Special *vs.* General Relativity

According to the special theory of relativity (STR) and taking into account the known formula for the potential energy of gravity, we have the balance of energies

$$M^* c^2 + M^* \Phi = Mc^2 + M\Phi + h\nu_g \qquad (1)$$

at the emission of photon by an excited nucleus of mass M^* in a gravitational field (GF). Here Φ is the Newtonian potential. Whence for the frequency of photon emitted in a gravitational field, we obtain (see, *e.g.*, [1])

$$\nu_g = \nu(1 + \Phi/c^2), \qquad (2)$$

Where ν is the photon frequency in the absence of GF (Φ=0). This equation presents evidently the gravitational red shift.

In the general theory of relativity (GTR), as known (see, e.g., [2,3]), gravitational mass and potential energy are ascribed to photons. Therefore, we have the following balance of energies

$$M^*(1 + \frac{\Phi}{c^2}) = M(1 + \frac{\Phi}{c^2}) + h\nu_G + h\nu_G \frac{\Phi}{c^2} \qquad (3)$$

(4)

instead of eq.(1). As a result, after contraction by the quantity $(1+\Phi/c^2)$, we obtain the expression

$$M^* c^2 = Mc^2 + h\nu_G \qquad (4)$$

$(5) = \nu$

answering the energy balance at the photon emission in the absence of GF. Whence it follows that the photon frequency does not change at its radiation in GF according to GTR:

$$\nu_G = \nu \qquad (5)$$

which contradicts directly the gravitational shift equation (2) and, consequently, STR.

At first sight, it may seem that the indicated difficulty can be overcome comparing eq.(2) with the formula

$$\nu_m = \nu\sqrt{g_{00}} = \nu\sqrt{1 + \frac{2\Phi}{c^2}} \cong \nu\left(1 + \frac{\Phi}{c^2} - \frac{\Phi^2}{c^4}\right) \qquad (6)$$

describing the "metric" frequency shift following from non-Euclideanness of metric. Here g_{oo} is the twice time component of the metric tensor. But even in this case formula (6) differs, as seen, from required equation (2).

What is more, the existence of two incompatible expressions (5) and (6) in GTR testifies to its inner contradictoriness.

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Gravitational Time Dilation & General Relativity

Attention has recently been called [1] to the incompatibility of interpretation of the known experiments on the measurements of a gravitational shift of photon frequency [2,3] and investigation of the dependence of time rate on the gravitational potential [4,5].

Recall that the generally accepted treatment of the results of the first group of experiments in the general theory of relativity (GTR) is the following. The photon frequency remains invariable at its emission in a gravitational field (GF):

$$\nu_G = \nu, \qquad (1)$$

where ν is the photon frequency in the absence of GF. But as the photon moves away from the body creating the field, it loses its energy in overcoming the gravitational attraction. This leads to decreasing frequency:

$$\Delta\nu_G = \nu\Phi/c^2, \qquad (2)$$

where Φ is the gravitational potential. We emphasize that this treatment is based on the ascription of gravitational mass to the photon, and as a consequence, gravitational potential energy (see, *e.g.* [6,7]). In spite of this, its inertial mass is equal to zero. Thus, the equality of inertial and gravitational masses is violated.

In the experiments of the second group, the readings of two atomic clocks are compared after one of them has remained at a location with a different gravitational potential. The difference of their readings confirms the dependence of time rate on Φ. As known, a high precision of the atomic clock provides the atomic standard of frequency based on the use of quantum transitions of atoms (molecules) from one energetic state to the other. Therefore the gravitational change of atomic clock is finally conditioned by changing the frequency of the corresponding transition by the equation

$$\nu_g = \nu(1 + \Phi/c^2). \qquad (3)$$

In order to eliminate the indicated contradiction in the interpretations, it is necessary to allow the photon frequency to change at its emission in GF according to eq.(3) in the experiments of the first group, but it does not change in subsequent propagation of the photon in GF [8,9].

In other words, one should refuse a familiar representation that the photon has a gravitational potential energy.

Thus, the GTR conclusion of non-variability of light frequency at its radiation in GF (based on the law of energy conservation) contradicts both the special theory of relativity and experiments on the investigation of the dependence of time rate on gravitational potential.

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On the Gravitational Redshift

In *Apeiron* of July-October '98, Prof. Munera (p.169) considers the gravitational redshift from the viewpoints of the Newton theory and the general theory of relativity (GTR). We emphasize that taking into account the relativistic relation for energy $E = mc^2$, *i.e.* in the Newton relativistic theory, the frequency shift of photon follows from the law of energy conservation.

When a free excited nucleus of mass M^* emits a γ-quantum (photon) $h\nu$, we have the balance of energies

$$M^* c^2 = Mc^2 + h\nu \qquad (1)$$

When the radiation process occurs in a gravitational field (with the Newton potential Φ), we have the corresponding energy balance

$$M^* c^2 + M^*\Phi = Mc^2 + M\Phi + h\nu_g \,. \qquad (2)$$

Whence, .taking Eq.(1) into account, it directly follows

$$\nu_g = \nu(1 + \Phi/c) \,, \qquad (3)$$

i.e., the gravitational redshift is a classical effect and does not require GTR.

What is more, the known GTR formula [1]

$$\nu_g = \nu\sqrt{g_{00}} = \nu\sqrt{1 + \frac{2\Phi}{c^2}} \cong \nu\left(1 + \frac{\Phi}{c^2} - \frac{\Phi^2}{2c^4}\right) \qquad (4)$$

is a consequence of the non-Euclideanness of 4-space (its time property). This expresses by the dependence of the g_{oo}-component of the metric tensor on the gravitational potential. Thus, according to GTR, "a clock goes the slower the larger the mass of matter placed near it."[1]

However, attention should be paid here to the following. As it follows from formula (4), the frequency of emitted and absorbed light increases with carrying atoms, say, in the direction of decreasing the gravitational field. It is evident that carrying the clock (atoms) can be replaced by the transportation of the radiation itself—light. As a result, it is that the light ray emitted in the region with a definite gravity potential from S_2 and having at its emission the frequency ν_2 has another frequency ν_1 when it arrives at S_1 [2]. For this (see, *e.g.* [3])

$$\nu_1 = \nu_2\sqrt{\frac{g_{00}(x_1)}{g_{00}(x_2)}} \cong \nu_2(1 + \Phi/c^2) \,, \qquad (5)$$

where $\Phi = \Phi_1 - \Phi_2$.

