The Hidden Time-Space-Mechanism

Part I. Oscillator Causal Physics

Introduction

The background of this work is the ancient Pythagorean thesis that the world comes into being by condensations and rarefactions (oscillations) between the spheres of time and the spheres of space, which at the foci cause condensation of the "Parmenidian one particles", out of which all matter is accreted 1). Thus, the basic presumption behind this work is that a spherical Time-Space-Oscillator "TSO" is the hidden mechanism behind physics and the investigation shows that this presumption is justified 2).

The Time-Space-Oscillator— Assumptions and Conditions

It is here presumed that a unit TSO consists of a standing TS-wave, confined between a nucleon, formed at the spatial focus, and an antinucleon, formed at the temporal focus (the spatial horizon). It is further presumed that a TSO unit obeys the energy formula for a classical simple harmonic oscillator "SHO" $E = m(A_o w)^2/2$ (Eq.1) having the velocity amplitude $A_o w = c\sqrt{2}$ (propagation velocity c). Here m is the mass-inertia, A_o the space amplitude, w the angular frequency, while $a = A_o w^2 = 2c/A_T$ is the acceleration amplitude of the oscillator ($A_T = \sqrt{2}/\omega$ is the time amplitude).

Necessary conditions for combining the mass m with the velocity amplitude $c\sqrt{2}$ is that m represents an inherent TSO-inertia or inductance omnipresent in whole TSO, and that the velocity amplitude refers only to the TSO-wave, as the focal nucleon mostly lacks translational motion. Also the TSO-energy E exists in every part of the TSO-unit, why it becomes possible to express it by any of the four fundamental energy Eqs.1-4). So TSO is an indivisible unit of a TS-wave, that can interfere in slits, and a focal nucleon (of condensed time), which can press instrument triggers, if in translational motion. This causally explains the particle wave duality.

In oscillatory motion one must distinguish between *e.g.* the velocity amplitude $c\sqrt{2}$ and the corresponding half period averaged value c, that is the propagation or translational velocity. Also the space amplitude A_o corresponds to a half period averaged distance $A_o/\sqrt{2}$, and the oscillative force ampl. F_o (Eq.4) corresponds to an efficient or 1/2 period averaged force $F_o/\sqrt{2}$. Thus $1/\sqrt{2} = \pi \int \cos(\omega t + \alpha)$ is the ratio of the half period averaged effect and the (rotating) amplitude in question.

$E = m(A_o w)^2/2$ (The TSO-energy displayed as energy of a classical SHO) 1)

$E = mc^2$ (The TSO energy displayed as condensed mass energy) 2)

$E = hn = hc/\lambda$ (The TSO energy displayed as wave energy) 3)

$E = F_o A_o/2$ (The TSO-energy displayed as efficient force × distance) 4)

$k_n = 2p/\lambda$ (k_n = wave number) $1/k_n = A_o/\sqrt{2}$ (A_o = space ampl. Eq.8) 5)

$\omega = 2\pi/P = 2\pi c/\lambda$($\omega$ = ang. frequency) $1/\omega = A_T/\sqrt{2}$ (A_T = time ampl. Eq.8) 6)

The crucial TSO-equations

If we first contemplate Eq.1) under these premises, we find that Eq.2) Einstein's $E = mc^2$ just describes the energy of a simple harmonic TSO. Eq.1) becomes identical with Eq.2), because $(A_o w) = c\sqrt{2}$ is the oscillative velocity amplitude (Eq.7). If we further combine Eqs.6&7) to Eq.8), we find that the space amplitude A_o of the unit TSO is $A_o = \lambda/\pi\sqrt{2}$ (λ = Compton). Here we have to introduce also a time amplitude $A_T = A_o/c = \lambda/\pi c\sqrt{2}$. (Eqs.6 &8)

$(A_o\omega) = c\sqrt{2} \rightarrow E = m(A_o\omega)^2/2 = mc^2$ 7)

$(A_o\omega) = A_o 2\pi c/\lambda = c\sqrt{2} \rightarrow A_o = \lambda/\pi\sqrt{2} = \sqrt{2}/k_n$ and $A_T = \lambda/c\pi\sqrt{2} = \sqrt{2}/\omega$ 8)

Table I

"Neutron"-parameters	Adjusted TSO-parameters
m_n = 1,674929.10–27 kg [S]	$m_o = F_oA_o/2c^2 = 1.674557.10^{-27}$ kg [S]
$E_n = m_nc^2 = 1.505351.10–10$ J [M2S–1]	$E_o = F_o A_o/2 = 1.505017.10^{-10}$ [M_2S^{-1}]
$\lambda_n = h/m_nc = 13.19592.10^{-16}$ [M]	$\lambda_o = A_o\pi\sqrt{2} = 13.19885.10^{-16}$ [M]
$A_n = \lambda_n/\pi\sqrt{2} = 2.970125.10^{-16}$ [M]	A_o (Eq.11) = $\pm 2.970785.10^{-16}$ [M]
$A_{Tn} = A_n/c = 0.990727.10^{-24}$ [S]	$A_T = A_o/c = \pm 0.9909469.10^{-24}$ [S]
$a_n = 2c/A_{Tn} = 6.0519695.10^{32}$ [MS^{-2}]	$a_o = 2c/A_T = 6.0506265.10^{32}$ [MS^{-2}]
$F_n = m_2c/A_{Tn} = 0.1013662.10^7$ N [MS^{-1}]	$F_o = 10^7/\pi^2 = 0.1013211.10^7$ [MS^{-1}]

Other adjusted TSO-parameters

$P_o = \lambda_o/c = 4.402662010^{-24}$ [S]	$A_oA_T = 2.943888.10^{-40}$ [MS]
$\omega_o = \sqrt{2}/A_T = 1.427134 .10^{24}$ [S^{-1}]	$A_o^2 = 8.825554.10^{-32}$ [M^2]
$\hbar = h/2\pi = 1.054573.10^{-34}$ [M^2]	$A_T^2 = 0.9819753.10^{-48}$ [S^2]

$F_o = ma = mA_o\omega^2 = mA_o^2/A_T^2 = m^2c/A_T$ 9)

The TSO-wave length λ is given by combining Eqs 1,2&3) to Eq.10 which is identical with the Compton wave length for the particle with mass *m* (and the De Broglie wavelength if the velocity *v* = c). It can also be written as a function of the space amplitude A_o if combined with Eq.8

$E = mc^2 = hc/\lambda \rightarrow \lambda = h/mc$ and $A_o = h/mc\pi\sqrt{2}$

or $h = A_omc\pi\sqrt{2}$ 10)

So far we have applied only the rules valid for a classical SHO consisting of a confined Time-Space-Wave with velocity amplitude $c\sqrt{2}$ and an inertia *m* inherent in TSO and equal to the particle mass. In this context Eq.10) "the Compton-De Broglie equation", becomes the equation that connects matter with time-space. But we do not know the exact mass m_o, which fits our Eqs.1-10). It ought to be between the proton and the neutron mass, but neither of them corresponds to an harmonic TSO due to charge resp. β-instability. Anyhow, we must try the neutron mass mn and use the values listed below. We then get the "neutron parameters" λ_n, A_n, A_{Tn} and F_n (by Eqs 10,8 &9) as recorded on the left side of Table.1.

Space/time ratio "Velocity of light"	c = 2,9979246.108 *m*/s
Planck's constant.	$h = 6.626076.10^{-34}$ Js
Neutron mass	$m_n = 1.674929.10^{-27}$ kg
Proton mass	$m_p = 1.672623.10^{-27}$ kg
Electron mass	$m_e = 0.910939.10^{-30}$ kg

Force $F_o = 10^7/p^2$: key to the hidden TSO-mechanism

From the neutron parameters we cannot come further without using a Pythagorean trick. Remark, that only time [S] and space [M] are fundamental dimensions in TSO, Kg gets [S] and J [$M2S^{-1}$]! So we simply presume that the force F_o is a function of π, operating between space and time [MS^{-1}]. Closest to $F_n = 0.10136.10^7$ N is $F_o = 10^7/\pi^2 = 0.10132.10^7$ [MS^{-1}]. This appears to be the secret key to the hidden realm behind physics. With this adjusted value of F_o, we can go backwards and adjust A_o by combining Eqs.3, 4 & 8) to Eq.11). Then also the other parameters are adjusted according to the right side of Table 1

$E = hc/\lambda = hc/A_o\pi\sqrt{2} = F_oA_o/2 \rightarrow A_o2 = hc\sqrt{2}/F_o\pi = 8.825554.10^{-32}$ [M2] 11)

QM and the Uncertainty Principle: causal in TSO

The above Eqs.1-11) and the parameters of Table 1. enable us to express time (A_T), space (A_o), force (F_o), mass (m_o = TSO inertia) in one another by aid of the space-time ratio *c* and Planck's constant *h* 3) according to Eqs.12-14). In Eq.14) if we substitute $h2\pi$ for *h* and recognize that $1/\sqrt{2} = \pi\cos(\omega t + \alpha)$, we arrive at a startling expression for $\hbar$ according to Eq.15)

$m_o = F_oA_o/2c2 = F_oA_T/2c$ (Eqs.1 &4) 12)

$m_o = h/\lambda_o c = h/A_o c\pi\sqrt{2}$ (Eqs.1 &3)

$\rightarrow h = m_o A_o c\pi\sqrt{2}$ 13)

$h = F_o A_T A_o c\pi\sqrt{2}/2c = F_o A_o A_T \pi/\sqrt{2}$ 14)

$\hbar = F_o A_o A_T/2\sqrt{2} = F_o\cos(\omega t+\alpha).\ A_o\cos(\omega t+\alpha).\ A_T\cos(\omega t+\alpha)$ 15)

Eq.15 is a simple and causal interpretation of QM and the Uncertainty Principle in contrast to present probabilistic interpretation. If Eq.15 is written $\hbar = A_o.(F_o A_T)/2\sqrt{2}$ it is equivalent to Heisenberg's $\Delta x \cdot \Delta p \geq \hbar$, because $A_o/\sqrt{2} = \Delta x$ and $F_o A_T/2 = \Delta p$. Written $A_T(F_o A_o)/2\sqrt{2}$, Eq.15 is equivalent to Heisenberg's $\Delta t \cdot \Delta E \geq \hbar$, because $A_T = \Delta t$ and $F_o A_o/2 = \Delta E$. This agrees fully with David Bohm's assumption of a hidden variable that exists behind QM.[4]

The units A_o, A_T, F_o are vectors with spontaneous values $l_o\cos(\omega t+\alpha)$ and 1/2 period-averaged values $l = l_o/\sqrt{2}$.. Like c, $\hbar$ is a vector, an angular momentum 3), but not a vector amplitude. The ang. frequency w is universal but each TSO has its own phase constant a. Thus in experiments with a few particles, their different phase constants a are decisive factors out of the experimenter's control. Hence, n particles implies n TSOs of different a forming a 3-n dimensional and real Hilbert space not a fictitious one as Pauli insisted[5], when he at the Solvay conference 1927 contended de Broglie's ideas of a pilot wave. This is in agreement with the statistical interpretations expressed by *e.g.* Nikolskij, Blokhintsev and Karl Popper [6].

Whatever we measure on the atomic level, the result depends on the parameters F_o, A_o, A_T, varying with time as $A_T\cos(\omega t+\alpha)$. They are phase dependent and yield of causal reasons statistical values with $(I/\sqrt{2})$ as the average. This may be a brave conclusion, but it is not far from Planck's original assumption that $\hbar$ is associated with an intermediary and linear oscillator at the black body wall 3,7), perhaps expressed by Eq.16

$\hbar$ (outside the particle) $= F_o A_o A_T/2\sqrt{2}$

$= \hbar$ (inside the particle) $= m_o A_o 2/A_T\sqrt{2}$ 16)

Conclusions

The ancient Pythagorean thesis that the world comes into being due to oscillations between the spheres of time and the spheres of space has been investigated and found to be in agreement with the hard facts of present physics. A Time-Space-Oscillator characterized by the velocity amplitude $A_o w = c\sqrt{2}$ inside its TS-wavefield, appears as the hidden mechanism behind physics and QM. Under this condition the energy formula for a classical SHO $E = m(A_o w)^2/2$. becomes identic with Einstein's $E = mc^2$, which is oscillative not relativistic, and thus justifies the TSO-perspective. The oscillative TSO-force F_o is preliminary estimated by aid of the neutron mass but turned to exactly $10^7/\pi^2$ by a Pythagorean interpolation, which is the very key to TSO. Among the stoichiometric relations revealed, the most startling one may be the new expression for Planck's constant $\hbar$

$\hbar = F_o A_o A_T/2\sqrt{2}$

$= F_o\cos(\omega t+\alpha).\ A_o\cos(\omega t+\alpha).\ A_T\cos(\omega t+\alpha)$

This equation reveals that the state of the particle is statistically dependent on the phase a that varies between different particles and can not be controlled in experiments. It also reveals the causal and statistical nature of Quantum Mechanics and of Heisenberg's uncertainty principle.

Prospects

In a second article the Planck Time TP and Length LP (16,1596.10-36 *m*) are introduced as subquanta or superstrings, which create the TSO-amplitudes A_T and A_o. Then a startling geometric ratio $A_o^2/L_P^2 = 10^{48}/\pi^2 c$ appears, that reveals TSO as two joined oscillators, one linear and one helical-torsional, with gravitation as the weak coupling between them. The grav. constant G then appears as pure geometrical $G = 10^{-55}(\pi^2 c)^2 2\sqrt{2}.c^3 = 6.671876.10^{-11}$ $[M^3S^{-3}]$. Further the ratio $A_o/L_P = 1838.4.10^{16}/\pi\sqrt{c} = m_o/m_e$ appears as a dissociation factor of the TSO-amplitude, when it splits in proton and electron amplitudes, the latter equal to $10^{16}\,L_P$. These facts indicate that protons and electrons are not perpetually existing particles but incessantly created by "dissociation" of the TSO amplitude A_o in pace with its frequency $\sim 10^{24}$ Hz. These dissociated amplitudes enable us to calculate the enigmatic electron and proton masses with an accuracy of 70 ppm. and the elementary charge $e = 16.02204\ 10^{-20}$ Coul. with an accuracy of 20 ppm. Finally it also enables us to combine the

electrostatic and the electromegnetic systems into a totally unified TSO-system, in which Coulomb gets dimension [M] and present magnetic permeability $m_o = 4\pi 10^{-7}$ is turned into $1/F_o = \pi^2 10^{-7}$ [SM^{-1}].

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Time dilation on satellites and rockets

The conventional habit of arbitrarily preferring the same particular reference frame for all time dilation experiments has led to a contradiction involving atomic clocks on satellites and the special theory of relativity. Physicists always analyze satellite clocks, as well as other time dilation situations, from the "inertial" reference frame of a place around the earth that has no rotational velocity—*i.e.*, the North Pole or the non-rotating center of the earth or an "underlying (inertial) nonrotating space." This special reference frame is referred to as the Earth Centered Inertial frame. However, contradictory predictions arise once one begins to analyze analogous experiments from the "inertial" reference frame of a non-rotating spot on the moon or the sun. The Orbiting-Clock Paradox addresses this quarrel between the implications of well-known experiments and the viewpoints of different astronomical bodies, forcing relativists to explain why the Earth Centered Inertial frame should be *preferred* to a Lunar Centered Inertial frame or Solar Centered Inertial frame for experiments where no such preference seems justified.

