A One-Stone-Many-Birds Disproof

We read with great interest the letter by J.O. Campbell (*Apeiron* 3, p. 125), who, using a set of ingenious conceptual experiments which entirely conform with thc observed Doppler effects—better, by combining the observed Doppler shifts—give a disproof that killed many birds with one stone:

> *If it is true that (i) a single rod will both expand and contract at the same time just to accomodate two observers, one receding and the other approaching, and (ii) a single monochromatic light source can emit red, blue and green light at the same time; then, of course, relativity is correct.*

That may be translated into

> *Since it is common sense that the two points above can never be true, then, of course, the tenets of length contraction and time dilation are incorrect, along with the following: 4-D relativistic space-time, Einstein s infallible equivalence of (inertial) frames and then his second principle, and so on*

The fact that even two observers in a single frame get different observed results for the same source(s) denies that infallible equivalence. Some uncritical physicists argue that this disproof is invalid because the Lorentz transformation was not used. They are wrong instead, ignoring that the said different results are observed facts, unchangeable. Any equation or theory should conform to observational facts; if, conversely, observational data need to be transformed to comply with an equation or a theory, then the equation or theory should be thrown into the rubbish.

It cannot be said too often that the method or technique used in Campbell's disproof is as ingenious, direct and clear, succinct and effective as we have ever seen.

By the way, few people seem aware that Li's first argument (*Apeiron* July 1995) is not valid, although his conclusion is correct, because the unavoidable signal time delay effects between his frames were not considered. Li's second argument is, of course, valid.

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Relativistic Armour Dented

A recent comment by G. Walton (*Apeiron*, 3, p. 126) shows the incompatibility between the second principle and the principle of reciprocity. (i) Starting from the premise of $c = c'$, algebra will lead to $v \neq -v$ which contradicts the assumption of $v = -v$, tacitly taken for granted by mathematicians and elevated to a fundamental principle by philosophers; or (ii) If we take $v = -v$ as a premise, we may, on the basis of algebra, derive $c \neq -c$ or other paradoxes. Moreover, as Walton correctly pointed out, few are aware that the reciprocal speed v', in terms of $t \neq t$, might not be the same as under the Galilean transformation where $t = t$.

From this small dent, anyone without prejudice can agree that the mathematics of relativity is false and invalid. Yet, most scientists disagree.

Here we offer further disproofs of the LT for readers' judgment or comments.

(1) No inner link between 4-D interval and PIVL

Omitting Voigt's transformation, the LT is assumed to be the sole coordinate transformation satisfying the so-called 4-D interval when $\mathbf{v} = (v, 0, 0)$:

$$x^2 + y^2 + z^2 - c^2t^2 \equiv x'^2 + y'^2 + z'^2 - c^2t'^2 \equiv F \qquad \text{(A)}$$

which supposedly stems from Einstein's two postulates, one of which is the principle of invariance of the velocity of light *in vacuo* (PIVL).

Yet, it is easily proven that the form (omitting the unchanged variables y, z)

$$\left.\begin{aligned} x' &= K\left(e^B x - Bct\right) \\ t &= K\left(e^B t - \frac{Bx}{c}\right) \end{aligned}\right\} K = \left(e^{2B} - B^2\right)^{-1/2} \qquad \text{(B)}$$

satisfies (A), where symbol B may be anything and need not be v/c. *Proof:* (A) and (B) may be rewritten in vector form, respectively, as

$$\widetilde{X}'X' = \widetilde{X}\widetilde{U}UX \qquad \text{(a)}$$

$$X' = UX \text{, viz. } \widetilde{X}'X' = \widetilde{X}\widetilde{U}UX \qquad \text{(b)}$$

where four-vectors $X_i = (x, y, z, \pm jct)$ and $X'_I = (x', y', z', \pm jct')$, $i = 1, 2, 3, 4$, and $j = (-1)^{1/2}$ U is the transformation matrix (y, z omitted):

$$U = \begin{bmatrix} Ke^B & jKB \\ -jKB & Ke^B \end{bmatrix}$$

then

$$\widetilde{U}U = \begin{bmatrix} K^2\left(e^{2B} - B^2\right) & 0 \\ 0 & K^2\left(e^{2B} - B^2\right) \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \qquad \text{(c)}$$

Substituting (c) into (b) leads to (a). *Q.E.D.*

The physical meaning of the above is obvious: There is no inner link between Eq. (A) and the PIVL, nor between (A) and the relative speed v.

(2) A mistaken start of derivation

Even despite (A) being irrelevant to the PIVL and v, a linear transformation to meet (A) ought, on the basis of linear algebla, to have a form like

$$\begin{aligned} x' &= ax + bt + x_o, \\ t' &= dx + et + t_o \end{aligned} \qquad \text{(Ca)}$$

Yet, Einstein (and the two authors Walton mentioned) instead adopted the form

$$\begin{aligned} x' &= ax + bt = ax + avt \\ t' &= dx + et \end{aligned}, \qquad \text{(Cb)}$$

where $x_o = t_o \equiv 0$, which must lead to the result: $v = v' \equiv 0$, a congenital disease of the LT. The reason is given below.

It is common sense that a free choice of initial conditions, x_o and t_o, is the indispensable premise for a coordinate transformation; a lack of such choice implies that relative motion of two frames is impossible. Obviously, the pre-set $x_o = t_o \equiv 0$ automatically excludes any possibility for such a choice.

(3) LT unqualified as a coordinate transformation

From the LT, Einstein draws the conclusion that "every reference-body (coordinate system) has its own particular time". That is, one has

$$y' = Ut' \text{ and } y = Ut, \qquad \text{(D)}$$

where $t' \neq t$, unless $v = 0$, (E)

which describes (say) two particles moving, started from the origin at $t = t' = 0$, at speed U along the y'- and y-axes, respectively.

On the other hand, substituting (D) into one of the LT forms, $y' = y$, yields

$$t' \equiv t$$

which is simply in conflict with (E)!

Thus, it seems that the LT is riddled with dents and hence is invalid. Farewell Relativity; to speak of "experimental evidence" for it is simply ironic.

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De Rerum Naturae

In the essay, "On the Nature of Things as Seen in the late 20th Century", (Astronomy Section) we read:

> *Second, a high speed of rotation near 300 km s ^{1}, as seen in the outer parts of many spiral galaxies that resemble the Milky Way, can sometimes appear to persist for up to ten galaxy diameters away from an outer edge, through dilute gas in almost empty intergalactic space. Meanwhile, the apparent speed of rotation in those galaxies often decreases from 300 to 200 to 100 to 0 km s ^{1}, as we examine stars and gas which lie closer to the galactic center. It is almost as if any spiral galaxy might be rotating as a "rigid body", where the speed of rotation seems to increase linearly with distance from the center."*

"Those various interpretations in terms of rotational velocity, seem completely contrary to the laws of Kepler and Newton for planetary motions in the Solar System, where Pluto orbits the Sun more slowly than Mercury, and not vice-versa. If the Milky Way galaxy were analogous to a Solar System but on a larger scale, one would expect its outer parts to rotate about the center more slowly than its inner parts, and not vice-versa, under the influence of high gravity. Furthermore, the speed of rotation should fall off measurably with increased distance from the center, and not remain constant at some high value far out into intergalactic space!

I believe galaxies do rotate somewhat like rigid bodies because and the rotation velocity does increase with increasing distance from the center. These are not stars orbiting a constant mass like the planets of the solar system. There is a mass gradient as r increases. Using the formula for orbital velocity and assuming constant density in the galaxy:

$$v = \left(\frac{GM}{r}\right)^{1/2}$$

but

$$M = \frac{4}{3}\pi r^3 \rho$$

where:

M = mass of galaxy being orbited

r = orbit radius

ρ = density of galaxy

Thus:

$$v = \left(\frac{G(4/3)\pi r^3 \rho}{r}\right)^{1/2} = r\left(\frac{4}{3}G\pi\rho\right)^{1/2}$$

Note that this is just like a rigid body ($v = wr$) where v increases with r. Actually I believe a galaxy's density (ρ) is a decreasing function of radius so the above result is not really accurate. But it should be obvious that objects at the center have very little mass to orbit so their speed is correspondingly reduced and the center object has zero orbital velocity.