Let the light be emitted on the Sun's surface, where its frequency

$$\nu_2 \cong \nu(1 + \Phi_2/c^2) \,. \qquad (4a)$$

According to (5), this radiation has frequency ν_1 when arrives on the Earth. Substituting formula (4a) in expression (5), we obtain

$$\nu_1 \cong \nu(1 + \Phi_1/c^2) \,. \qquad (4b)$$

As the frequency of the arrived radiation coincides with the corresponding "terrestrial frequency," then according to GTR, the shift of spectral lines should not be observed.

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General Relativity: Incompatibility of two formulae for frequency shift

In my previous notice [1], I emphasize the following. The gravitational shift of spectral lines predicted by Einstein [2] is a consequence of the relativistic law of energy conservation in a gravitational field.

Below, attention is given to the fact that there are two incompatible formulae for the light frequency in the general relativity theory (GRT).

On the one hand, according to GRT [3]: "The radiation frequency of an atom on the surface of celestial body is a little bit smaller than the radiation frequency of the atom of the same element in free space ...."

This is expressed mathematically by the known Einstein formula

$$\nu_E \cong \nu_0(1+\Phi/c^2), \qquad (1)$$

where ν_0 is the frequency of free photon and, Φ the Newton gravity potential ($\Phi = -|\Phi|$).

On the other hand, according to GRT "a photon in a gravitational field has 'kinetic energy' $h\nu$ and 'potential energy' $h\nu\Phi$, and their sum remains constant"[4], where $c = 1$. The second quantity for very weak fields can be neglected. As a result, we have

$$h\nu_0 = h\nu + h\nu\Phi/c^2, \qquad (2)$$

whence it follows

$$\nu_W = \nu_0(1+\Phi/c^2)^{-1} \cong \nu_0(1-\Phi/c^2). \qquad (3)$$

> *"We see that the light frequency increases with rising the absolute value of the gravitational field potential, i.e. when approaching the bodies creating the field; on the contrary, the light frequency decreases as a ray moves away from these bodies."*[5]

It is quite evident that formula (3) is incompatible with equation (1).

Remark that formulae (1) and (3) can be considered also as consequences of general equations for the covariant [5]

$$E_t \cong E_0(1+\Phi/c^2) \qquad (4)$$

and contravariant

$$E^t = g^{tt}E_t \cong E_0(1-\Phi/c^2) \qquad (5)$$

components of energy.

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Gravity's Gravity Slows Pioneer

Here is a kinematic explanation for the frequency shift of radio signals from the Pioneer spacecraft discussed in *Apeiron* (p.107, vol. 6) by Ghosh and Banerjee.

It is based on Newtonian physics applied to the hypothesis that the equivalent mass of the gravitational energy of the Sun itself acts gravitationally.

The spacecraft is influenced by increasing amounts of gravitational equivalent mass as it proceeds radially outward, leading to a constant force of attraction towards the Sun.

Let us first suppose that the density of this equivalent matter falls off as $1/R$ in a manner similar to potential energy.

If the density of a shell at radius R is given by k/R, where k is a constant which scales the density of the shell at unit distance, then the mean density of the entire sphere is $3k/2R$.

This unintuitive result is helpful in simplifying the calculation of the mass of the sphere. As Pioneer travels away from the Sun, it is under the gravitational influence of increasing amounts of equivalent matter from the inner spherical shells, while shells of equivalent matter outside the sphere of its radius have no direct influence, as was determined by Newton.

It is then easily found that the gravitational potential energy available for kinetic energy due to equivalent matter around the Sun varies linearly with the radial distance.

The associated constant force manifests itself in the anomalous constant acceleration inferred for Pioneer.

Pioneer's acceleration allows the density of equivalent matter associated with the gravity of the Sun in the vicinity of the Earth to be estimated at 14 nanograms per cubic meter, with the constant which scales the density estimated at $k = 2$ in the MKS system. One might be concerned that the gravitational potential energy due to equivalent matter around the Sun grows without bound as the radial distance increases. As a point of interest relating to Mach's principle, the distance Pioneer needs to travel while experiencing a constant force arising from the equivalent matter around the Sun in order to equal its energy from annihilation can reasonably taken to be the Hubble light-sphere radius, c/H.

If we speculate that $R = c/H$, then Hubble's constant can be estimated to be $H = a/c$, where a is Pioneer's acceration. The mass of equivalent matter contained in the sphere enclosed inside the Hubble light-sphere radius is roughly the estimated mass of the Hubble light-sphere.

John Gifford has noted previously in *Apeiron* a similar constant acceleration ($a = Hc$) in regard to the cosmological redshift, so unless this is a gross misinterpretation, whatever is happening is likely to be a universal phenomenon and we should expect the same constant acceleration to be associated with stars and galaxies.

It is a very long way off for Pioneer, but at some distant point between the Kuiper belt and the Oort cloud, as the Sun's gravitational force continually diminishes, the anomalous constant force

will start to dominate. From that transition point, orbits will be clearly non-Keplerian.

Can Pioneer escape from our solar system? Given its kinetic energy, Pioneer could travel at most 10 light-years against the presumed constant force. If we imagine that Pioneer was headed for a Sun-like star 4 light-years away which had a similar constant force of attraction, then it is reasonable to expect that the forces would cancel at the midpoint 2 light-years away, and that the energy to reach the midpoint is approximately equivalent to 1 light-year travelling against the constant force.

Can Pioneer make it to Alpha Centauri? Yes, it appears to have sufficient energy to overcome the constant force for that journey.