The question

Consider the following time keeping situation: Clock A is on a satellite that is in a free-fall orbit around some star or planet. Clock B is in a rocket that is launched from the satellite so that it maintains the same altitude as the satellite with respect to the star or planet but is flying in the opposite direction of the satellite's orbit. Thus, if we ensure that the velocity of the counter-orbiting rocket does not reach a certain extreme, then its velocity will be less than that of clock A with respect to the non-rotating center of the planet or star. According to velocity dependent time dilation of the special theory of relativity (STR), which of these two clocks runs faster? The clock in the satellite that is moving faster with respect to the "non-rotating space" of the star or planet? Or the counter-orbiting clock within the rocket?

The author of the article contends that no one can successfully answer this question with an explanation that is logically consistent with both the fundamental rules of STR and all known experimental results. (It is important to stress that velocity dependent time dilation occurs in conjunction with and independent of all gravitational effects on clocks, and this question concerns only velocity dependent time dilation as defined by the STR. Thus, for simplicity sake, it may be best to assume there is a special device on the rocket and satellite that maintains an equal gravitational environment for both clocks.)

The problem

The answer to the question depends on the reference frame that one is supposed to choose—which, in turn, depends on the somewhat tricky definition of the term "inertial." According to STR, time slows down in systems that are moving with respect to some "inertial" (or non-accelerating) frame of reference. The faster one moves with respect to some inertial reference frame the less one ages with respect to that reference frame. Thus, if the satellite can be thought of as a valid inertial frame, then the

velocity of its clock would be assumed to be zero—which would mean that the satellite clock should run *faster* than the rocket clock. But if the proper frame of reference is the planet or star around which the satellite orbits, then one would calculate the satellite clock to have the velocity of its orbit—which would mean the satellite clock should run *slower* than the rocket clock. Unfortunately, it seems that the choice between these reference frames and their conflicting predictions is not always clear.

The Earth/Moon paradox

The difficulty in explaining the proposed situation emerges when one tries to determine the answer for the following two situations. 1) What is the outcome of the challenge when a rocket takes off from the moon in the opposite direction of the moon's orbit around the earth so that the rocket is moving more slowly with respect to the Earth Centered Inertial frame? Should the clock on the moon or the clock in the rocket run faster? 2) And what is the outcome of the challenge when a rocket takes off from the earth in the opposite direction of the earth's orbit around the sun so that the rocket is moving more slowly with respect to the Solar Centered Inertial frame? Should the clock on the earth or the clock in the rocket run faster? It would appear that a careful examination of certain experiments relating to this issue (particularly Vessot, Hafele-Keating, and Global Positioning System experiments) leads to a paradox.

The Vessot experiment [Vessot, R. F. C. and Levine, M. W., et al, 1980] showed that a clock in a rocket moving in a vertical direction in the Earth Centered Inertial frame loses time with respect to earth clocks — even when this rocket moves in the opposite direction of the earth's orbit around the sun so that it is moving more slowly with respect to the Solar Centered Inertial frame. The Vessot result is also consistent with all twin paradox explanations. If we imagine the astronaut in a rocket that maintains a steady position with respect to a non-rotating point on the sun, then the earth would orbit around the sun and eventually meet back up with the rocket a year later. And, according to velocity dependent time dilation, the astronaut twin is always supposed to age more slowly than the stay-at-home earth twin—no matter how the astronaut twin manages to return to earth.

However, the Hafele-Keating experiment [Hafele, J. C. and Keating, R. E., 1972] and Global Positioning System (GPS) calculations have found the opposite effect occurs for satellites orbiting the earth. According to the data of these last experiments, clocks moving against the direction of earth satellites in orbit (so that they are moving more slowly with respect to the Earth Centered Inertial frame) would run *faster* than the satellite clocks.

The reason for the different predictions is that when physicists calculate the velocity dependent time dilation for the Vessot experiment (or all twin paradox scenarios), they neglect the orbital velocity of the earth. Yet, according to Hafele-Keating and GPS, calculations for the velocity dependent time dilation for satellite (or airplane) clocks depend entirely on the orbital velocities of the satellites (or airplanes). Thus, whether a rocket takes off from the earth or a satellite of the earth, the contemporary analysis would have physicists *prefer* the Earth Centered Inertial frame in every case in order to make their predictions. Thus, in each case, physicists very carefully ignore the reference frame of both the non-rotating center of the satellite and the non-rotating, *non-orbiting* reference frame of the sun. But if one wants to use the reference frame of the earth for the moon/rocket experiment, then one should explain why we should ignore the reference frame of the sun for the earth/rocket experiment. Yes, this geocentric method of preference allows physicists to form predictions that are in accord with experimental results, but this method of preference appears to be at odds with the rules of the special theory of relativity

Conclusion

The author contends that electromagnetic phenomena and muon decay within the vicinity of the earth's orbit appear to slow down as the velocity of their systems increases with respect to one very specific reference frame and no other. This reference frame orbits the sun at the

velocity of the earth but does not spin with the earth. Such a choice of reference frames is allowed in many theories, particularly theories involving a medium for light, but no such arbitrary preferences are allowed in the observer-based special theory of relativity. The author argues that no one can provide an answer for the orbiting-clock question that includes a specific explanation for when to use certain orbiting reference frames in a manner that is consistent with STR and all experimental results.

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In memory of Stefan Marinov

Stefan Marinov, doubtless, was the outstanding person. For the first time I have met with him on the second international conference "The Problems of the Space and Time in the Science", taking place on September 16-21, 1991 in Leningrad. Stefan was cheerful and friendly the person, which has at once become soul of all conference: reported with sharp clarifications on difficult problems, came to the aid in interlanguage dialogue and so on. Marinov, as well as Russian, in perfection possessed languages: Italian, English, German...

The erroneous of the Theory of Relativity for him was obvious and for a long time passed a stage. On this conference and subsequent ones he was carried away by creation of a Perpetual Mobile: he reported the problems of the theory, demonstrated experiments, which, on his belief, testified to a opportunity of creation of a Perpetual Mobile. I remember the last meeting, where he has informed, that the achieved effect will be realized by his italian friends in a design of a Perpetual Mobile, which soon they will test. I have asked: 'Stefan, what will you do, if it will not work?" "I shall begin on-new! "— he has answered. I silently shook he by a hand.

Despite persecution, which he has tested for his antirelativity: a premise in madhouse, turn out from native Bulgaria and so on, Stefan seemed by the person of inexhaustible optimism. And now he is not present! I do not know the reason, on which Stefan has left from life. Maybe this is wreck of hopes about a Perpetual Mobile, or probably the burden on the thorny way of a true Seeker has appeared heavier.

One see, all clearly. The world, offered by modern physics: by the Theory of Relativity and Quantum Mechanics, is unreal and faulty. But what it?..

Do not maybe think about it? Maybe to put into mouth chewing-gum and to be loaded in show on a TV set?

The death of Stefan Marinov is not a death of the separate person. It is symptomatic. He is inquisitive sacrifice of our civilization. Any of us can appear in his rule. Millennium Twain has well said in his word: 'Isn't it time we wiped the slate clean -- of the ruling mindset of deliberate lies, conformist media, selfish misdirection and criminal destruction? We have precious little time".

Jorge C.Cure speaks, that it would like to believe that Marinov's death will indeed have an impact on the community of dissidents in physics. I think, Marinov's death has shown, that it is impossible alone to search for true. The conceptions about the world is created all mankind. Even if to pass through all thorny ways, the alone do not find true. Alone can find its peace. It can be join with peace of true of other Seeker, then it is need to attach to third peace of true and so should proceed so long as the true will not become whole and accessible to all people.

Who, carried away by process of true search, thinks, that true he will alone find and wholly, should know following. Even if his search will successful, the people will not accept the true,

and it will leave into non-existence together with a true Seeker.

Now Stefan Marinov—it already a history of antirelativity motions. For me he has remained in memory bright, inquisitive and interesting person with light-blue eyes.

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Appeal to experimental physicists

Dear friends!

I want to involve your attention in acceleration of elementary particles up to superluminal velocity.

There are no obstacles to achievement of such velocities, except worldoutlook, stipulated by the theory of relativity (TR).

The essence of a obstacle is following. In a nature objectively there are interactions between bodies. The electromagnetic interaction depend not only on distance between bodies, but also on their relative velocity. Now the description of interactions is constructed so that equations for interactions of stationary bodies and the equations for interactions of moving bodies were identical. Therefore, to satisfy with a empirical data, it is necessary parameters at rest to transform to parameters at movement on relativisticl transformations, known as Lorentz's transformations.

If the interactions between moving bodies to describe such, as they is, i.e. in the form of the force depending on distance and velocity between interacting bodies, transformations of the space, time and the mass are not necessary.

Secondly, the TR creators, which are carried away by aether, are plunged in error assuming, that they build not only the description of interactions, and create the world, in which the material bodies are subjected to changes pursuant to relativical ratios. As the relativical transformations at superluminal velocity became imaginary, the superluminal movements have be forbidden by TR.

Except relativical description of the interactions there are other descriptions. In my works [1,2] I have developed a force method of description, based on expression for force of interaction of two bodies, which depends from distance and velocity between bodies.

The superluminal movements exist in the nature: jets of substance and separate fragments of galactic in far space move with velocities, exceed velocities of light in some times; the space particles with superluminal velocities are introduced into atmosphere of the Earth. I offer to receive superluminal movements on the Earth.

I offer to organizations and scientists to participate in this work. In many organizations all necessary is present, to accelerate particles up to superluminal velocity under the approach offered in my articles [2,3]. If necessary the scheme of experiment can be changed and adapted to being present conditions.

I offer also to use methods developed by me for calculation of accelerators and nuclear conversions. They are exacter the approach of TR.

For what are necessary superluminal movements on the Earth?

1. There are new propulsion engine for human voyagers to other star systems.
2. This is the powerful tool in antiasteroid protection of the Earth.
3. There are new ground technologies.
4. There are new purposes and prospects for mankind.

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Why Relative Speeds and Relative Clock Rates Don t Form Groups

Introduction

It is noble of Phipps (1997b) to admit error in response to Good (1997) and to other critics of Phipps (1997a). If everybody had the honesty to admit error, much confusion would be prevented. He has also raised further issues, and I will now react to some of them. In particular I don t agree with his claimed empirical refutation of the special theory of relativity (STR or SRT).

Phipps (1997a) asked whether clock rates have group properties. Good (1997) asked "Why should they?", Velocities might have group properties in 3 + 1 dimensions, and certainly in 1 + 1 dimensions (assuming KSRT or KSTR, the kinematics of the special theory of relativity), but almost obviously relative speeds do not, and hence neither do relative clock rates. This will be explained further in Secs. 3 and 4.

Philosophical background

Mach (1883 –1942, p. 274) regarded Newton s concept of absolute time as "an idle metaphysical conception". Mach thought that it is sufficient to note, as an empirical fact, that clocks usually agree with each other, regarding durations, within experimental error. We could reasonably call this "Mach s law" although it was tacitly known long before Mach. A relativist would amend it by referring the law to any fixed inertial frame. It may then be called the "amended form of Mach s law".

It has been discovered over the ages that "clocks" can be invented that agree with one another, in the measurement of durations, to greater and greater accuracy, within any inertial frame of reference. Newton s metaphysics, updated by Minkowski, seems to provide an explanation. Complete accuracy is impossible as we know from quantum mechanics, so perhaps the future affects the past on a small enough scale. (Compare Good, 1962.) But I will leave quantum effects aside.

I think Newton s concept has some merit in ordinary parlance. It can be regarded at least as a useful fiction in the sense of Jeremy Bentham (Ogden, 1932, 1959) or Hans Vaihinger (1911, 1935).

Poincaré (1905, 1952, p. xxvi) greatly emphasized that the principles of geometry and mechanics are conventions but "these conventions are not arbitrary". This statement could be worded as saying that a convention is a convention is a convention (like Gertrude Stein s rose) but the fact that a specific convention is *useful* is a law of nature. For example, if a clock does not keep time with other clocks we say, by convention or definition, that it is out of order or is not a proper clock. But this convention is useful because we can usually explain why it doesn t agree with other clocks. For example, it might have been dropped on the floor.

So when Phipps (1997b) says, "Such, such are the joys of theory beautified by pure logic" he was anticipated by Poincaré except that Poincaré was not sarcastic about it. Phipps s sarcastic style is often amusing but sometimes he overdoes it.

A modern example of Poincaré s principle is that the speed of light is now *defined* as 299,792,458 ms^{-1}. In other words, the meter is defined as "equal to the distance travelled by light in free space in 1/299,792,458 second". (See the OED where three earlier definitions of the meter are also given.) Phipps says sarcastically and wrongly (in his list of References) that "the Minkowskian metaphysic has been swallowed hook, line, and sinker by the priests of the measurement temple". The purely experimental work by the "priests" had nothing to do with Minkowski s well known exaggeration about the fading away of the independent reality of space and time, nor with his "mystic formula" 3.10^5 km = $\sqrt{-1}$ secs. (Minkowski, 1908, 1923, pp. 75, 88). He was indirectly referring to the analogy between the Euclidean metric and the pseudo-Euclidean relativistic squared interval $x^2 + y^2 + z^2 + \tau^2$ when τ = ict. He didn t think a ruler was a clock nor that his wife was a hat.

I think the authorities on measurement deserve our respect for the remarkable accuracy of their work. It denigrates their efforts to call them "priests". The discrepancies between their beliefs don t lead to religious wars.

Relative speeds don't form a group

Even in Newtonian kinematics, relative speeds, as distinct from relative velocities, don't form a group. For consider collinear clocks 1, 2, 3, denote by v_{ij} the velocity of clock j relative to clock i, and let $V_{ij} = v_{ij}/c$ where c = 299,792,458 ms^{-1} (i, j = 1, 2, 3) or any other constant speed. We don't need bold type for vectors when only one spatial dimension is considered. We can regard the V_{ij} as standardized velocities, although they are not velocities but are real numbers. They are positive, negative, or zero. In Newtonian kinematics they are unbounded. The corresponding standardized speeds are the absolute values $|V_{ij}|$ and are non-negative numbers. The (standardized) velocities (in Newtonian kinematics) form a familiar group under addition (in 1 + 1 dimensions), the additive group of real numbers, where zero is the identity and the "inverse" of V_{ij} is $-V_{ij}$. This argument doesn't apply to speeds because a positive speed doesn't have a inverse in that sense. Moreover speeds cannot form any kind of group because (in Newtonian kinematics in 1 + 1 dimensions) the composition of two standardized speeds $|V_{ij}|$ and $|V_{jk}|$ is $|(|V_{ij}| \pm |V_{jk}|)|$ and is therefore not unique. (See below for the strict interpretation of *composition*.) The first essential property of a group is that the composition of two given elements should be uniquely defined. Because relative speeds don't form a group in one spatial dimension they cannot do so in any number of spatial dimensions. That argument applies to Newtonian kinematics, and it implies the same result for any kinematic theory, such as STR, that tends to the Newtonian theory when $c \longrightarrow \infty$. For, if relative speeds formed a group in such a theory, we could deduce, as a limiting case, that they would form a group in Newton's theory and this is false as we have just seen.