For the case of the halo region outside the galaxies, I suspect the density falls off radically. For example if, in this region, $p \sim 1/r$, this would just balance the r term in the above formula and rotation velocity would be constant.

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H.R. Drew replies

I am grateful to the correspondent for bringing to our attention certain unsolved problems of galaxy dynamics. He suggests: (1) the mass of any galaxy should increase in proportion to its radius out to the visible edge; (2) such mass should then decrease beyond the visible edge in dilute intergalactic space; and (3) those two hypotheses may explain the altered frequencies of light as seen across the widths of many galaxies, in terms of orbital motion under the influence of Newtonian gravity.

In response to his suggestions, one would like to ask whether any other hypotheses might explain the same data in a less arbitrary fashion.

Specifically:

(1) Where might all of the imaginary mass be located in the outer parts of galaxies, whether spiral or elliptical? Why should it not influence the predictions by general relativity for gravity in the Solar System? How could any scenario for galaxy formation leave most of the mass along the outside? If certain microlensing events monitor the abundance of mass in our own galaxy, why should many more of such events be seen in the direction of the galactic center than along the outside, if most of the mass lies on the outside (*Science* 275, 1416-7, 1997)?

(2) Why should the mass of any galaxy decrease beyond its outer edge by some precise amount, so as to create constant but high orbital velocities far out into intergalactic space?

(3) In order to avoid hypotheses (1) and (2), could the altered frequencies of light as seen across the widths of galaxies be attributed to: (a) an altered energy of gravity or (b) an altered counting of time, over large scales of space and time that may extend for thousands of light years, from the edge of any galaxy to its center?

Modern astronomers seem to have made a serious error, by assuming that altered frequencies of light can always be interpreted as Doppler shifts. Experimental data as cited in *Apeiron* 4, 26-32, 1997 show that such an assumption is not correct for the Hubble redshifts of distant galaxies, nor is it likely to be correct for the redshifts of quasars. If the Doppler interpretation fails in those two cases, how can we be sure that it will hold for the internal motions of galaxies, which can only be explained in terms of motion if huge amounts of unseen, undetectable mass lie along the outside?

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Special Relativity and Mathematics

Thank you for printing my long letter on special relativity (SR) with its horrible symbolism (Issue, Jan. 97, pp.33 and 15). But I am disturbed by the fate of figures which, as kinematics is geometry, are not mere pictures but an essential part of SR argument. Since nobody reads the mathematics either, we might as well separate the text of articles, such as Dr. Whitney's (*e.g.* 'thus, see p.n' *etc.*) and collecting the symbolic bits and pieces ($R_0 ctt = (\ )...$) neatly together on p.n for those besotted enough to look them up.

But the matter is unfortunately symptomatic of the catastrophic regression of mathematical physics to pure algebraic gibberish, because the essential correlation between symbols and figures is no longer seen. My protest may thus serve to draw attention to the root cause of the remorselessly advancing tyranny by mathematics, a state of affairs lamented even by the otherwise uncritical establishment. Historians may figure out why mathematicians continue not only to ignore but to dismiss with contempt the essential distinction between 3D diagrams of moving points (*e.g.* vectors in the case of constant speeds) and 4D graphs of displacement as a function of the time. The Lorentz transformation (LT) establishes the ratio t'/t which is required if the coefficient c, representing the speed of light, is to be invariant. Poincaré, dismissed as hypercritical, to his credit, at least recognized that the 'verified' outcome, hailed as a necessary truth by relativists, was disturbing: in consequence of his failure to correct v' it had seemed that space-time itself undergoes reciprocal contraction. As the case is as simple as it is central to the confusion, I may be allowed briefly to restate it, with all figures, as an essential part of the argument, to be left in their places; since ASCII can't manage refinements I omit anything liable to turn into nonsense.

Consider the coincident X-axes of S and S' such that $OO' = vt = v't'$, and a point P such that $OP = ct$ and $O'P = ct'$, where $c > v$ (Fig.1).

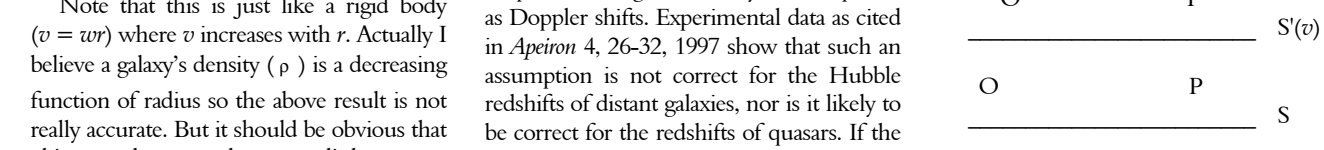

Fig. 1

Since everybody followed Poincaré in putting $v' = v$, we seem to get

$$ct' = ct\left(1 - \frac{v}{c}\right)$$

$$ct = ct'\left(1 + \frac{v}{c}\right) = ct\left(1 - \frac{v^2}{c^2}\right)$$

As this seems false, we must put

$$ct' = kct\left(1 - \frac{v}{c}\right)$$

$$ct = kct'\left(1 + \frac{v}{c}\right)$$

whence we find the reciprocal length contraction demanded by the principle of equivalence, namely

$$k = \left(1 - \frac{v^2}{c^2}\right)^{-1/2}$$

But of course $v' \neq v$, namely

$$v't:ct' = vt:(c - v)t$$

whence $v' = vc/c - v$.

For a point P such that OP = $-ct$ and O'P = $-ct'$, we get

$$v' = \frac{vc}{c + v}.$$

Now the inverse transformation succeeds without difficulty; if we insist on reciprocal contraction we find that it vanishes as $k = 1$, for we have

$$ct = kct'\left(1 + \frac{v'}{c}\right) = k^2 ct.$$

Similarly, in the composition of velocities we have a point P moving such that O'P = $w't'$; we seek w, where wt = OP, OQ = ct and O'Q = ct' (Fig.2).

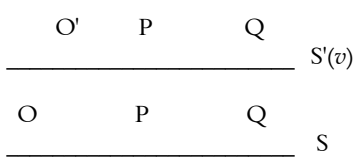

Fig. 2

We have

$$w't':ct' = (w - v)t:(c - v)t$$

so that

$$w = v + w'\left(1 - \frac{v}{c}\right).$$

In the case of isotropy figures and texts are inseparable; lack of space forbids the text to be printed all over again, and I must beg readers to construe the correct figures from my letter.

Since the patient sorting out of the gigantic muddle of SR mathematics cannot be the business of academic journals, I am now publishing the Special Relativity Letter. Those who currently find difficulty in getting heard because of the domination of editorial boards by mathematicians as supposed experts will have their stuff printed unvetted and unedited (with figures) for discussion; in addition, material published elsewhere will be subjected to that patient scrutiny which would be too tedious and lengthy for journals dedicated to higher things. Those troubled by SR mathematics (contraction, time dilation, isotropy, simultaneity) are therefore invited to request a copy (free for non-mathematicians for the time being) and to send me their pieces for publication.

Allow me finally to reply to the letter by L. Szego and P. Ofner (*Apeiron*, Jan.97, p.34). One of my correspondents rightly wonders whether critics have actually read Einstein's 1905 paper; it is clear that the authors have not done so. Einstein presents a shambles of incompatible expressions; some have come to be favoured because physicists like to determine validity by experiment; for a magnificent compilation of variants see Munch [1]. The time ratio sought by the authors is given by the LT. They argue that the relativistic effect of contraction cannot really happen in a real system; they ignore that contraction, being reciprocal, is explicitly declared to be not real but purely apparent, mathematical or kinematical. (As we now know, as distinct from any real contraction which would necessarily be non-reciprocal, it is merely the result of a mathematical error and does not exist.) Further, it is not the case that the derivation of the LT, namely of the ratio t'/t, requires many data and complicated calculations; it follows from a simple kinematical consideration. It is not true that SR does not clearly define the relative speed v; following Poincaré, the entire literature explicitly defines K' as moving with speed v and concludes that the relative speed measured by K 'must of course be the same'. The authors are to be congratulated for questioning this latter assumption.

