution to defend Schoen and Yau or admit they have made an error in awarding the 1982 and 1990 Fields Medal to Yau and Witten respectively [49].

Endnotes

1. Some believed that there is no force in general relativity. This is incorrect because a force is nothing other than that it gives an acceleration to a test particle. For the isotropic solution, $ds^2 = [(1- M\kappa / 2r)^2 /(1 + M\kappa/2r)^2] c^2 dt^2 - (1 + M\kappa/2r) 4(dx^2 + dy^2 + dz^2)$ where $\kappa = G/c^2$, M is the total mass, the static force F_s would be
$$F_s \approx G\frac{Mm_p}{r^2}\left(1-[\frac{M\kappa}{2r}]^2\right),$$
2. In the Newtonian gravitational theory, the acceleration mass and gravitational mass are indistinguishable.
3. 3) Tsipenyuk & Andreev were puzzled because they did not know the existence of the repulsive gravitation.
4. 4) The weight reduction of a charged capacity was considered as an experimental error, because it was believed that, according to Maxwell's theory, there is no force beyond a charged capacitor.
5. The discovery of the Euclidean-like structure in a physical space clarifies the difference between a physical Riemannian space and a mathematical Riemannian space embedded in a higher dimensional Euclidean space. This was the crucial point needed to settle the difference between Einstein and Whitehead [67].
6. Many speculated that the black holes exist. However, nobody has come up with any evidence that the event of horizon (a crucial point that must be observed for a black hole) is observed.
7. Due to the existence of repulsive gravitation, Einstein no longer can claim that gravitational mass is equivalent to acceleration mass. This is why Einstein rejected repulsive gravitation, in addition to his invalid belief on E = mc2.
8. This leads to the settlement that the mass in this metric is just the acceleration mass without wrongly including the electromagnetic energy due to the charge. For this, even Nobel Laureate t' Hooft had mistaken [29].
9. G. t' Hooft incorrectly believed that the mass of an electron includes its electric energy. This exposes that he does not understand Newtonian mechanics and also special relativity adequately..
10. Frank A. Wilzcek incorrectly believed that E = mc2 is unconditional [30]. Thus, their proof (Frank. A. Wilczek along with David Gross and H. David Politzer) for asymptotic freedom is actually incomplete. Recently, I met Prof. Wilzcek at his office at MIT, and he agrees that E = mc2 may not always be valid.
11. Because this repulsive force is against Maxwell's theory and Einstein's theory, many disregard this repulsive gravitational force as a theoretical error.
12. They failed to understand that this attractive gravitational force is due to current-mass interaction.
13. Since the Einstein equation has no bounded dynamic solution the problem of Mercury actually has not been solved [14]. Although there is not yet an equation that can produce gravitational wave, such a wave must exist because the photons have the combinations of the electromagnetic wave energy and the gravitational wave energy [18,19].
14. The reduction of weight while the temperature increases, is due to the increment of repulsive gravitational force.
15. Before the repulsive gravitational force is discovered, such phenomena were incorrectly regarded as miracles.
16. We assume that force from the current-mass interaction in the sun is comparatively very weak because there is no clear current direction in the sun.
17. It is clear that there is much work on astrophysics to be done with a five-dimensional theory.
18. That, the gravitational energy cannot be localized is due to a deficiency of the Einstein equation [17].
19. A common characteristic of such attempts is that they do not have any new experimental supports.
20. Michael Francis Atiyah has been leader of the Royal Society (1990-1995), master of Trinity College, Cambridge (1990-1997), chancellor of the Univ. of Leicester (1995-2005), and President of the Royal Society of Edinburgh (2005-2008). Since 1997, he has been an honorary professor at the University of Edinburgh. However, Atiyah does not understand physics as Prof. Peter C. Sarnak, Chairman of the 2011 Shaw Prize Committee for Mathematics found out. It is known that Witten was awarded at the insistence of Atiyah.
21. Ludwig D. Faddeev, the Chairman of the Fields Medal Committee, wrote ("On the work of Edward Witten"): "Now I turn to another beautiful result of Witten – proof of positivity of energy in Einstein's theory of gravitation. Hamiltonian approach to this theory proposed by Dirac in the beginning of the fifties and developed further by many people has led to the natural definition of energy. In this approach a metric γ and external curvature h on a space-like initial surface S(3) embedded in space-time M(4) are used as parameters in the corresponding phase space. These data are not independent. They satisfy Gauss-Codazzi constraints – highly non-linear PDE, The energy H in the asymptotically flat case is given as an integral of indefinite quadratic form of γ and h. Thus, it is not manifestly positive. The important statement that it is nevertheless positive may be proved only by taking into the account the constraints – a formidable problem solved by Yau and Schoen in the late seventies as Atiyah mentions, 'leading in part to Yau's Fields Medal at the Warsaw Congress'." Faddeev failed to see that the so-called 'natural definition of energy' actually excludes the dynamic cases by assuming all the dynamic solutions are bounded [57].
22. I met S. T. Yau in his office at The Chinese University of Hong Kong in 1993 to discuss the solutions of Einstein equation. I informed him that there is no bounded dynamic solution for the Einstein equation. Apparently, Yau did not know that Logunov and Mestvirishvili have found in 1989 that general relativity does not have the classical Newtonian limit. After he lost his claim that the Einstein equation has bounded dynamic solutions, he claimed that there is no self-consistent theory in physics [68]. Then, my response was that I asked him how to grade the work of his students in physics. (I was his senior in our High school Pui-Ching. In fact, we were trained by the same teacher Mr. Y. C. Wong.) Then, Yau claimed he has lost his interest in general relativity but he did not acknowledge publicly that their positive mass theorem is incorrect [69]. In Wikipedia, it still incorrectly claimed Yau's proof of the positive energy theorem demonstrated – sixty years after its discovery – that Einstein's theory is consistent and stable. It is unfortunate that Yau has dedicated this wrong paper to Prof Chern [53].
23. S. Hawking is the first theorist who advocates a separation in theories, whereas Newton is the first who proposed the unification. It is interesting that they are buried next to each other.
24. Lao Tze is a Chinese philosopher at the time as Confuscius.
25. I had informed the existence of Repulsive gravitation to Kate Kirby, CEO of APS in the APS Business Meeting in March, 2015 [17]. I am glad that it is under her leadership that so many changes and advances have happened.
26. Recently, I went to Hong Kong for lectures. However, the time

