Some Rectifiable Inconsistencies and Related Problems in Einstein’s General Relativity

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Abstract

Einstein’s accurate predictions created a faith that makes a critical analysis of general relativity over due. Since his field equation has no dynamic solutions, the observational confirmations have been exaggerated. Einstein’s covariance principle has been proven to be invalid. This error comes from Einstein’s theory of measurement that adapts the mathematical notion of distance in Riemannian geometry as if valid in physics, and his supporting arguments are actually based on invalid applications of special relativity. However, such a theory of measurement was not used in Einstein’s predictions. Nevertheless, Einstein’s equivalence principle plays a crucial role in rectifying the shortcomings of his theory, and the Maxwell-Newton Approximation is proven as independently valid for massive sources. Then, general relativity leads to the discovery of the charge-mass interaction that would explain the space-probe pioneer anomaly discovered by NASA. Thus, unification of gravitation and electromagnetism is proven necessary. Moreover, since the photons must include gravitational energy, particle physics would not be clearly understood without gravity.

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Key Words: Einstein’s principle of equivalence; Einstein-Minkowski Condition; covariance principle; Local time; Euclidean-like Structure, photons.
1. Introduction

Einstein’s general relativity is currently regarded as a top scientific achievement, although it is known to be very difficult to understand. Observations accurately confirm the three predictions of Einstein [1, 2], namely: 1) the gravitational redshifts, 2) the perihelion of Mercury, and 3) the deflection of light. Recently it is found, however, that difficulties in its understanding actually came, in part, due to its being not a self-consistent theory [3-8].

Einstein’s accurate predictions created a faith on his theory. Although problems were raised by Whitehead [3] and Eddington [4] on Einstein’s theory of measurements, they are soon forgotten since nobody was able to solve them. Currently, instead of trying to improve the theory, many theorists tried very hard to make physical sense out of just any solutions of Einstein’s equation [9-11]. As a result, even the well tested Einstein’s requirement on weak gravity was rejected [9] and physical principles such as Einstein’s equivalence principle (see Appendix A) and the principle of causality are misinterpreted and/or neglected.

Currently many physicists still believe that general relativity is a perfect theory [12], although fundamental issues were unsolved after more than 90 years [5-8]. It seems that general relativity actually has never been well understood (see Appendix B). Another basic misunderstanding was that general relativity deals only with phenomena of macroscopic scale. This is found to be false since the notion of photon is also related to gravity (see Section 5).

2. Issues related to the Observational Confirmation

Moreover, there are unsolved issues in the confirmations for the predictions of Einstein’s theory as follows:

1) The gravitational redshifts were based on Einstein’s 1911 preliminary assumption equivalence between acceleration and Newtonian gravity. However, such an assumption is inconsistent with Einstein’s equivalence principle proposed later in 1916 [1, 2]. Fock [13] found that it is impossible to have a metric that is consistent with Newtonian uniform gravity. This shows that gravitational redshifts can be derived from an invalid theory although the gravitational redshifts can be derived from Einstein’s equivalence principle [1, 2].

2) Although Einstein did “derive” the perihelion of Mercury, Gullstrand [14] pointed out to the Nobel Committee that Einstein’s field equation may not be able to produce a solution for a two-body problem. Thus, Einstein’s derivation may not be valid. Because of this, Einstein was awarded a Nobel Prize just for his work on the photo-electric effects. Moreover, the suspicion of Gullstrand has recently been confirmed as valid since Einstein’s field equation indeed cannot produce a physical solution for a two-body problem [5, 15]. Recently ‘t Hooft tried to rebuttal this conclusion with his “counter” example [11]. However, this only exposed that he neglected Einstein’s equivalence principle as well as the principle of causality [11, 16] and the fact that a plane-wave is only a conditional idealiza-
tion. So, such an agreement with the perihelion only suggests that his theory would be on the right track. In other words, for dynamic cases, Einstein’s equation needs to be improved with modifications [5].

