Relativity, Gravity and the Physics Puzzle

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A variety of problems in Relativity theories, and even incompatibility with other branches of physics, have been appearing in the literature for many decades. Fitting together the pieces of the physics puzzle seems to be a long standing problem. However, by applying natural philosophy principles to fundamental laws concerning gravity, energy, and relativity, an error in Newton's law of gravity is discovered and corrected, real relativistic changes to objects in moving frames are derived, and the pieces of the puzzle then fit together. The seemingly independent fundamental laws of physics are shown to be related to each other by the corrected laws of relativity and gravity. It is shown that the source of gravity is almost certainly electrostatic in nature, the attractive force being proportional to the *number of nucleons* in objects, shedding some light on the construction of neutrons and nuclei. Some of the discoveries herein are: the source of gravity is not mass, c is not a universal constant and the Planck units are nonsense. A review of the errors found and their causes completes this brief investigation into relativity and gravity.

1. Introduction

It is believed and generally accepted that the laws of physics should be logically connected, but, it appears that fitting together the pieces of physics has been surprisingly difficult. This paper is a brief exploration of relativity and gravity for the purpose of exposing and correcting the faults in current theories containing anomalies, contradictions, paradoxes, and non-compliance with principles that together have created the "fitting together" puzzle. It first derives the relativistic changes to mass, length and natural frequencies in a stationary frame of reference (FoR), leading to a necessary change to Newton's law of gravity. Relativistic changes in moving frames are then derived, one item being found to differ from currently believed values, and it found that the pieces of the physics puzzle do then fit together. Except for a theory of gravity and associated neutron matters it does not consider other associated matters irrelevant to this purpose in any great depth, if at all.

- ENERGY is the key.
- RELATIVITY turns the key.
- GRAVITY opens the door.

The principle of Conservation of Total Energy (CTE) states that energy cannot be created, nor destroyed, and includes the principle of Equivalence of Mass and Energy [1] (i.e. mass is potential energy (PE); it may be considered to be a highly concentrated form of energy).

When, around the turn of the twentieth century, it was realized that lengths of material objects in motion would be changed compared to their stationary size, and this would be accompanied by changes in the mass and natural frequencies of those "gross bodies", [2] the subject of relativity was born. A few years later, the changes in mass, length, and natural frequencies of gross bodies when moved up or down a gravitational field were predicted, [3] the frequency change being confirmed many years later by experiments [4] (frequency being the only one of the three that it was possible to measure to sufficient accuracy, with the Mossbauer effect).

From philosophical considerations, physicists have come to certain conclusions regarding the physical laws of nature:

1. The laws of physics should be the same in all parts of the universe, in particular
2. The force of attraction between the same material objects should be the same in all parts of the universe, and
3. The properties of matter in inertial frames of reference, under the same physical conditions, should be the same in all parts of the universe.

All these things led to the Principle of Relativity, a modern version of which states that the laws of physics should have the same mathematical form in all inertial systems, that speeds are always relative to a chosen FoR, and since they could change (be relativistic), masses, lengths and time units are relative to chosen standards of mass, length and time unit, respectively, in a chosen FoR, so that there are no *absolute* definitions for any of these units (the Planck units are shown later to be meaningless). It also means that other features, such as the reversibility of effects (route independence), and properties of matter, are preserved in moving frames. In this paper the phrase "moving frames" will mean FoRs accelerated to a constant speed relative to the chosen frame by externally applied energy (i.e. not by gravity).

Thus, an observer in an enclosed vehicle accelerated to a high constant relative speed could not detect that he was moving relative to another inertial FoR without reference to external information. The values of constants of proportionality in his physics equations depend on the definitions of his standard units of mass, length and time, which, as observed above, can all change in relativistic circumstances.

All cases herein are assumed to be conservative systems, where there is no dissipation of energy.

And so to gravity, without which there would be no up, no down, no atmosphere, no people, no planets, no stars, but just possibly a thin soup of basic mass particles pervading all space. That could have been a possibility, but it omits another fundamental fact; that charged particles also exist and they attract and repel each other, so, attached to mass, they could cause coagulation, forming atoms and larger objects. The existence of charged particles or any other source of attraction precludes the thin soup theory.