For STR, essentially the same argument can be used, instead of using a limiting argument, by noting that the composition of two standardized speeds $|V_{ij}|$ and $|V_{jk}|$ is

$$\frac{|(|V_{ij}| + |V_{jk}|)|}{1 + |V_{ij}|\cdot|V_{jk}|} \quad \text{or} \quad \frac{|(|V_{ij}| - |V_{jk}|)|}{1 - |V_{ij}|\cdot|V_{jk}|}$$

which is not a unique function of $|V_{ij}|$ and $|V_{jk}|$.

Clock rates in the special theory of relativity

For this section, it is convenient to recall what Phipps calls his "theorem":

> *"In SRT [STR] all inertial clocks run at the same intrinsic rate: i.e. R[1,1] = R[2,2] = R[3,3]."*

Recall that Phipps's definition of R[i,j], when i ≠ j, is "the rate of clocks at rest in [inertial] system i as measured by clocks at rest in j, and R[j,j] symbolizes the intrinsic or self-measured rate of clocks at rest in system j." These definitions contain the tacit assumption that, for any given i and j, R[i,j] and R[j,j] have definite values. In particular, all clocks in the same system run at the same rate. It is clear further from the wording in Phipps's proof that he assumed that R[j,j] is a *number*. Suppose, for example, that, for some j, R[j,j] = 7. Then the "intrinsic rate" of clocks in system j is 7. That can only mean that a clock in system j runs seven times as fast as some other clock. (It cannot mean seven of something *per second* because it's a pure number.) But since the other clock is not specified I have to assume that it is a clock in system j. But then that other clock would have a rate of 1/7 compared with the first clock, and this would contradict the tacit assumption that R[j,j] has a definite value. This form of argument shows that R[j,j] = 1. Therefore Phipps's theorem, and more, is seen to follow by a semantic analysis of his definitions *without reference to relativity theory*. The equation R[j,j] = 1 is simply a way of expressing the modified form of Mach's law. It is excessive to call it a "theorem".

If Phipps's assumption is weakened, allowing R[j,j] to have more than one value, then the only alternative solution is that there are just two values for R[j,j] namely ± 1. This would mean that some of the clocks in system j were synchronously going forward in time, and the others were synchronously going backwards. As an aside I like the concept of two universes coexisting, one of them consisting of antimatter, and each going backwards in time relative to the

other. When, on extremely rare occasions, two black holes collide (or one black and one white), one from each universe, there would be a big bang starting a new universe with two parents of opposite signs. This idea is crazy enough to be true, as Bohr might have said, and also crazy enough to be false. It is only quarter-baked and is stated only as an "aside". Let me return to the main topic.

The expressions "intrinsic rate" (of a clock), and clock rate as a "state function", are unnecessarily vague, for if they mean anything they are just another way of implying the operational assumption that R[j,j] has a definite value when j is given. Perhaps the vague use of terminology encourages creativity as in brainstorming and dreams. All words are vague but some are vaguer than others, even to the point of becoming metaphysical. "Intrinsic clock rates" and "state functions" are close to the upper limit unless rules of application are provided. The concept of a "state" in quantum mechanics is given some meaning by the Schroedinger equation combined with Max Born's interpretation, but Phipps's "state function" is more obscure.

Dr. Phipps has somewhat disarmed criticism by saying that the "theorem" might have no [physical] meaning. But its physical meaning, as I said, is surely a denial of the speculation in Good (1962) or a way of stating the amended form of Mach's law.

Let us now return to STR. The relative clock rate of an inertial clock or observer Ω_j as measured in the reference frame of Ω_i is $(1 - V_{ij}^2)^{1/2}$. This formula puts speeds and relative clock rates into one-one correspondence. To answer the question of whether relative clock rates form a group (in 1 + 1 dimensions) strictly we should first carefully define a composition law. (In Sec. 3 I implicitly took the following definition for granted.) For this purpose, consider three collinear clocks or observers, Ω_1, Ω_2, and Ω_3 at rest in inertial systems 1, 2, 3, and let R(i, j) denote the relative clock rate of Ω_j as measured in system i. (I am writing R(i, j) for Phipps's R[j, i].) Then the composition law, if it means anything and also exists, states that the composition of R(1, 2) and R(2, 3) must be R(1, 3). But the speed $|V_{13}|$ cannot be defined uniquely in terms of $|V_{12}|$ and $|V_{23}|$, as we have seen. Therefore, because of the one-one correspondence mentioned above, R(1, 3) cannot be defined uniquely in terms of R(1, 2) and R(2, 3). In other words *the set of relative clock rates cannot have a composition law*, and *a fortiori* cannot form a group (nor a semi-group, a ring, or a field). This proof would apply under the sole assumption that relative clock rates and relative speeds are in one-one correspondence, not necessarily by the usual relativistic formula.

The CERN muon experiment

Phipps (1997b) discusses an experiment in which a cloud of muons travels fast on a circle relative to the laboratory which is treated as (approximately) at rest in an inertial system, S. He says that the half-life of the muons in circular orbit is 29 times that of muons in the laboratory and that this is an empirical fact. This verifies the claim by Einstein (1905, 1923, p. 49) concerning the circular clock paradox but Phipps doesn't say that. (Einstein ignored gravitation in 1905.) Instead Phipps imagines another cloud of muons moving in a straight line with the same speed as the ones moving on a circle, but instead in an inertial system S'. He infers that the muons in S' would also be long-lived, and that this is "essentially an empiricism". But, he says, according to the "theorem", "the intrinsic running rates of S-clocks and S'-clocks are *the same*", and he says this "apparently marks a flat contradiction between theory and observation". But, as pointed out in Sec. 4, the "theorem" is merely a restatement of the modified form of Mach's law, namely that *within each inertial system* the clocks agree with one another. *It doesn't say anything about the relative rates in one system as measured in another system.* So we cannot use the theorem to arrive at the contradiction 1 = R[i,j] ($i \neq j$) as Phipps claims in effect. One more attack on STR has gone down the drain. Imaginative people, like Dr. Phipps, come up with many ideas some of which are stimulating but wrong.

Noninertial observers

Phipps says that "acceleration plays no overt role in SRT [STR]". More explicitly, the standard

form of the theory applies to inertial (non-accelerating) observers, but even a noninertial person can make observations. To see how to cope to some extent with such deviant observers see Lowry (1963), Taylor and Wheeler (1963/66, p. 94), Terletskii (1968), and Good (1990, 1991, Sec. 3). I believe those works can be made more general without altering KSTR.

Group properties of velocities

That in 1 + 1 dimensions velocities form a group in KSTR was mentioned in Sec. 1 and has been known at least since Einstein (1905/23, p. 51). It is natural to ask whether it is true in 2 + 1 and 3 + 1 dimensions. To answer requires careful definitions related to the fact that the product of two Lorentz matrices is a Lorentz matrix followed by a spatial stationary rotation. I believe the answer is "yes" when all the velocities are measured in a single coordinate system, but a proof would not be simple. Dr. Phipps will perhaps describe my belief as "religious". Compare Phipps (1986, p. 267) where he says C. Møller's expression "for physical reasons" really means "for religious reasons". Møller's faith was justified (Good, 1995, p. 791).

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Campbell's length experiment revisited

Campbell (1996) considered two physical setups called a "length experiment" and a "time experiment". In Good (1997) I discussed only the former and will continue that discussion herein. (I will refer to the "time experiment" at the end.) In the "length experiment" there is a straight rod (or segment) of length L as measured in an inertial frame of reference in which the rod is stationary. On the same line there is an observer O′ to the right of the rod, and O″ to the left of the rod, both moving with a speed v to the right, O′ moving away from the rod and O″ moving towards it. Campbell argues that the rod will appear to expand (that is, to be of length greater than L), when measured by O′, that is, in the frame of reference in which O′ is at rest, whereas it will appear to contract according to O″. The assertion regarding the point of view of O′ of course contradicts the "Lorentz contraction" which can be regarded as a consequence of the Lorentz transformation, LT (see, for example, Bergmann, 1976, p. 40). So I was surprised to read in Campbell (1997) that he regards the LT as valid and even that he had a new demonstration for it. It is somewhat paradoxical that Xu & Xu (1997a), who express extremely strong approval of Campbell (1996), say in their 1997b that the LT is "riddled with

dents". So, even without analysis, it follows that either they are wrong about the LT or Campbell is.

At the end of Campbell (1997) he says that, when I use the LT, I can be "absolutely certain" that it is correct. I used it in Good (1997) to prove that O′ and O″ are in agreement regarding the length of the rod, as measured in their frames of reference (which are essentially the same), thus contradicting Campbell's thesis with "absolute certainty".

Campbell (1996) regarded his thesis as obvious without further discussion and in Campbell (1997) he says that "things are obvious to one only according to his gifts". I would agree with that statement provided that "giftedness" covers knowledge as well as intelligence. There were many intelligent people who thought the earth was flat partly because they were ignorant of arguments of Anaximander, Pythagoras, Aristotle, and Eratosthenes. For the benefit of giftless characters like me Campbell proceeds to explain why his thesis is obvious to enlightened people like himself.

In that explanation he expands on his 1996 paper but to refute Campbell's thesis it is sufficient to re-examine that earlier paper. We must recall that photons, green and orange, were emitted simultaneously from the ends of the rod. Although Campbell (1996) was not explicit about it, the simultaneity mentioned here was in the frame of reference in which the rod is at rest. It is one of the most familiar features of STR, the Special Theory of Relativity, and of the LT, that simultaneity of two events in one inertial frame is not simultaneity in another frame moving with respect to the first one. When Campbell explains how O′ determines the length of the rod "by measuring the difference in arrival times of the green and orange photons and multiplying by the velocity of light" he is implicitly assuming that the photons were emitted simultaneously in the O′ frame of reference. Thus Campbell implicitly assumed that simultaneity is the same in two different inertial frames. This assumption already denies STR and the LT. It is easy to seem to refute a theory by unconsciously denying one of its familiar properties right from the start. Such an argument is liable to deceive many people who want to believe it such as Xu & Xu. As in politics and religion the wish is father to the belief. P.M.S. Blackett remarked in conversation in 1946 ± 1 that a physicist regards a mathematical argument as correct if it gives the right answer. I call that "Blackett's Law"! It is naughty to obey Blackett's Law.

We have thus seen in two different ways that Campbell's thesis concerning his length experiment, is mistaken, and it remains for him to nobly admit error. To err is human and to refuse to admit it is also human.

As a less important matter, Campbell (1997) says "Prof. Good asserts 'This is not true' without pointing out an error". But what I said was "This is not true ... according to STR (in which the length of the rod appears to change in the same way for both travellers: see below)". And "below" I pointed out, by using the LT, why Campbell was in error. Campbell overlooked the two words "see below".

Readers might ask what is wrong with the explanation given for the benefit of the giftless given in Campbell's note of 1997. He says "When the green photon arrives at O′, the orange photon will be a distance L behind ...". That distance L is of course as measured in the frame of reference in which the rod is at rest; but in the same sentence Campbell unconsciously assumes it is the distance in a frame moving with velocity v relative to the rod. This assumption violates the concept of the Lorentz contraction. So one again Campbell has implicitly assumed that the LT is wrong although he regards the LT as "absolutely certain".

Campbell (1997) assumes that I was satisfied with what he said about his "time experiment" because I did not comment about it. I merely chose not to read it carefully because the issue of *Apeiron* that contained Wilhelm's letter was not (and is not) readily available to me. But let me ask a question about the "time experiment" anyway. In it, there are three sources of green monochromatic light all with the same frequency. Because of the Doppler effect the light is seen as red, blue, or green by various observers. In his Conclusions Campbell infers that "a single monochromatic source can emit *red*, *blue*, and *green* light at the same time". This inference

is wrong, — it is the *received* light that has various colors, not the *emitted* light. Whatever Campbell's unclear justification for the inference (which he called (ii)), it does not appear to have specific reference to STR because his argument makes use only of the Doppler effect. That effect occurs also in prerelativistic physics although its magnitude is different from that in STR. My question is what justification for his (ii) did Campbell have in mind and was it was relevant to STR?

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Einstein was not so erroneous

1. Consider two inertial systems S and S′ where S′ has velocity **v** with respect to S and measured in the system S. (The meaning of **v** can be made more rigorous by using algebra, as, for example, by Good, 1997b. Here I treat the concept of the relative velocity in an informal manner.) Let the x and x′ axes be chosen parallel to **v** in both systems and as the same line. These choices are made for convenience and have no effect on S and S′ regarded as physical entities.

As in Szego & Ofner (1997a, b), here abbreviated to S & O (a, b), let us at first consider 2 + 1 dimensions, two spatial and one temporal, so that an "event" (or "point event") has space-time coordinates such as (x, y, t) in S and (x′, y′, t′) in S′.

Let observers Ω and Ω′ be at rest in systems S and S′ respectively, so that Ω′ has velocity **v** with respect to Ω. Let Ω and Ω′ choose their x and x′ axes as abovementioned (so it is unnecessary to put v in bold type), and, with no real loss of generality, they choose their space-time origins, (0,0,0) and (0,0,0), at the same "event". When $t = t' = 0$ the y and y′ axes are temporarily identical and their positive directions are the same. When t and t′ advance, both Ω and Ω′ regard the y and y′ axes as always parallel. At time t in system S, the *space-time* coordinates of the *spatial* origin in S are (0,0,t) according to Ω. Of course Ω regards his spatial origin as stationary but advancing in time. (I say "his" because our observers happen to be men.) A similar remark applies to Ω′ and his spatial origin. Each observer regards the other's *spatial* origin as moving with velocity v or − v, although each regards the other's *space-time* origin as the same as his own, with coordinates (0,0,0). We should be careful when we talk about "origins" to avoid ambiguity.

Now consider the special Lorentz transformation (LT) or Voigt-Lorentz transformation,

$$x' = \gamma(x - vt), \quad y' = y, \quad t' = \gamma(t - vx / c^2) \qquad (1)$$

where $\gamma = (1 - v^2/c^2)^{-1/2}$. Of course these equations mean that if (x,y,t) are the space-time coordinates of any physical event in the coordinate system of Ω, then the coordinates of the *same* physical event according to Ω′ are (x′, y′, t′) where these coordinates are defined by equations (1). All of this is very well known but it is useful here to say it explicitly. It helps to clarify the distinction between the physical setups considered by S & O (a, b) and by Good (1997a).

2. In my setup there were two processes, (i) a photon moving up the y axis, of course with speed *c*, and (ii) another photon moving up the y′ axis. Because these are two different processes, it is necessary to be careful before bringing in the LT. This care was exercised by Good (1997), and it led to satisfactory "bingosity".