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Precise Value of the Hubble Constant

For seven decades, from 1929 to the present time, astronomers have attempted to measure the value of the Hubble Age and its reciprocal, the Hubble Constant, with widely varying results [1]. Even the most recent study known as the "Key Project of the Hubble Space Telescope," which occupied a period of eight years from 1991 to 1999, is in dispute [2].

Yet the precise value of the Hubble Age, and its reciprocal, the Hubble Constant, may be found accurately by simple arithmetic from the speed of light and the gravitational constant, whose values are known to an accuracy of seven significant figures. The basis for this statement is that the values of the speed of light and the gravitational constant are universal constants in outer space (flat space), far removed from any massive body, and that when one universal constant is multiplied or divided by another universal constant, the result is necessarily a universal constant.

The statement is made subject to the caveat that the values derived are those in outer space far removed from any massive body, for it is well known that the values of the speed of light and the gravitational constant are reduced in the presence of massive bodies.

The statement is also subject to the premise that the speeds of the bodies whose distances are being measured are accurately reflected in the redshifts in light emitted by them. It is well known, however, that a high gravitational potential at the source may contribute to an additional redshift that has nothing to do with distance. And it is also known that a local Doppler effect due to purely local motion of the source may also cause a deviation of the redshift produced by distance of the source. The total redshift due to all factors is given by the following formula which is known as the Composite Redshift formula

$$(1+z_C) = (1+z_D)\,(1+z_G)\,(1+z_H)$$

where the symbols C,D,G, & H, represent respectively the Composite, Local Doppler, Gravitational, and Hubble (distance) redshifts.

The local Doppler and gravitational redshifts are variables, but it is assumed here that the Hubble Age (H^{-1}) and its reciprocal, the Hubble constant, (H), are truly universal constants whose accurate values have been sought for a very long time. Although, it is possible that in certain cases the gravitational and local Doppler redshifts may attain high values, in most cases the gravitational and local Doppler shifts are not significant.

Finally, although the correct values of the Hubble Age and Hubble constant are used, the formulas for distance under different theories produce different results.

Subject to these qualifications, the correct values of the universal constants are shown below.

Universal Constants

(all values in CGS system of units)

Speed of light
$c = 2.997925 \times 10^{10}$ cms/sec

Gravitational constant
$G = 6.67259 \times 10^{-8}$ cm^3/gm-sec^2

Acceleration constant
$a = 6.67259 \times 10^{-8}$ cm/sec^2
(where M=1 gram and d=1 cm)

Distance constant
$d = c^2/a = 1.346936 \times 10^{28}$ cm
= 14.237 billion l.y.

Time constant
(H^{-1}) $d/c = 4.492894 \times 10^{17}$ sec
= 14.237 billion years

Hubble constant (H)
$c/d = 2.225736 \times 10^{-18}$ sec^{-1}
= 68.68 kms/s/mpc

Universal M/R const.
$c^2/G = 1.346936 \times 10^{28}$ gms/cm

Planck's constant
$h = 6.6260755 \times 10^{-27}$ erg-sec

Photon energy loss per cycle
$hH = 1.474789 \times 10^{-44}$ erg

Photon mass loss per cycle
$hH/c^2 = 1.64092 \times 10^{-65}$ gram

Exponential Decay formula for distance:
$d = \ln(1+z)$ (14.237 billion ly)

NOTE: The last three items above pertain to the alternative theory under which photons decay exponentially by the ejection of tiny material particles, (dark matter), with each cycle.

Criticism not warranted

Some of the above valuations have been criticized on the ground that they are not true constants. The acceleration constant, $a = GM/d^2$, has

been criticized on the ground that the assignment of the value of 1-gram to M, and the assignment of the value of 1-centimeter to the distance, d, is arbitrary, thereby taking that item out of the category of universal constants. And since the values of other items in the list of constants, such as the distance constant and the time constant, embody the acceleration constant, they too are rendered invalid for the same reason.

This criticism is not warranted. It is true that the formula, $a = GM/d^2$, is a general formula that governs the rate of acceleration due to gravity in the vicinity of any massive body, for example at the surface of planet Earth where $a = 980$ cm/s^2. But the formula for acceleration of a small particle due to gravity in the vicinity of a very massive body must be distinguished from the formula for acceleration between two small particles toward each other. The formula, $a = GM/d^2$, is derived from the fact that the force required to accelerate a small body, $F = ma$, is the same as that in the formula $F = GMm/d^2$, where M is a large body and m is a small body. Therefore, when we combine the two formulas, we have $ma = GMm/d^2$, and when we cancel m, the mass of the small body on both sides, what remains is $a = GM/d^2$. However, when we start with the general formula, $ma = G(m)(m)/d^2$, where the masses are both small and equal, and we cancel one of the small masses on each side, what we have left is $a = G(m)/d^2$). Then if we assign the value of one gram to m and one centimeter to "d," we have $a = G$ (one gram/one centimeter^2). And since $G = 6.67259 \times 10^{-8}$ cm^3/gram-s^2, the final result is $a = 6.67259 \times 10^{-8}$ cm/sec^2.

For those who prefer the MKS system, we have by similar reasoning: $a = 6.67259 \times 10^{-11}$ meter/sec^2. In effect, the gravitational constant, G, has become the universal acceleration constant, where the value of the acceleration constant in each system of units corresponds to the value of G in the respective systems.

The two accelerations in the respective systems are therefore identical, and the acceleration constant in CGS units is correct as stated in the list of constants above.

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Einstein and Hierarchy

On page 108 of *The Meaning of Relativity* Einstein wrote that we cannot have an infinite universe "unless the mean density of matter vanishes". By this he meant that the density of matter in an infinite universe must approach zero as the radius of the universe approaches infinity. And this in turn is exactly what happens in our hierarchically structured universe. But what is shocking about Einstein s statement is that he goes on to say that this is less probable than the likelihood that the mean density approaches a finite number as the radius approaches infinity.