It has been assumed in the past (and present) that gravity is an inherent property of basic mass, but, since the time of Newton mass has taken on a more specific meaning and it is shown herein that gravity can only be a byproduct of the charged particles.

2. Relativistic Changes

2.1. Changes in Mass Relative to Frames of Reference

It was apparently not realized at that time that the abovementioned (relativistic) changes actually resulted from the principle of CTE, but was credited to motion [2] and gravity [3] instead. A change in mass is a normal result of applied energy (E) and the principle of equivalence of energy and mass (m), and is always accompanied by the other changes. Attributing those changes to gravity and speed was unfortunate as those assumptions have had unforeseen consequences, by wrongly predicting relativistic changes for objects in free-fall, for example, where the transmission frequencies from spacecraft Pioneer 10 and 11 [5] were not as predicted by such theories.

Neither gravity nor speed has a mechanism for changing mass, but if a heavy object is forced up a gravitational potential, or accelerated to a speed, relative to its original position, energy has to be supplied. From the principle of CTE, its mass will increase in the FoR attached to the object, (in which its velocity is always zero, designated herein as its "own frame"), by the amount of energy applied (ΔE) converted to mass. This is represented by the equation

$$m = m_o + \Delta E / c^2 \tag{1}$$

where m is the new mass, m_o is the original mass and c^2 is the ratio of energy to mass. [1]

In the gravity case the object takes up a different position in the same FoR, but in the speed case there are two types of reference frame, one being its own frame and the other being any external FoR in which the object is moving; the original own frame usually being chosen as the basic reference frame for comparing any relativistic changes.

In the speed case, a moving object has kinetic energy (KE) in external frames equal to the supplied energy, which is also equal to the increase in mass-energy in its own frame, ensuring that the total energy of the object is the same in all FoRs, as it cannot be created, nor destroyed. In external FoRs, if an object is undergoing *unrestricted* motion, all the applied energy goes to increasing the speed and an increase in mass of the object cannot occur, contrary to most text books where the increased mass is assumed in relativistic momentum, [6, 7] for example.

Thus, the energy added can be measured either by the force and the distance for which it was applied (the change of PE), or by the change in kinetic energy observed, and hence, by the application of the principle of equivalence of mass and energy and Eq. (1), the relative change in mass (γ) can be found, where

$$\gamma = m / m_o \tag{2}$$

In the gravity case, the energy applied is equal to $\Delta PE = m_o gH$ for small changes in altitude, where g is the acceleration of gravity at that location and H is the vertical distance moved, and gives, from Eqs. (1) and (2)

$$\gamma = 1 + gH / c^2 \tag{3}$$

For larger changes in altitude, the change in g must be taken into account when it becomes significant. See Eq. (12).

In the speed case (at a constant gravitational potential) $\Delta E = \Delta KE = m_o v^2 / 2$ for unrestricted motion, where v is the change in speed, giving, from Eq. (1)

$$\gamma = 1 + v^2 / 2c^2 \tag{4}$$

2.2. Relativistic Changes for the Gravity Case

The other relativistic changes, for length (L) and natural frequencies (f) of material objects, expressed in terms of γ, may be obtained for the gravity case from the two basic physics equations for energy. The first equation (late 1800s) expresses the equivalence of mass and energy [1] by the mathematical equation

$$E = mc^2 \tag{5}$$

and the other, [8] attributable to Planck and involving frequency, where h is the Planck constant,

$$E = hf \tag{6}$$

Combining (5) and (6), it follows that

$$hf = mc^2 \tag{7}$$

For objects displaced through a gravitational potential, since c^2 and h are well known to be constant in this "stationary" FoR, Eq. (7) shows that f is proportional to m. Therefore, f changes at the same rate as m, and for an increase in m to γm_o by a change in altitude,

$$f = \gamma f_o \quad or \quad T = \gamma^{-1} T_o \tag{8}$$

where T is a time unit (the reciprocal of frequency), and the subscript 'o' denotes the home frame value of each quantity, where the measuring instruments were calibrated. The frequency change was confirmed by several experiments, two of which are quoted in [4].