3) From both the Schwarzschild and the harmonic solution, Einstein obtained the same first order deflection of light in terms of the shortest distance $r_0$ from the sun center [1, 2]. Then, in support of his covariance principle, Einstein [2] remarked, “It should be noted that this result, also, of the theory is not influenced by our arbitrary choice of a system of coordinates.” Obviously, this gauge invariance, if correct, should be supported by all physical quantities in all orders of calculations. However, as will be shown later that such requirements are actually not satisfied. Thus, Einstein’s covariance principle is proven invalid, and general relativity of Einstein was not a complete theory. Fortunately, the Maxwell-Newton approximation has been proven as the valid first order approximation for gravity due to massive sources [17] such that the binary pulsar radiation experiments can be explained satisfactorily [5, 15]. This also shows that the bending of light can be validly derived from general relativity, and that Einstein’s notion of weak gravity is valid [15, 17]. According to this approximation, as has been shown [6], $r_0$ is at least accurate to the first order. Moreover, validity of this approximation implies also that the coupling constants have different signs [5] and thus the physical assumption of unique gravitational coupling sign is invalid in physics [15].

3. Logical Maturity and Confusion in General Relativity

Although the deflection angle to the second order also shows gauge invariance in terms of the impact parameter “b” [18, 19], careful analysis shows that this calculation actually implies that the theory is intrinsically not gauge invariant since, for each gauge, the shortest distance $r_0$ is different from that for another gauge [6]. To defend this inconsistency, the editorial of the Royal Society claimed [20] only $b$ is a true measurable physical quantity, but $r_0$ is just an arbitrary label. However, $r_0$ plays a crucial role on Einstein’s deflection angle of the first order approximation [1, 2]. Thus, if Einstein’s claim is due to inadequate deliberation, the argument of the editorial of the Royal Society is due to having not reached the expected maturity in logic.

This logical immaturity [21] also led to earlier incorrect support to [22] Bondi, Pirani & Robin [9] who rejected Einstein’s requirement on weak gravity since it is inconsistent with Einstein’s covariance principle. They also failed [7, 17] to see their solution violating the principle of causality. Moreover, they challenge other theorists, who believe in both Einstein’s requirement on weak gravity and his covariance principle. Nevertheless, prominent theorists such as Straumann [23], Wald [24], and Will [25] failed responding to this inconsistence [5] discovered since 1959.

Moreover, such logic immaturity is not just isolated incidents of this Royal Society. For instance, Penrose [10] accepted a metric solution with unphysical parameters [15] because the principle of causality was neglected. Hawking [26] claimed, “In relativity, there is no real distinction between the space and time coordinates, just as there is no real
difference between any two space coordinates.” He also claimed, “an arrow of time, something that distinguishes the past from the future, giving a direction to time”, and thus there are differences.

In fact, although the International Society on General Relativity and Gravitation was formed, founders of the society such as P. G. Bergmann [27], H. Bondi [9], V. A. Fock [13], J. L. Synge [28], J. A. Wheeler [29], and etc. have never reached a consensus. Under the auspices of this society, “General Relativity and Gravitation” is published. However, members of the Editorial Board actually do not sufficiently understand physical principles, such as Einstein’s equivalence principle and the principle of causality [22-31]. For instance, except in Einstein’s original works, there are no textbooks or references [30] (including the British Encyclopedia) that explained Einstein’s equivalence principle correctly although this principle is stated squarely in page 57 of Einstein’s book, “The Meaning of Relativity” [2]. They also failed to understand that Einstein’s final position on $E = mc^2$ as only conditionally valid [32], and misunderstand also the experiments of the binary pulsars [5, 15]. Some theorists even incorrectly criticized Einstein without getting the facts straight first [12, 28, 30]. Nevertheless, they have committed a common error, acceptance of Einstein’s covariance principle because of inadequate understanding of the difference between mathematics and physics [6, 7].

4. The Root of Einstein’s Difficulties and Rectification

Einstein’s difficulties are due to incorrectly adapt the mathematical notion of local distance in Riemannian geometry as if valid in physics [8, 33]. Moreover, Einstein’s theory of measurement is actually based on invalid applications of special relativity [1] (see Appendix B). Whitehead [3, p.83], strongly objected,

“By identifying the potential mass impetus of a kinematic element with a spatio-temporal measurement Einstein, in my opinion, leaves the whole antecedent theory of measurement in confusion, when it is confronted with the actual conditions of our perceptual knowledge. The potential impetus shares in the contingency of appearances. It therefore follows that measurement on his theory lacks systematic uniformity and requires a knowledge of the actual contingent physical field before it is possible.”