S & O (b) accept all this but say they were considering a different setup. Let us carefully discuss the ending of S & O (a). The last paragraph begins:

"If we accept that $c = y'/t'$ and $c = y/t$ are both valid [as would be required by Einstein for photons travelling up the y and y′ axes respectively], we have $y'/t' = y/t$. [Note that this refers to two distinct photons so the LT is inapplicable.] The STR claims that $y' = y$."

Actually the LT claims this when one is discussing a *single* photon. Nevertheless one can assume, if one wishes, that $y' = y$ for the two photons without reference to the LT, and it would then indeed follow that $t' = t$ as asserted by S & O (a). But this equation refers to two distinct photons and therefore sheds no direct light on the LT. So when S & O (a) say "This means that the time units do not change when a system moves", they do not notice that this comment is inapplicable to the LT. Thus S & O (a) are mistaken when they claim that Einstein's definition of *c* leads to a contradiction with the LT.

3. S & O (b) correctly inferred that I had not considered S & O (1996). I have now obtained a copy of that article and will prove that it too is erroneous though ingenious.

As before, there are two observers, Ω and Ω′ (called W and H or "we" and "him" by S & O, 1996), but now restricted to a single spatial dimension; and the velocity of Ω′ with respect to Ω is v which might be positive or negative. A photon is emitted (first event) towards a point B when the observers Ω and Ω′ coincide at a point A to the left of B. "When it [the photon] reaches B [second event] Ω′ arrives at a point A′ to the left of A if $v < 0$ and to its right if $v > 0$. [The simultaneity implicit in the word "when" is according to system S.] "Thus [if $v < 0$] light has covered a longer distance relative to system S′ than to system S. Unless we adjust the time as measured by Ω′ [we do indeed if we use the LT], it would mean that S′ light travels faster in S′ than in S, faster than *c*!' This is generally thought to be impossible." From this, S & O(1996) infer that the LT breaks down when $v < 0$.

To discuss this argument it will be convenient to use the symbol Δ to refer to advances of x, x′, t, and t′ between the two events defined above. (These advances are all positive because the photon moves to the right.)

Because the special LT is linear, we infer from the LT that

$$\Delta x' = g(\Delta x - v\Delta t), \quad \Delta t' = g(\Delta t - v\Delta x / c^2). \quad (2)$$

Therefore, in reference to the abovementioned photon for which $\Delta x = c\Delta t$, we have

$$\Delta x' = g(c\Delta t - v\Delta t) = g(c - v)\Delta t \quad (3)$$

and

$$c\Delta t' = g(c\Delta t - v\Delta t) = g(c - v)\Delta t. \quad (4)$$

Therefore, if $v \neq c$, by combining (4) and (5) we have

$$\Delta x' / \Delta t' = c. \quad (5)$$

Thus the speed of light in system S′ is *c*, in accordance with the familiar postulate, and this is true whether v is positive or negative. So I disagree with S & O (1996) when they claim that the LT cannot be applied when v is negative.

Now

$$\Delta x'/\Delta x = \Delta x'/(c\Delta t) = g(c - v)/c = (c - v)(c^2 - v^2)^{-1/2} \quad (6)$$
$$= [(c - v)/(c + v)]^{1/2}$$

Therefore $\Delta x' > \Delta x$ if v is negative whereas $\Delta x' < \Delta x$ if v is positive. Thus the LT leads to agreement with one of the requirements of S & O (1996). They were mistaken when they claimed that the LT disagrees with the requirement $\Delta x' > \Delta x$ when $v < 0$. Most mistakes are mistakes in sign. (Most of the rest involve factors of 2.)

4. *Another claim.* S & O (a) claim that Einstein (1916, 1960, 1961, pp. 115-120) gave an incorrect proof of LT for 1 + 1 dimensions, equations (1) above. Certainly Einstein's argument was incomplete. He considered the equations $x - ct = 0$ and $x' - ct' = 0$ as the equations of a light signal in systems S and S′ respectively. He, or his translator, said "Obviously this will be the case when [and only when] the relation

$$(x' - ct') = l(x - ct) \quad (7)$$

is fulfilled in general, where λ indicates a constant [mathematically independent of x and t]; for, according to (3) [my (7)], the disappearance ["vanishing" in the usual language of algebra] of $x - ct$ involves the disappearance [vanishing] of $x' - ct'$."

Clearly Einstein was assuming that both x' and t', and hence $x' - ct'$, are linear homo-

geneous functions of x and t, and he should have said so. (He was writing for the very intelligent woman in the street and he oversimplified. The blurb exaggerates when it describes the book as a "clear explanation that anyone can understand".) Compare Einstein (1923, p. 44) where he said somewhat vaguely "It is clear the equations must be *linear* on account of the properties of homogeneity which we attribute to space and time." But S & O (a) say "The proof is obviously wrong, because one can not regress zero to zero. Zero can not 'disappear'." (Yes, the print cannot fade away like Lewis Carroll's Cheshire cat but x – ct can "vanish" in the usual sense of that word in algebraic exposition, that is, it can equal zero.) But Einstein was not talking about regression theory. His exposition was faulty, but his proof was not. In fact it was elegant. His lapse was one of omission, not commission. Hence the title of S & O (a) was not justified by their arguments. Einstein made errors but not the ones suggested by S & O (a).

5. S & O (b) say that two inertial systems cannot overlap. But in 3 + 1 dimensions, two inertial observers Ω and Ω' are at rest in two three-dimensional Euclidean spaces. (Don't confuse the observers with the events that they observe.) Two three-dimensional linear manifolds in four dimensions intersect in a linear manifold of dimension at least 3 + 3 – 4 = 2; that is, in a plane. Thus the two inertial systems overlap spatially and by mutual agreement between Ω and Ω', they could have $t = t'$ in the domain of spatial overlap.

6. I think S & O should now join the club and nobly admit error. Einstein and Phipps sometimes admit error, so the club contains reputable physicists as well as the rest of humanity. To err is human and unfortunately to refuse to admit error is also human.

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Reply to Walton

1. Among the reasons for my difficulty in understanding Walton (1996) were misprints and unintelligibility:

(i) *Misprints.* For x = ax – avt, replace the first x by x′. For u = a(u – v)/(du + a), replace the first u by u′. For v = – av/e, replace the first v by v′. There is a sentence beginning with the words "We have" and the rest of the sentence or sentences is or are not printed. Figs. 1 and 2 are not discussed in the text. Perhaps they are discussed in the missing material. (I have noticed two further misprints and two more in Walton, 1997.)

(ii) *Unintelligibility.* Consider the question: "Incidentally, has it occurred to anybody to consider that the reciprocal speed v′, in terms of the redefined time of the system S′ moving with speed ± v, namely $t' = gt(1 + v/c)$ [for his setup] might not be the same as under the Galilean transformation $t' = t$? [Of course $\gamma = (1 - v^2/c^2)^{-1/2}$.] A person familiar with the kinematics of STR would regard this question as like asking whether anyone has considered that 4 = 4 is not the same as 4 = 5. Of course the identity $t' = t$ is an immediate denial of "time dilation" which follows from the Lorentz transformation (LT).

My difficulties in understanding Walton (1996) have been ameliorated by the reference in Walton (1997) to Einstein (1960, p. 34). I now spell out the model with a little elaboration. For dimensions 1 + 1, one spatial and one temporal, two observers Ω and Ω', at rest in inertial systems S and S′ respectively (where S′ has velocity v as measured in system S), both choose their space-time origin as (0,0) without real loss of generality. (The choice of origin does not change the physics although to assume it does is

an error I have seen.) Of course S and S′ share the same spatial axis because we have assumed just one spatial dimension in the model, but the equation x = x′ is true only at the origin. A photon, starting at the origin (event 1 say) ends up at a photographic plate (event 2). *For the second event*, Einstein (1961) uses the LT, and the equation x = ct, to point out that

$$x' = \gamma(c - v)t, \quad ct' = \gamma(c - v)t \qquad (1)$$

and therefore x′ = ct′. This confirms that the speed of light is the same in the systems S and S′ in accordance with one of the basic assumptions of the special theory of relativity.

Einstein, in his original paper of 1905, assumed that the speed of S, as measured in system S′, is –v. This is known as the principle of reciprocity, and has been regarded as not entirely certain, for example in the careful analysis of Lucas & Hodgson (1990). Walton (1996) claims that physicists have made an "incredibly stupid" error in overlooking that the reciprocity assumption leads to a contradiction when combined with a simple (incorrect) argument. This argument is based on what may be called the *Walton equations* (for the photon)

$$ct' = ct(1 - v/c), \quad ct = ct'(1 + v/c) \qquad (?) \qquad (2)$$

in which he has omitted the factor γ (on the right-hand sides) from the equations of Einstein (1961, p. 34). Walton attributed the contradiction to the reciprocity assumption instead of to the omission of the factor γ. I have used the Wing Books edition of Einstein's book where the γ is present. (Was it by any chance inadvertently dropped in the Methuen edition?)

If Walton wishes to be elected to the Nobility he should show with *extreme lucidity* why he omitted the factor γ in his claim of "incredible stupidity". Was he assuming Newtonian kinematics or what? If the factor γ is reinstated in the Walton equation, then their compatibility is seen by multiplying the equations together and recalling the definition of γ. Bingo!

2. I do not know whether my interpretation in Good (1997) of Walton (1996) was correct: It would be sufficient for the Stockholm committee to ignore Good (1997).

3. In his first paragraph Walton (1996) says that the proposition that $c = 0$ was used by Brown & Maia (1993). I think he had in mind pages 392 and 393 of that paper. On page 392 they consider the case u = 0 and on a footnote on page 393 they consider a *different* situation where u is close to *c*. This does not imply that they assume $c = 0$ anywhere. I could not find that assumption on any other page of their long paper. Brown and Maia might be irritated if Walton has misquoted them.

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Further debate about the Lorentz transformation

1. I now continue my debate with Xu & Xu. See Xu & Xu (1997a, b) or Xu & Xu (a, b) and Good (1997a). They believe that the special Lorentz transformation (LT) is "riddled with [logical] dents" whereas I see no logical dents in the LT, let alone holes. Our debate is concerned only with the self-consistency of the LT and of the special theory of relativity (STR), not with empirical evidence.

2. The (special) Lorentz transformation is defined by the identities

$$x' = \gamma(x - vt), \quad t' = \gamma(t - vx/c^2) \qquad (1a)$$

$$y' = y, \quad z' = z \qquad (1b)$$

where $\gamma = (1 - v^2/c^2)^{-1/2}$. It is important to hold in mind what the LT means. (At first I shall ignore the equations 1b.) The coordinates (x, t) refer to an arbitrary "event" (point event) in one inertial system, say S, and the coefficients (x′, t′) refer to the *same* event in another inertial system S′ moving with velocity v with respect to S. Of course x, y, z are spatial and t is temporal, etc. I

like to imagine two observers Ω and Ω' at rest in S and S′ respectively.

(1a) can be expressed in the forms

$$\begin{pmatrix} x' \\ ct' \end{pmatrix} = L(v)\begin{pmatrix} x \\ ct \end{pmatrix} \quad \text{and} \quad \begin{pmatrix} x' \\ t' \end{pmatrix} = M(v)\begin{pmatrix} x \\ t \end{pmatrix} \qquad (2)$$

where $t = ict$, $t' = ict'$, $i = \sqrt{-1}$, and where $L(v)$ and $M(v)$ may be called the 2×2 Lorentz and Minkowski-Lorentz matrices (for Minkowski introduced $\sqrt{-1}$ into STR),

$$L = L(v) = \begin{pmatrix} g & -gv/c \\ -gv/c & g \end{pmatrix} \qquad (3)$$

$$M = M(v) = \begin{pmatrix} g & -igv/c \\ igv/c & g \end{pmatrix}. \qquad (4)$$

The advantage of M is that its transpose is equal to its inverse so that much of the theory of (real) orthogonal matrices can be carried over to M. This can be regarded as the basic reason for Minkowski's success in geometrizing STR.

When the differential form of (1a) is used, as in Xu & Xu (b), it refers to a sequence of events corresponding to the motion of a particle P, and dx/dt and dx'/dt' refer to the velocities of P as measured in S and S′ or by Ω and Ω' respectively. One could, with slightly greater generality, use the differencing symbol Δ in place of d, corresponding to just two events which might sometimes refer to the initial and final positions of a particle. But in this section I use the differential notation so as to stay as close as possible to the relevant parts of the algebra and calculus of Xu & Xu (b). I will now prove that Section I of that paper is definitely wrong.

Suppose P has velocity u as measured in system S and velocity u′ in S′. Then $u = dx/dt$ and $u' = dx'/dt'$. But Xu & Xu write v' for dx'/dt'. This notation is misleading because $dx/dt = u$ not v, and we will soon see that Xu & Xu have misled themselves. They continue, at first correctly,

$$dx'/dt' = (dx - vdt)/(dt - vdx/c^2)$$

(because the γ in the numerator cancels the γ in the denominator), hence, in their notation,

$$dx - vdt = v'dt - v'vdx/c^2$$

so

$$v(dt - v'dx/c^2) = dx - v'dt.$$

This is correct so far, but they now divide by dt and interpret dx/dt as v whereas it is actually u. (To use their own terminology, their mathematics is seen to be "spurious".) Their error leads them to a contradiction which they interpret as a refutation of the LT. The correct inference is

$$v = \frac{u - v'}{1 - v'u/c^2}$$

which, in the non-misleading notation, means

$$v = \frac{u - u'}{1 - uu'/c^2}. \qquad (5)$$

This is the formula for the combination of velocities along a single straight line: the velocity of P relative to S is u, and the velocity of S′ relative to P is $-u'$ (because the velocity of P relative to S′ is u′ by definition) so (5) is seen to be an interesting example of the familiar formula in STR for the combination of velocities on a straight line. Thus, when the argument by Xu & Xu is corrected it leads not to a contradiction but to a familiar formula of STR, slightly disguised. Bingo! (You believe a theory is *coherent* if you can say *bingo* at least once and never have to say *ouch*. This is known as the philosophy of science.) Their error demonstrates the importance of not forgetting the meaning of the LT when criticizing it, and of the danger of introducing a misleading notation. Xu & Xu should now nobly say clearly, and without beating about the bush, that their Section 1 was mistaken. If they now deny this, their error would be worsened because that denial would prove conclusively that they do not understand what the LT means. I trust them not simply to evade the issue.