Therefore, as speed $v = L / T$ and a speed c measures the same at different altitudes, L must change as T changes, hence

$$L = \gamma^{-1} L_o \tag{9}$$

All quantities involved in physics equations in these circumstances change by the above amounts according to their dimensions. Note: The above relativistic changes are the same as predicted by General relativity. [3]

2.2.1. Concerning Newton's Law of Gravity

Item (2) in section 1 above requires that the constant of proportionality (G) in the mathematical form of Newton's law (1665), giving the force (***F***) of attraction between two gross bodies (M and m) a distance d apart, must be a universal constant when measured with the same instruments transported to any part of the universe. But, it seems, everyone has failed to notice that when the above relativistic changes *for a change in altitude* are applied to the dimensions of G ($M^{-1}L^3T^{-2}$), where

$$G = Fd^2 / Mm\,, \tag{10}$$

it is found that G has a value of $\gamma^{-2}G_o$, which means that it is not constant (independent of γ) at different altitudes, which violates the above requirement. For G to be constant it becomes obvious that the mass items in the denominator of Eq. (10) must be replaced with non-relativistic items. That is, gravity does not emanate from mass, so "gravitational mass" does not exist. That concept arose from the assumption that the source of gravity is mass.

Since the weight of gross bodies in a gravitational field is proportional to their attractive potential, the masses in Newton's equation should be replaced with the numerical value of their weights (Ww) relative to a standard unit weight, giving

$$F = GWw / d^2\,. \tag{11}$$

The dimensions of G become $\mathrm{ML^3T^{-2}}$, and G becomes constant with altitude. This results in setting the factor of proportionality G to a fixed value, independent of altitude or substance variations, and includes a factor for converting weight ratios to force of attraction.

Due to the Earth's attractive force the downward acceleration (g) of an inertial mass (m) is, from Newton's second law of motion $g = F / m$ and Eq. (11),

$$g = GWw / mD^2 \tag{12}$$

where W is the effective relative weight of the Earth, which is determined from the measurements of the other items, and D is the distance to the center of the Earth. The relativistic change in g, now due only to the mass m, becomes proportional to γ^{-1} instead of γ for an increase in altitude; that is, it now increases the effect of a change in the distance D instead of decreasing it, but is far too small to be detected for terrestrial changes in altitude.

2.3. Relativistic Changes for the Speed Case (Moving Frames)

Having obtained the correct dimensions of G (above), the changes in length and frequencies of an object in moving frames are now obtained by the application of the principles indicated in section 1 above, and simple mathematical logic, as follows.

By the principle of CTE we assert that the applied energy causing motion increases the mass (in its own FoR) by the factor γ. For the preservation of the properties of matter in all moving frames, and since density is a common important factor, it is required that the densities of objects remain constant under the same physical conditions, i.e. mass per unit volume must stay constant, hence,

$$L_v = \gamma^{1/3} L_o \tag{13}$$

where the subscript v denotes the moving FoR.

Applying the above changes (in M and L) to its dimensions, G stays constant in moving frames when

$$T_v = \gamma T_o\,,\ \text{or}\ \ f_v = \gamma^{-1} f_o\,, \tag{14}$$

and G becomes a *universal* constant. Confirmation of Eq. (14) was made by experiments and observations [9] that, in moving frames, frequencies are reduced in the predicted ratio. It then follows that these changes cause c to change, as a unit of speed V, being L/T, is therefore $\gamma^{-2/3}V_o$, so that

$$c_v = \gamma^{-2/3} c_o\,. \tag{15}$$

When the local tools of measurement have also been changed in the same ratios, all changed quantities will measure the same as in the home frame, in particular the speed of locally emitted light will measure the same in all FoRs even when its real speed is different. That is, relativistic changes are not measurable within the same FoR.