What is sad in all this is that it should have been unnecessary, that mathematicians refuse to consider the possibility of error, and that one has to defend the supreme virtues and achievements of conventional mathematics, as the method best suited to scientific investigation, not only against those who have foisted upon us their ludicrous abstractions, but even against physicists as their gullible disciples.

References:

1. N. Munch, "Clarity from precise notation in special relativity (SRT) equations". Unpublished paper #82A, available from the author, 9400 Five Logs Way, Gaithersburg, MD 20879 (USA).

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The Radical Theory of Quantum Touching

Readers of the @ Issue section of *Apeiron* Vol. 3, No. 3-4 may be unfamiliar with the theory that Professor Myron Evans was criticising and which he refers to as 'the theory of Quantum Touching'. This theory has been developed by the author in collaboration with Dr. Anthony D. Osborne at the Mathematics Department of Keele University, England, where it is part of an ongoing Maths/Philosophy project. The following is an encapsulation of that theory.

The theory that has been dubbed 'Quantum Touching; has, as Professor Evans has stated,[1] a forty-year long history. The record of it begins in 1954 with a short correspondence between Albert Einstein and the author, who was then a young telecommunications engineer. In 1984 it became an official project at the Department of Mathematics, Keele University, England, in a rare arts/science collaboration between a philosopher and a mathematician (*i.e.*, between the author, who was by now a Philosophy of Science graduate and Dr. Osborne of the Maths Department).

The title 'Quantum Touching' however, is somewhat inept, having been ascribed to the theory by its critics rather than its authors. The term 'touching' in this context was coined by Gilbert Lewis, in 1926 [2] to describe the now well-known consequence of Special Relativity, that there is no intrinsic time (proper time) nor distance registered by a photon traveling at speed c between an emitter and absorber. This means, if we adopt Lewis' viewpoint, that in quantum interaction the emitter and absorber are contiguous in accordance with Newton's third law of instantaneous, in-line, equal and opposite action and reaction. However, since at the macrophysical level the bodies concerned maintain their distance throughout, to describe them as 'touching' in these circumstances is, to say the least, confusing.

A more appropriate title, therefore, for the modern theory developed on the basis of Lewis' 1926 demonstration might be 'Quantum Immediacy', which accommodates the descriptions of both the macroscopic distance and the Lewisian, microscopic instantaneity. What it describes, in effect, is instantaneous or unmediated action-at-a-distance. Now in Professor Evans' opinion there is no such thing as instantaneous action-at-a-distance. However, that is not the opinion of all scientists. Followers of Mach, such as John Barbour, Tom Phipps (Jr,), David Roscoe, Peter Graneau, André Assis and many others are convinced of action-at-a-distance, or non-locality. The only problem with action-at-a-distance is that it conflicts with Einstein's relativistic implication that no physical influence can travel faster than the 'finite speed of light'. The theory of Quantum Immediacy was formulated to address this problem of the seeming incompatibility between the implicit immediacy of Mach's principle and the so-called Einstein separation.

Essentially, the new theory is a theory of relativity. However, unlike the conventional Einsteinian theory it does not seek to replace Newtonian physics but to incorporate it. The theory, that is to say, is of a revisionary intent. Its purpose is, with modern hindsight, to overwrite with simple logic, the purely circumstantial development of current relativity whose origins were in experiments with 'ether wind' and so on. This by no means entails replacing the tried and tested Einsteinian formulæ. We merely

1 Evans, M.W., *Apeiron* Vol. 3, No. 3-4, July-Oct. 1996. p. 123.

2 Lewis, G.N., 1926, 'Light Waves and Corpuscles', *Nature* 2973, 117, p. 256.

demonstrate that by means of simple Pythagoras, these same formulæ can be derived from absolutistic precepts of the classical kind.

The basis of this demonstration is a neo-Newtonian picture of space as being, at any instant, an absolutely extended distribution of physical objects in automatically paired and balanced angular momentum interrelations, so that the instantaneous lengths of the moment-arms in the angular momenta define the distances between the bodies. Newton's assumed straight-line inertial motion mv is then taken as the theoretical limiting case of an angular momentum mvr with infinite r, which means that for non-zero v the angular momentum $J = mvr$ is also infinite. From this it follows that for all finite angular momenta the length of r is also finite and the motion, in consequence, naturally orbital, which obviates any need to postulate the usual fictitious forces of 'gravitation', 'electrostatics' or whatever to account for non-rectilinear free motion. Angular momentum, in all its various plain and convoluted forms, becomes sufficient in itself to define other forms of orbital motion such as, for instance, that of electrons around protons. The mathematical details of this are as described in our *Physics Essays* paper entitled 'Instantaneous Gravitational and Inertial Action-at-a- Distance'. [3]

Now at the microphysical end of the scale, the smallest possible amount of angular momentum is, of course, the quantum $h/2\pi$. This has its own built-in, instantly balanced mass and counter-mass (conventionally called the 'electron' and 'proton') with their irreducible cycle, orbital radius and period. In these automatically paired angular momenta there is no question of any physical influence having to travel from the one mass to the other in order to maintain the balance. The quantum is a completely integrated and irreducible package of mass, length and time. Its occurrence is like that of a 'still' in cinematography where, by definition, nothing moves but only occurs, in a finite and irreducible time, like the imperceptible period in which a single still occupies the gate of the movie projector before being replaced by another.

By that same cinematic analogy, all motion is produced by sequences of these instantly and absolutely extended quantum 'stills'. These instantaneous extensions, in which masses are automatically paired and balanced on the ends of moment-arms whose dimensions are those of pure length, may thus be conceived as the quantum elements of absolute space; and the discrete or cinematic quantum jumps from one still, or angular momentum configuration, to another may be conceived as the elemental action-components of absolute (or proper) time.

Now it might seem that this cinematic model merely resurrects the space and time of classical mechanics, which might be regarded as a retrograde step in the context of modern relativistic physics. There is, however, a profound difference between this cinematic model and the classical model. Not only does it dispense, as we have seen, with rectilinear inertia and all the fictitious 'forces' created by that assumption; it also replaces the classical continuum by an angular momentum *discretum*. This defines a 'field' like that of conventional electrodynamics, except of course, that this field is now quantised, not continuous. Its continuity on the macrophysical level is therefore not absolute but statistical—like the continuity of Heraclitus' candle-flame, which burns steadily in still air while its components are in a constant and rapid state of flux. That is to say, the angular momentum field consists of statistical numbers of instantaneous, Lewisian actions-at-a-distance between objects. The macroscopic distances-apart of objects are thus the lengths of the moment-arms on the opposite ends of which they are instantly and automatically (albeit statistically) balanced.

In this ultimately quantised or discretised Heraclitean continuum or field, as in any field-continuum, a disturbance at one place automatically spreads. In this Heraclitean field the disturbances are elemental shifts in angular momentum, which are instantly transferred throughout the system due to the overall conservation of angular momentum which, as Tom Phipps picturesquely puts it, permits of 'no holding-pattern'.[4] And since these instantaneous interactions, in action units h, between angular momentum systems in units $h/2\pi$ have to be resonances, they possess in that regard the phase-properties of waves. But, of course, they cannot have the ordinary motion-characteristics of waves because in the cinematic model there is no motion in those instantaneous phase-linkages or quantum stills. All motion, including wave-motion, consists of cinematic sequences of those instantaneous extensions.