Since Einstein’s notion of distance depends on the metric, which in turn depends on the motion of matter, using such a theory to describe motion can only lead to confusion. Whitehead also rejected Einstein’s equivalence principle, which he has mistaken as the source of errors. Moreover, Einstein’s theory of measurement is inconsistent with the observed light bending [34, 35], is the root for ambiguity of coordinates, and ended up with the need of his covariance principle as an interim measure. Thus, inconsistency in general relativity seems to be inevitable.

Nevertheless, Einstein’s theory of measurement may not be an integral part of general relativity [8] since such a theory was not used for his predictions [1, 2]. In fact, it is found that such a theory is actually based on invalid applications of special relativity [1] (see Appendix B). Moreover, based on Einstein’s equivalence principle, it is found that the
local distance is determined by the Euclidean-like structure that is compatible with physical measurements [33]. Thus, Einstein’s errors in general relativity are rectifiable.

5. Discussions and Conclusions

Fundamental concepts in a great theory are often difficult to grasp [36]. To mention a few, this happened to Newton, Maxwell, Planck, Schrödinger, and C. N. Yang [37]. Einstein is simply not an exception. Unlike Newton, Einstein did not have adequate background in mathematics, and this affects the logical structure of his theory (see also Appendix B). He believed the solutions with different gauges as equally valid [2], but did not see that his covariance principle is inconsistent with his notion of weak gravity [5]. Zhou Pei-Yuan [38, 39] of Peking University was the first who correctly rejected Einstein’s covariance principle but accepted Einstein’s equivalence principle [29].

Currently a basic general misunderstanding was that general relativity deals with only phenomena of macroscopic scale. This misunderstanding is based on the inadequate assumption of Einstein that photons consist of only electromagnetic energy. This is not consistent with the facts that electromagnetic energy is not equivalent to mass, but that the $\pi_0$ meson can decay into two photons [16, 40]. Thus, Einstein’s proof of $E = mc^2$ is incomplete [41] since photons must include non-electromagnetic energy. Moreover, it is found [16, 42] that the notion of photon is also necessarily related to gravity. Thus, the notion that gravity can be ignored in particle physics is incorrect.

Nevertheless, Einstein is still a great theorist since the implications of general relativity such as the need for unification have been discovered and verified [43, 44]. However, theoretical developments [11, 44] and NASA’s discovery of the Pioneer anomaly imply that Einstein’s theory is clearly inadequate [45, 46]. Moreover, based on general relativity, the mass-charge interaction is discovered and the conditional validity of $E = mc^2$ can be further proven experimentally. Strictly speaking, Einstein’s field equation has not been confirmed since the Maxwell-Newton Approximation is a direct result of Einstein’s equivalence principle [17]. In other words, to obtain a valid field equation for the dynamic case is still not accomplished although the approach of modification has been confirmed [5, 15]. It is hope that this paper would be useful for the progress of general relativity.

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Appendix A: Einstein’s Principle of Equivalence, the Einstein-Minkowski Condition


‘Let now K be an inertial system. Masses which are sufficiently far from each other and from other bodies are then, with respect to K, free from acceleration. We shall also refer these masses to a system of co-ordinates K’, uniformly accelerated with respect to K. Relatively to K’ all the masses have equal and parallel accelerations; with respect to K’ they behave just as if a gravitational field were present and K’ were unaccelerated. Overlooking for the present the question as to the “cause” of such a gravitational field, which will occupy us later, there is nothing to prevent our conceiving this gravitational field as real, that is, the conception that K’; is “at rest” and a gravitational field is present we may consider as equivalent to the conception that only K is an “allowable” system of co-ordinates and no gravitational field is present. The assumption of the complete physical equivalence of the systems of coordinates, K and K’, we call the “principle of equivalence;” this principle is evidently intimately connected with the law of the equality between the inert and the gravitational mass, and signifies an extension of the principle of relativity to coordinate systems which are non-uniform motion relatively to each other.’

Later, Einstein made clear that a gravitational field is generated from a space-time metric. Thus, his principle was proposed for the gravity as an integral part of the physical space.

What is new in Einstein’s equivalence principle in 1916 is the claim of the Einstein-Minkowski condition as a consequence [8, p. 161]. While his 1911 preliminary assumption was based on intuition, the Einstein-Minkowski condition has its foundation from mathematical theorems [28] in Riemannian geometry as follows:

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

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

In these theorems, the local space of a particle is locally constant, but not necessarily Minkowski. However, after some algebra, a local Minkowski metric exists at any given point and that along any time-like geodesic curve \( \Gamma \). However, it should be noted also that the particle P is resting at the local Minkowski space.