To find the relativistic changes to h we note that the product hc has the same dimensions as G, so both are universal constants. Therefore, $h_v c_v = h_o c_o$, and

$$h_v = \gamma^{2/3} h_o \tag{16}$$

When the above (real) relativistic changes are applied to energy equations (5) and (6), they both predict that a unit of energy is reduced by $\gamma^{1/3}$. Predicting the same value with both equations is an independent confirmation of the above results and the principles involved.

Further confirmation of all the above results is also supplied by Bohr's 1913 equations [10] for the radius r (=length, in all directions) of a hydrogen atom (r is proportional to h^2 / m) and its natural resonant frequencies (f is proportional to m / h^3). That Bohr's frequency equation has been experimentally confirmed on numerous occasions is a severe understatement.

The above also confirms that the fine structure constant has the same value in all inertial FoRs.

3. Electrostatic Gravity Matters

Up to the present time the source of gravity has been only conjecture and assumption, but the discovery of the work of Kopernicky and Hughes [11], published in 2005 offers a very convincing theory that a tiny difference between the forces of electrostatic attraction and repulsion (in favor of attraction) between electrically neutral atoms (matter) separated by macroscopic distances could be the source of gravity and naturally leads to an inverse square law of attraction between objects at distances of separation greater than a millimeter or so. Positive and negative charges in atoms form electrostatic dipoles to create these forces, the resulting "gravitational" force being the required number of orders of magnitude smaller than electrostatic force. The potential attractive force of an object becomes proportional to the *number of electrostatic charges* in the object. At much lesser distances of separation the electrostatic forces are much larger than any possible gravitational force (and, according to Kopernicky and Hughes, are instrumental in forming crystalline structures), so a gravitational field is therefore meaningless at very small distances.

A more recent paper supporting electrostatic gravity [12] is that by Morton F. Spears (deceased), who derived an equation for gravitational force that includes an expression for the value of G in terms of electrostatic parameters, and also points out some of the practical problems in its accurate measurement due to the electrostatic properties of the medium between the attracting objects. Thus, without corrections, a value derived using the

Earth as one of the objects would differ significantly from one derived from two objects separated by a relatively large distance in air.

Hence, since there are no other real candidates, it is claimed that the force of gravity is the average residual attraction of matter to other matter, resulting from electrostatic dipoles in matter, in random attitudes, at distances very large compared to the dipole spacing. *G* becomes independent of altitude.

Positive and negative charges need to be substantially equal in number in objects to create an attractive force, so neutrons must have one of each with their charges separated, otherwise they would *weigh nothing* and nearly all atoms would weigh less than half their known amounts compared to hydrogen, which is plainly not true. So, except for that strange particle-pair, *positronium* (without a nucleus), which is also of no gravitational interest for the obvious reasons of having a miniscule lifetime, the potential gravitational attraction attributable to an object should be proportional to the number of *nucleons* in the object, except that small variations per nucleon are expected to occur due to different configurations of the dipoles for different substances and, in some cases, distortions due to ionization.

Since gravity appeared to emanate from mass, let us now examine what we call matter, mass and weight in more detail. Matter may be described as a conglomeration of mass and electric charges and it is postulated that only certain combinations and configurations create a gravitational field, the actual mass contained in the matter having no gravitational effect. The word "gravity" (the tendency of two "gross bodies" to physically attract each other) is appropriate, but the term "gravitational mass" implies that the source of attraction is mass, and so perhaps, the term "gravitational matter" would now be more appropriate to distinguish it from singly-charged, or uncharged, particles (e.g. electrons, neutrinos), which have mass but no potential gravitational attraction.

The international standard mass of platinum-iridium defines a mass of 1 kg. It is also used to *define* a unit of force, as that force which produces a (frictionless) horizontal acceleration of 1 m/sec on it at the home location, so it is an inertial mass. But copies of it are *gravitational* copies since they are compared by weight (they exert the same gravitational force as the standard). It is, therefore, also a standard 1Kgm *weight* at the home location and therefore, *by definition*, grams weight is numerically equal to grams mass *for that substance at the home location* (i.e. $w = m_0$).

Consequently, it is probable that a copy would only have *exactly* the same *inertial mass* as the standard if made of the same substance, the variable ratio of mass number (number of nucleons) to atomic (inertial) mass for different substances being relevant here. Therefore that ratio should, ideally, be set to 1.0 for the substance of the actual standard, instead of the arbitrary choice of carbon 12.