3. One familiar consequence of the special LT, equations (1a), is the identity

$$x'^2 + t'^2 = x^2 + t^2 \qquad (6)$$

where $t = ict$ and $t' = ict'$. (The distinction between an identity and a mere equation, that is not an identity, is familiar in elementary coordinate geometry although it is acceptable to call an identity an equation. For example, $3x + y = 3x + y$ is an identity whereas $3x + y = 0$ is the equation of a line.) If we imagine, for a moment, counterfactually, that t and t' are real, the identity (6) would show again that the 2 by 2 matrix, M, of the transformation would be or-

thogonal and conversely. See, for example, Mirsky (1955, p. 224) for the real case. The same algebra applies formally when t and t' are imaginary and shows that M is pseudo-orthogonal, i.e., as in the real case, $M^{\mathrm{T}} = M^{-1}$ (T denotes transposition). Again, by adapting Mirsky (1955, p. 225), we see that another necessary and sufficient condition for M to be pseudo-orthogonal is that

$$(\Delta x')^2 + (\Delta t')^2 = (\Delta x)^2 + (\Delta t)^2 \qquad (7)$$

is an identity. Here $\Delta x = x_2 - x_1$, etc., where (x_1, τ_1) and (x_2, τ_2) are the coordinates of a pair of "events" in system S and (x'_1, t'_1) and (x'_2, t'_2) respectively are those of the same events in system S′. All of this generalizes to 3 + 1 dimensions where $(\Delta x)^2$ is replaced by $(\Delta x)^2 + (\Delta y)^2 + (\Delta z)^2$, but in this section we consider the case of 1 + 1 dimensions, one spatial and one temporal, so that equations (1b) are ignored.

The expression $(\Delta x)^2 + (\Delta\tau)^2$ is known as the squared relativistic *interval* in 1 + 1 dimensions. Sometimes the sign is changed. The identity (7) expresses the invariance of the squared interval.

A property of an orthogonal or pseudo-orthogonal transformation matrix is that its determinant is ± 1. The minus sign can be rejected if we make the very mild assumption that the determinant of the transformation depends continuously on v. For when v = 0 the transformation must be the identity, whose determinant is of course 1, and the determinant cannot jump from 1 to – 1 as we algebraically vary v continuously.

A (real) proper orthogonal 2 × 2 matrix (proper in the sense that its determinant is +1) can always be expressed in the form

$$\begin{pmatrix} \cos a & -\sin a \\ \sin a & \cos a \end{pmatrix} \qquad (8)$$

which represents an anticlockwise rotation through a real angle α (Mirsky, 1955, p. 234). By using the same formal algebra as used by Mirsky, we can see that every "proper" pseudo-orthogonal 2 × 2 matrix ("proper" again in having its determinant equal to 1) is of the form (8) but with α purely imaginary say $\alpha = i\lambda$. (I am replacing the λ of Good, 1997a, by –λ.) This is what is meant by the familiar statement that the Lorentz transformation can be expressed as a rotation by a purely imaginary angle (iλ) where λ is real and $\tanh\lambda = v/c$. All real values of λ are possible and give distinct matrices unlike for the case of the matrix (8) in which additions of multiples of 2π to α are immaterial. This helps to explain why the Minkowski-Lorentz matrix is uniquely determined by the invariance of the relativistic "interval" when v is specified, as mentioned, for example, in Good (1997a). Of course v always exists because it is defined as the velocity of the system S′ (or of any of its spatial points) relative to, and as measured in, the system S.

Einstein (1905/1923, p. 46n, footnote) said "The equations of the Lorentz transformation may be more simply derived from the condition that in virtue of those equations the relation $x^2 + y^2 + z^2 = c^2t^2$ shall have as its consequence the second relation $x^2 + h^2 + z^2 = c^2t^2$." (In our notation the second equation is of course $x'^2 + y'^2 + z'^2 = c'^2t'^2$.) The meaning is clear enough though the words "In virtue of those equations" should be deleted. Xu & Xu deny this deduction on the grounds that the two given equations (which represent wave fronts of light emanating from the common space-time origin) do not explicitly mention v, and that "therefore" v should not appear in the deductions. Of course Einstein took for granted that the velocity of S′ relative to S should be used in the deduction. Einstein was not God, but also he was not silly. It is too picky-wicky to make a federal case of the fact that Einstein did not explicitly mention v in his footnote. Footnotes often omit repetitions of what is in the main text.

Xu & Xu (a, b) deny that the matrix is unique and give reasons for this denial. I will label these reasons (i) and (ii).

(i) In Xu & Xu (b) they say "Then the LT itself simply cannot preserve the specified speed v constant". This assertion was based on the argument that is refuted in Section 2 above.

(ii) In Xu & Xu (a) they ingeniously introduced the matrix

$$U = \begin{pmatrix} Ke^{B} & iKB \\ -iKB & Ke^{B} \end{pmatrix}, \quad K = (e^{2B} - B^2)^{-1/2}, \qquad (9)$$

(where it is implicit that $K > 0$ and $e^{2B} > B^2$) as preserving the relativistic interval (of course $i = \sqrt{-1}$; they write $j = \sqrt{-1}$, being engineers). They claimed that this matrix does not correspond to a Lorentz transformation. But in Good (1997a) I pointed out that,

$$U = \begin{pmatrix} g & i\,gv/c \\ -i\,gv/c & g \end{pmatrix} \qquad (10)$$

where $v = cBe^{-B}$, $\gamma = (1 - v^2/c^2)^{-1/2}$. In other words, contrary to what Xu & Xu say, U *does* correspond to the LT with minus this value for v. The velocity is not abolished by a change of notation! To pretend that it is is abolished would be sleight of hand. In Section I of Xu & Xu (b) they say "even if no problem λ is ... $\tanh^{-1}(v/c)$:" Later on they do claim a problem with the above proof that U is the matrix of a Lorentz transformation. For the moment, they say "there exist other forms [name two please] comparable to (1) [the special LT], such as (y', z' are omitted)

$$x' = g(x - vt), \quad t' = g(vx/c^2 - t). \text{"} \qquad (11)$$

They mean that (7) is true for this transformation. But its matrix is

$$\begin{pmatrix} g & -gv \\ gv/c^2 & -g \end{pmatrix} \qquad (12)$$

whose determinant is –1. As pointed out in Section 3 above, a transformation with determinant –1 is ruled out by the continuity assumption. Such a transformation might correspond to two inertial systems, one in each of two "conjugate" universes in which each is running backwards in time relative to the other one (*c*.f. Good, 1962, p. 153; 1990; 1997b). In this fascinating model each of the systems has velocity +v with respect to the other one! This can be readily seen from the identities (11). (For the spatial origin in S′ is represented by $x' = 0$, i.e. $x = vt$ from (11); whereas the spatial origin in S, namely $x = 0$, gives $x'/t' = v$ from (11) instead of –v from the LT, identity (1a).) Obviously, Xu & Xu did not intend to refer to a conjugate universe, otherwise they would have said so.

So Xu & Xu have not yet presented a linear transformation, for our universe, that satisfies the invariance (7) of the relativistic interval in 1 + 1 dimensions, and is also not the familiar special LT. (They do not quarrel with the linearity of the transformation but they object to its homogeneity. This objection is discussed soon in connection with the choice of space-time origin.) My conclusion is based (a) on the fact that v always exists, and is well defined; (b) on the continuity of the determinant of the transformation with respect to v, and (*c*) on the decision by the observers Ω and Ω' to choose their space-time origins at the same physical "event". This last condition is inessential because we can rewrite (1a) as

$$\Delta x' = g(\Delta x - v\Delta t), \quad \Delta t' = g(\Delta t - v\Delta x/c^2). \qquad (13)$$

According to Xu & Xu(b) it is an "inadmissible model that allows for no free choice for (x_0, t_0); not the choice of $(x_0, t_0) = (0, 0)$ as Good said". But I and many others simply allowed Ω and Ω' the freedom to be kind enough to choose their space-time origins at the same event. They were also cooperative in choosing their x and x' axes parallel to their relative velocity. *An applied mathematician chooses his coordinate system conveniently*. But, as I just mentioned, one can avoid the matter, if one wants to for some reason, by working with the difference operator as in (13).

4. Xu & Xu(b, p. 132) claim that (1a) and (1b) are incompatible by interpreting the equation $y' = y$ in (1b) to mean that the y' and y axes are "in the same frame". The y' and y axes coincide only when $t = t' = 0$. They move relative to one another with speed $|v|$ and are therefore *not* in the same frame. The assertion by Xu & Xu that "all clocks in the same frame ... should have identical time rates", though true, is therefore irrelevant to their claim.

5. Consider now column (ii) of p. 130 of Xu & Xu (b). To represent the condition of the invariance of the speed of light they write

$$x_1 - ct \equiv 0, \quad x_1' - ct' \equiv 0 \qquad \text{(Xu \& Xu, 2a)}$$

clearly referring to a photon that starts at the origin and where t and t' should be $t_1$and t_1'. (I do not know why they used the identity signs.) To represent the meaning of v they write

$$x_2 - vt \equiv 0, \quad x_2' + vt' \equiv 0 \qquad \text{(Xu \& Xu, 2b)}$$

where the equations respectively represent the fact that a particle at rest in S' has velocity v in S, and that one at rest in S has velocity –v in S'.

(Again t should be t_2 and t' should be t'_2.) Equations "(2a)" and "(2b)", regarded as algebraic equations detached from their meanings, do not imply the LT. But when the invariance condition is stated clearly, as in Section 2 above, the LT can be uniquely derived as shown therein.

6. In Section III of Xu & Xu (b) they give an example of the familiar principle that from a logical contradiction everything can be derived. (I suppose they do this because they think, incorrectly, that they have derived a logical contradiction from the LT and they therefore feel justified in being sarcastic.) My favorite example is a proof that Bertrand Russell was the Pope. (For example, 3 = 1, therefore 1.5 = 0.5, therefore 2 = 1, therefore two men are one man.) The principle was used by A.M. Turing to help to win World War II (Good, 1994, p. 159).

7. Xu & Xu (b) ask me what does $y' = y$ mean in (1b). It is necessary first to define a choice by Ω and Ω' of the y and y′ axes, orthogonal to the x and x′ axes and parallel to eachother, and identical at time $t = t' = 0$. The z and z′ axes can be defined in a similar manner. A convenient reference for these definitions is Bergmann (1976, pp. 33-34). Then Ω and Ω' should calibrate their y and y′ axes, and z and z′ axes, using the same instructions, holding in mind the definition of a metre (meter) given in the Oxford English Dictionary, — "the distance travelled by light in free space in 1/299,792,458 second". The second would be defined by atomic clocks of identical construction. Another way to answer the question, with at least strong intuitive appeal, is to say that we do not even need the equations $y = y'$ and $z = z'$. All we need for deducing the identity (7) from

$$(\Delta x)^2 + (\Delta y)^2 + (\Delta z)^2 + (\Delta t)^2 = (\Delta x')^2 + (\Delta y')^2 + (\Delta z')^2 + (\Delta t')^2 \qquad (14)$$

is to subtract the ordinary Euclidean identity

$$(\Delta y)^2 + (\Delta z)^2 = (\Delta y')^2 + (\Delta z')^2 . \qquad (15)$$

To justify (15) we can consider a Euclidean plane orthogonal to **v** and containing the common space-time origin. The Euclidean distances within that plane are the same in S and S′ when $t' = t = 0$. As time proceeds, this "orthoplane", as we may call it, separates into an orthoplane at rest in S and one at rest in S′. Each of the observers Ω and Ω' regards his orthoplane as at rest and the other as moving parallel to its original position with the velocity **v** or **–v**. In spite of this motion, Ω and Ω' agree with one another regarding distances within the orthoplanes because there is supposed to be no Lorentz contraction in directions orthogonal to the velocity. The contractions are *between* the planes, i.e. to the distance *between* them, not *within* them. This agreement regarding Euclidean distances can be written in the form (15) by virtue of Pythagoras's theorem.

Against what I have said in this section, I can imagine someone arguing that, for all we know, all distances and rods and rulers in the plane might be contracted by the same factor for one observer Ω, and he would not observe any contractions. But Ω' would notice the contraction is S unless this contraction occurred for both observers. This metaphysical conjecture is like saying we continually switch souls and memories (a theory that would improve our ethics if we believed it), or like saying that, on the evidence so far, emeralds are "grue", — green until June 1, 2005 and then blue. This gruesomeness is known as Goodman's induction paradox. I gave my resolution of it in Good (1968/1970, p. 23). Let us not get too picky.

8. Xu & Xu (b) attempt to disprove the fact that my λ is the "rapidity" $\tanh^{-1}(v/c)$. For this purpose they assume that their equations (2a) and (2b) share exactly the same meanings of x and t even though they had themselves pointed out that these meanings are not exactly the same because they refer to distinct processes or "world lines". They argue, by (2a) and (2b) that $1 - (v/c)^2 = 1 - (dx/dt)^2/(dx/dt)^2 = 0$.

Their equations (2a) represent the path of a photon in two coordinate systems; whereas their equations (2b) represent paths of material particles, one at rest in system S from the point of view of Ω', etc. To assume that x and t, etc. have exactly the same meanings in (2a) and (2b) is logically on a par with a beginning student of coordinate geometry who does not know that the equations $x + 3y = 7$ and $2x + 5y = 4$ represent two distinct lines! It is only at their point of

intersection that these two equations are both true, with exactly the same meaning of the symbols. The convention of writing two equations in x and y to represent two distinct curves or lines is standard in coordinate geometry, and one is supposed to understand that the symbols are not supposed to have *exactly* the same meanings in the two equations. This convention economizes in notation. To insist that the two equations represent only the points of intersection of the two curves would show a lack of understanding of the usual convention, and a total lack of familiarity with coordinate geometry. And what of *three* equations such as $x = 0$, $y = 0$, $x + y = 1$ which represent the extended sides of a triangle, and have no points in common to all three lines? Would Xu & Xu claim that these three equations imply that Russell was the Pope and that Einstein was God?

It is also incorrect to claim that the LT implies

$$\mathrm{STONE}'^2 - \mathrm{EGG}'^2 = \mathrm{STONE}^2 - c^2\,\mathrm{EGG}^2,$$

even if the misprint is corrected. It is well known that eggs and stones are not measurements of length and time. They say that this nonsense easily follows from the special LT (1a). Presumably they are implying, with the utmost sarcasm, that space and time cannot be integrated into space-time. In other words they are simply denying STR by fiat. This is like a flat-earther trying to refute the theory that the earth is round by simply claiming that it is of course flat and then laughing his head off.

9. I think Xu & Xu are so anxious to disprove the LT by logic alone, i.e. non-empirically, that they make one mistake after another; including their approval of incorrect arguments by two other writers.

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On the Role of Space and Time in Relativity Theory

Several articles and letters have recently appeared in an issue of this journal on the subject of the role of space and time in relativity theory (Galeczki, Good, Phipps, Selleri, Whitney, 1997). While the ideas that these authors convey are interesting, I believe that there is something essential that is missing in their discussions. I wish to add this in this note. My stand is developed in detail in a series of papers since 1971 (Sachs, 1969, 1971, 1993).

There is a tacit assumption in the foregoing *Apeiron* communications—the same erroneous claim, in my view, that the physics community has been making for the past 90 years—that space and time and their transformations in relativity theory are physical entities in themselves. Einstein himself asserted this interpretation when his theory was first published in 1905.

But from his later writings (see, *e.g.* Einstein, 1949) I believe that he changed his mind about this meaning. In the latter reference (as well as earlier of his writings) Einstein said that, after all, rods and clocks are material entities—configurations of atoms and molecules—and to scientifically predict physical effects in them (such as shrinking sticks and retarding clocks), one must solve dynamical laws of matter, since space and time are not physical entities in themselves.

