Practical and theoretical assessment of relativistic theory v. 2.

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Abstract.
The Special and General theories of Relativity (SR and GR) have provided a deep mathematical formalism which has proven scientifically useful. However, it must be remembered that all scientific theory is but a model, and any model will necessarily demonstrate limitations and particular discrepancies compared to experimental results, which in turn define its limitations of theoretical utility and correspondence to reality. Theories are subject to the particular conditions of constraint under which they are devised, and also, the associated formalism may create artifacts within expressed physical theoretical applications which, although born of abstract formalism, might be taken as real physical quantities and effects. Within these concerns, one might ascertain the proper limits of a model like GR and the extrapolation of curved space time, and re-examine SR as well, for GR is based on SR.

Introduction.

The sorts of errors noted above have, in our personal view, contributed to the existence of several, likely false, pieces of science which are reflections of theoretical limitation, and the mistaking of abstract formalism for real physical objects; for example, black holes, dark matter, dark energy, and curved space-time. [1, 2]

Although touted as a complete explanation of much of our observed world there are questions, often unacknowledged, which should be addressed in order to understand the limits and identify the useful aspects of relativistic theory. From van Flandern's seminal essay *Gravity, What the Experiments Say* [2] the following points are brought forward (See also [1]):

Why do photons from the Sun travel in directions not parallel to the direction of Earth's gravitational acceleration toward the Sun?

Why do total eclipses of the Sun by the Moon reach maximum eclipse about 40 seconds before the Sun and Moon's gravitational forces align?

How do binary pulsars anticipate each other's future position, velocity, and acceleration faster than the light time between them would allow?

How can black holes have gravity when nothing can escape because escape speed is greater than the speed of light?

Also, there is the question of causality involving static field dynamics. [2, 3]

Gravitational lensing and red shift can be explained without recourse to theory involving paradoxical notions. One can explain it with refraction (and atmospheric interactivity) as in: [4,5,6,7] and [2]. Remembering the basic relation between a foundational SR and dependent GR, note the following from the above reference [7]: ". . . special relativity is nowhere exactly valid in the universe at large, because at cosmological distances the universe is a medium with high energy density (since it is everywhere filled up with light or stars), and the space within galaxies is a notorious physical medium filled up of gases, particles and dust." Please recall SR was conceived within particular conditions of constraint: light moves at *c* ***only*** as it propagates *in a vacuum*.

From, [6] "General Relativity predicts no diffraction with gravitational lensing since gravity warped space-time should bend all wavelengths equally. General Relativity theorists suggests the lack of diffraction in lensing is evidence their theory is correct. Yet "Einstein Rings" are blue. . . . The blue color is an indication of diffraction." And also from the same source: "If refraction is the actual cause of lensing, a major assumption driving the dark matter search would be swept away. Because of such assumptions, critics suggest that even after decades of searching, dark matter remains dark — because it does not exist." Indeed, this is our view as well. See also [8,9].

Do recall that GR, is in fact, based all but entirely upon (minimization of) time dilation. Is Bernard Burchell correct in his startling conclusion which states: "The acceleration time dilation aspects of General Relativity (GR) are internally self-contradictory and thus could not be true." [10]? He may well be. We suggest that there are alternatives which can provide scientifically useful systems of calculation and analysis, and those systems are free from relativistic paradox.

In Tom Van Flandern's essay, *The Speed of Gravity what the experiments say*, a solid and specific empirical answer is provided (see original article for embedded references):

"The most amazing thing I was taught as a graduate student of celestial mechanics at Yale in the 1960s was that all gravitational interactions between bodies in all dynamical systems had to be taken as instantaneous. [2]

Yet, anyone with a computer and orbit computation or numerical integration software can verify the consequences of introducing a delay into gravitational interactions. The effect on computed orbits is usually disastrous because conservation of angular momentum is destroyed. [2]

While relativists have always been partial to the curved space-time explanation of gravity, it is not an essential feature of GR. Eddington (1920, p. 109) was already aware of the mostly equivalent "refracting medium" explanation for GR features, which retains Euclidean space and time in the same mathematical formalism. In essence, the bending of light, gravitational redshift, Mercury perihelion advance, and radar time delay can all be consequences of electromagnetic wave motion through an underlying refracting medium that is made denser in proportion to the nearness of a source of gravity. (Van Flandern, 1993, pp. 62-67 and Van Flandern, 1994) . . . The principal objection to this conceptually simpler refraction interpretation of GR is that a faster-than-light propagation speed for gravity itself is required. In the context of this paper, that cannot be considered as a fatal objection. [2]

We conclude that the speed of gravity may provide the new insight physics has been awaiting to lead the way to unification of the fundamental forces. . . . Moreover, the modest switch from SR to LR [Lorentzian Relativity] may correct the "wrong turn" physics must have made to get into the dilemma presented by quantum mechanics, that violate the locality criterion may now be welcomed into conventional physics." [2]

Note in [3] we find the following conclusion: "Therefore, the energy of potential energy of static fields was transported and, accordingly, represents information." We will state the matter even more clearly: Between refraction and information one may yet account for gravitation and resultant effects without any paradox, even mysterious quantum ones! [11]

Also recall the familiar fact that the celebrated Apollo missions used instantaneous gravitational propagation speed in the calculations which assured mission success [1]. Also please remember van Flandern's central role in creating the GPS system, and that no relativistic corrections are made to the system. "The system manages to work, even though they use no relativistic corrections after launch," Van Flandern said. "They have basically blown off Einstein." [12]

With these facts in mind, one must wonder if valid alternative theories and models exist which do not depend on Relativity as defined by Einstein, that may allow the usage of vital equations like $E = mc^2$? Is there another way to look at the situation, which does not depend on curved space-time, or the limit of light speed? We will present several such solutions for consideration.