In fact, many copies of the standard mass are made of stainless steel, and most, if not all, are gravitational copies. Such copies are not valid inertial copies, so some experiments depending on inertial mass are likely to have an inbuilt error, probably hidden by the experimental accuracy. In effect, the standard mass is almost wholly used as a standard *weight*.

In practice, the weight ratios of the two objects in Eq. (10) *have always been used* in the determination of *G*, numerical equivalence with mass being assumed, and the result was (fortuitously) exactly that required for Eq. (11) (masses not relativistic); i.e. the numbers are the same, but the dimensions of *G* are now changed to ML^3T^{-2} .

The well known postulation of "the equivalence of inertial and gravitational mass" appears to come from the belief that if gravity is acting on matter as part of an experiment, then it is gravitational mass, and experimenters testing that equivalence in a gravitational field have thereby, unwittingly, already labeled inertial mass as gravitational mass, and, of course, found excellent agreement. [13] And the numerical equality by definition of grams mass and grams weight (of the same substance at the home location), as shown above, also seems to have been overlooked.

The postulation that *g* is the same for all substances [13] is based on the doubtful assumption of the equivalence of inertial and "gravitational mass" $w = m$ applied to Eq. (12), and on practical experience in that differences in rates of fall are far too small to be measured with sufficient accuracy. It is to be expected that differences in the rates of fall will be a small fraction of the differences in the ratios of mass number to atomic mass. No data on this has been found by the author. It is hoped that some sufficiently accurate data will be available in the not too distant future.

It appears that the use of the name mass for two different attributes of matter has been the cause of much confusion and inadvertent assumptions in the subject of gravity.

4. Associated Neutron Matters

It is postulated that neutrons are needed in nuclei to provide the necessary binding forces, with their negative charges placed against and interposed between the positive charges of multiple protons. If neutrons had no charges (just inert mass) they would not provide any binding force to prevent disintegration of the nucleus due to the repulsive forces of the proton charges unless a new attractive force was invented. Hence, there must be approximately the same number of neutrons as protons in a nucleus (except where there is only one proton), and more where rules of configuration (complicated structures) demand it, the remaining unbalanced positive charges on the neutrons replacing the electrostatic role of the protons in the atom. When sharing their negative charge with several protons, neutrons would be expected to form weaker bonds, leading to less stable nuclei. It is probable that the opposite charges of neutron and proton in the nucleus are in contact but do not annihilate each other, while the positive charges on the neutrons become relatively well separated. The "contact forces" are far greater than those from separated charges, probably being the source of the so called "strong force".

Thus, the necessity of a neutron having weight from a non-relativistic source gives some insight into the construction of neutrons and nuclei. Different nuclear structures are expected to give rise to differences in attractive forces for the same mass number (different substances) as well as in binding energies, so a possible connection between them could be a subject for investigation.

5. Some Consequences

It should now be accepted that the equivalence of mass and energy determines the change in mass of an object (in its own FoR), and Bohr's equations then indicate the changes in lengths and frequencies relative to the mass change, for both cases.

Other theories fail to predict the identical changes for moving frames, with the result equations (5) and (6) predict contrary values for a unit of energy, and densities do not stay constant.

One unexpected consequence of the correction to the dimensions of G concerns the so-called Planck Units. [14] The ratio of the dimensions of hc to the Newtonian dimensions of G gave rise to a quantity having dimensions of m^2 and the square root was accepted as a gift from nature defining an absolute mass, in spite of the fact that this violated the principle of relativity. This mass and other absolute values for length, frequency, etc., obtained by various combinations of those physical constants (h, c, G), are known as Planck Units, all of which are now invalid and meaningless as that ratio is now dimensionless (2.974×10^{-15} approx).

6. Conclusion

The above results demonstrate the fact that the laws of physics are proportional relationships, and, except for G, have local constants of proportionality appropriate to the relative velocity of the moving FoR, as both h and c have new values in moving frames, even though they will measure the same as in the home frame.