The interpretation of space and time as physical entities has been a view in science for the millenia since Euclid. It is my belief, from an historical perspective, that the revolutionary aspect of Einstein's theory of relativity was to change the paradigm to one where one relegates space and time to not more than measures—a language of continuous parameters that one uses in order to express the physical properties of matter and radiation in laws of matter, in a covariant (frame-independent) manner. The space and time are not the only possible language to express the laws of matter, but it has been found to be useful in correlating these measures with empirical perceptions of physical length and duration. The space and time parameters themselves, then, are the 'independent variables' (invented) in which we map the dependent variables' (discovered)—the solutions of the laws of matter, which in turn come from nature.

To further explicate this paradigm change recall how the role of space and time and their transformations came about in Einstein's relativity theory in the first place. Einstein discovered in the late 19th century that there are no solutions of Maxwell's equations in any inertial frame relative to an observer's frame, that describe light as propagating in a vacuum at any speed other than the universal speed c. While this result seemed to defy common sense, he saw that it was based on the tacit assumption that the form of the Maxwell field equations is in one-to-one correspondence in all possible inertial frames of reference. He then generalized this conclusion by asserting that the expressions of all of the laws of nature, not only the Maxwell formalism for electromagnetism, must correspond in all reference frames. This is the assumption of the 'principle of covariance' of special relativity. It is the axiomatic basis of the theory of special relativity. [Later on, the extension of the covariance principle to any sort of relative motion led to the theory of general relativity].

Thus we see that the role of space and time in the theory of relativity refers to the language we choose to express a law of nature, in a covariant manner. The transformations of the space and time parameters from one reference frame to another continuously connected one, so as to maintain the form of the law, is then analogous to the translation of a verbal language—say from English to French or vice versa—so that the meanings of sentences in both languages are preserved. But the respective languages themselves do not alter or induce any new meanings in the sentences of the languages.

What is under discussion are the meanings of the Lorentz transformations that are contractions of spatial measures or temporal measures. What most other authors have usually assumed is that these are indeed physical changes, such as the shrinking of sticks in one reference frame and not in another or the physical retarding of clocks in one reference frame and not in another (leading, e.g. to the 'twin paradox') Such an interpretation in leading to logical paradoxes is intolerable in any scientific theory.

But there are no paradoxes in relativity theory because what is implied by the principle of covariance is, rather than physical changes, the Lorentz transformations refer to scale changes. That is to say, all that is meant is that one must contract the scale of space or time measures in the moving frame in order to maintain the form of the law of nature. This would be analogous to changing the number of digits on the face of a moving clock, in order to preserve the form of the law of nature in the moving frame, though not affecting the workings of the clock behind its face! Indeed, this is all that the space and time transformations mean in the theory of relativity—it then leads to no logical paradoxes at the outset.

With this view, which was implied by Einstein's original analysis of the Maxwell field theory and stemming from the principle of covariance, sticks do not shrink nor do clocks retard because of their motion relative to an ob-

server (as Whitney (1997) also so clearly concluded). If such physical effects should happen, they must be predicted by some dynamical law, not by the kinematic relations of the space and time variables and their transformations.

I thank the Theoretical Physics Group, Imperial College, London, for their kind hospitality in the Fall, 1997, when this note was written.

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The Doppler Effect

This is a response to O. J. Campbell's note (October, 1997) entitled "Enigma of light". In his note, Campbell raised two questions: (1) Is light wave propagation (sic) affected by an ether or space-time continuum; (2) Is light energy speed a constant? Campbell concludes that, if there were a medium through which light propagates, then the Doppler effect should be a function of two speeds, the speed of the source with respect to the medium, and the speed of the source with respect to the observer. This is true, but Campbell insists that the Doppler effect depends only on the relative speed between source and observer.

I believe Campbell is wrong about that. The best evidence of a medium, in my opinion, is the discovery of the cosmic background radiation which serves as a basis for measuring the absolute motion of our planet Earth with respect to the background radiation. This was first measured by Conklin in 1969. The proper general formula for the Doppler effect in terms of frequency is set forth in my paper on that subject published in *The Toth-Maatian Review* in 1996. (See Dart 1996). The Doppler effect is a function of the speed of the source and the speed of the receiver (observer) relative to the background radiation, and the angles between the paths of the source and observer and the path of the light. Time dilation for both the source and the oberver must also be taken into account.

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A Brief Comment on Good's "Refutations"

I.J. Good as a "defender of the faith", by virtue of a series of "refutations" [1], assumes that he has argued down those critiques of the SRT, including "four of Dingle's ... arguments".

Is this true? A brief comment mainly on his defense of the LT is given here, reaching a contrary conclusion that his "neat confirmation of the LT" is worth nothing.

It is well known that Einstein was an unprecedented expert at circular logic. Many of his followers have inherited his mantle. Good's "refutations" demonstrate that he is an excellent follower, very good at making fallacious *petitio principii*. For example:

1. Rather than offer a direct "refutation" of the proof by Szego & Ofner, Good feeds us "a neat confirmation of the LT" instead, by means of a "world line" that remains to be proven.
2. To prove "the self-consistence" of the LT, he appeals to the 4-D (4 dimensional) quadratic invariant, which also needs to be "confirmed" by Good.
3. To dismiss the argument on time rates by his opponent, he successively shifts the issue onto the questionable "proper time", "world line", and then "the interval"... and so forth.

Not only that, his "neat confirmation of the LT" is full of inferior mistakes and confusion in

common sense. To deal with these mistakes and confusion, which are common among relativists (including those dissidents who defend the LT, hereafter), I will put some content in lemma or theorem form, which should help those defenders pay better attention.

I The result $t' = t$ from the LT Itself

As was shown in [2], the LT

(1a) $x' = \gamma(x - vt); t' = \gamma(t - xv/c^2)$

(1b) $y' = y; z' = z$

proves itself to be inconsistent, producing contradictory and absurd results. For example, the LT may create the result $t' = t$ while giving $t \neq t$, because (1b) is in conflict with (1a). By coincidence, L. Szego & P. Ofner have a similar argument [3].

Good considers himself in the right that he has refuted this argument. Unfortunately, however, in his "refutation" [1] he has made at least two ridiculous mistakes:

1) He misunderstands the concept of "coordinate". It is common sense that the coordinate variable, for example, y' (or y) for a point P_r (*cf.*, Fig.1, p.131, Ref. 2b) is defined as a projective component on the y'-axis (or y-axis) of its vector path O-P_r, no matter what the path may be, without need to consider the path itself. In other words, the co-ordinate representation is not understood by Good due to lack of basic knowledge of mathematics.
2) He improperly uses Pythagoras's theorem due to his failure to recognize that the theorem is based on Euclidean geometry, which is incompatible with non-Euclidean geometry, so it cannot apply to the alleged 4-D world. If Good cannot understand this, I can do nothing for him before he grasps mathematics enough to be able to make the differences between the two clear.

Moreover, he is up to his tricks, consciously or unconsciously, as we will show. Good says[1]:

> *"(For) a typical event… By the Lorentz transformation, equations (1), in the primed system the coordinates of the same event are"*
>
> (G) $(-\gamma vt, ct, \gamma t)$.

However, it is clear that the said "coordinates of the same event" ought to be

(X1) (x', y', t'),

substituting $y' = ct'$ this yields

(X2) $(-vt', ct', t')$, viz., $(-\gamma vt, \gamma ct, \gamma t)$,

a result which differs from Good's (G), the false $(-\gamma vt, ct, \gamma t)$!

Note: What Good wants to refute is our proof that the LT contradicts itself, *viz.*, (1b) is in conflict with (1a). How does Good "refute" this? He puts (1b), whose consistency with (1a) is in question, directly into (X1). How blatantly absurd: a typical *petitio principii*!

Excuse me for saying that Good not only has poor logic and knows little of the coordinate representation, but also is not acquainted with basic algebra known to students. From $x \neq x$ and $y' = y$ in Eq.(1), a standard student is sure to know that the relativistic relation for the x'-axis to x-axis should be different from the relation for y'-axis to y-axis, or the LT itself is false. Good is made puzzled by his own "qualifications" as to "as measured in [which] system" (see Ref.1, p127), so badly!

Now we proceed to establish a strict proof for $t' = t$.

Lemma 1.1 It is an inevitable derivative of the LT that clocks on y'-axis and clocks on y-axis have the same time-rate, $t' = t$, i.e.,

(A0) $R(y') \equiv R(y)$.

PROOF The three equations

(A1) $y' \equiv y$;

(A2) $y' \equiv ct'$;

(A3) $y \equiv ct$

should be accepted simultaneously by Good; the reason is trivial and simple:

1) Eq.(A1) is one of the LT equations (see (1b) above); and
2) Eqs.(A2) and (A3) are prerequisites the LT rests on.

In short, Good has no reason to object to the three in any case, unless he rejects the LT itself or its prerequisites.

Substituting (A2) and (A3) into (A1) yields

(A0)' $t' \equiv t$

which is equivalent to (A0), saying that time-rate of any clock on y'-axis is the same as that of any clock on y-axis. Q.E.D.

In view of the above and recalling his own words that "If their argument were correct" the proof of $t' = t$ "of course would refute the LT"[1], Good "should now nobly admit" that he is mistaken and withdraw his "Bingo" refutation, at least before he can refute the above.

II The LT are inconsistent

From (X2) Good should see that

(X3) $y' = ct' = \gamma ct \neq y$,

is in conflict with the form $y' = y$, (1b)! That is, (1b) contradicts the result out of (1a).

Lemma 1.2 The relations below should hold simultaneously if the LT were valid:

(A4) $R(x') \equiv R(x)$;

(A5) $R(x') \equiv R(y')$ and $R(x) \equiv R(y)$.

PROOF Eq.(A4) is a direct result given by the LT, (1a); both relations in Eq.(A5) should be valid because clocks on the same frame can be synchronized and of course have the same rate, a premise on which the LT rests. Q.E.D.

If Good rejects (A4) he is dismissing the LT. If denies (A5), then he is objecting to Einstein himself, who says that "every reference-body (coordinate system) has its own particular time."[4a] It does not seem to be serious for one to comment the SRT, negative or positive, before he has carefully read at least the seminal publications by Einstein, especially the paper in 1905. Unfortunately, there are so many, defenders or dissidents, who have never done so.

From the lemmas above, a theorem may be set up.

Theorem 1 The LT is a set of intrinsically incompatible equations, and hence its derivatives, such as the alleged time-dilation and length-contraction, are physically meaningless.

PROOF Substituting (A5) into (A4) yields

(A6) $R(y') \neq R(y)$

in conflict with (A0)! That is, (1a) is simply incompatible with (1b), noting that (A4) comes from (1a) while (A0) from (1b). In this case, to take the LT's derivatives serious is ironic. Q.E.D.

Lemma 1.1 through argument 1 must be accepted by Good; otherwise he should argue down them by giving tit-for-tat refutations that obey mathematical rules and postulates of the SRT.

It is easily seen that this argument is equally valid for against the alleged length-contraction. In fact, time-dilation and length-contraction as Einstein's own tenets are concurrent phenomena happening simultaneously. He spoke of the latter effect such that "the y and z dimensions of ... every rigid body of no matter form do not appear modified by the motion, the x dimension appears shortened" (see Ref.4b, p48). From this Good should have agreed that since one of the two concurrent effects does not appear in "y and z dimensions", the other should not either, despite no words about the latter by Einstein. Einstein's silence just revealed his own guilty conscience. Leave this aside, now theorem 1 has given the same result, on mathematical ground!

Clearly, all arguments of ours (the above, and hereinafter) involve only mathematics that should be accepted by Good, and do not involve how to measure or how to view. Hence they will not be affected by the alleged "qualifications" as to "as measured in [which] system" (see Ref.1, p127), a myth story which is parroted by Good directly from Einstein.

Another fallacious belief common in the relativists needs to be cleared up. Good believes that when applies to only a single point (event) the LT is valid. Fortunately, since all arguments in theorem 1 and the two Lemmas do not exclude the case of one event, they should be valid for a single event. The fact that the LT leads to the same result for a single event here and for two events there [2a] should lead Good to give up his own belief.

Moreover, all arguments above neither involve nor restrict number of the observed events. This implies that theorem 1 is as valid for all points (events) with the same y' (or y) coordinate value as for a single. If Good disagrees, I cannot but say we should throw the LT away only by virtue of this point that it could apply to a single event only. If Good still does not understand this, I can do nothing for him before he has knowledge enough to learn what a theory is

for in general, or what a coordinate variable is for in particular.

So far Good should be convinced that Minkowski's world line is nothing but a fiction, tallying with neither physical world in reality, nor fundamental mathematics rules.

If Good himself had consistently respected "qualifications" as the LT requires and made no errors else, he should have found it is himself, instead of H. Dingle, that was fallacious.

III The LT are useless

The LT even does not apply to a single point (event) outside the x-axis, as has been shown [2b]. To free Good from doubts, let me repeat the argument in a different way.

Lemma 2.1 The LT cannot apply to any point (event) not along x-axis.

PROOF If any point (event) not along the x-axis , say P_r (see Fig.1in Ref.2b), is observed or described, its coordinate variables should have relations

(B1)
$$t = \frac{r}{c} = \frac{\sqrt{x^2 + y^2 + z^2}}{c}$$

(B2)
$$t' = \frac{r'}{c} = \frac{\sqrt{x'^2 + y'^2 + z'^2}}{c}$$

where t or t', time variable in unprimed or primed coordinate system, corresponds to the interval for a light signal to travel from origin O or O' to point P_r, according to Einstein's model [4b].

Substituting $x' = \gamma(x - vt)$, $y' = y$ and $z' = z$ given by the LT into (B2), yields

(B)
$$t' = \frac{r'}{c} = \frac{\sqrt{x'^2 + y'^2 + z'^2}}{c} = \frac{\sqrt{g^2(x - vt)^2 + y^2 + z^2}}{c}$$

which certainly *contains* variables y and z unless the observed (event) point happens to be on x-x'-axis. However, one of the LT equations, (1a),

(C)
$$t' = g\left(t - \frac{xv}{c^2}\right)$$

contains no y, nor z, and hence differs from (B). Since (B) represents the time variable of any point Pr not along x'-axis as just shown, the different (C) of course does not describe it. Q.E.D.

Note: The argument above has been subjected to objections from some influential scientists. Yet, their objections merely demonstrate that the coordinate representation is not understood.

IV The Mistaken LT From Mistaken Deduction

At least two crucial errors in the LT derivation that have been copied over and over since last century have been shown [2]. Unfortunately, some still do not understand. Now let me have a brief repetition. One error is: Eq.(1a) of the LT is derived from the equation

(D1) $x'^2 - c^2t'^2 = x^2 - c^2t^2 (= f)$

where time variable is explicitly $t' = x/c$ or $t = x/c$. It is clear that (D1) is different from

(D2) $x'^2 + y'^2 + z'^2 - c^2t'^2 = x^2 + y^2 + z^2 - c^2t^2 (= F)$

where time variable is $t' = r'/c$ or $t = r/c$, because the time variables in (D1) differ from those in (D2). It follows from Lemma 2.1 that only can (D2) represent any event not along x-x'-axis, but (D1) cannot. As a result, those forms of "an imaginary rotation" or so listed by Good are fallacious because they stem from the improper (D1).