An important consequence of this, in keeping with conventional field-theory, is that the angular momentum field exists and is extended as a (statistical) whole prior to the propagation of wave-energy through it. That is to say, its parts are not localised, or Einstein-separated, so that there is no question of a wave or wave-packet ('photon') absurdly creating its own medium to travel in as it moves along. The field, in other words, is existentially pre-extended, as in classical physics, like the surface of a lake along which ripples spread, or a taut wire along which a wave is 'pinged'. Each state of the medium (the water-surface, the wire or whatever) is at any instant, cinematically speaking, a single still in the cinematic distance-time sequence which is the velocity of the wave.[5]

This brings us to the connection between the cinematic model and relativity. In the *discretum*, as we have described it, there is no limit to the distance by which an object may be displaced between one auto-extended still and the next. That is to say, as in classical mechanics, there is no limit to the speed at which a body may travel. The dimensions of this cinematic motion are therefore, altogether, four. Three of them are the classical dimensions of all-distance-and-no-time—that is, the ordinary dimensions of instantaneity, or pure space—and the fourth is the dimension of all-time-and-no-distance, the dimension of pure duration or sequence.

In the cinematic model these axes of pure distance and pure time define, between them, a geometrical—or, rather, geometrodynamical—space-time in which the velocities of bodies (or, at least, their approximate straight-line segments) are quotients of the two orthogonal, or mutually exclusive, measures, ranging from zero to infinity as in classical physics. In classical physics, of course, space and time are regarded as independent measures. In the cinematic model, however, the distance over which a body moves and the time it takes in moving that distance are dependent measures, so that all four dimensions, like the three orthogonal dimensions of ordinary geometry, are measured, implicitly, in the same units. In other words, all four cinematic dimensions are, in effect, times, as reflected in the decision, by the International Standards Conference in Paris, to define the length of the standard metre as metre/c = 3.3 nanoseconds, where c is no longer the 'velocity' of anything but simply what Herman Bondi has called a 'conversion-factor' for interconverting measures in metres and measures in seconds in the same way that c^2 interconverts measures in kilograms and measures in joules.[6]

This means, of course, that the trajectories of these moving bodies have geometrical space-time lengths which are the resultants of the two orthogonally projected measures, all-distance-and-no-time, and all-time-and-

3 Pope N.V. and Osborne, A.D.. 1995, *Physics Essays* 8, 3, pp. 384-397.

4 Discussion between Prof. T.E. Phipps (Jr.) and the author at the 1990 PIRT Conference, Imperial College, London.

5 All interactions in the field are instantaneous and longitudinally extended in accordance with Newton's third law and with Lewis's demonstration of proper-time contiguity (to say nothing of the $\mathbf{B}^{(3)}$ electrodynamics of Evans and Vigier—which connection Evans originally welcomed but now, strangely, dismisses).

6 Bondi, H., 1965, *Assumption and Myth in Physical Theory*, C.U.P., p.28.

no-distance, according to the Pythagorean relation:

$$t_R = \left[\left(\frac{s}{c}\right)^2 + t^2\right]^{½} \qquad (1),$$

where t_R is the resultant or relatively dilated time, as in Einsteinian Special Relativity. That this simple Pythagorean formula is the same as Einstein's can be seen if we substitute for s in (1) the equivalent expression vt_R, where v is the relative velocity s/t_R in standard relativity. This produces, after simplification:

$$t_R = t\left(1 - \frac{v^2}{c^2}\right)^{-½} \qquad (2),$$

which is identical to the Einsteinian formula for time-dilation in Special Relativity.

From these simple Pythagorean formulæ it follows that whereas the limit of the velocities of bodies expressed as the distances s travelled in their own proper times t is infinite, those same motions expressed as standard relative velocities $v = s/t_R$ have a finite upper limit c, which is not a velocity but an unreachable asymptote of all true velocities.[7] Meanwhile, the asymptote itself is the speed—if such it can be called—of the pure quantum-jump of resonant (*i.e.*, wave-like) action from one body to another between one angular momentum still and the next.

The cinematic model, then, combines the conceptions of wave-motion and instantaneous action-at-a-distance in a simple, commonsense way. The instantaneously extended actions-at-a-distance are the quantum 'stills' of the model, and the waves are space-time sequences of these quantum stills, which propagate cinematically at speeds up to the limit c. These waves, because they are stochastic or statistical are, in effect, the probabilistic wave-functions of de Broglie and Schrödinger—except, of course, that unlike the hidden and mysteriously collapsing 'wave-function' of current wave-dynamics, the substratum for these waves is an up-front reality, like the classically conceived absolute 'field' or 'ether' of the Realists of physics, such as Selleri and Vigier. Also, in our cinematic model, unlike the 'photon wave-packet', whose beginning and end are Einstein-separated or localised, the waves between the emitting and absorbing bodies remain throughout (statistically) 'anchored' at both ends. There is thus no more chance of our quantum interactions remaining undirected than there is of a wave leaving a plucked wire and going off on its own.

This has major implications for the source-sink interconnected behaviour of waves and particles in modern versions of the allegedly 'mysterious' Thomas Young two-slit experiment.[8] The mystery is supposed to be that of how a material particle such as a 'photon' or 'electron' can travel through the two slits at once, as it has to—or so it is reasoned—in order to make the typical interference-pattern of strikes at the receiving end. Does it de-materialise itself into a pure 'wave-function' to pass through the slits and then materialise at the screen by some strange 'collapsing' of that wave-function? If not, then how else can these material particles possibly manifest that wave-like interference?

The logical answer is that in the angular momentum *discretum* as we have described it nothing travels or extends in any purely random, open-ended way. All motions and extensions are angular momentum geodesics of one kind or another and, as such, are synchronous or phase-related in the manner of waves. In that statistical realm the geometro-mechanical certainty of classical motion is replaced by probability. This means that all the different extensions between the various bits of the apparatus are proper-time-instantaneous interconnections (analogous to 'standing-waves') of this same, statistical or 'probabilistic', phase-related kind. This, of course, includes the lengths of the paths through the two slits from the source to each point on the screen. As statistics, then, for source-screen interaction, those lengths are either in-phase or out-of-phase with each other—that is, they differ between some odd and some even number of half-lengths of the intrinsic length λ (customarily called the 'wavelength') of the energy to be applied, *i.e.*, $\lambda = h/mc$ for light quanta and h/mv for particles. (Note that since the path-lengths are instantaneous, the interference they cause at the receiving end has nothing to do with the speeds of whatever it is that passes along them, whether it be light or particles.) Between points where the paths are exactly in-phase and where they are exactly out of phase, the probabilities for source-screen interaction go from maximum to minimum in accordance with the usual probability-amplitude ψ. In the theory we are proposing, ψ is no mysteriously hidden and collapsing 'wave-function'. The interference is that of the entirely non-mysterious geometrodynamical features of the paths themselves.

It is not the particles, then, that go through both slits and interfere at the far end—indeed, how could that possibly be?—but the paths, measured in length-units equal to the wavelength of the applied energy. (The fact that there is no way of determining which slit the particle goes through without detecting it, thereby 'collapsing' the probabilities to a certainty at that point and thus destroying the interference-pattern, can present no problem. Heisenberg's indeterminacy principle makes it a tautology that a motion which is indeterminate cannot be determined. Why should we seek to determine the definitionally indeterminable? Silly questions notoriously generate silly answers!)

In conclusion, then, the cinematic model not only reproduces relativistic time-dilation and its standard consequences for relativistic mass and so on, it also provides the instantaneous action-at-a-distance required by the law of moments, the law of the conservation of angular momentum and Newton's third law. It therefore satisfies Mach's principle whilst setting a finite upper limit c, as in Einstein's Special Relativity, to the cinematic or sequential propagation of interactions in the angular momentum *discretum* or field. Moreover, it dispenses, as does General Relativity, with the Newtonian assumption of rectilinear free motion and its associated explanation of orbits in terms of the usual fictitious 'forces' of gravity, electrostatics and so on. All that is missing (apart from these 'forces', which are unified by dispensing with them en masse) are the theoretical 'photons' and 'gravitons' which are supposed to travel through a primordial and continuously extended void to mediate interaction between one theoretically isolated place and another, requiring 'spooky superluminal guiding-waves' to steer them towards their assignations.