It is pointed out here that this analysis could also have been made by employing experimental results and Bohr's equations instead, as in Natural Relativity (NR), [15] where it led to the same overall results (which are unique) and thence to the fact that the dimensions of G were wrong. No other algorithms can satisfy Bohr's equations for frequency and length and the two energy equations, for both cases.

Nature has provided two universal constants in the form of hc and G, both of which have dimensions ML^3T^{-2} , yet each component is relativistic, indicating that those components are interrelated in such a way that there exists two combinations of their relativistic properties causing the whole to be constant in any chosen FoR, one for each case (where there is, or is not, resulting motion) and at the same time enabling the properties of matter to be preserved in moving frames.

The apparently independent fundamental laws of physics are related to each other by the laws of relativity. The same laws of physics predict coherent results for all cases, by merely adjusting the factors of proportionality for different frames of reference.

The fact that hc and G have the same dimensions invalidates the Planck units, thus the principle of relativity is now preserved and any results in physics research from the application of those units are therefore useless.

It all fits together, like the interlocking pieces of a puzzle.

Since Einstein's Special Relativity theory (SR) is the current popular theory of relativity, it will often be used below to demonstrate popular errors discovered above.

But the SR pieces do not fit properly; some parts fit, others do not, which lead to the many problems. In deriving SR in 1905 Einstein correctly assumed that the speed of light is measured the same in all frames of reference but wrongly assumed that the measured speed was the real speed and that the factor of proportionality in Maxwell's equations was a universal constant, just, apparently, as does everyone else (assumes factors of proportionality are universal constants). This same error was also made by Lorentz the year before in deriving his transformation equations. [16] Yet inertial mass is a factor of proportionality between force and acceleration, and is universally accepted to be relativistic, so, if one factor can be relativistic then so can others, even if they are called "constants" of proportionality. They are only *local* constants.

By ignoring how objects came to be moving relative to each other and assuming the speed of light was the same in all FoRs, Einstein, in his derivation of SR, produced an equation [2] (differing from Eq. (4)) that was only valid for motion restricted to a maximum speed of that of light, which happened to be true for charged particles accelerated by an electric field. [17] It appears to be very likely that this only confirms the generally accepted theory that an electric field propagates at that speed, and not that the speed of light was a universal limiting speed. For restricted speeds, where some increase in mass will take place to compensate for the reduction in the otherwise attainable speed, (for the same KE), see NR, [18] where that increase is calculated.

Unfortunately, it was also not realized in SR that the derived changes for the gravity case disagreed with the expected universal constancy of G, or that the preservation of properties of matter was an important factor in a relativity theory. SR also assumed that motion caused changes to lengths only in the direction of that motion, [2] which leads to a number of well known problems, not the least of which is distortion of space, illustrated by the carousel anomaly where the circumference of the rotating circular table is then less than π times the diameter.

Examples of some other problems with relativity theories are (i) the impossibility of defining the same size unit of energy with Eqs. (5) and (6) in moving frames if c and h are assumed constant, (ii) a different resulting mass is predicted when the velocity of an object is reversed to a previous value, if it has a non-linear mass-velocity equation such as in SR, and so offends the principle of CTE, (iii) the change in mass due to applied energy causing unrestricted motion is sometimes not restricted to the object's own frame, "relativistic momentum" being an example, [6, 7] which involves an invalid mixture of FoRs and also violates the principle of CTE. Also, theories that take no account of how objects came to be moving, thereby losing any connection to energy, cause more anomalies such as the famous clocks paradox, [19] which vanishes when energy is taken into account. In fact, it is the applied energy that makes the relativistic changes real instead of only apparent as in SR.

Einstein went on to produce a theory of gravity based on mass distorting space, which offends common sense and has no supporting evidence, and retained the constant value for the speed of light, both of which we now know to disagree with the facts discovered in section 2 above. He assumed the measured speed was the real speed, the expected speed being the illusion.

Surely faulty relativity and gravity theories should now be replaced with coherent theories that are based on known cause and effect, such as outlined herein, before thousands more man-years are wasted blindly following the old theories.

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