Alternative systems of calculation and valid theoretical alternatives.

In the nineteenth century, the existence of a material medium, the aether, pervading all space was a generally accepted concept. The supposed mechanical vibrations of this medium were used to explain the wave propagation of light. One great challenge facing experimentalists, therefore, was to detect the actual presence of this medium. At the time, optical experiments were the most accurate available. Easily the best known was that performed by Michelson and Morley in the 1880's. It is well recorded that this experiment failed to detect the physical existence of the aether. In the history of the development of special relativity, this is the first juncture where questions should be raised. Was it actually true that the experiment did fail to detect the physical existence of an aether? The controversy surrounding this seemingly straightforward question continued throughout the twentieth century and is not resolved even today. It is claimed in the vast majority of, if not all, textbooks that no absolute motion was detected but, in truth, the published data revealed a speed of 8km/s. However, this made use of Newtonian theory to calibrate the equipment and was a figure much less than the 30km/s orbital speed of the earth. It was purely due to this second point that the detected speed was less than the orbital speed of the earth that a null result was claimed. It is now claimed by some that modern analysis leads to a different calibration for the equipment and that this, in turn, leads to a speed in excess of 300km/s. The claim is then that the experiment both detected absolute motion and the breakdown of Newtonian theory. This first supposed detection of absolute motion has supposedly been confirmed by other experiments.

However, it quickly became accepted generally that the Michelson - Morley experiment did, in fact, fail to detect the existence of an aether and there then resulted a major challenge to the theoreticians to explain this null result. After much preliminary work by such as Lorentz and Poincaré, Einstein's special theory of relativity emerged as the accepted explanation but that acceptance came several years after the appearance of his basic paper, years during which Lorentz's relativity theory had been widely accepted as valid. However, since those early years of the twentieth century, there has been much discussion of the results of the Michelson-Morley experiment; it being claimed on many occasions that the experiment did not, in fact, produce a null result. The controversy still exists, to the extent that there are plans to perform the experiment yet again in an attempt to establish beyond all doubt the true facts of the situation. Nevertheless, one important piece of physics is invariably omitted from all these considerations. At the time of the original Michelson-Morley experiment and, indeed, at the emergence of the special theory of relativity, the notion of a boundary layer was unknown. Although Stokes had broached the idea in the middle years of the nineteenth century [13], boundary layer theory was introduced only in 1904 by Prandtl. His original publication was in an obscure journal [14] and it was quite some time before the ideas became both known and accepted.

However, if an aether did exist and if the ideas of boundary layer theory are accepted, then the Michelson-Morley experiment, since it was performed on the surface of the earth, would have been performed within the boundary layer between the earth and the aether. At the earth's surface the relative speed of earth and aether would be zero and so, on the basis of this, a null result should have been expected. Ideally, the Michelson-Morley experiment should be repeated, but this time well away from the possible boundary layer. Seemingly this would necessitate performing it well away from the earth and from all other planets. If the results of such an experiment were not null, the existence of an aether could be denied no longer and it would not be mandatory to assume the constancy of the speed of light. An important consequence would be that, as has been shown by Thornhill, the speed of light would be proportional to the square-root of the temperature of the background radiation. In turn, as has been noted elsewhere [15], this would negate the need for the inflationary scenario in the description of the very early universe.

In a series of articles going back to at least 1985, Thornhill has revisited the whole question of the validity of the special theory of relativity. However, he has approached the question from the point of view of a fluid mechanician. More recently [16], he concerned himself with contrasting the space-real time of Newtonian mechanics, including the aether concept, with the space-imaginary time of relativity involving no aether. By using the theory of characteristics, he showed that the usual Maxwell equations and sound waves in any uniform fluid at rest possess identical wave surfaces in space-time. Also, in the absence of charge and current, Maxwell's equations reduce to the same wave equation which governs such sound waves. This equation is not general and invariant but becomes so when transformed by Galilean transformation to any other reference frame. The same is true of Maxwell's electromagnetic equations which are not general but unique to one frame of reference; in fact, if the argument of Abraham and Becker [17] is followed through to its logical conclusion, it is seen that, in a general frame of reference, Maxwell's equations assume a form which is invariant under Galilean transformation and in which the operator $\partial/\partial t$ is replaced by Euler's total time derivative moving with the fluid, namely

$$D/Dt \equiv \partial/\partial t + \boldsymbol{u}.\boldsymbol{\nabla}$$

where $\boldsymbol{u}$ is the constant relative velocity between the two frames in question [18]. The resulting progressive equations are then invariant and apply to electromagnetic waves in a uniform aether moving with constant velocity $\boldsymbol{u}$ relative to the frame of reference. It is what Thornhill regards as the mistake of believing Maxwell's original equations invariant which has led to the Lorentz transformation and special relativity. Also, he would contend that it has led to the misinterpretation of the differential equation for the wave cone through any point as the quadratic differential form of a Riemannian metric in space-imaginary time.

It should be noted that the modified form of the Maxwell electromagnetic equations referred to here has been derived independently on a number of occasions by a variety of people. Possibly most notable among these is Heinrich Hertz, whose derivation of the modified form is included in his 1893 book, *Electric Wave* [19]. This is truly notable because the date precedes relativity by so many years. Phipps [20] has queried whether Maxwell was aware of this work by Hertz and, if he was, why it didn't provoke him to re-examine his equations himself. However, it is possible, even likely, that Maxwell was aware of this work because it is known that he visited America and discussed the possibility of carrying out experiments using an interferometer to check on the possible influence of higher order terms in his theory. It is thought by some that this is what provoked Michelson to set up and perform his now famous experiment. If this speculation is true, the second part of Phipps' query remains as to why Maxwell didn't re-examine his electromagnetic equations. Of course, it is possible that he did but failed to complete a derivation in a moving medium. However, it is probably more important to note that, if Maxwell did know of Hertz's work, then others would have also and it is surprising, therefore, that special relativity came about as it did. Indeed, following Thornhill's reasoning, it may be felt surprising that special relativity, as known today, ever surfaced.