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On the Numbers

You were good enough to publish a letter of mine in *Apeiron* Vol. 3, No.2, in 1996, in which letter I commented on Dr. Pesteil's numbers of 210 and 1.228. In my discussion I pointed out that the two numbers most commonly occurring in Universe ratios, *viz*. 1.23 and 1.19, also occur in Solar System ratios, together with the number 0.724. These numbers, I argued, were explainable in the Solar System if the system formed by cold body break-up of a protostar and, later, a proto Jupiter.

I realised from the hypothesised geometrical relationships of the initial parts of the Solar System that the numbers 1.23, 1.19, and 0,724 must be simply related mathematically, but try as I might I could not discover the relationship. This February I finally stumbled upon the solution; one so simple that it makes me want to kick myself

7 Pope, N.V. and Osborne, A.D., 1987, 'A New Approach to Special Relativity', *International Journal of Mathematical Education in Science and Technology*, 18, No.2, pp. 191-198.

8 See, *e.g.*, *New Scientist*, 11th March 1995, pp. 18-19; also *Newsweek*, June 19th, 1995, pp 67-69 (reports on experiments by Raymond Chiao, *et al.* at the University of California, Berkeley).

for not seeing it years earlier. Because the solution relates the Universe numbers 1.23 and 1.19, and I believe that the relationship is unknown, I thought it may be of interest to your readers.

The relationship of the three numbers 1.23, 1.19, and 0.724 can best be illustrated by three simple equations. They are:

(1) $1.23 = 1.19^{1.19}$ (within 0.001%)

This mathematically relates all ratios of 1.23 and 1.19, together with the ratios that are powers and products of the two numbers; e.g. 2.3 ($= 1.23^4$), 2 ($= 1.19^4$), 8/3 in the equation for the number of protons and neutrons in the observable Universe ($= 1.19^4/1.23^2$ very nearly—0.32% different).

(2) $1.19 \times 1.23 \times 1.38 = 2$ very nearly (within 0.9953% of 2 4 and 0.7264% of 1.19^4)

Here the reciprocal of 0.724 (= 1.38122, say 1.38) is used. Without giving the argument here, I suggest the equation should be for the Universe $1.19 \times 1.23 \times y = 2$, where y is approximately $1.36640 = 0.73185^{-1} = 0.98068^{-16}$.

This is supported by:

(3) 1.23 to the power $1.23^2 = 1.36778 = 0.73111 \sim 1 = 0.98062^{-16}$———$A$

When A is substituted for y in equation (2) we obtain:

$1.19 \times 1.23 \times 1.36778 = 2.00055$

It is therefore possible to arrange the equation $axbxc = 2$, where $a = 1.19$, $b = 1.23$, and $c = 1.366778$, to give:

$$a \times (a)^a \times \left[(a)^a\right]^{(a^a)^2} = 2$$

and it seems to me that this cannot be an accidental equation but is one of significance.

Is 1.23^2 of significance in the study of the Universe? I think it is, First note that in Kokus' Table 3, "Fundamental Dimensionless Numbers', (*Apeiron* 20, 1994, 3), the fine structure constant is given as 1/137, which is $1/1.37 \times 1/100 = 1/1.23^{1.23^2} \times 1/100$ very closely (within 0.16%), which is suggestive, But note the following:

Pesteil (*Apeiron*, Autumn 1991, p.13) states that the $m_{neutron}/m_{electron}$ ratio is 1838.684 and th $m_{proton}/m_{electron}$ ratio is 1836.1527; and gives as an approximation for these numbers $150^{1.5} = 1837.117$. The number $150^{1.5}$ suggests $\left(1.23^2\right)^{1.23^2} \times 100^{1.23^2}$ or more simply $\left(y \times 10^{1.23^2}\right)^2$, where y comes from (3) above. The product comes to 1985.339971. Does this have a relationship to one of the electron ratios? It would seem so, for using the proton/electron ratio:

$1836.1527/1985.339971 = 0.92485554 = 0.98066^4$.

The number 0.98066 is virtually identical to A in (3) above and even closer to the number at the end of (2).

Accidental? I doubt it, for it mirrors similar differences in some Solar System ratios, where the difference is usually 0.98 or 0.98^2. I would then suggest that the figure 1.36778 (or 0.73111) is a figure of importance for Universe calculations.

It should also be noted that $(0.724/0.73111)^2 = 0.9806447$ or $0.980^{32}/0.980600^{33} = 1$, again suggesting the numbers are not accidental.

I have done sufficient work to be certain that the number 0.724 is closely correct for the Solar System. I suggest that in the case of Universe relationships, where the ratio appears, it should be 0.73111. Why? In my opinion bodies big and small rarely divide exactly as mathematical theory requires. A slight variation to perfection normally occurs, leading to a slight variation in the ratios. I suggest this is what occurred for the Universe and the Solar System.

But I am straying into the realms of speculation and I should not let it be so in this letter, which is to point out the three relationships:

(a) 1.19 to the power 1.19 = 1.23;
(b) 1.23 to the power $1.23^2 = 1.367$;
(c) $1.19 \times 1.23 \times 1.367 = 2$;

so that very many apparently unrelated ratios in Universe calculations are, in fact, mathematically closely related.

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Einstein s Errors

A few physicists agree that some mathematically derived *apparent* "relativistic effects" of the Special Theory of Relativity (STR) cannot be applied to any real such effect. However, a large majority considers that they can. But Einstein himself stated that truth is different in mathematical physics and in experimental physics.

A fundamental assumption of the STR is that the Lorentz transformation enables an observer in an inertial system to perform valid calculations of data in another inertial system. We show here that this cannot be done.

The STR calculates such data by using the Lorentz transformation, which as we have shown , is valid only in some cases, but not in others. A derivation of that transformation was given by Einstein. This derivation was faulty, even though its fault was not pointed out as far as we know. Neither was its limited validity mentioned by Einstein.

Another shortcoming of the STR is that it applies its results of one-dimensional considerations to "moving" inertial systems. These results are not valid for two of the three spatial dimensions of such systems.

Discussing two "inertial systems" the symbols x,y,z are used for the spatial dimensions in the "stationary" system K, and the corresponding ones in the "moving system" K are denoted x',y',z'. Time as measured in the two systems is denoted by t and t' respectively.

The movement of electromagnetic radiation in the two systems is stated by the two equations $x - ct = 0$ in K, and $x' - ct' = 0$ in K. Einstein then claims that $(x - ct)$ and $(x' - ct')$ are proportional by a factor of λ. Proof of this is that both sides of the following equation "disappear" at the same time

$$(x' - ct') = \lambda (x - ct)$$

This proof is obviously wrong, because one can not regress zero to zero. Zero can not "disappear". The equation shows also that lambda can be any random number. Therefore its use in any manner for further reasoning is an error.

This faulty definition of the Lorentz transformation was not used in Einstein's original paper, where previous work of Lorentz, Poincaré and others was relied on. But when this transformation is applied for finding real effects in a different inertial system, it leads to false results.

That such results can appear to be correct, is due to the fact that all theoretically possible observation occurs from the direction in which the transformation is valid for *receding* objects

A third error is due to the inadequate definition of the velocity of light. This can lead to an apparent change of the unit of time when a system moves. In system K it is defined by the equation $c = x/t$. Because c is said to be equal in all systems in all directions, $c = y/t$ also applies. Valid definition of c in K can not be found in K unless y and t are both known. An observer in K can get these values only by using c. Thus these definitions are circular in nature, hence false.

If we accept that $c = y'/t'$ and $c = y/t$ are both valid, we have $y'/t' = y/t$. The STR claims that $y' = y$. Therefore if c is a universal constant $t' = t$. This means that time units do not change when a system moves.