What Einstein added to these theorems is that physically such a locally constant metric must be Minkowski. However, Pauli’s [47] version that a simplified but corrupted version of these theorems is as follows:

“For every infinitely small world region (i.e. a world region which is so small that the space- and time-variation of gravity can be neglected in it) there always exists a coordinate system \( K_0 \) \( (X_1, X_2, X_3, X_4) \) in which gravitation has no influence either in the motion of particles or any physical process.”

Thus, Pauli regards the equivalence principle as merely the mathematical existence of locally constant spaces.
A main difference between Pauli and Einstein is that Einstein obtains the local Minkowski space by an appropriate physical acceleration while Pauli would accept just a mathematical transformation. Nevertheless, Einstein’s equivalence principle is often misinterpreted. For instance, Will [48] claimed “’Equivalence’ came from the idea that life in a free falling laboratory was equivalent to life without gravity. It also came from the converse idea that a laboratory in distant empty space that was being accelerated by a rocket was equivalent to one at rest in a gravitational field.”

Apparently, Pauli [47], and Will [25, 48], overlooked Einstein’s [1, p.144] remark, “For it is clear that, e.g., the gravitational field generated by a material point in its environment certainly cannot be ‘transformed away’ by any choice of the system of coordinates…” Furthermore, Einstein [49] stated that the gravity of the earth is not equivalent to an accelerated frame, although Bergmann [27] confused Einstein’s equivalence principle with his “Einstein’s elevator”.

Misner, Thorne, & Wheeler [29, p. 386] claimed that Einstein’s equivalence principle is as follows: -

“In any and every local Lorentz frame, anywhere and anytime in the universe, all the (Nongravitational) laws of physics must take on their familiar special-relativistic form. Equivalently, there is no way, by experiments confined to infinitestimally small regions of spacetime, to distinguish one local Lorentz frame in one region of spacetime frame any other local Lorentz frame in the same or any other region.”

In their eq. (10.14), they got an incorrect conclusion on the local time of the earth in the solar system. However, Eddington [4], Straumann [23], Wald [24], and Weinberg [50] did not make the same mistake.

Moreover, a gravitational field and the bending of light need not be related to a non-vanishing curvature according to Einstein’s equivalence principle. As Einstein [51] explained to Laue, “What characterizes the existence of a gravitational field, from the empirical standpoint, is the non-vanishing of the $\Gamma^i_{jk}$ (field strength), not the non-vanishing of the $R_{\alpha\beta\gamma\delta}$,” and no gravity is therefore just a special case. This view is crucial because it justifies that the geodesic equation is also the equation of motion of a massive particle under the influence of only gravity.

Nevertheless, misunderstandings continued. Thorne [12] criticized Einstein’s principle for ignoring tidal gravitational forces. However, Einstein had already clarified this issue in a letter to A. Rehtz [51]:

“The equivalence principle does not assert that every gravitational field (e.g., the one associated with the Earth) can be produced by acceleration of the coordinate system. It only asserts that the qualities of physical space, as they present themselves from an accelerated coordinate system, represent a special case of the gravitational field.”

Also, Wald [24] and Ohanian & Ruffini [52] believed merely the equivalence of inertial and gravitational masses.

**Appendix B: Measurements in General Relativity and Einstein’s Invalid Applications of Special Relativity**

Although Einstein initially conceived his theory by considering a linear acceleration, the exposition of his theory started from considering a rotation [1]. An advantage is that free fall local spaces in the case of a rotating disk are Min-
kowskian (not just assumed). Specifically, he considered an inertial system of reference K (x, y, z, ct) and a system K’ (x’, y’, z’) in a uniform rotation $\Omega$ relatively to K. The origins of both systems and their axes of z (the axis of rotation) and z’ coincide. The flat metric of K is,

$$ds^2 = c^2 dt^2 - dr^2 - r^2 d\phi^2 - dz^2$$

where $x = r \cos \phi$, $y = r \sin \phi$, (1)

in the cylindrical coordinate system. Then, one would have a metric for K’ (x’, y’, z’) of the following form [53],

$$ds'{}^2 = g_{\mu\nu} dx'^\mu dx'^\nu,$$

where $dx'^\mu = dx', dy', dz', cdt'$ (2)

and dt’ is the local time. For reason of symmetry (i.e., based on the principle of causality [15]), a circle around the origin in the x-y plane of K may at the same time be regarded as a circle in the x’-y’ plane of K’.