Every schoolboy knows that the universe is hierarchically structured from the microscopic world to the macroscopic, and that there is not the slightest evidence to the contrary. At the astronomical level we have groups of stars, each with a density of about one gram per cubic centimeter. These are separated by much space which greatly dilutes the density of the galaxy. And galaxies in turn form groups which are separated by much space, which further dilutes the density, and so on ad infinitum. Then what was Einstein thinking about? We can only conclude that he was not thinking very clearly.

A.K.T Assis has taken the position that the universe is infinite, but that its density in the large is finite. This flies directly in the face of Einstein's rule, which is correct, that we cannot have an infinite universe unless the density approaches zero as we approach infinite size. Therefore, when Assis and others write to the contrary, what they are writing is nonsense.

The late Gerard de Vaucouleurs was the only astronomer who actively and strongly supported the notion of hierarchy. The others, with few exceptions, prefer nonsense.

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An Inconsistency in Newton's Derivation of the Barometric Equation

1. Introduction

Newton's (1686) derivation of the barometric equation contains an important inconsistency in his treatment of central forces. He did not include all of the important ones.

This inconsistency, which led Newton (1686) to an incomplete form of the barometric equation, continues to be propagated today both in the teaching and the practice of atmospheric science, physics, and applied mathematics (Anderson 1991, Banks & Kockarts 1973, Day 1966, Holton 1992, Joos 1950, Kuethe & Chow 1976, Lindsay 1933). The purposes of this paper are to provide: detailed physical and mathematical support for the statement that Newton omitted important central forces, a more-correct derivation, and a more-correct barometric equation.

2. Theory

Newton (1686) used only three pertinent physical conditions in his central-force derivation of the pressure within a static fluid about a non-rotating, non-accelerating planet. They were:

1. the force (toward the center of gravity) produced by the external pressure on the top surface of the Cartesian incremental volume,
2. the force (away from the center of gravity) produced by the external pressure on the bottom surface of the incremental volume, and
3. the gravitational force on the mass within the incremental volume.

Newton (1686) began his derivation in Proposition XX, Theorem XV by use of a spherical solid body surrounded by a static fluid. He took the position that the weight of all of the layers of fluid on a very small area of the solid surface was the same as if a right cylinder (a tube with sides parallel to a radial from the center of gravity) of the same height as the outermost 'static' fluid layer and the same cross-sectional shape and size as that very small area (of the solid surface) was filled with the fluid, and the cylinder's end was placed over that same very small area. He then covered Earth's surface perfectly with these cylinders. Earth is not flat, so the cylinders diverged as they extended away from the solid surface. Newton claimed that the fluid not within the cylinders was held up 'archwise' without providing any force on the surface of the planet. Equation (1) is the differential form of Newton's barometric equation (Anderson 1991, Banks & Kockarts 1973, Day 1966, Holton 1992, Joos 1950, Kuethe & Chow 1976, Lindsay 1933).

$$dp/dz = -(N)(m)(MG/z^2), \qquad (1)$$

where

p is the atmospheric pressure;
z is the vertical height above the center of gravity;
N is the number of molecules per unit volume of fluid;
m is the mass of a molecule;
M is the mass of the primary (planet or other body);
G is the gravitational constant;
the fluid consists of only one type of molecule; and
the positive direction is away from the center of gravity.

We start with an incremental volume of static fluid portrayed in the Cartesian coordinate system (Beyer 1987, Constant 1957). I assume that Δx, Δy and Δz are each extremely small compared to z, and begin with Newton's three physical conditions.

If the walls of the cylinders press against the external fluid, though, the external fluid must press against the walls. The condition that Newton did not include, but that must be included, is the central force component of each external force on the cylinder's side.

Observe that the external force exerted on each side surface of the incremental volume is perpendicular to the side surface but is not perpendicular to the radius (r) connecting that surface with the center of gravity of the primary. Newton ignored each of these four side forces and the component of each in the direction of the center of gravity. But this is a central force problem, so we can not ignore any significant central forces.

The external pressure pressing against the incremental volume's $-\Delta x/2$ face yields a side force of magnitude $p(\Delta y)(\Delta z)$ and of direction $+x$. This side force's component in the negative z direction is zero but its component toward the center of gravity is $-p(\Delta y)(\Delta z)(\Delta x/2)/r$. I note that taking the vector sum of the four 'side force' components in the direction of the center of gravity yields a force in the $-z$ direction. As long as Δx, Δy, and Δz are each extremely small compared to z, the magnitude of the sum (in the "negative z" direction) of these four 'side force' components can thus be represented as

$$F_{4C} = (4)[-(p)(\Delta x)(\Delta y)(\Delta z)/2z] = -2p[(\Delta x)(\Delta y)(\Delta z)]/z. \qquad (2)$$

The inclusion of F_{4C} (the fourth Cartesian force) in the derivation of the barometric equation leads to a replacement for equation (1). The more-correct Cartesian coordinate system resultant equation is:

$$dp/dz = -(N)(m)(MG/z^2) - 2p/z. \qquad (3)$$

By incorporating the external side forces' components in the Cartesian system mathematical analysis we remove Newton's inconsistency.

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On Argument

When intelligent people argue about something, reach opposite conclusions and apparently can get no further than repeated assertions that the other is wrong, it is time to examine the premises of the argument. There must be some difference in the points from which the two (or more) began, either in the explicit premises or in the implicit assumptions about the meaning of the premises. In effect, there are unstated axioms.

May I therefore suggest that, if we are to make progress in understanding what Messrs Good, Campbell and Xu are fighting about, they should each be asked to state their assumptions in careful detail. We might then be able to decide whether there is illogic involved, or whether there are three people on a mountaintop looking in different directions.

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Sciences Confronting a Revolution

Several discussions between I.J. Good and I [1]-[4] are over. It seems time to make a brief and tentative summary, though there are many mistakes and flaws more hidden in the LT itself and its derivation, which need to be dealt with.

• The STONE-EGG argument Good slighted proves, at least, that
(i) if the LT satisfies the 4-D invariant is completely worthless, though "Minkowski space-time invariance" has been hailed since; and
(ii) the LT is not a mathematics at all.