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Laszlo Szego
Peter F. Ofner

Moving Rods

In recent @ *issue* correspondence "On Moving Rods and Clocks" L. Szego and P. F. Ofner call attention to the absurdities that result from assigning "reality" to STR's metric effects. I happen to accept the CERN evidence[1] of reality of time dilation effects. There is something there that must be taken more seriously than many dissident theorists would prefer. But concerning *spatial metricity*, I should like to call attention to the existence of a logical disproof[2] of the Lorentz contraction. To presume that nonoccurrence of the latter is equivalent to rejection of time dilation is actually to acquiesce tacitly in the idea of "spacetime symmetry." This is a "symmetry" that is born of Maxwell's equations and is killed beyond resurrection the moment the first-order superiority of Hertz's Galilean invariant covering theory[3,4] of Maxwell's equations is recognized.

The gist of the logical disproof[2] of the Lorentz contraction follows: First, we recognize that a kinematics (STR) based on exclusion of acceleration is both nonphysical and logically incomplete because it makes no provision for *axis calibration* by (necessarily accelerative) transfer of metric standards. Numbers cannot be assigned to physical descriptive symbols until such calibration has occurred at least in thought. Consider the spatial metric standard, a material "meter stick," to be at rest in an inertial system *K*. We wish to transfer it (by some program of longitudinal force applications to its material particles) into a new state of rest in a relatively moving inertial system K', *without altering its stress-free internal energy state*. (Force is not supposed to enter kinematics, but it must, where consistent quantification of spatial magnitudes is to take place. In fact "inertiality" is absence of "force," so force is there, although *in absentia*.)

Stress-freedom is the crux of the problem: How do we accelerate an extended structure while keeping its internal energy state constant? STR says to push harder on the back than on front of our meter stick, so that the rear worldline will curve forward more sharply than the front one, in just such a skillfully-engineered, formula-determined way as to produce always the Lorentz contraction on successive hyperplanes of constant *K*-time. In that way the metric standard arrives in K' still a valid (stress-free) metric standard. But that, in addition to being ludicrous, is easily proven to be logically incorrect.

We frankly renounce the Lorentz group, because accelerations must be admitted from the outset. Consider a "point observer" O who is transferred from rest in *K* to rest in K' by any program *P* of accelerations. Consider O the prototype of a space-filling set of similar observers who at all moments of their own proper times or of *K*-time are precisely comoving with O. That is, each is subject to the identical force program *P*. Call this set of identically-accelerated observers the "O-set." Let our metric standard lie at rest in *K*, while the O-set is accelerated from rest in *K* to rest in K'. During this transfer of observers we know one thing with certainty about our metric standard: it is continually stress-free, because it just sits there in *K*. Now consider the "worldlines" of the two ends of this stress-free metric standard as plotted by observer O and his comoving friends. The relative motion being accelerative, these worldlines will each be curved. The crucial point to notice is that the worldlines of the two meter stick ends thus plotted will be *curved identically*. There will be no greater curvature at the back end than at the front. Thus on each hyperplane of constant proper time of the O-set observers (shared motion, shared proper time) identical worldline curvatures of the front and back point of the meter stick will occur and will be plotted in the "world" of O-set space-proper-time. Hence at no moment can the separation of these points, as measured on hyperplanes of constant O-set proper time, vary from their original separation of precisely one meter.

The O-set observers (who are "inertial" in the *generalized sense*[2,4] that if *all* particles including those of accelerometers comove no acceleration can be measured), when finally all brought to rest in K', thus measure the stress-free metric standard as preserving the same one-meter length it had when they rested in *K*. A *relative motion* of the meter stick and observer has thus arisen under circumstances in which we can be quite certain the standard has been preserved stress-free throughout. Assert a generalized relativity principle comprising acceleration. We have only to postulate, then, that on arrival at a state of rest in K', the O-set observers become equivalent to the space-filling set of resident (Einsteinian) observers permanently at rest in that system. In other words metricity in any inertial (or "generalized inertial") system does not depend on the history of acceleration of observers at rest in it: All comoving observers are kinematically equivalent.

So now we know the program of forces needed for stress-free transfer of any material metric standard. It is that program which causes front and back worldlines of the standard to curve identically; namely, the trivial program that always applies equal forces, front and back (or, more generally, to each material particle of the structure). That is all that is needed to restore "rigidity" as a permissible idealization and to overthrow STR.

Historical note: How did Einstein deal with axis calibration in 1905? He finessed it. First he had two inertial systems at rest together, so that the standard meter stick was at rest in both and both observers agreed on what the "meter" meant. Then he "set into motion" one of the inertial systems, presumably with its own replica meter stick at rest in it. So, acceleration, like the fog, came in on little cat's feet—quietly. And what program of forces accomplished this "setting into motion?" Ah, now there silence truly reigned supreme. He did not yet have his equations of the Lorentz transformation derived, so he could not tell us *how much* harder to push on the back of this meter stick than on the front of it. So the "meter" was free to become anything, *ad lib*. Funny how three generations of logic-choppers have studiously overlooked the chopping opportunities in the axis calibration vineyard. *O kinematics*, *O logic*, *O scholarship*, *O space-tempora*, *O mores*!

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Producing Superluminal Particles

My paper [1] about a way of production of superluminal particles has elicited some interest. The essence of the method is that the one object is accelerated by the second object in their joint relative motion. For example, a bunch of protons moves with a velocity *v* nearly equal to the speed of light *c*, ahead of a bunch of electrons, which move with the same velocity *c*, and accelerates them in relative movement. When a bunch of electrons comes nearer to bunches of protons, it will have velocity 0.3 *c* relative to the protons and 1.3 *c* relative to the laboratory. By using relative movement it is possible to accelerate bunches of particles of equal sign, only accelerating bunch should push bunch, which is accelerated.

This approach has raised some questions. For example, Robert J. Hannon (4473 Staghorn Lane, Saratoga, Fl 34238 USA) poses the following questions.

> *The fundamental question that must be resolved before your method of achieving superluminal velocities can be applied is: Can electromagnetic force propagate in empty space at a velocity greater than c? Does the field of charged particle moving at v nearly equal to c propagate space at v + c? Perhaps superluminal velocity might be achieved by transfer of momentum between particles of different masses. A collision between a proton moving at 0.1 c with a positron at rest should accelerate the positron to a velocity much greater than c, assuming such a collision is possible .*

Other kind of questions are asked by relativist physicists who represent modern establishment physics. Referring to the law of velocity addition in the Theory of Relativity, they believe that increments of velocity in relative movement and velocity of relative movement cannot be added. Therefore the total velocity of the accelerated bunch will not exceed the speed of light.

As is known the relativistic law of velocity addition is stipulated by a length contraction and a time dilation in relative movement, accepted in the Theory of Relativity. Thus superluminal motion and the Theory of Relativity are not compatible. Therefore to answer all the above questions, first of all we must solve the latter problem.

The problem is as follows. Man is surrounded by the world, which he studies and describes. In this world one body acts on another. The action of one body on another is perceived when the latter is accelerated. For the description of this action man has invented force. This kind of description of action gave us Newton's three laws, which form the basis of mechanics. Except for the description of interactions with the help of forces in the second half of the 19th century, the description of interactions with the help of energy is just beginning. Therefore the force representation of interactions has begun to fall out of use, and we have begun to study the interactions of moving charged and magnetized bodies. This tendency has led to the result that, since the works on electromagnetic phenomena by J.K. Maxwell, G.A. Lorentz, A. Einstein and others , a description of interactions has developed, in which it is supposed that forces do not depend on relative motion of interacting objects.

In reality all electromagnetic experiments testify, that bodies moving relative to each other interact with one another differently from when they are motionless. For example, when two charges are in relative motion the force between them is not defined by Coulomb's law. To agree to a rule on the independence of interactions from relative motion with experimental dependence on motion, we have invented dependence of a length, time and mass on velocity of motion in the Theory of Relativity. Thus the relativistic way of describing electromagnetic interactions has been invented, in which the interaction of relatively moving objects is described as interaction of immovable one, but the distances, time and mass should change in accordance with G.A. Lorentz's transformation.