The other is that F in (D2) should be zero according to the PIVL. Unfortunately, however, most relativists improperly argue that (D2) applies to photon when $F = 0$ whereas to ponderable particle if $F \neq 0$. Yet, they fail to show any theoretical ground or empirical evidence. Anyone is free to set forth any equation or explanation as he pleases, but mathematical rules show him less respect. Be careful, when you write down an equation, scientists!

We have shown the LT to be a set of 0/0 type equations. Some still hold doubt to it. To convince them, I present the same proposition in theorem 3, but in another way.

Theorem 2.2 The LT is a set of intrinsic 0/0 type equations.

PROOF According to the basic definition of any speed, the specified (uniform) speed v between two (inertial) frames is doomed to give the relations

(E1) $v = dx/dt = x/t + C$

and

$$v = dx'/dt' = x'/t' + C'$$

where C or C' is a constant depending on initial condition of the observed point (event). On the other hand, the PIVL gives

(E2) $c = x/t = dx/dt$

and

$$c = x'/t' = dx'/dt'$$

where c is the accepted speed of light. Both Eqs.(E1) and (E2) are irresistibly decided by the three: the definition of speed, mathematical rule, and the PIVL. The first two cannot be dismissed by anyone, the reason is simple: if he rejects the two, then he therefore should have to deny the LT that rests on the two. Only can the PIVL that remains in open question be rejected.

It is clear that (1a) contains both c and v. Substituting both (E1) and (E2) into its differential forms yields

$$dx' = \frac{(dx - v\,dt)}{\sqrt{1 - v^2/c^2}} = \frac{(dx - dx\,dt/dt)}{\sqrt{1 - (dx/dt)^2/(dx/dt)^2}} = \frac{0}{0}$$

$$dt' = \frac{dt - v\,dx/c^2}{\sqrt{1 - v^2/c^2}} = \frac{0}{0}$$

both of which are explicitly 0/0 type expressions, a conclusion resting on mathematics. Q.E.D.

Note: 1) In the argument above, we only use mathematical rules and the definition and the PIVL. Both mathematical rule and definition are no room to be refuted, as mentioned just. Thus only rejecting the PIVL can refute the argument above down, vice versa.

2) Since those influential scientists such as Voigt, Larmor, Poincaré, *et al.*, made such a gross error hidden in those 0/0 type of forms in history, it has been discovered or revealed by only a few, to my knowledge. Yet, in order to dismiss the argument, some say I have "made a common error" [only "a few", how can say "common"?]. In fact, their objection rests on the common failure to distinguish between Euclidean and non-Euclidean worlds, plus some blind belief.

3) The belief that a specific equation must hold because some quantitative attribute(s) is (seemingly) assigned to it is naive! It is an irony principle that mathematical rules acorn any futile authority and any premise or hypothesis that infringes them, as well!

IV Conclusions

From the theorem and lemmas above which each is life-and-death to the LT, one has that

(1) The LT is a set of inconsistent equations, producing contradictory and absurd results;
(2) It is disqualified as a coordinate transformation, because it cannot apply to any point outside x-axis and the x-axis alone cannot form a (spatial) 3-D frame;
(3) It is a set of 0/0 type of equations and hence is doomed to create arbitrary and absurd results;
(4) Its derivation has crucial errors and flaws.

Thus we can set up theorem 2 (its proof is omitted).

Theorem 2. The LT proves itself a mistaken mathematics from mistaken derivations based on mistaken premises, disqualified as a coordinate transformation.

It is just by virtue of wantonly trampling on mathematical laws that the blatant fallacious LT could come out. Anyway, the LT is good for nothing except as evidence that mathematics, or linear algebra in particular, is not fully understood even by those influential scientists, past or alive, including H. Poincaré, H. Lorentz, H. Minkowski, and A. Einstein. The SRT as a bulwark of modern science resting on such a mathematical foundation must go down in history as an unprecedented stupid farce. At the meantime its so-called "revolutionary" derivatives are doomed to vanish, such as: relativistic speed law, relativistic Doppler formulae, the PIVL, the so-called relativistic space-time theory and all its derivatives.

Now it becomes stupid for any physicist having read this to say that the problem with the SRT is not in mathematics but in physical

explanation of experiments only, unless he argues down it.

Where is the way out for modern science, especially for physics and astrophysics and cosmology? A brief answer may be found in [2a].

In any case I will like to meet any real (genuine) challenges, but not futile or inferior ones.

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A Good Example of Establishment Thinking

Since establishment physics journals virtually never print *any* fundamental criticisms of their dogmas, even in their letters columns, I wonder if Roy Keys is not overdoing the spirit of tolerance we dissidents take pride in displaying, by allowing no fewer than five disrespectful blasts at dissident authors in the same issue, by I. J. Good of Virginia Tech [1]. Let us call these collectively, and their author, *5(IJG)* [*not* "IJG^5," after Good's own usage of the term "Xu^2" to refer to co-authors Xu Shaozhi and Xu Xiangqun. No, 5 (IJG), by elementary algebra, Yu + Xu does not equal Xu^2, but rather 2(Xu). Or it would, if these two Xus were not actually different names, with different tonality, not distinguished in English transliteration. Also, please note that Chinese authors often place their family names—in this case, Xu—first.]

I do not aim here to offer specific defenses on behalf of authors Szego and Ofner, Phipps, Xu and Xu, Walton, or Campbell; in varying degrees they seem to have defended themselves rather well. Instead I wish to examine the assumptions, the methodology, and the debating style of 5(IJG), to clarify just what he really stands for.

First, let it be noted that even if 5(IJG) has found errors in each of the articles he criticizes—and the most prestigious author, Phipps, admits a measure of error—he has still not, thereby, proven that special relativity (SR or STR) is invulnerable, any more than the 1887 Michelson-Morley experiment proved that there is no aether, just because it did not find it (as is claimed far too often). Instead it proved only that *with this specific device* no aether was found. Similarly, the most 5(IJG) could have proven was that *the specific arguments* he criticizes did not show SR to be faulty.

Yet other approaches might still do so, just as Sagnac's approach in 1913 did demonstrate that the aether exists. At the same time, incidentally, Sagnac showed that the velocity of light is not constant in every coordinate system.

Evidently 5 (IJG) can't believe this latter; in attacking Szego and Ofner, he says he has confirmed "the constancy of the speed of light in [all] inertial systems." But all he has done is to play a little mathematical game with the Voigt-Larmor-"Lorentz" transformations, one that has nothing at all to do with the constancy of the velocity of light *relative to every observer*—which is the real, practical meaning of the second postulate of SR. This postulate has never even come close to being confirmed, and in fact it is logically incompatible with the first postulate of SR (an adaptation of the Galilean relativity principle). Why does 5(IJG)thus lean on a mere thought experiment, anyway? He instructs Walton that "attacks on STR should be based on *empirical* evidence;" but if so, should not *defenses* of it be similarly based?

I presume 5(IJG) sees no need to deal specifically with alleged empirical support for SR, because his profession constantly boasts that such evidence is overwhelmingly abundant. Yet every last example of this evidence is subject to alternate interpretations, nearly all of them much more in tune with realism and objectivity; this fact is not well known because the mainline journals refuse to publish it.

Physicists are blissfully unaware that contemporary relativism, widely influential in many disciplines, teaches that all kinds of data can usually be interpreted in more than one way. This situation is quite mind-boggling, in

view of the fact that the central dogma of modern physics, SR, is the most famous relativism of our era.

Where the standard liturgy *does* involve a thought experiment, the renowned and endlessly repeated 1905 argument for relative simultaneity, it commits an utterly incredible yet virtually unknown blunder: as clearly shown by philosopher Melbourne Evans [2], Einstein here gives each of two light beams two different velocities (explicitly: first, c + v and c –v; then later, surreptitiously but quite certainly, exactly c in each case). This amounts to a violation of the law of non-contradiction, perhaps the central principle in all of logic (but logic is part of philosophy, and of course physicists routinely scorn philosophy), and it totally vitiates Einstein's claim of relative simultaneity. If Einstein had remained *consistent* in assigning a velocity to each light beam, no matter what velocity he chose, his argument would have led only to showing that simultaneity is *absolute*—which it is.

Despite his advocacy of empirical evidence, 5(IJG) admits in his response to Szego and Ofner that he is a "defender of the faith" who is "confident in advance" that it is his opponents' ideas, not his cherished dogmas, that are riddled with error. So it seems to most of us, 5(IJG): you people act a lot more like true believers in some rigid, unquestioned faith, than like true scientists who will open your journals and your halls to fundamental, forward-looking debate. Without doubt, for many decades you have been as rigidly intolerant of differences of opinion as have most of the political ideologues and religious fundamentalists of our time. And in the process, you have imagined you oppose illogic—in *Apeiron* authors; even in the brave, clear-thinking Herbert Dingle—while you live in an illogic-ridden house of cards yourself.

This house is already well on the way to collapsing, 5(IJG). It's becoming hard to keep up with events. Even the major journals have begun allowing a few unorthodox ideas. In April 1997, Ralston and Nodland reported anisotropic (thus anti-SR) light velocity on a cosmic scale [3]. And very recently, we find the rapidly developing conversion of that prestigious dabbler in scientific dissidence, J.-P. Vigier.

In the same letters column in which you write, J. Paul Wesley upbraids him for wrongly claiming the 1887 M-M experiment disproves classical addition of velocities, when in fact the additive approach fully explains the null result [4]. (This is a very common misinterpretation, showing how little today's physicists know of the recent history of their discipline; the validity of the additive interpretation of this data was widely recognized early in the 20th century.) Yet almost simultaneously, the same Vigier published an article in which, leaning heavily on the work of Irish engineer Al Kelly, he virtually abandons the central tenets of SR (while, ironically, seeking a *general*-relativistic interpretation of the Dufour-Prunier experiments [5].

With gratuitous rudeness, 5(IJG) accuses his opponents of being "flat-earthers," and insists they admit error. How similar this is to the puerile level of conversation once imposed on me by the one physicist known to have played a role in keeping our Natural Philosophy Alliance (Wesley, Kelly, Szego, Ofner, Phipps, Xu Shaozhi, Waldron, Campbell, and *Apeiron* editor Roy Keys have all joined it) from staging a symposium at a national AAAS meeting in recent years. This man told me that since I believe in common sense, I must believe in a flat earth. Physicists of course seek to avoid common sense—and "*ordinary* life", as 5(IJG) puts it in criticizing Phipps—in favor of a world of bizarre and irrational concepts, preconceived belief in which governs the paradigms they accept and the spin they put on evidence (as Kuhn showed, such crucial choices often depend on non-scientific motives). The same man also challenged me: "Did it ever occur to you that you might be *totally wrong*?

Yet it is his side, the side of 5(IJG), that most firmly refuses to consider being wrong. As for belief in outdated and wrong ideas, it is Einstein's SR that in effect calls into question whether Ptolemy or Copernicus was correct about whether or not the earth moves; and yet this muddled situation is simply ignored, along with many other illogical and inadequate features of SR, and of modern physics in general.

5(IJG) might, if he wishes, seek enlightenment at the NPA's Philadelphia meeting next

February, mentioned elsewhere in this issue. We promise to treat him politely.

References

[1] I. J. Good, five letters criticizing five articles, *Apeiron*, Vol. 4 (Oct, 1997), pp. 126//132.

[2] Melbourne Evans, "The relativity of simultaneity: a critical analysis," *Dialectica*, (Switzerland), Vol. 16 (1962), pp. 61-82, 299-300.

[3] See *New York Times*. 18 April 1997, pp. A1-A22 (citing article in *Phvsica1 Review Letters*).

[4] J. Paul Wesley, "No evidence for photon rest mass, " *Apeiron*. Vol. 4 (Oct, 1997), p, 133.

[5] J.-P, Vigier, "New non-zero photon rest mass interpretation of the Sagnac effect as direct experimental justification of the Langevin paradox," *Physics Letters* A, Vol. 234, (15 Sept, 1997), pp. 75-85.

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Fanciful maths?

The failure to spot the phenomenal blunder responsible for the mystery and paradox of SR should make us wary of the power of mathematics to discover dynamic effects without physical causes, and of sophisticated space and time transformations like F. Selleri's [1]. In view of the fact that, as in SR, the algebra may well appear correct at the formal level, it would be a waste of time to subject his argument to scrutiny. If, despite the comparative simplicity of SR, we could have missed an obvious logical and kinematic constraint (correction of the relative velocity), there is little chance to clear S.'s ambitiously raised hurdles. Nevertheless, one questions (37) which would have us 'looking 'simultaneously at two ends of a stick; this ignores the delay during which the origin of S would have shifted; the derivation of f_1 seems suspect.

With respect, the grandiose algebra is plain silly; would zoologists dream of classifying all animals as millipedes and, by a long-winded appeal to constraints, laboriously prove every single one of the coefficients denoting non-existent legs to be zero? In the case of SR, the infatuation with this style [2, 3] had merely served to render a simple argument about moving points unintelligible. This kept us going round in circles and perpetually missing the second inverse of the Lorentz transformation, $x = (x' + v t')/\lambda$, $t = (t' + v x'/c^2)/\lambda$, equally correct but fitting the bill, though perhaps unpopular, with mathematicians and physicists alike, because it got us back where we started: you can't get physics out of the maths unless you first put it in.

We should remind ourselves that SR changes of space and time had appeared compelling, in consequence of Poincaré's and Einstein's world-shaking discovery of this apparently mathematically necessary property of the manifolds of pure mathematics. Now seen to have been a chimera, it applied to physical existence merely by logical implication. Clocks got in from misleading operationalist jargon; time was the conventional auxiliary variable of analytic geometry and pure mechanics, referring to successive points on the number line (1 light second, 2 light seconds, ...) but not to anything ticking.

Selleri's scheme lacks such a compelling mathematical foundation. Its appeal is to physics: 'light 'propagation in physical space, lengths and clocks at rest or moving. Why should physical effects associated with light propagation implicate space and time scales? Those less sensitive to space-time mysticism will regard as more serious the objection that such inertial frames do not exist; the hugely complicated dynamic effects without physical causes would be unobservable. If this is moonshine, nobody but bored mathematicians could be interested in it. Why publish it in a physics journal: are we meant to admire the maths, is it meant to exhaust or frighten us, or to ingratiate us with those who seek to get rid of creative real physics altogether?

References

[1] F. Selleri (1997). *Apeiron* 4, 100-103.

[2] F. Klein (1927). "Die spezielle Relativitätstheorie in Mechanik und mathematischer Physik "; Ch. 2 of *Vorlesungen über die Entwicklung der Mathematik im 19. Jahrhundert*, Teil II (Berlin: Springer).

[3] F. Klein (1939). Elementary Mathematics from an Advanced Standpoint. Part II: Geometry (London: MacMillan).

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The Twin Paradox does not exist

Dr. Whitney [1], regrettably, parrots conventional misconceptions.