The reason is simple: STONE and EGG, meaningless in mathematics sense, neither form nor meet any quantitative relation; yet, replacing (x, t) by them, the LT can still meet a quantitative relation, the so-called 4-D invariant.

It is meager to regard the (x, t)-(STONE, EGG) as a rose by another name; it is only too innocent to believe that an equation must have meaning because some quantitative attribute(s) is (seemingly) assigned to it.

• "The simplest" but crucial proof that $y' = y$ gives $t' = t$ rests on
(i) the mathematical rule that an equality divided by any non-zero (speed) quantity $u \neq 0$ remains its equality: $y'/u = y/u$; and
(ii) Einstein's tenet that every "coordinate system has its own particular time"[5] so that $y'/u = t'$ and $y/u = t$.
Note that first of all the y' or y, no matter whatever may refer to, *is a length*, and that a length divided by a speed is equal to a time.

I trust that, making the above clear, Good would accept the argument offered by me in different ways. As to the triplet identities

(A1) $y' = y$
(A2) $y' = ct'$
(A3) $y = ct$,

it is clear that both (A2) and (A3) rest on the PIVL the LT predicates on, and should apply to (A1) just as the PIVL should. Remind that in any case y' or y in (A1) *is a length* the PIVL apply to. As a result, (A1)-(A3) can coexist within the SRT framework. Only can one who rejects the PIVL or the LT be qualified to reject the triplet.

Since both (A2) and (A3) fit (A1), and since (A1) applies to *any* event(s) in a plane with coordinate value y' (or y), the triplet of course hold for an infinite of *such events*, not only for one event, unless the LT is rejected.

• Specifying the relative speed v to be constant is one thing; whether or not the speed v as a parameter in the LT preserves itself is another. Is the parameter v allowed by the LT to be constant? A series of irrefutable examinations from various angles concur that the answer is in the negative, unless $v = 0$ or/and $v = c$. Anyone of insight sees that Good's refutations rely on circular arguments or fallacy *petitio principii*.

• The LT leads itself to the final result: $v = 0$ and $v = c$, which means that both

(B1) $x'^2 - c^2t'^2 = x^2 - c^2t^2$ and
(B2) $x = vt$ (and $x' = -v't$)

can never coexist. That is, the PIVL represented by (B1) is incompatible with the principle of inertia (or of relativity) reflected by (B2). In other words, Einstein's kinematics model based on the PIVL is untenable. This is just why the LT turns out to be a set of "expressions of the indeterminate form 0/0," on which unfortunately Good just touch lightly, overlooking its fallaciousness and uselessness. No wonder why Good failed to really understand two serious and important arguments, i.e., the STONE-EGG "joke" and the N-M unequaled-equaled "game" cited in [4a].

• The LT itself is purely a human make-up product, for

(C1) $t' = \gamma(t - vx/c^2)$ and $x' = \gamma(x - vt)$

are mistakenly derived from the incompatible (B1) and (B2), and

(C2) $y' = y$ and $z' = z$

are illegitimately borrowed from the Galilean transformation.

• Eq.(C1) contains no variables y and z and hence requires

(C3) $y' = y = z' = z \equiv 0$

contradicting (C2). The self-inconsistent LT can readily produce various "Bingo" (contradictory) results to "corroborate" everything.

So far Good should see that the errors made by the "leading scientists" such as Einstein turn out to be school-boy ones, having escaped from the attention of generations of scientists.

• Good should easily see that the Lorentz group does not meet the definition of a 4-D group, for he has made the correct assertion that four variables in the 4-D quadratic "are not independent".

The rest of refutations by Good is left to himself. I trust that he will settle them well by virtue of his existing knowledge, only if casts away prejudice and dual-standard so as to correctly understand what our arguments say, plus carefully reads Einstein's 1905 paper.

In conclusion, the LT proves itself a fallacious product violating mathematical rules, logical rules, and definitions of speed and of distance, etc., and hence whole the relativity theory is, just as the Emperor's New Clothes, worthless except as evidence that, at least, mathematics, physics, and logic are not fully mastered by the "leading scientists," VIPs or ciphers, past or alive, including H. Poincaré, H. Lorentz and A. Einstein, *et al*.

No one has power capable of rescuing the LT from collapsing. It is ridiculous to speak of "experimental confirmations" for the SRT. Sciences are confronting a revolution, involving basic physics, astrophysics, cosmology, philosophy, and even mathematics, etc.

Further Challenges from Good (and others) are welcome. As I see it, it is valueless to follow the example of Max Born, who was lost to H. Dingle in the debate of "clock paradox" despite Dingle's wrong assertion that "The internal consistency of the Lorentz transformation can be demonstrated mathematically; it is … unquestionable"[6].

I must say, Good is the best opponent I have met; I have no intention of hurting him (and even Einstein). The sole aim I take at is errors and confusion caused by the false SRT. I think an opponent is not amount to an enemy; instead, opponents may become friends in the common cause to rescue modern science from its astray. Let us as opponent-friends make more to greet the coming revolution.

References

[1] I.J. Good, *Apeiron*, (a) 6(1-2) 144, 1999; (b) 5(3-4) 244, 1998; (c) 4(4) 126; 130, 1997.

[2] Xu Shaozhi, *Apeiron* (a) 6(1-2) 147, 1999; (b) 5(3-4) 247, 1998; (c) 5(1-2) 123, 1998.

[3] I.J. Good, *Physics Essays*, (a) 10(1) 164; 10(2) 327; 10(3) 454, 1997; (b) 11(2) 248, 1998.

[4] Xu Shaozhi and Xu Xingqun, (a) *Apeiron* 4(4) 130, 1997; 3(2) 86, 1996; (b) *Physics Essays*, 9(3) 380, 1996; (c) *Galilean Electrodynamics* 3(1) 5, 1992.

[5] A. Einstein: (a) *Relativity: The Special and General Theory*, p.26 (Methuen, London, 1936); (b) *Ann.Phys.* 17, 1905.