Einstein argued that if circle is measured from K’, because of Lorentz contraction, the circumference would be greater than $2\pi r'$ although the so measured radius $r' = r$. Moreover, based on special relativity, Einstein claimed [1],

“An observer at the common origin of co-ordinates would therefore see it lagging behind the clock beside him…

So, he will be obliged to define time in such a way that the rate of a clock depends upon where the clock may be.”

Thus, Einstein defined a physical space-time coordinate system together with a metric that relates to local clock rates and local spatial measurements. Subsequently, Einstein concluded,

“We therefore reach this result: In general theory of relativity, space and time cannot be defined in such a way that differences of the spatial co-ordinates can be directly measured by the unit measuring-rod, or differences in the time co-ordinate by a standard clock.”

This is the conclusion that Whitehead considered as unacceptable in physics.

Moreover, Einstein continued, “The method hitherto employed for laying co-ordinate into the space and time continuum in a definite manner thus breaks down, and there seems to be no other-way which would allow us to adapt systems of co-ordinates to the four-dimensional universe so that we might expect from their application a particularly simple formulation of the laws of nature. So there is nothing for it but to regard all imaginable systems of co-ordinates, on principle, as equally suitable for the description of nature. This comes to requiring that:-

The general laws of nature are to be express by equations which hold good for all systems of co-ordinates, that is, are co-variant with respect to any substitutions whatever (generally co-variant).

Nevertheless, many (included this author) had failed to see that his arguments are actually invalid. To see his errors, one must go into the details instead of glossing over his claims.

Now, consider a particle P resting at K'(r’, $\phi'$, z’, ct’). The local space of P is $L^*(dR, dX, dz', cdt)$ with a Minkowski metric. In K, P has a position (r, $\phi$, z,) and its local space (dr, r$d\phi$, dz, cdt) has the Minkowski metric. These two local spaces have a relative velocity $r\Omega$ in the $\phi$-direction. Moreover, let X in the same direction of r$\phi$.

Then, according to special relativity, one has $dz = dz'$ and $dr = dR$, and the Lorentz transformation as follows:
It follows that if dX is measured simultaneously (i.e., dt = 0) from K, from (4a) one has
\[ dX = \left[1 - \left(\frac{r\Omega}{c}\right)^2\right]^{-1/2} rd\phi. \]  
(5a)

This is a space contraction for L* (dX > r d\phi). For a clock fixed at L* (i.e., dX = 0), from (3b) we would have
\[ cdT = \left[1 - \left(\frac{r\Omega}{c}\right)^2\right]^{1/2} c dt \]  
(5b)
if measured from K. This is a time dilation for L* (dt > dT).

From (5a), Einstein concluded that \( U/D > \pi \), where D is the diameter of a circle and U is its circumference. Since all the measurements in (5a) are done in K, Einstein mistakenly considered the integration,
\[ U = \frac{1}{2}\int \left[1 - \left(\frac{D\Omega}{2c}\right)^2\right]^{-1/2} \frac{\partial}{\partial \phi} \int Dd\phi = \pi D \left[1 - \left(\frac{D\Omega}{2c}\right)^2\right]^{1/2} \]  
(6)
valid. However, the error is that the distance dX in (5a) is not in K*, but in a local space L*, which depends on \( t \) and \( \phi \). Moreover, although all L*s at different \( \phi \) are at rest relative to K*, they are under different accelerations. Thus, integration (6) would not make sense as distance in K*. Moreover, the space K is in a relative motion with respect to K*. This is in a different situation for space contractions and the time dilation since the space S and such a local space L are at rest with each other. Thus, (5a) and (5b) actually have nothing to do with Einstein’s equivalence principle.

In other words, for this case, Einstein’s claims for space contractions and the time dilation are supported with invalid arguments. It is amazing that theorists (including this author) did not discover this earlier. Thus, Einstein actually did not provide a theoretical basis for his theory of measurement, and thus it should be examined very carefully.