In yet another article [21], Thornhill showed that the equations governing general small amplitude wave motions to first order in the general unsteady flow of any general fluid also reduce to the same wave equation with constant thermodynamic wave speed in the case of a fluid at rest. The said wave equation was shown to hold in a unique frame of reference and is not, therefore, invariant under Galilean transformation. However, it emerged that it will transform under Galilean transformation into a form which is invariant for all other frames of reference. The wave surfaces of Maxwell's equations are then as for sound waves in any uniform fluid at rest. Again it follows that Maxwell's equations will hold only in a unique frame of reference and should not remain invariant when transformed into any other frame of reference. In particular, he showed that the envelope of all wave surfaces passing through any point at any time is, for the wave equation and, therefore, for Maxwell's equations also

$$c^2dt^2 = dx^2 + dy^2 + dz^2, \qquad \text{(i)}$$

where c is the constant thermodynamic wave speed. As he pointed out, this is a differential equation and the immediate task should be to solve it; this he does. It is obvious that this equation is

$$ds^2 = c^2dt^2 - dx^2 - dy^2 - dz^2$$

with $ds = 0$. Thornhill's claim is then that this is where one mistake occurred, and has continued to occur. His contention is that there is no requirement for Maxwell's equations to remain invariant under transformation and that the above expression for ds^2 has meaning in the present context only when $ds = 0$. He suggests that Minkowski erred in apparently failing to recognise that equation (i) above is merely the differential equation of the envelope of the wave surfaces. A further point to be noted at this juncture is that Maxwell's equations, as normally considered, are derived for a medium at rest. It is conceivable that, if those equations had been derived for a moving medium originally, the controversies surrounding special relativity might never have arisen because that particular development might never have been required.

The above situation concerning Maxwell's equations and sound waves then raises the question of whether, or not, mathematics is required to tolerate the same equation being transformed in different ways for different applications. As Thornhill puts it, "does mathematics allow the wave equation to conform to Galilean transformation when it is applied to sound waves, to Lorentz transformation when it is applied to electromagnetic waves, and to either or both of these transformations when it is considered purely as a mathematical equation, or does mathematics insist that the Galilean transformation is unique and must apply equally to all equations so that the same equation must always be transformed by the same Galilean transformation, no matter to what it is applied, or whether it is applied to anything at all?"

It is recognised that the abandonment of special relativity and a return to Newtonian mechanics would result in a backlog of problems requiring conventional solutions. However, the claim is that such problems would lead eventually to the methods of unsteady gas dynamics and the theory of characteristics, such has already occurred in some instances. Thornhill himself has already tackled the problem of the kinetic theory of electromagnetic radiation and derived Planck's formula for the energy distribution in a black body radiation field from the kinetic theory of a gas with Maxwellian statistics [22]. It is in this article that he shows that, if there is an aether, the speed of light is proportional to the square root of the temperature. In this latter paper, and in a companion one [23], he argues persuasively against another reason for denying the existence of an aether. This asserts that the Maxwell equations indicate that electromagnetic waves are transverse and so, any aether, if it exists, must behave like an elastic solid. Thornhill points out that Maxwell's equations show that the oscillating electric and magnetic fields are transverse to the direction of wave propagation and say nothing about condensational oscillations of any medium in which the waves propagate. The deduction that electromagnetic waves are transverse might be felt an alternative way of claiming the non-existence of an aether. However, if an aether does exist, then, since electric field, magnetic field and motion are mutually perpendicular for plane waves, the deduction from Maxwell's equations would be that the condensational oscillations of the aether are longitudinal, in analogy with sound waves in a fluid.

Further, as has been pointed out by Thornhill [24], the reason Lorentz 'invariance' gives so many correct results is because one consequence of the Prandtl boundary layer theory is that the viscosity of the aether ensures that the local aether moves with all observers and all observers who move with the local aether have the same unique local wave-hyperconoid given by the differential equation

$$(dx/dt)^2 + (dy/dt)^2 + (dz/dt)^2 = c^2. \qquad \text{(ii)}$$

This follows since the general wave-hyperconoid

$$(dx/dt - u)^2 + (dy/dt - v)^2 + (dz/dt - w)^2 = c^2$$

is invariant under Galilean transformation and, locally, $u = v = w = 0$ for all observers in their rest frames. Again, as noted already, the invariance of (ii) between all observers is established by using Galilean transformation, Newtonian mechanics and the aether concept.

Hence, it would appear that there are genuine points of concern over the total validity of the special theory of relativity. However, it must not be forgotten that another major accepted consequence of the theory was that energy and mass are related via

$$E = mc^2.$$

However, is this actually true?