[6] H. Dingle, *Nature*, 197 (1963) 1248.

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I relinquish the floor to Xu

Xu or Xu & Xu and I have interchanged arguments about the self-consistency of the Lorentz transformation. But it might confuse the reader when we "speak at the same time": see *Apeiron* 6 (1 & 2), pages 144-149. To remedy this problem, I hereby relinquish the floor to Xu for the time being. I hope but don't expect that he will admit to his errors, or else explain his position with the utmost lucidity.

I.J. Good

Is Newton's Law of Gravitation self-contradictory?

Mooney (1999) starts with the two sentences:

> *Newton's Law of Gravity [Gravitation] involves a contradiction. On the one hand it states that gravity is dependent upon the mass of bodies and on the other it states that for bodies near the surface of the Earth, it is not dependent upon the mass of bodies.*

Unfortunately, Mooney has here used gravity in two different senses. The first usage refers to the force of gravitation whereas the second one refers to the acceleration of bodies. In view of Newton's second law, Mooney's two statements are mutually corroborative, not mutually contradictory. I hope he will now confess.

Newton's theory can be questioned on the grounds that it requires the assumption that the influence of gravitation is instantaneous, or very nearly so, and this might have worried him. The need for this assumption is familiar and can be easily explained in elementary terms (Good, 1975). It should be presented in high-school courses on dynamics.

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Good, I.J. *Amer. J Physics* 43, 640 (1975).

Mooney, S. *Apeiron* 6(1 & 2), 138 (1999).

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Courtesy, Correctness, and Absolute Simultaneity

I hesitated for a long time before responding to I. J. Good's answer [1] to my criticism of his attacks on five critics of special relativity (SR) [2], but finally I decided that it is best to put something on record, if only to satisfy those who merely skim these debates, and who might decide that the last word on record may not have been answered because it is essentially correct.

Actually the correctness, as well as the courtesy, still resides overwhelmingly on the side of the dissidents opposing SR. Focusing at first on the less important first two-thirds of his reply, let me challenge Good's preposterous claim that since the believers in a flat earth of centuries ago were "often intelligent," a comparison to them should not be taken as an insult. Surely no one even minimally familiar with contemporary usage could fail to see that calling a dissident a "flat-earther" will be taken as a severe insult. So what if Good did not apply this term to every single person he criticized? It still serves to illustrate accurately his arrogance in the recent debate.

It is also highly unconvincing to claim that an accurate accusation of "gratuitous rudeness," such as I levelled against Good, is itself necessarily rude—any more than an observation that a man is fat means the observer is also fat. As far as rude statements from other dissidents go, of course a few exceed reasonable bounds now and then—one of them in particular insults most other dissidents too—but still the grand average finds dissidents much more courteous and civilized than are defenders of contemporary dogma. See below for only one of several examples I could cite, of one such defender erupting into loud rage at an attempt to undermine SR.

Good's frequent appeal to his adversaries to "admit error" also illustrates the fundamental arrogance of his debating style. In the issue of *Apeiron* in which my criticism of him appeared, in the very first four lines of a dreary 14-page catalog of disagreements with dissidents [3], he manages to include this haughty phrase twice, once attached to an contemptible accusation that dissidents do not admit error because they are not honest—! How much more palatable, by comparison, is the page and a half in the same issue in which Mendel Sachs makes an equally futile and yet far more courteous attempt to rescue something from SR [4].

I am willing to concede that Good was being flippant when he said he was a "defender of the faith," and that he does not worship Einstein in a formal religious sense. But contemporary physicists in general, most of them not being nearly so willing to debate their critics as Good is (which is to Good's credit), do defend their dogmas with a degree of intolerance typical of those who defend theological dogmas—an intolerance very different from a genuinely scientific approach to searching for truth.

I also readily concede that Good was being facetious in speaking of "Xu^2," as I obviously was in my response to this usage.

The last third of Good's reply, decorated with equations and therefore in today's typical mindset empowered with scientific authority, deserves especially close attention—because it is so far off the mark, and because such attention leads to ample evidence that SR is in fact rife with internal contradictions, as Good repeatedly denies in the first two-thirds of his response.

The main things Good proves in this concluding segment are: (a) his overzealous willingness to attribute words and ideas to his opponents that in fact they never wrote or believed in; and (b) what a very short distance he has traveled towards a thorough analysis of the simultaneity problem.

Admittedly my thumbnail outline of my view of how Einstein erred in this famous thought experiment was too brief to be really clear [2, p. 129]. But Good is so anxious to attack us non-believers, that he rushes ahead to try to fill in the gaps in my argument with his own concoctions and accusations. He starts by failing to notice that when I speak of Einstein making an "incredible...blunder" by assigning two different speeds to each of two light beams, I state that Einstein's attribution of constant c came later than his attribution of additive speeds. This later part of his argument I said was done "surreptitiously" (In fact, it was assumed, not stated explicitly. Yet we can discover what it was, by deducing what was necessary to produce Einstein's final result; see below for more details.) Good attacks this claim and says that no, this attribution of a speed of c was done correctly, and "up front." But if it were up front, it would not have been done "later," as I said it was. Good is talking here, as I was not, about the very early stages of Einstein's argument, where he does mention a c, as the value of the speed of the light going to the stationary observer.

Fortunately, Good's argument here is more complete than mine was, and is marred only by a failure to specify which direction the train is moving in; but this can be deduced easily enough. This I can analyze it with little trouble.

A chief feature of Good's unjustified attempts to put ideas in my head is his strange assumption

that I would find anything objectionable in his equations (1) through (3), and the argument they are attached to. Obviously, just about anyone with the most elementary conceptual and mathematical skills can quickly realize that the stationary observer Ω will calculate the light beams to have reached the moving observer Ω' at the additive speeds c + v and c – v, as observed in the coordinate system of Ω. *The error is not that Ω states that these speeds are additive as measured in his own coordinate system, but that he then attributes the same speeds to the coordinate system of Ω'; he says that Ω' would also attribute additive speeds to the light approaching him on the train*. But this statement flatly contradicts the second postulate of SR, which in effect claims that every observer, in every relatively moving coordinate system, measures all light approaching him at the fixed and unchangeable speed of c. An observer in another relatively moving system, not located at either the origin or the end point of the route of a light beam, is free to attribute additive speeds to said beam, but these are valid only in his own system (Sometimes they are called "closing velocities)—*i.e*., they are according to the orthodox way in which SR is interpreted in today's establishment.