Therefore, to clarify the issue of measurements, one should derive a space-time metric and shows that such a metric satisfies Einstein’s equivalence principle. We shall derive a metric for the case of a rotating disk that Einstein should have done. According to Landau and Lifshitz [53], the transformation to a uniformly rotating reference frame K’(x’, y’, z’) with angular velocity \( \Omega \) has the form [53],
\[ x = x' \cos \Omega t - y' \sin \Omega t, \quad y = x' \sin \Omega t + y' \cos \Omega t, \quad \text{and} \quad z = z', \]  
(7a)
or
\[ r = r', \quad z = z', \quad \text{and} \quad \phi = \phi' + \Omega t \]  
(7b)
Then a metric in terms of the coordinates in K’(x’, y’, z’) can be obtained from (7b); and
\[ dr = dr', \quad dz = dz', \quad \text{and} \quad d\phi = d\phi' + \Omega dt. \]  
(7c)
The transformed metric in system K’*(x’, y’, z’, ct) would have the following form,
\[ ds^2 = (c^2 - \Omega^2 r^2) dt^2 - 2\Omega r^2 d\phi' dt - dr^2 - r^2 d\phi'^2 - dz'^2 \]  
(8)
and
\[ g^{ctc} = 1, \quad g^{rr'} = g^{zz'} = -1, \quad g^{\phi\phi'} = -(1 - \Omega^2 r^2/c^2)^{-1}, \quad g^{ct\phi} = g^{r\phi} = -\Omega/c \] (9)
are the non-zero elements of the inverse metric. Then, one obtains that the force on a resting particle P with mass m is
\[ mv^2/r', \] which is also the force due to rotation. Note that (7a) implies also
\[ r' = r, \quad x' = r \cos \phi', \quad \text{and} \quad y' = r \sin \phi', \] (10)
Thus, (10) means K’(x’, y’, z’) also has a Euclidean-like structure. Thus Einstein’s claim would be incorrect.

The system K* (x’, y’, z’, ct) with metric (8) could have led to the “light speed” \( r d\phi'/dt \) larger than c because \( t \) is related to the local clocks resting at (x, y, z). Moreover, one could have misinterpreted metric (8) as having no space contraction [8, 30]. To rectify these problems, one must have a metric in terms of the local time \( t' \) of K’(x’, y’, z’).

Now, consider the local space L*, from (4a), (4b) and (7c) we have,
\[ dX = [1 - (r \Omega/c)^2]^{1/2} r d\phi', \] (11a)
and
\[ dT = [1 - (r \Omega/c)^2]^{1/2} \{dt - [1 - (r \Omega/c)^2]^{-1}(r \Omega/c^2) r d\phi'\} \] (11b)
Then we have
\[ ds^2 = (c^2 - \Omega^2 r^2) \{dt - [1 - (r \Omega/c)^2]^{-1}(r \Omega/c^2) r d\phi'\}^2 - dr^2 - [1 - (r \Omega/c)^2]^{-1} r^2 d\phi'^2 - dz'^2. \] (11c)
We note that local space L* is the local space of the Einstein-Minkowski condition. Consequently, we should have
\[ ds^2 = g_{ctc} c^2 dt'^2 - dr'^2 - (1 - \Omega^2 r^2/c^2)^{-1} r'^2 d\phi'^2 - dz'^2. \] (12)
Now, (11a) shows that the metric has space contractions. According to Landau & Lifshitz [50], we should have
\[ ds^2 = (c^2 - \Omega^2 r^2) dt'^2 - dr'^2 - (1 - \Omega^2 r^2/c^2)^{-1} r'^2 d\phi'^2 - dz'^2. \] (13)
where
\[ dT = [1 - (r \Omega/c)^2]^{1/2} dt' \quad \text{and} \quad cdt' = cdt - (r \Omega/c) r d\phi'[1 - (r \Omega/c)^2]^{-1}. \] (14)
Eq. (14), which is different from (5b), implies that for a local clock fixed at K’ an observer at K would have
\[ dt' = dt. \] (15a)
Thus, as Kundig [19] has shown, time dilation (14) can be verified. Moreover, since \( r = r' \), (11a) and (5a) imply
\[ r d\phi'[1 - (r \Omega/c)^2]^{-1/2} = dX = r' d\phi' [1 - (r \Omega/c)^2]^{-1/2}, \quad \text{and} \quad r d\phi = r' d\phi' \] (15b)
Thus, Einstein’s claim of \( U/D > \pi \) is not valid. Note that \([1 - (r \Omega/c)^2]^{1/2} r d\phi'\) is a distance measured in different L*.
Therefore, the integration of (11a) is not a distance in K’. However, relations (5a) all are measured in K.