The relativistic way of describing electromagnetic interactions has become dominant in 20th century science. However, are many scientists who continued to develop a classical method of describing interactions, among them I mention several: Oliver Heaviside [2], G.F. Lomakin [3], T.G. Barnes with colleagues [4], C.W. Lucas, Jr. and J.W. Lucas [5], V.I. Suhorukov with colleagues [6], Xu Shaozhi and Xu Xiangqun [7], O.D. Jefimenko [8], T.E. Phipps, Jr. [9] and many others. In my works, for example [1], I have obtained an expression for the strength of interactions between relatively moving charges, which is based on the experimental laws of electromagnetism, in the following form:

$$\vec{F} = \frac{q_1 q_2 \left(1 - \beta^2\right)\vec{r}}{\varepsilon \left\{ r^2 - \left[\vec{\beta} \times \vec{r}\right]^2 \right\}^{3/2}}, \qquad (1)$$

where $\vec{\beta} = \vec{v}/c_1$ is standardized velocity, $\vec{v}$ is the velocity of one object relative to the other; $\vec{r}$ is the distance between the objects; $c_1 = c/\sqrt{\varepsilon\mu}$ is the velocity of propagation of action in the medium; c is the velocity of light *in vacuo*; and ε and μ are the dielectric and magnetic permeabilities of the medium. *In vacuo* $\varepsilon = \mu = 1$ and $c_1 = c$.

This expression for the force is rejected by other scientists [4], [5], [8]. The law of interaction (1) allows us to solve all problems of electromagnetic interactions of relatively moving bodies. In this case the relativistic transformations for length, time and mass are not used, and the relativistic formula for velocity addition is not used. In other words, this method of describing interactions completely replaces the Theory of Relativity.

Now we shall pass to the answers of R.J. Hannon's questions.

From many experiments we know, that electromagnetic action (light, radiowaves and *etc*.) are propagated in space with the speed c_1. Thus, in a rarefied medium, the vacuum, $\varepsilon = \mu = 1$ and $c_1 = c$. But here it is necessary to pay attention to one feature. The propagation velocity is always measured from one object to another. Therefore, irrespective of the receiver and source of electromagnetic action it is impossible to speak about propagation velocity of electromagnetic action in the space. The experiments only testify that if the receiver and the source are stationery relative to one another, the propagation velocity of action between them will be equal to c_1. For example, the speed of light between the Earth and Jupiter at their parallel orbital velocities, or the velocity of light between two opposite mirrors in A.A. Michelson's experiments will be equal to c_1. If a receiver and source move away from one another with velocity v or approach one another with the same velocity, the electromagnetic action will be propagated between them with the velocity $c + v$ (+ in case of approaching). For example, as was shown by O. Roemer in 1676, between Jupiter and Earth, when the latter approaches or recedes from it with orbital velocity v_E, the speed of light is equal to $c + v_E$, and this was proven by B.G. Wallace [10], in the case of the motion of Venus relative to the Earth with velocity v_V, the speed of radiowaves between them is equal to $c + v_V$.

Thus, action between objects propagates with the speed $c + v$, where v is velocity of their relative motion. The interaction between two objects should be determined only by relative velocity of motion. From experiment we know that the interaction of two bodies depends on their relative velocity and not on the velocity of each body relative to any space. For example, the electric voltage on the coil ends, inside which the magnet moves, only depend on their relative velocity and this voltage does not depend on their velocity relative to Earth's surface. Therefore if one charged particle acts on another charged particle, their interaction will only depend on their relative velocity, but not on the particle velocity relative to other bodies, empty space, ether *etc*. The experiment states so.

In addition, it is necessary to consider the electromagnetic interaction and its propagation not in abstract space and not in reference systems, but to between interacting objects. The electromagnetic (EM) interaction is not waves in some media, as now it is present in the physics. The EM-action is changing in time and that is all. There is no medium, there is no vibration of particles of this media, and there are no waves which are like waves on the water.

Therefore if two particles, for example a proton and positron, move at identical direction with velocity c, they will interact between one another and the positron will acquire additional velocity and its absolute velocity will be greater than the velocity of light. We shall calculate the conditions under which the acceleration of particles to superluminal velocity is possible in this way. We shall consider the interaction of two charged particles, the proton and positron, with the help of the law (1). In this interaction, as it was shown in our work, for example [11], their relative velocity at distance R will be

$$v_{rel} = c_1\sqrt{1 - (1 - \frac{v_0^2}{c_1^2})\exp\frac{2\mu_1}{c_1^2}(\frac{1}{R} - \frac{1}{R_0})} \quad (2),$$

if in the beginning of the interaction they were at a distance R_0 and had relative radial velocity $v_{rel} = v_0$ and where

$$\mu_1 = \frac{q_1 q_2 (m_1 + m_2)}{\varepsilon\, m_1 m_2}, \qquad (3)$$

q_1 and q_2 are charges and m_1 and m_2 are the masses of interacting particles.

If a proton (Fig.1) moves from infinity with velocity v_0 and acts on an immovable positron, equation (2) becomes

$$v_{rel} = c_1\sqrt{1 - (1 - v_0^2 / c_1^2)\exp\frac{2\mu_1}{c_1^2 R}}\ . \quad (4)$$

In a further interaction of proton and positron the distance between them is diminished to R_{min} at velocity $v_{rel} = 0$ (see Fig. 2).

Then substituting $v_{rel} = 0$ into (4) we can define the minimum distance between interacting particles

$$R_{\min} = -\frac{2\mu_1}{c_1^2 \ln(1 - v_0^2 / c_1^2)}. \qquad (5)$$

As the proton mass is greater than a position mass, the proton velocity will be the same, *i.e.* $v_{pr} = v_0$, and the positron will have the same velocity $v_{pr} = v_0$.

The interaction continues and the positron will move away from the proton. The relative positron velocity can be calculated from (2) if we set $v_0 = 0$ and $R_0 = R_{min}$. The acceleration of the positron will be completed when the distance between the particles R is equal to infinity; and from (2) we obtain the relative velocity of the positron

$$v_{rel} = c_1\sqrt{1 - \exp\frac{2\mu_1 c_1^2 \ln(1 - v_0^2 / c_1^2)}{2\mu_1 c_1^2}} = c_1\sqrt{1 - 1 + v_0^2 / c_1^2} = v_0 \qquad (6)$$

Therefore the full velocity of positron will be

$$v_{po} = v_0 + v_{\text{rel}} = 2v_0. \qquad (7)$$

We shall consider that interaction law (1) is kept and this equation is correct, if R_{min} is greater than the sum of the radii of the proton R_{pr} and positron R_{po}. Let us calculate the initial proton velocity v_0 which allows to bring the particles together at the distance

$$R_{min} = R_{pr} + R_{po}. \qquad (8)$$

Substituting (8) in (5) we obtain

$$\beta_0 = v_0 / c_1 = \sqrt{1 - \exp\frac{-2\mu_1}{c_1^2(R_{pr} + R_{po})}} \qquad (9)$$

We can write the coefficient

$$k = \frac{-2\mu_1}{c_1^2(R_{pr} + R_{po})} = -\frac{2q_1q_2(m_1 + m_2)}{\varepsilon c_1^2 R_{pr} m_1 m_2 (1 + R_{po} / R_{pr})}. \qquad (10)$$

Now we can use the following particle parameter:

$m_1 = m_{pr} = 1.672 \times 10^{24}$ g;
$m_2 = m_{po} = 9.1095 \times 10^{28}$ g;
$q_1 = {}_2 = e = 4.8 \times 10^{10}$ cm$^{1.5}$g$^{0.5}$/s;
$\varepsilon = 1$; $\mu = 1$;
$c_3 = 3 \times 10^{10}$ cm/s; $R_{po} = 2.817 \times 10^{13}$ cm;
$R_{pr} = 1.535 \times 10^{16}$ cm.