1. SR predicts time dilation (p.104)? It does no such thing; the effect appears necessary on purely mathematical grounds. Time pieces failing to comply would have to be rejected as defective. But as we now know, the mysterious distortion of mathematical manifolds, paradoxically reciprocal, is merely the consequence of an error: we leave the relative velocity uncorrected and argue from false quantities. The phenomenon, under the specified conditions, does not exist.
2. Since the derivation of the relativistic proportionality coefficient is fallacious, the Twin Paradox does not exist. Surely one should have expected participants in the debate about this conundrum to check first on their mathematics.
3. The argument about clock synchronization (p.105-106) argues from the 4D model, blindly accepted at the turn of the century by uncritical adherents of manifold jargon. This model ignores the essential distinction between the simple and composite functions of the pure mathematics of motion, an important discipline now sadly fallen into neglect, and between their graphical representations (4D and 3D). Surely one should expect mathematical physicists to care sufficiently about the logical foundation of their craft to understand the vital importance of this distinction; Dr. W.'s desynchronization model ignores it. Since SR, despite its comparative simplicity, has misled us to believe that dynamic effects can be derived mathematically in the absence of physical causes, we would be wise to retrace our steps rather than be lured into further model development.
4. Since the Twin Paradox is not understood to lack mathematical foundation, its resolution (p.106-7), and the reference to mesons (p.107), are misconceived.

In conclusion, such uncritical use of deceptive mathematical sophistication serves neither mathematics nor physics.

Reference

[1] C.K. Whitney (1997). *Apeiron* 4, 104-109.

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Remarks on F. Selleri's Transformations

F. Selleri (*Apeiron*, Oct., '97) follows a 90+ year tradition of inappropriately shifting assumptions in his otherwise elegant derivations. Shifting assumptions include: *interval vs point-value* nature of terms (i.e., his x, x_0, t, t_0); *use of light vs its non-use* to relate those terms; *symmetry vs non-symmetry* of relativistic length and time changes; and *linearity vs non-linearity* of equations[1].

Linearity was introduced (without a whit of proof) by Einstein in 1905 "on account of the property of homogeneity which we attribute to space and time". It was used to unjustifiably focus[2] on a single root, which in some situations is Lorentz's length contraction factor. Prof. Selleri follows in that same tradition of assuming linearity without experimental proof. But the presumed universality of Einstein's 2nd principle (for constancy of c) and Einstein's relativistic Doppler equations clearly show two roots for alternate orientations of c and v for any magnitude of v, as will be illustrated.

Consider a frame with two equal length rods AB and AE as in Fig. 1. A light starts at the origin and moves outward to reach B and E. Rod lengths, as seen by an observer Q on that frame, are denoted AB_Q and AE_Q. As seen by Q, these are "proper" lengths and do not change in the eyes of Q, since no one has ever seen changes in "proper" lengths in his own frame[3].

That frame is then moved at constant v past observer P, who is on a 'stationary' frame as in Fig. 2, with v aligned with the x and x_0 axes. When light reaches B and E, it is deflected by mirrors and marks points d_0 and e_0 on x_0. At his leisure, observer P can measure distances $A_0d_{0,P}$ and $A_0e_{0,P}$ on his own frame; these are also proper distances seen by P on his frame. With this assumption of *light-use* and the 2nd princi-

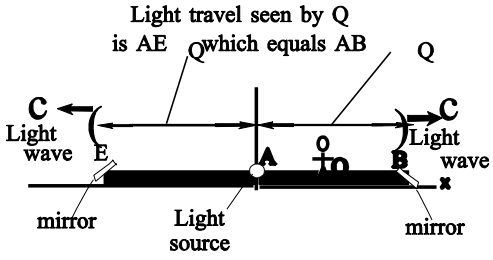

Fig. 1

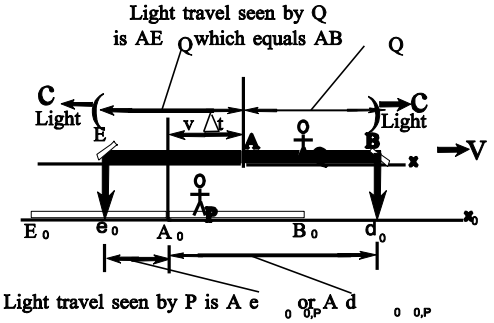

Fig. 2

ple, we can reduce the wave equations along the x and x_0 axes to:

$$x = ct \text{ and } x_0 = ct_0 \qquad (1, 2)$$

In these, the terms x,x_0,t,t_0 must be ***intervals*** not point-values, since point-values cannot describe a velocity. Along +x and $+x_0$ axes and using the more specific notation in Figs 1 and 2, equations (1, 2) become:

$$AB_Q = c\Delta t_{AB,Q} \text{ and } A_0B_{0,P} = c\Delta t_{A0,B0,P} \qquad (1a,2a)$$

where $\Delta t_{AB,Q}$ and $\Delta t_{A0,B0,P}$ are the elapsed times (per the 2nd principle) for the light travel along AB_Q and $A_0B_{0,P}$ respectively. Along the -x and $-x_0$ axes (where c and v are opposed), (1, 2) become:

$$AE_Q = c\Delta t_{AE,Q} \text{ and } A_0E_{0,P} = c\Delta t_{A0,E0,P} \qquad (1b,2b)$$

As long as the 2nd principle is used and light path lengths are known, no clocks are needed and neither clock-times nor simultaneity are issues.

Both P and Q agree that Q's measured length AB_Q is *smaller* than P's measured length $A_0B_{0,P}$. and that Q's measured AE_Q is *greater* than P's measured $A_0E_{0,P}$. In the eyes of P who is on the 'stationary' frame, that cannot be so (per the 2nd principle) and he therefore says that AB_Q must have *contracted* with v, and that AE_Q is too big and therefore must have *dilated* with v.

Thus in special relativity (SRT), if the 2nd principle is assumed, there are *two roots.* That contradicts linearity, and Selleri's (and Einstein's) derivations are specious.

These multiple roots and non-linearity can be confirmed in other ways. The Lorentz transformation reached by Einstein (E-LT) can be seen to have two roots by reversing the sign of either v or c. That is easier to observe as follows. Assume the 2nd principle and *light use*, and hence (1) is applicable. The inverse E-LT for the x and x_0 axes is:

$$x_0 = \gamma(x + vt)$$
$$t_0 = \gamma(t + (v/c2)x)$$

where $\gamma=(1-v^2/c^2)^{-1/2}$. Divide the first equation above by x and the second by t, substitute x=ct and rearrange and you reach:

$$x_0/x = \gamma(1 + v/c) = t_0/t \qquad (3)$$

which is identical to Einstein's optical Doppler equation when x is wavelength and t is period of light waves. Reversing the sign of either v or c clearly changes the value of (3) for any magnitude of v, as confirmed daily by Doppler data. In Doppler, the 2 roots for any v are the values of frequency shift for approaching and receding light. This confirms that the single root concepts of linearity are incompatible with the basic principles of SRT, even though linearity was an important assumption in SRT derivations.

When SRT equations are used with assumptions other than the *2nd principle* and ***light use***, then E-LT as well as other SRT equations can have a variety of self-conflicting solutions. Some of those are described in Selleri's article. But, if one adheres to the 2nd principle and its implied *light use* to relate length and elapsed times (as in Doppler measurements), then such alternative solutions can be rejected.

Symmetry. Another example of shifting assumptions can be seen in Selleri's deduction of the Lorentz-Fitzgerald contraction [his (14)] and Larmor time dilation [his (16)], Taken together, these presume unsymmetrical relativistic changes of lengths and times. But, if we assume SRT's 2nd principle [Selleri's (17)] and *light use*,

we can divide (2) by (1), we see the *symmetry* of lengths x_0/x and elapsed-times t_0/t in that $x_0/x = t_0/t = c$. We also see the symmetry in my (3) above for the same assumptions. Both of these contradict the non-symmetry of Selleri's (14) and (16) which have obviously shifted away from the implicit relationships between x,x_0,t,t_0 provided by *light-use* and the light-wave equations, simplified to my (1, 2).

Conclusions from all of this

The reader will recognize Fig. 2 as a modified 'train paradox', except that no clocks are used so simultaneity of clock-times cannot be used to "explain" the dual results of that paradox. Those dual results are real and demonstrate the unsuitability of SRT itself in that different values of lengths (and elapsed times) are required for parts of the 'train' of length EAB. That is, parts of the same 'train' must simultaneously contract and dilate. Worse, if the light path is changed to a round-trip from E to B to E, then the *same* sections must contract and dilate at the same instant—a physical impossibility. It's conceivable that the incompatible assumption of linearity was introduced in 1905 to avoid this obvious flaw. In any event, unless errors can be found in the foregoing, it seems justified to reject SRT and its 2nd principle and seek a more appropriate solution to the kinematic problems resulting from *measured* light-speed constancy.

References and notes:

1. For definition of linearity here, c.f., Eshbach, *Handbook on Engineering Fundamentals*, p. 2-18, Wiley (1945): "A system of linear equations containing the same number of unknowns as independent equations gives one and only one set of values which satisfy all equations simultaneously, that is, one solution."
2. Einstein, as translated in Miller, A.I., *A. Einstein's Special Theory of Relativity*, p. 397, Addison-Wesley Publ. (1981), uses the cited linearity definition to equate elapsed-time $(\tau_1-\tau_0)$ to $(\tau_2-\tau_1)$ on the moving frame *as seen by P on the 'stationary' frame*, and thus show that only one relativistic correction factor $\gamma=(1-v^2/c^2)^{-1/2}$ was needed. In effect, that was saying that $A_0E_{0,P}$ was equal to $A_0B_{0,P}$ in Fig. 2 -- an incredible affront to logic.
3. If changes in "proper" lengths on Earth were measurable, we should measure the Earth's diameter reducing to zero in the direction in which a photon passes and 'looks' at us. Moreover, a multitude of photons passing in all directions would reduce the Earth to an infinitesimal point. Since that has never been measured, it is safe to assume changes in proper lengths cannot be measured in one's own frame of reference.
4. More details on shifting assumptions are in: Munch, N.E., "Do Michelson-Morley details contradict both Lorentz's and Einstein's theories?" in Volume 2 of the Proceedings of the 4th International Conference on *Problems of Space, Time & Motion*; and in "Examples of conflicts in special relativity resulting from shifting assumptions" in Part 1 of the Proceedings of *Problems of Space, Time & Gravitation*; both held in Sept. 1996 in St. Petersburg, Russia. Reprints are available from the author.

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Space and Time transformations

The space and time transformations by Franco Selleri (*Apeiron* 4, 3-4) rely upon homogeneity of space and time, linearity (implied by inertiality) and three assumptions:

1. Lorentz-Fitzgerald contraction,
2. Larmor retardation of clocks,
3. Invariance of two-way velocity of light.

Although both 2) and 3) are questionable, I would like to remind readers that 1) has never been confirmed experimentally! The experiments of Brace (1904), Trouton and Rankin (1908), Wood, Tomlinson and Essen (1937) and Sherwin (1987) all gave excellent null-results. This fact, according to Selleri, implies with necessity that at least one of 2) and 3) have to be false too.

Compared to those of Voigt-Poincaré-Lorentz, Selleri's transformations have two attractive features: a) they allow absolute simultaneity, and b) they do not allow "Thomas precession," both features related to the independence of t from x_o.

All of us who accept the nono-existence of the "Thomas precession" must, however, be

open to reanalyze the famous CERN "g-2" experiment—"one of the brightest stars in the crown of modern physics"—in which the g-factor of the muon was derived from the beat frequency between the cycolotron frequency and the frequency of the (non-existence) of the "Thomas precession."(Newman *et al.* 1978)

References

1) Brace, D.B., *Phil. Mag.* VII, 317 (1904)
2) Trouton, Fr. T. and Rankine, A. O., *Proc. Roy. Soc.* 72,132 (1908)
3) Wood, A.B., Tomlinson, G.A. and Essen, L., *Proc. Roy. Soc.* 158, 606 (1937)
4) Sherwin, C. W., *Phys. Rev.* A35, 3650 (1987)
5) Newman, D. *et al., Phys. Rev. Lett.* 40, 1355 (1978)

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Natural Philosophy Alliance Meetings

This group of dissident physicists, founded in 1994 after many of them met in San Francisco (See *Apeiron*, Oct. 1994), has grown to over 160 members, from 21 nations; and it remains very active holding meetings in various parts of the U.S. In May of 1995, in Norman, OK, 22 attending NPA authors read papers in conjunction with the meeting of the Southwestern and Rocky Mountain Division of the American Assocn. for the Advancement of Science; and in June of 1996, 31 of them again linked up with the SWARM Division, in Flagstaff, AZ. SWARM Director Donald Nash has proven to be very tolerant of the NPA's Neo-Newtonian brand of thought. In 1997, three NPA meetings were held: a small one in May at College Station, TX, again with the yearly SWARM meeting; and two independent ones—a larger one in Storrs, CT in June, and a smaller one in San Luis Obispo, CA in July. In May, 1998 the NPA will again hold one major general meeting with the SWARM division, in Grand Junction, CO. Anyone wishing to learn more about this meeting should contact its Director, John Chappell, by writing to the address below. A detailed announcement about it appears on the NPA web site:

http://www.ebicom.net/~rsf1/npa/npa_home.shtml

In addition, a small specialized NPA meeting will occur on 14 Feb. 1998, at Friends Select School in Philadelphia, during and very near to the annual meeting of the AAAS (at which for the 3rd year in a row physics referees have denied the NPA a chance to stage a regular symposium). This meeting will take place precisely 100 years after the birth date of the late Parry Moon, prominent dissident physicist and the husband of the NPA's Vice-President, Univ. of Connecticut Math Prof. Domina Eberle Spencer. Much effort is being made to attract a large audience to this meeting.

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ERRATA

Vol. 4, Nr. 4. (October 1997)

1. Line 1, right column, p130,

$$g = \sqrt{1 - b^2}$$

should read

$$g^{-1} = \sqrt{1 - b^2}$$

2. Line 3, the same column,

$$dt' = g\left(dt - cdx/c^2\right)$$

should read

$$dt' = g\left(dt - vdx/c^2\right)$$

noting vdx instead of cdx.

3. Line 5 from bottom, $24 \times 599.22 - 3352.33 = 6 \times 599.22 - 3352.33$ read

$24 \times 599.2\dot{2} - 3352.3\dot{3} = 6 \times 599.2\dot{2} - 3352.3\dot{3}$

noting: .2222... and .3333... (recurring) instead of .22 and .33.

4. Line 20, left column, p.131,

$STONE'^2 - EGG'^2 = STONE^2 - c^2EGG^2$

should read

$STONE'^2 - c^2EGG'^2 = STONE^2 - c^2EGG^2$

noting: plus *c* squared before *EGG*.'

5. Line 5 from bottom, "*y* '= *y* y in (ib)" should read "*y* '= *y* in (1b)".
6. Last line, "event r" should read "event P_r."
7. Line 11, middle column, "O '= P_r" should read "O '–P_r".
8. Line 13, "O 'to Pr" should read "O 'to P_x."
9. In reference [2], (1906) should read (1905); in reference [3], 1996; 4(2-3) should read 1995; 4(2-3).