is not suitable for a public lecture. So, instead I taught Hong Kong people to measure weight reduction due to heating-up. Now I learned from Hong Kong that they have new results already. It is found that gold has the largest per-gram weight reduction among all available metals.
27. A smart Chinese woman, Wu Ze Tian, advocates learning from nature instead of just human being.
28. It is clear that the Nobel Committee for Physics had outdated knowledge on gravitation, but did not know it.
29. In particular, Einstein's pioneer work has not established general relativity as a self-consistent theory. Einstein's covariance principle as pointed out by Zhou Pei Yuan is invalid. His notion of gravitational mass is also invalid in physics although this is commonly used in the scale to measure mass. However, this method can measure only the gravitational attraction from the earth, but not the inertial mass. A question is why do many scientists avoid to show Einstein is wrong by doing the weight reduction experiments? This is because many have committed to general relativity so long that a failure of general relativity is also their personal failure.
30. Note that since this paper was presented in an APS April meeting in 2019, it should have been published in the Physical Review D. However, the editor of this journal put this article in "not under active consideration" for more than half a year. This shows that APS is still behind in some developments of physics, in spite of the efforts of Dr. Kate Kirby, CEO of APS. This also explains why most of Einstein's errors are not known from the journal of APS. In particular, the error of the general validity of E = mc2 that involves the validity of the Nobel Prize for David J. Gross, H. David Politzer, and Frank Wilczek.
31. Some claimed that the speed of light is coordinate dependent. This shows a deficiency in physics. In general relativity, this comes from Einstein's invalid covariance principle that has been pointed out by Zhou Pei-Yuan as invalid. And this conclusion is confirmed by explicit examples provided by Lo [58,59].

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