One man who, over a period of time has produced much interesting and relevant material is Harold Aspden. Early in his later writing [25], he reveals some very interesting facts which, while probably well-known to some, will be far less well-known to the vast majority. He points out that physics, particularly electrodynamics, made tremendous and very rapid progress in the later years of the nineteenth century. One of the highpoints of this had to be the discovery of the electron by J.J.Thomson in 1897. This, of course, is well-known but what is less well-known is that this was followed, in 1901, by Kaufmann's discovery [26] that the electron's mass increased with speed. In fact, Kaufmann actually measured variation in the charge/mass ratio with increase in speed. The immediately obvious point concerning this piece of information is that it clearly predates Einstein's 1905 paper introducing his special relativity. It is also worth noting, because it is often either forgotten or deliberately ignored, that the explanation for this variation with speed had been provided by Thomson and others before the advent of Einstein’s special relativity. Aspden has obviously delved very deeply into the scientific history of the now famous formula linking energy and mass and this is to the benefit of all, whether or not individuals agree with his conclusions. He notes that, as far as the formula $E = mc^2$ is concerned, definite reference was implied in a book of 1904, - *The Recent Development of Physical Science* by W.C.D.Whetham - where there was reference also to a suggestion made by Jeans to the effect that the energy of radioactive atoms might be “supplied by the actual destruction of matter”. In other words, in an article of 1904 published in *Nature* (vol.**70**, page 101), Jeans directed everyone’s attention to the store of energy which was available by the annihilation of matter, “by positively and negatively charged protons and electrons falling into and annihilating one another, thus setting free the whole of their intrinsic radiation”. Jeans further noted that, initially, he felt he was advocating something new but actually found that Newton had anticipated something similar two centuries earlier, as is recorded in Query 30 of the 1704 edition of *Optics*. However, returning to the question of the equation $E = mc^2$, as Aspden notes, while specific reference to it does not appear in Whetham’s book, all the necessary background physics is well presented in mathematical terms. No doubt, Thomson had arrived at his result by assuming the energy of the magnetic field due to the motion of a charge e at a speed v to be $e^2v^2/3ac^2$ and thinking of this as equalling the kinetic energy $mv^2/2$. The equality of these two expressions results in:

$$mc^2 = 2e^2/3a,$$

where the expression on the right-hand side is the energy Thomson recognised as that of an electron with its charge contained within a sphere of radius a. Hence the implied equivalence of mass and energy is deduced.

Again, it should be noted that J. J. Thomson himself referred to the relation $E = mc^2$ in a series of lectures he delivered at Yale University in 1903. These lectures also appeared as a book [27] published initially in 1904. Hence, it is undoubtedly the case that this most famous of physics’ relationships was both known and used well before the advent of Einstein’s special theory of relativity. Indeed, more recently, J. P. Wesley [28] has noted that this relation is an experimentally verifiable fact and has shown that, by accepting that, he has been able to deduce other relations normally accepted as being linked solely with the special theory of relativity. Possibly the most important example is the following:

Wesley diverges from traditional Newtonian mechanics as a result of his noting that, since mass/energy equivalence is an established fact, if this applies to any form of energy, it follows that there must be a mass equivalent for kinetic energy. This fact has to be included, therefore, in traditional Newtonian mechanics as a modification. Consider a body at rest whose measured mass is *m*. Suppose this same body then moves and when in motion, possesses a kinetic energy *T* then, the mass equivalent is T/c^2 and, therefore, the total momentum of the body is given by

$$\boldsymbol{p} = (m + T/c^2)\boldsymbol{v}$$

From Newton's Second Law, it follows that the force acting, *P*, is given by

$$\boldsymbol{P} = \frac{d}{dt}\left(m + {}^{T}\!/_{c^2}\right)\boldsymbol{v}$$

Since the rate of working of the force equals the rate of increase of the kinetic energy, it follows that

$$\frac{dT}{dt} = \boldsymbol{v}.\frac{d\boldsymbol{P}}{dt} = \boldsymbol{v}.\frac{d}{dt}\left(m + {}^{T}\!/_{c^2}\right)\boldsymbol{v}$$

Next note that, if $\gamma = \left(1 - {}^{v^2}\!/_{c^2}\right)^{-1/2}$,

$$\frac{d\gamma}{dt} = \frac{\gamma^3}{c^2}\boldsymbol{v}.\frac{d\boldsymbol{v}}{dt}$$

and so

$$\frac{dT}{dt} = \boldsymbol{v}.\frac{d}{dt}\left(m + {}^{T}\!/_{c^2}\right)\boldsymbol{v}$$

$$= \left(m + {}^{T}\!/_{c^2}\right)\boldsymbol{v}.\frac{d\boldsymbol{v}}{dt} + (\boldsymbol{v}.\boldsymbol{v})\frac{1}{c^2}\frac{dT}{dt}$$

$$= \left(m + {}^{T}\!/_{c^2}\right)\frac{c^2}{\gamma^3}\frac{d\gamma}{dt} + \frac{v^2}{c^2}\frac{dT}{dt}$$

Rearranging leads to

$$\frac{dT}{dt} = (mc^2 + T)\frac{1}{\gamma}\frac{d\gamma}{dt}$$

or

$$\frac{1}{(mc^2 + T)}\frac{dT}{dt} = \frac{1}{\gamma}\frac{d\gamma}{dt}$$

Integrating both sides with respect to *t* and noting that *T* = 0 when *v* = 0 leads to

$$T = mc^2(\gamma - 1),$$

a result normally associated with the Special Theory of Relativity.

Another person to obtain results normally associated with special relativity but without recourse to the postulates and methods of that theory is Mandelker who, in his 1954 book, *Matter Energy Mechanics* [29], derives the usual special relativity formula for the change in mass with speed without recourse to the methods and techniques of special relativity. This follows on Wesley's derivation of the expression for kinetic energy again without recourse to the methods of special relativity. However, is this derivation by Mandelker correct?

Newton's second law should properly be written as he himself intended

$$\boldsymbol{F} = \frac{d}{dt}(m\boldsymbol{v}) = m\frac{d\boldsymbol{v}}{dt} + \boldsymbol{v}\frac{dm}{dt}.$$

The propensity for writing and speaking of this law in the form force equals mass multiplied by acceleration and which assumes the mass constant, is possibly the cause of much trouble in physics over all the years since Newton.

An element of work done, dW, is given by

$$dW = F.d\boldsymbol{s} = m\frac{d\boldsymbol{v}}{dt}.d\boldsymbol{s} + \frac{dm}{dt}\boldsymbol{v}.ds$$

Then, if energy and mass are linked via

$$E = mc^2$$

as is verifiable experimentally, by conservation of energy

$$dW = dE$$

or

$$m\frac{d\boldsymbol{v}}{dt}.d\boldsymbol{s} + \frac{dm}{dt}\boldsymbol{v}.d\boldsymbol{s} = c^2 dm$$

This may be rewritten

$$mvdv = (c^2 - v^2)dm$$

or

$$\frac{vdv}{c^2 - v^2} = \frac{dm}{m}$$

which may be integrated to give

$$logm = -\frac{1}{2}log(c^2 - v^2) + logA$$

where A is a constant of integration.