Thus, some claims of Einstein appear to be valid because he made two mistakes that cancel each other. However, Einstein’s theory of measurement is invalid because Einstein incorrectly regarded space contractions, which are obtained from a local space at free fall, as measured in the frame of reference. Note that metrics (8) and canonical metric (13) relate each other with the relations (7c) and
\[ cdt' = cdt - (r \Omega/c) r d\phi'[1 - (r \Omega/c)^2]^{-1}. \] (16)
If one believes that dt’ is a global variable, then one integrated them, and would get (7b) and
\[ ct' = ct - \left( \frac{r \Omega}{c} \right) \phi' \left[ 1 - \left( \frac{r \Omega}{c} \right)^2 \right]^{-1} \]  

(17)

If (16) were integrable. However, (17) is not valid in physics. A problem is that \( \phi' \pm 2\pi \) is the same position, but \( t \) and \( t' \) would not be the same. As shown in (14), \( dt' \) is related to \( dT \) of the local inertial systems \( L^*(dR, dX, dz', cdT) \) at different \( t, r, \) and \( \phi' \), and thus (16) is not integrable.

Now, the Einstein-Minkowski condition is satisfied, and Einstein’s notion of local time and local clocks are supported. Thus, the Euclidean-like structure (10) is physically realizable in terms of measurements. In turn, this implies directly that Einstein’s claim on larger circumference/diameter ratio of a circle is invalid. The root of this error is due to confusing the notion of distance with the notion of invariance.

Einstein stated that the light speed is measured “in the sense of Euclidean geometry [2],” and, **all Einstein’s predictions are in terms of the Euclidean-like structure.** For instance, a ray of light, traveling at a shortest distance \( \Delta \) from the center of sun with mass \( M \), will be deflected by an amount \( [1, 2] M \Omega / 2\pi \Delta \). The secular rotation of the elliptic orbit of the planet in the same sense as the revolution of the planet, amounting in radius per revolution to \( 24\pi^2 a^2 / (1 - e^2) c^2 T^2 \).

In addition to \( \Delta, e \) the numerical eccentricity and \( a \) the semi-major axis of the planetary orbit in centimeters are defined in terms of the Euclidean-like structure, and \( T \) the period of revolution in seconds is defined in terms of the time of a “quasi-Minkowskian space” [50]. Thus, it is clear that Einstein’s theory of measurement has not been used in his calculations. In other words, his invalid theory of measurement is actually independent of the theory of general relativity.

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Comments

Einstein’s accurate predictions created a faith that makes a critical analysis of general relativity over due. As Whitehead pointed out, the main difficulty was due to Einstein’s theory of measurement that incorrectly adapts the mathematical notion of distance in Riemannian geometry as if valid in physics. Moreover, Einstein’s supporting arguments are actually based on invalid applications of special relativity. However, nobody (including this author) questioned the validity of his arguments. Note that such a theory of measurement was actually not used in Einstein’s predictions. This shows how much the so-called experts in general relativity actually understand about relativity. It is noted also that many errors in general relativity is due to logical immaturity of theorists.

Moreover, the observational confirmations have been exaggerated since his field equation actually has no dynamic solutions. Einstein’s covariance principle has been found to be invalid. Nevertheless, Einstein’s equivalence principle plays a crucial role in rectifying the shortcomings of his theory, and the Maxwell-Newton Approximation is proven as independently valid for massive sources. Then, general relativity leads to the discovery of the charge-mass interaction that would explain the space-probe pioneer anomaly discovered by NASA. Thus, unification of gravitation and electromagnetism is necessary. Moreover, it has been found that the photons must include gravitational energy, and therefore a difficulty in particle physics could be the efforts of trying to have a good and clearly understanding without gravity. Moreover, since gravity is neglected in quantum mechanics, it is not a final theory.

Dear Professor Szekely:

Thank you very much for your email that accepts my suggestions for the improvement of the paper. Accordingly, a clean up version, which is ready for posting, is attached herewith. Moreover, the paper is edited with some typo-errors corrected. However, if there are some more such errors, please take the trouble of correcting them. Thank you.

Thank you for your kind attention.

Sincerely yours,

C. Y. Lo