And yet, despite this blunder, Einstein's simultaneity argument might still be acceptable as a reflection of the real world; it might merely vitiate the second postulate of SR, by illustrating how it is fundamentally contradictory with the first postulate of SR. Things would happen in this way in the real world, if the luminiferous aether of the "at-rest" coordinate system permeated the space of the moving train, and controlled the velocity of light in the coordinate system of this train. This is a reasonable viewpoint; in effect, it reflects what happens in the Sagnac experiment and in the countless repeats of same, and it shows that Einstein's claim of a constant c in every inertial system is invalid. What matters, what controls the velocity of light, cannot be a system composed of mere abstract sets of points and lines (To claim that it can is to commit the fallacy of misplaced concreteness); it must be some real force, such as might be supplied by an aether made of something other than massless photons. (Good does not see this, because as he admits, he is unfamiliar with the very crucial Sagnac effect. Ah, so typical, that establishment physics just sweeps under the rug the most embarrassing empirical data. On Sagnac, see more below.)

But there is much more still. The "utterly incredible and yet virtually unknown blunder" I accused Einstein of making refers to something quite different from what Good carelessly assumes; it refers instead to Einstein's concealed attribution of constant c for light speed in the coordinate system of the train, near the end of his chain of argument (mentioned above). This is where Einstein reasons his way—or more accurately, fails to reason his way—from the reception of the light by the moving observer, Ω', to the emission of the light beams as they set out for this observer. Illustrating the widespread tendency in modern physics to confound what is observed and the event being observed, Einstein proceeds directly from his statement that Ω' sees the beams at two different times (a statement resulting from his contradiction of his own second postulate, as discussed above), to a claim that what is simultaneous in one system is not simultaneous in any relatively moving system. He makes this sweeping generalization without having gone to any trouble at all to make an explicit deduction, backwards in time, from the reception of the light on the moving system, to its emission. And he does this all from just one thought experiment! (One might suppose, if he had much respect for the process of induction and the principles of statistics, that he might have conducted at least 30 different thought experiments, on 30 different trains, to see if he got the same answer every time!)

In trying to reconstruct this missing deduction, it is easy enough to see that if we remain consistent with the initial stages of the argument, which tell us that the light travelled to Ω' at the additive speeds c + v and c – v, then the two beams would have departed at the same times in the moving system, and so no relative simultaneity would result! But if, as no doubt Einstein would have said if challenged to fill in the gaps in his chain of reasoning, the light were assumed—at this stage of the argument—to have travelled over the specified equal distances to the moving observer at a constant speed c, consistently with the second postulate of SR, then they must have also departed at different times, and we would have relative simultaneity in the process of emission. But to make this assumption contradicts what was said earlier about these speeds. First they were additive, and yet now they are constant. *This is a violation of the Law of Non-Contradiction, the most fundamental principle of logic*. You cannot affirm both A and non-A in the same chain of argument, and wind up with a valid argument. As it turns out, Einstein's claim of relative simultaneity depends entirely on this crucial logical error. If he affirms the same speed for the light beam throughout his argument, it does not matter what speed is chosen; inevitably, simultaneity will be shown to be absolute—as it surely is, throughout the real world.

We owe this decisive analysis to retired University of New Mexico philosopher Melbourne Evans; it is one of the supreme gems of dissident thought. He had to publish it in Europe, in 1962; then as now, the journals tend to be more open-minded over there. Soon after I met Evans in 1964

and first learned of this argument, I went over it for a physicist at the university where I was seeking a Ph.D. in history of science. He listened intently, grasped what I was saying, and then shouted loudly: "You can't be right; you can't be right; you can't be right!" Earlier this same physicist had threatened to destroy my Ph.D. program, even in another field, if I dared to write a thesis critical of SR. Lack of courtesy, of course; but also far more than that: an attitude far more insidiously destructive of scholarly progress and human welfare, than anything we dissidents do as we seek tolerance and truth. I did get my Ph.D., with another thesis topic, but I have never been allowed even a hint of a career in history of science, after criticizing SR at meetings while still in graduate school [e.g., in my paper on Sagnac, reference 5, originally read at a regional history of science meeting in the U.S.]. Numerous examples of similar maltreatment and ruined careers have been cited by other dissident scholars.

"Admit error"—? Look in the mirror, Dr. Good. Study your own words more carefully. And in general, physics has far more than "error" to confess.

Unfortunately, no one has yet been able to explain completely how establishment physicists and philosophers have managed to overlook the flaws in this argument for nearly a century, stifling knowledge of Evans's results in the process. It no doubt has something to do with a serious bias against logic, which is closely allied with contempt for common sense, and with the tendency to dismiss believers in common sense with insulting and entirely inappropriate accusations of being "flat-earthers."

Finally, let me try to provide Good with the help he requests in learning about the Sagnac experiment. It was performed in 1913, and reported in rather obscure (to us) French physics journals in 1913 and 1914. One of the clearest accounts of it is found in my 1965 history of science article [5]. The most common of its countless repeats since then now occur daily in the GPS satellite system; they keep on proving the existence of a preferred coordinate system, and thus of an ether (which may be defined functionally as whatever produces a preferred coordinate system]). A thorough defense of these proofs against ill-conceived claims that they really fit with special and general relativity was published not long ago by preeminent GPS expert (also a member of the Natural Philosophy Alliance) Ronald Hatch. [6]

References

[1] I. J. Good in *Apeiron* vol. 5 no. 3-4, July-Oct. 1998

[2] J. E. Chappell, Jr. in *Apeiron* vol. 5 no. 1-2, Jan.-Apr. 1998.