If $m = m_0$ when $v = 0$, then A is seen given by

$$log m_0 + \frac{1}{2} log c^2$$

and substituting back and rearranging leads to

$$log \frac{m}{m_0} = \frac{1}{2} log \frac{c^2}{c^2 - v^2}$$

or

$$m = \frac{m_0}{\sqrt{1 - v^2/c^2}}$$

the familiar expression normally associated with special relativity.

All the above is achieved without recourse to the traditional notions of special relativity and without use having to be made of the almost totally mathematical approach involving use of the Lorentz transformation equations. This is important because many of the puzzles associated with traditional special relativity may be traced back to the Lorentz transformation equations and it is these puzzles, many of which are really mathematical in fundamental nature rather than physical, which caused Herbert Dingle so much trouble. After many years promoting special relativity, Dingle [30] raised several worries and objections; most notably possibly that concerning the seeming non-symmetry of the problem of the so-called ‘clock’ or ‘twin paradox’. Whatever a person’s personal views may be, it is undoubtedly true that the history of this dispute (fully documented in the given reference) hardly indicates a satisfactory resolution of a genuine problem. Here, after all, was a major query being raised by one who had been a very genuine supporter of the special theory of relativity as put forward by Einstein and, once again, a person well-known and well-established in academic circles. Dingle experienced real concerns over the validity of the theory and, as well as those, he recognised that there were in existence *two* special theories of relativity, one attributable to Lorentz and the other to Einstein. The difference between the two, as he pointed out, was a big one; the first retained the concept of an aether, the second did not.

As far as the special theory is concerned, it is undoubtedly true that controversy has simmered just beneath the surface from the very early days. The general theory, however, seemed to offer the only solution to problems which had been taxing theoreticians for some considerable time. Doubts were expressed but, as has so often been the case where Einstein’s theories of relativity are involved, the concerns of the doubters were regularly dismissed. Again, though, as in the case of special relativity, not all the facts are made readily available to modern day audiences. In Newtonian mechanics, although not specifically mentioned usually, the effects of gravity are assumed to propagate at infinite speed. This follows from Newton's original concept of action-at-a-distance. More recently, the thought has developed that, in reality, gravitation propagates at the speed of light. One example that originally caused problems was the value of the observed advance of the perihelion of the planet Mercury. Newton's theory explains an advance of the perihelion but not of the observed magnitude. It is proclaimed nowadays that Einstein's general theory of relativity was the first to explain the advance correctly. It is true that it does predict the correct value for the advance but, as Aspden reveals, Einstein wasn't the first to offer a satisfactory explanation. This honour falls to a German schoolteacher, Paul Gerber, who presented a theoretical argument giving the precise value of the anomalous advance of the perihelion of Mercury in an article entitled *The Space and Time Propagation of Gravitation* and published in 1898 [31]. Gerber actually derived exactly the same formula for the advance as that given by Einstein in 1916 and, in fact, had assumed that the effects of gravity propagated with the speed of light, in common with ideas of today. Aspden comments that Gerber may have made mistakes in his argument but implies that the basic argument was correct and all that was needed was for someone to tidy it up. Instead, this work was, and still is, virtually unknown. This is surprising because the article addressed a major problem of the time, appeared in a highly regarded journal and the fact that it appeared in German would have posed less of a problem to international audiences then than it might now.

The arguments surrounding the advance of the perihelion of Mercury and other phenomena supposedly explained by the general theory of relativity and only by that theory have continued apace ever since the theory first saw the light of day. Most suggested alternative explanations have been dismissed, often with a sad shake of the head as if to suggest some degree of sympathy for someone who could be so deluded as to think they could even contemplate offering an alternative. Nevertheless, in more recent years, alternative ways of explaining the shift of the perihelion of Mercury and the bending of light rays have emerged. One of the most recent is that due to Lavenda [32]. He set out to explain the time delay in radar echoes from planets, the bending of light rays, and the shift of the perihelion of Mercury via Fermat's principle and the phase of Bessel functions. It is undoubtedly true that he has succeeded in explaining these three phenomena by this means. However, he met fierce opposition when it came to publishing this work. Why? Nowhere does he claim to be attempting to usurp the position of general relativity; he merely wishes to point out that some results, at least, may be obtained by means other than use of the general theory of relativity. As he himself says, “Sometimes new insight can be gained by looking at old results from a new perspective.” This highly perceptive suggestion by Lavenda might usefully be noted by all who oppose the publication of anything that even appears to question either special or general relativity, or indeed any who oppose publication of anything purely because it fails to conform to some arbitrary element of ‘conventional wisdom’. The alternative suggests an amazingly blinkered view, often by some of the publicly acknowledged giants of the scientific world. The only way forward in any pursuit of knowledge is to admit all possibilities. Once you close one door, you instantaneously rule out one avenue of approach and, therefore, possible advance. Intellectual giant though Newton undoubtedly was, everyone is quite happy to query details of his theories, and rightly so. Hence, why is questioning of Einstein’s theories regarded by so many as totally unacceptable? This is a question to which no-one probably knows the true answer. Nevertheless it is a question which needs to be raised and one of which the public at large should be aware. To emphasise a point raised above, alternative approaches do exist which lead to the solution of problems which may also be solved using the methods of general relativity and, as Lavenda has said, examining these alternatives could lead to new insights.

For mathematicians, the general theory of relativity has always been regarded as a thing of real beauty. This is a position which any non-mathematician may find extremely difficult to comprehend but it is, nevertheless, very true. It must always be remembered that mathematics is a subject which may be studied on at least two very different, but equally important, levels. It may be studied as a purely academic subject in its own right. In this approach, the mathematics is all important and, to the practitioner, can be, and often is, extremely beautiful. It must be noted also that, academically, this approach to mathematics is fully justified; it is a highly worthwhile academic pursuit. However, the second major view of mathematics is as the language of physics. In this context, mathematics may still be seen as extremely beautiful but here it is, and indeed must be, subservient to the physics in importance. Once mathematics is used as the language of physics, it is being used as a tool in an attempt to describe physical situations. It is no longer truly important in its own right. Now, it is the physics of the situation under consideration which is all important and must provide the driving force for any work which ensues. Again, the mathematics is being used in this case to help model a physical situation and it must be remembered always that that is all that is being attempted – to produce a model of a physical situation. It is highly unlikely that any such model will be an exact representation of physical reality; it will be merely an approximation. How good that approximation proves to be is determined by what follows from the theory. Does it, for example, make valid predictions about the physical situation which originally occasioned the investigation? If it does, the accuracy of these predictions will prove a useful guide to the worth of the theory. However, where great care must be taken is in ensuring that the physical situation under consideration isn't, in any way, forced to 'fit' this theory; it is vital to avoid the accusation that observations are interpreted with the predictions of the theory in mind.

The general theory of relativity is one of those topics which rely heavily on very beautiful mathematics, to the extent that the physics of the situation can even tend to be obscured by that very mathematical beauty. Mathematics is a beautiful, rewarding subject in its own right and, academically, no justification is needed to support its study. However, as mentioned above, where study of physics is concerned, mathematics is simply a tool to be used by the physicist in aiding the resolution of a physical problem. In these circumstances, it is the physics which is all important. A theory cannot be adopted to the exclusion of all others simply because the mathematics is beautiful. As far as general relativity is concerned, as has been stated on several occasions, the only results which can be truly trusted are those with a Newtonian analogy. It must be remembered also that, in practice, the results of the theory are used only rarely where descriptions of the physical world are involved; the results are used far more frequently to speculate about the physical world, especially its origins. One must wonder about the worth of speculating about the physical world and its origins on the basis of a purely abstract mathematical theory – however beautiful the mathematics may be. Some of these speculations, which dominate much present day thinking, involve the imposition of a physical meaning to a mathematical singularity. Both the notions of the 'Big Bang' and of relativistic black holes fall into this category.

Santilli's Iso-Gravitation:

There is a modern interpretation of gravitation which has attempted to address the clear theoretical inconsistencies in Einstein's work, and that is Santilli's Iso-Gravitation (SIG). Experimental inconsistencies which plague Einstein's Relativities and subsequent attempts at grand unification with quantum aspects have thereby been treated, and a possible solution offered. The said inconsistencies regarding unification are:

I. The physical consistency of electroweak interactions on a flat Minkowski space cannot be salvaged when joined to a theory on the curved Riemannian space because the insufficiencies of the latter carry over to the former;

II. Within a grand unification, the covariance of Einstein's gravitation carries over to electroweak interactions, by therefore destroying their gauge invariance and, consequently, the very structure of electroweak interactions;

III. Electroweak interactions represent both particles and antiparticles, while Einstein gravitation solely represent matter, thus rendering any grand unification technically impossible and catastrophically inconsistent if attempted. [33] (p. 64)

From the above referenced source and page, we see the solution is based on isomathematics, tied to conditions:

". . . possess an invariance similar to that of the Poincare symmetry in special relativity so as to predict the same numerical values under the same conditions at different times. The best known way to achieve an invariant theory of gravitation is via the use of Lie's theory. But the latter theory solely applies to linear systems. The necessary non-linearity of gravitation then precludes any realistic possibility of achieving an invariance via the use of 20th century mathematics. The above occurrence forced the author to construct the isotopies (intended as axiom-preserving) of 20th century applied mathematics . . . today known as isomathematics . . . " [33]

See also [34].

It will, therefore, be useful to articulate a general summation of the history and basic principles of iso-mathematics and SIG.

Since his early days as a student in his native Italy, Ruggero Santilli has been deeply concerned with the large number of inconsistencies present in modern day science. From the outset he recognised that, in order to make real progress, it would be necessary to develop new forms of mathematics. After many years research, he succeeded in developing three new forms – isomathematics, genomathematics and hypermathematics. In essence, in each of these the commonly accepted unit is replaced by increasingly more complicated units. This seemingly little modification does, however, lead to a vast amount of literature in which all the necessary ramifications are explored in detail. Hence, in each new form, there are new numbers and new rules for all common mathematical manipulations. Once all this was in place, attention was turned to re-examining numerous problems in physics, chemistry and, although scientifically more complicated and needing use of hypermathemaics, even biology. To truly understand Santilli's solutions in each of these fields, it is necessary first to master the techniques involved in this new mathematics.

While admiring Einstein's contributions to modern science, he recognised some of the problems associated with his work. For example, he noted that the original assumptions refer to conditions, such as the constancy of the speed of light, in a vacuum. This actual assumption caused him great concern because, as he noted, the speed of light is known to depend on the medium in which it propagates with the speed in a vacuum c_0 being related to that in the medium by

$$c = c_0/n,$$

where n is the familiar index of refraction. Hence, whether or not c is less than or greater than c_0 depends on whether n is greater than or less than unity, and both situations can occur in nature. These concerns necessitated examining from a slightly different viewpoint the results of Einstein's theory of special relativity. It should be remembered always though that Santilli considers special relativity exact under the conditions stated by Einstein himself; that is, (i) for point particles and electromagnetic waves, (ii) propagation in a vacuum, (iii) when referred to an inertial reference frame. If any one of these conditions is violated then, in Santilli's view, the theory becomes inapplicable, but not violated because it was never constructed to deal with the new conditions. It is in this latter case that the need arises for the new theory developed by Santilli himself.