[3] I. J. Good in *ibid.*

[4] M. Sachs in *Apeiron* vol. 5 no. 3-4, July-Oct. 1998

[5] J. E. Chappell, Jr., "Georges Sagnac and the Discovery of the Ether." *Archives Internationales d' Histoire des Sciences*, vol. 18 nos. 3-4 (July-Dec. 1965), pp. 175-190.

[6] Ronald R. Hatch, "Relativity and GPS, parts I and II." *Galilean Electrodynamics*, vol 6 (1995), no. 3, pp. 51-57, and no. 4, pp. 73-78.

John E. Chappell, Jr.

'Space is 3-Dimensional' 1

Prof. Galeczki's article, Space is 3-Dimensional (*Apeiron*, January/April 1999), is a masterpiece. While it is true, as he says, that "non-Euclidean geometries are well established branches of mathematics," it is also true that they are invalid. Geometry and algebra are inseparable, and there can be but one valid version of each; otherwise, you will be sorry.

In this same issue of *Apeiron*, Dr. Strel'tsov elegantly demonstrates a contradiction in the curved-space geometry of General Relativity Theory.

Curved-space is invalid mathematics because, among other reasons, it violates the continuity axioms of both Eudoxus and Cantor and treats "infinity" as though it were a real number, which it is not.

These views are not original with me; Felix Klein lectured on this at Göttingen University during the 1920's after conducting extensive studies of the new geometries in the Erlangen Program. A summary of Klein's thoughts on this can be found in Number, Space, Motion and Time (*Galilean Electrodynamics*, July/August 1997).

There are precise fundamental notions of a point, straight line and plane, and these notions must be consistent with the geometrical axioms of connection, order and continuity, which Klein calls ".. .the leading concepts and statements which one must of necessity put into the front rank of geometry in order to be able to deduce mathematical proofs from them by pure logic. What did Klein think of curved-space geometry? He said: "I regard it, rather as the death of all science. The axioms of geometry are, according to my way of thinking, not arbitrary..."

At the turn of this century, Hilaire Belloc wrote an essay entitled The Barbarians in which he said:

> *The spirit (of the Barbarian)...in its most grotesque form challenges the accuracy of mathematics: in its most vicious, the clear processes of the human reason. The Barbarian is as proud as a savage in a top hat when he talks of the elliptical or the hyperbolic universe and tries to imagine parallel lines converging or diverging - but never doing anything so vulgarly old-fashioned as to remain parallel.. The Barbarian wonders what strange meaning may lurk in that*

ancient and solemn truth, Sine Auctoritate nulla vita.

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'Space is 3-Dimensional' 2

With respect, allow me to suggest that Dr. G. Galeczki's tortuous and verbose defence of 3D space (*Apeiron*, 6 no.1-2, Jan.-Apri1 1999) is pointless, misleading and misconceived. Unfortunately, one cannot afford to shrug it off, for the topic is too important.

The defence is pointless; users of 4D models (including *e.g.* Selleri, Strel'tsov, Whitney) never deny flat 'space', whether that of perception ('physics') or of 'pure' mathematical physics, is 3D. If (iff!) there is here a dispute, it should concern the status of the time variable'. The discussion is misleading; it confuses the mathematically illiterate and repels the rest. If physics is to reclaim common sense, it might emulate Aristotle rather than appeal to the yokel.

In the space-time graph of classical pure mechanics any two variables, say r and t, or x and t, are referred to coordinates. If we pompously introduce the misleading term basis vector, there would here be two basis vectors. By analogy, the space-time model of classical pure mechanics with three space coordinates has four coordinates and four dimensions; if we misleadingly use the term basis vector, one would say that there are here four basis vectors.

What tends to be forgotten is that pure mechanics has two different kinematic or dynamic 'models', the (3 + l)D, or 4D, space-time graph as distinct from the 3D vector space. In addition, users of (3 + l)D models ignore that there exist two fundamentally different types of linear equations and their equally fundamentally different respective quadratic forms. The difference, one clearly and immediately evident from the formal structure of an equation, determines whether we use partial differentiation or the chain rule. In the vector space model, any element containing the time would be merely a resultant vector. (The bombastic term basis vector should be avoided at this elementary level. The jargon keeps changing; and the underlying concept has become muddled in consequence of scale and non-Euclidean transformations.)

Without clarification of the difference between 3D and (3+1)D at the purely formal analytical level, any defence of 3D space wholly misses the point. It is also disappointing that Dr. G. has felt no need to consult the huge and sophisticated philosophical and mathematical literature where German scholars are acknowledged as leading.

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ERRATA: V5N3-4

Page 255 right column, last line:
$t' \neq r'/c$ should read $t' = r'/c$ and $t \neq r/c$ read $t' = r/c$.

ERRATA: V6N1-2

Page 111:
R, $\mathbf{M}_o$, $\mathbf{r}_o \otimes \mathbf{R}$, $\omega \otimes \mathbf{r}$, $\mathbf{r}_o \times \mathbf{F}$,$\mathbf{r} \otimes \mathbf{mv}$,$\mathbf{v} \otimes \mathbf{B}$ (bold face)
Page 112 (formula 1): **SS** (bold face)
before formula 1: "convergence"
Page 113 (formulas 6-8): lines represent 1D, 2D, 3D cases
(after formula 8): "The Third Principle of General Relativity" is a section title
(formula 13): add "≡0"
Page 147:
In Eq.(1): $t' \quad \gamma \; t - vx \; c$ should read $t' = \gamma(t - vx/c^2)$;
In Eq.(3a): $x' \quad y' \quad z' - ct'$ should read $x'^2 + y'^2 + z'^2 - c^2 t'^2$;
Line 2 above Eq.(3a): surprisingly to me when I read should read
surprising to me when I found
Right column, line 8: Null Set should read The Null Set;
line 20: previous should read previously;
Page 148, right column, line 4 from bottom: need read needed;
line 20: previous should read previously.
Page 159, right column, lines 1 and 2, two places: γr read γ.