Again he noticed various inconsistencies in Einstein's celebrated general theory of relativity, noting particularly that several arose due to the introduction of the so-called Newtonian approximation. For example, this approximation results in the introduction of a mass into what was initially assumed to be an *empty* space. He was concerned also with powerful evidence suggesting a lack of curvature of space and/or space-time. Due to the fact that he also acknowledged Einstein's general theory of relativity as being, in reality, a theory of gravitation, led to his development of his own so-called iso-gravitation which, as its name implies, draws heavily on the isomathematics referred to above. It should be noted also that the new theories of isogravitation and also genogravitation and hypergravitation apply for both interior and exterior problems and are also special cases of his iso- geno- and hyper-relativity.

Isomathematics is formed by an isotopic lifting of the conventional associative product between generic quantities into an iso-product [33, 35]. In this way, problems that have remained unsolvable under the older formalism based in the mathematics and differential calculus of Newton-Leibniz might be fruitfully addressed. Lie's theory can be freshly conceived to articulate non-linear, non-local and non-Hamiltonian systems (that is, variationally nonself-adjoint systems not representable with a Hamiltonian) [33, 36]. To achieve fundamental time evolution invariance Santilli created Iso-Differential calculus [37]. A comprehensive compilation of these and other vital mathematical derivations and formalism are available here: [38, 39, 40].

IsoMechanics was then created by the isotopic lifting of Newton's equations allowing the representation of extended bodies and then, the iso-action principle permitting the representation of optimal control theory in determination of wing geometry within a fluid dynamic model; followed by the Schrodinger-Santilli isoequations of hadronic mechanics and the Heisenberg-Santilli isoequations to create a *completion* of existing quantum theory. [33] (pp. 64-65.)

Iso-Gravitation was formulated while maintaining Einstein's field equations including their primary verifications, although formulated upon a new geometry over new fields with null curvature. [33] (p.66) Minkowski-Santilli IsoSpace [41,42] was derived allowing isotopies of Minkowski space which preserve the original flatness despite the dependence of the isometric on local coordinates. Lorentz-Santilli isosymmetry was then derived to be locally isomorphic to the original symmetry as is crucial for achieving compatibility of isogravitation with 20th century theories and for attempting a consistent grand unification of gravitation and electroweak interactions. [33] (p. 67) Further development ensued, including analysis of complex isotopies of rotational symmetries, spin, topology preserving deformations of the sphere and the first proof of the universal invariance of all possible non-singular Riemannian line elements [33] then, the isotopies of the spinorial covering of the Poincare symmetry and others, which were in turn confirmed by independent papers [43,44]. In this way, the pathway leading to the essential equations and axioms of functional IsoGravitation applied to interior and exterior problems, anti-matter and eventual grand unification of quantum and gravitational aspects has indeed been developed, articulated and subsequently verified.

Conclusion.

The rich formalism of Einstein's relativistic science is over 100 years old. Not surprisingly, the model has been stretched past its original intended applications in the many years since its conception. History yields a treasure trove of alternative systems and models, and new insights such as those found in Santilli's Iso-Gravitational theory could well help science to progress past its entrenched doctrines. The paradoxical aspects of relativistic interpretations of physical processes are troubling. It may be possible to achieve the same valid results, and perhaps also, results of greater or equal accuracy free of paradox, by using alternative models and systems of calculation. Should science seek to advance past its obvious current limits, it must permit the introduction and exploration of alternative paradigms to Einstein's relativity. Only in this way will our race and the scientific achievement which supports it flourish.

References:

1. Suede, M. 2010, “The Speed Of Gravity – Why Einstein Was Wrong”, https://www.libertariannews.org/2010/05/14/the-speed-of-gravity-why-einstein-was-wrong/

2. Van Flandern, T. 1998, “The speed of gravity what the experiments say”, *Physics Letters* A 250: 1-11
http://www.sciencedirect.com/science/article/pii/S0375960198006501
http://www.ldolphin.org/vanFlandern/gravityspeed.html

3. Gomez, A. L. G. 2001, **“**Experiments indicate that the speed of gravity is minimum 20 billion times c”,
http://www.alfonsoleonguillen.net/velogravtom.html

4. Gupta, R. C. 2014**,** “Bending of Light Near a Star and Gravitational Red/Blue Shift: Alternative Explanation Based on Refraction of Light”,
https://arxiv.org/ftp/physics/papers/0409/0409124.pdf

5. Edward Dowdye, Jr., “The Failed Attempts to Detect Macro Lensing”,
https://www.youtube.com/watch?v=6kJ8gTdOsek

6. Hall, A., 2015, "Lensing by Refraction…not Gravity?"
https://www.thunderbolts.info/wp/2015/11/26/lensing-by-refraction-not-gravity/
7. Santilli, R. M., 2010, **"**EXPERIMENTAL VERIFICATION OF ISOREDSHIFT AND ITS COSMOLOGICAL IMPLICATIONS",
http://www.santilli-foundation.org/docs/Isoredshift-Letter.pdf
8. Thornhill, W. 2006, "Grey Matter vs Dark Matter",
http://www.holoscience.com/wp/grey-matter-vs-dark-matter/
9. Santilli, R. M., 2015, **"**Representation of galactic dynamics via isoshifts without universe expansion, dark matter and dark energy",
http://www.i-b-r.org/scientific-rebirth-8.htm
10. Burchell, B., "2011", "General Relativity Pt. 2",
http://www.alternativephysics.org/book/GeneralRelativity2.htm
11. Dunning-Davies, J., Norman, R. L., 2016, "The Enigma that is Light",
https://www.researchgate.net/publication/304232983_The_Enigma_that_is_Light?ev=prf_pub
12. Bethell, T., 1999, "Rethinking Relativity", *The American Spectator*. Retrieved from: http://www.ldolphin.org/vanFlandern/
13. G. G. Stokes, 1845, *Phil. Mag.* **XXVII**, 9
14. L. Prandtl, 1904, Proc. 3rd. Internat. Math. Congr.
15. G. H. A. Cole & J. Dunning-Davies, 2001, in *Recent Advances in Relativity Theory*, vol. 2 (eds. M. C. Duffy & M. Wegener), 51
16. C. K. Thornhill, 1996, Hadronic J. Suppl. **11,** 209
17. M. Abraham & R. Becker, 1932, *The Classical Theory of Electricity and Magnetism*, Blackie & Son Ltd., London pp. 141-2
18. J. Dunning-Davies, 2002, Hadronic J. **25**, 251
19. H. Hertz, 1893, *Electric Waves*, Macmillan, London
20. T.E.Phipps, 2002, Galilean Electrodynamics, **13**, 63
21. C. K. Thornhill, 1993, Proc. R. Soc. (London) **442**, 495
22. C. K. Thornhill, 1985, Speculations Sci. Tecnol. **8**, 263
23. C. K. Thornhill, 1985, Speculations Sci. Technol. **8**, 273
24. C. K. Thornhill, 2004, Hadronic J. **27,** 499
25. H. Aspden, 2005, "Physics without Einstein; A Centenary Review",
www.aspden.org
26. Kaufmann, 1901, Gottingen Nach. **2**, 143
27. J. J. Thomson, 1904, *Electricity and Matter,* Archibald Constable & Co. Ltd., Westminster

28. J. P. Wesley, 2002, *Selected Topics in Scientific Physics*, Benjamin Wesley, Blumberg
J. Dunning-Davies, 2013, Hadronic J. **36**, 1
http://viXra.org/abs/1304.0152
29. J. Mandelker, 1954, *Matter Energy Mechanics*,
Philosophical Library, New York
30. H. Dingle, 1972, *Science at the Crossroads*,
Martin Brian & O'Keeffe, London
31. P. Gerber, 1898, Zeitschrift f Math, u Phys., **43**, 93
32. B. H. Lavenda, 2005, Journal of Applied Sciences, **5**(2), 299
33. Santilli, R. M., 2015, "Rudiments of IsoGravitation for Matter and its IsoDual for AntiMatter", *American Journal of Modern Physics*, 4(5) 59-75. doi: 10.11648/j.ajmp.s.2015040501.18
34. R. M. Santilli, Foundations of Theoretical Mechanics, Volume I (1978), and Volume II (1982), Springer-Verlag,
http://www.santilli-foundation.org/docs/Santilli-209.pdf
http://www.santilli-foundation.org/docs/santilli-69.pdf
35. R. M. Santilli, 2006, "Lie-admissible invariant representation of irreversibility for matter and antimatter at the classical and operator levels," Nuovo Cimento B bf 121, 443,
http://www.santillifoundation.org/docs/Lie-admiss-NCB-I.pdf
36. M. Santilli, Foundations of Theoretical Mechanics, Volume I (1978), and Volume II (1982), Springer-Verlag,
http://www.santilli-foundation.org/docs/Santilli-209.pdf
http://www.santilli-foundation.org/docs/santilli-69.pdf
37. R. M. Santilli, 1996, "Nonlocal-Integral Isotopies of Differential Calculus, Mechanics and Geometries," in Isotopies of Contemporary Mathematical Structures, P. Vetro Editor, Rendiconti Circolo Matematico Palermo, Suppl. Vol. 42, 7-82
http://www.santilli-foundation.org/docs/Santilli-37.pdf
38. R. M. Santilli, Elements of Hadronic Mechanics, Vol. I (1995), Vol. II 91995), Academy of Sciences, Kiev, available in free pdf downloads from,
http://www.santillifoundation.org/docs/Santilli-300.pdf
http://www.santillifoundation./org/docs/Santilli-301.pdf
39. S. Georgiev, 2014 and 2015, Foundations of the IsoDifferential Calculus, Volumes I, II, III, Nova Scientific Publishers

40. R. M. Falcon Ganfornina and J. Nunez Valdes,2015, Foundations of Santilli Isotopies, original version in Spanish, International Academic Press (2001), English translations, Algebras, Groups and Geometries Vol. 32, pages 135-308 http://www.i-b-r.org/docs/Aversa-translation.pdf

41. R. M. Santilli, 1994, "Isotopic quantization of gravity and its universal isopoincare' symmetry" in the Proceedings of "The Seventh Marcel Grossmann Meeting in Gravitation, SLAC 1992, R. T. Jantzen, G. M. Keiser and R. Ruffini, Editors, World Scientific Publishers pages 500-505 http://www.santilli-foundation.org/docs/Santilli-120.pdf

42. R. M. Santilli, 1983, "Lie-isotopic Lifting of Special Relativity for Extended Deformable Particles," Lettere Nuovo Cimento Vol. 37, 545 http://www.santillifoundation.org/docs/Santilli-50.pdf

43. J. V. Kadeisvili, 2000, "Direct universality of the Lorentz-Poincare'-Santilli isosymmetry for extended-deformable particles, arbitrary speeds of light and all possible spacetimes" in Photons: Old problems in Light of New Ideas, V. V. Dvoeglazov Editor Nova Science http://www.santilli-foundation.org/docs/Santilli-25.pdf

44. A. K. Aringazin and K. M. Aringazin, 1995, "Universality of Santilli's iso-Minkowskian geometry" in Frontiers of Fundamental Physics, M. Barone and F. Selleri, Editors Plenum http://www.santillifoundation.org/docs/Santilli-29.pdf