As $m_1 >> m_2$, we can write equation (10) as

$$k = -\frac{2e^2}{c^2 R_{pr} m_{po}(1 + R_{po} / R_{pr})}. \qquad (11)$$

Substituting parameters in (11) we obtain $k = -1.34$. Then according (9) the initial proton velocity we can take

$$\beta_0 = \sqrt{1 - \exp k} = 0.859, \qquad (12)$$

i.e. $v_0 = \beta_0 c = 0.859\ c$. Thus in accordance with Eq. (7) the positron can be accelerated to velocity $v_{po} = 2v_0 = 1.72\ c$, *i.e.* we obtain superluminal positrons.

Above we have considered interaction of protons with positrons. Up to this superluminal velocity the electrons can be accelerated with the help of antiprotons. As we see, the conditions of acceleration are quite feasible.

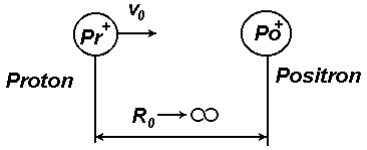

Fig.1. The Beginning of Acceleration

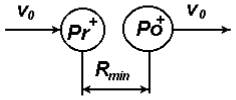

Fig.2. The Middle of Acceleration

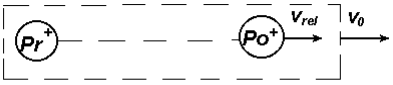

Fig.3. The End of Acceleration

Such acceleration can be realized, if the bunch of heavy particles strikes motionless cloud of resting particles. The probability of direct collision of particles will depend on the densities of these particles. Then the further problem will arise how to diagnose superluminal accelerated particles or to separate them from heavy particles. Some variants of a solution may be envisioned here. It is possible to use Cerenkov's counters of superluminal particles. It is possible to reject the heavy particles using cross electromagnetic action. After rejecting devices only the bunch of superluminal particles will move along an axis of the apparatus. It is also possible on the analysis of results of collision to define the density of angular distribution probability of particles, which will characterize the availability of superluminal particles. Knowledge of the trajectories of interacting particles will be required in this case. They are calculated in our work and are published in the form of tables in my book [12].

This is how to obtain superluminal particles. Their diagnostics is real. All that is required is an unprejudiced attitude and attention to this problem of experimental physics, having the necessary technical devices.

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Rebuttal of M. Y. A. Raja *et al.*

I have just been made aware of the existence of these papers [*Appl. Phys. B*, 64, 79 (1997) and *Appl. Phys. Lett*., 67, 2123 (1995)] by Prof. Dr. S. van Enk of Innsbruck. They were published again without my knowledge by my former colleagues at UNCC. My rebuttal is given in two sections: scientific and non-scientific background. This conduct again raises serious questions of ethics and the erosion of the right of reply. The authors are fully aware of my address and could have sent preprints at any stage. It appears that this work was actually in progress while I was still at UNCC, but I was not told of it, although nominally a full professor.

I still have no access to the second reference and therefore deal in this reply with the first.

Scientific Rebuttal

The paper is an empirical demonstration of the visible frequency inverse Faraday effect, (due to $iB^{(0)}\mathbf{B}^{(3)}$) and of the lack of induction *in vacuo* due to $\mathbf{B}^{(3)}$. The vacuum Maxwell equation for $\mathbf{B}^{(3)}$ is described in the volumes of *The Enigmatic Photon*, and is:

$$\nabla \times \mathbf{B}^{(3)} = \frac{\partial \mathbf{B}^{(3)}}{\partial t} = 0 \qquad (1)$$

and therefore there is no Faraday induction *in vacuo* due to $\mathbf{B}^{(3)}$. The authors *do not refer* to this work and rely on out-dated semi-classical, phenomenological theory which they somehow claim to disprove. The authors corroborate eqn. (1) to good precision. They also verify empirically the existence of the inverse Faraday effect due to $iB^{(0)}\mathbf{B}^{(3)}$. As predicted by relativistic $\mathbf{B}^{(3)}$ theory the effect at visible frequencies is proportional to the beam power density, *I*.

Unfortunately, the authors entirely fail to understand that the $\mathbf{B}^{(3)}$ field is defined in gauge theory by:

$$\mathbf{B}^{(3)^*} = -ig\mathbf{A}^{(1)} \times \mathbf{A}^{(2)} \qquad (2)$$

where g is a proportionality constant and $\mathbf{A}^{(1)} \times \mathbf{A}^{(2)}$ the conjugate product of complex potentials. Their attempt to measure the optical Faraday effect, while laudable, fails because of this. In other words the interaction of $\mathbf{B}^{(3)}$ with a fermion is described by definition through the interaction of $\mathbf{A}^{(1)} \times \mathbf{A}^{(2)}$ with the spinor. Since atomic and molecular matter can be thought of as composed of fermions (electrons, protons and neutrons), the basis of the interaction is always as described.

Therefore they succeed in two corroborations of the theory but fail to detect the optical Faraday effect.

The paper contains serious misconceptions about $\mathbf{B}^{(3)}$ theory. For example, I quote: "If a circularly polarised beam possesses an axial magnetostatic field, it must induce a voltage signal in an inductive coil as the beam traverses through it." The $\mathbf{B}^{(3)}$ field, however, is not a magnetostatic field, *i.e.* is *not* the curl of a vector potential but is defined as in eqn. (2) from standard gauge theory. Its Maxwell equation *in vacuo* is eqn. (1), from the same standard gauge theory. Eqn. (1) shows that the $\mathbf{B}^{(3)}$ field produces no Faraday induction *in vacuo*, and this is verified by the authors with laudable care and precision.

The authors appear to claim, however, that their eqn. (3), quoted from non-relativistic, phenomenological theory of about 1992, is refuted by the existence of the inverse Faraday effect, which they have reproduced empirically. This claim is arbitrary, however, and is based on a subjective choice of parameterization (three positive parameters, magnitude not given) in the wrong (non-relativistic) context. It is now known that the interaction of $\mathbf{B}^{(3)}$ with one fermion is determined from first principles by the Dirac equation as described in *The Enigmatic Photon*. Classically it is determined by the relativistic Hamilton Jacobi equation. Regrettably, the authors refer to none of this work. The interaction is described in this special issue by Jeffers, using radio frequencies.

At visible frequencies, the relativistic Hamilton Jacobi and Dirac equations give the result that the inverse Faraday effect is proportional to beam power density, expressed through $iB^{(0)}\mathbf{B}^{(3)}$, and this is as observed by the authors, who therefore give a clear *corroboration* of part of the relativistic theory, albeit in a solid sample of complicated internal structure. They should repeat the experiment in an electron beam to give a more definitive corroboration at visible frequencies, then repeat with radio frequencies.

Unfortunately, misguided preconception, and ignorance of the exact one fermion theory, led these authors into a bizarre interpretation of the data, one in which these are used in an attempt to refute $\mathbf{B}^{(3)}$ theory. There are some very shaky theoretical pronouncements, I quote: "Evans [18] proposed that $\mathbf{B}^{(3)}$ field (*sic*) vanishes in a transformation from the photon's reference frame to the laboratory frame as the photon moves with the speed of light." Unfortunately for Raja *et al*., Evans did no such thing. This sentence shows that the authors understand nothing of the fact that the photon moving at *c* has no rest frame, and has no non-relativistic behaviour. They do appear to understand, however, that $\mathbf{B}^{(3)}$ is invariant under Lorentz boost. This type of thing shows that despite the recent literature, the authors still do not grasp the fact that the lack of Faraday induction is due to eqn. (1), *i.e.* standard gauge theory.

Their failure to see the optical Faraday effect is as described already, and explained as in my previous reply to Rikken, which the authors ignore. This reply has been developed in detail in the third volume of *The Enigmatic Photon*, which is also ignored. They also ignore detailed discussion at UNCC and by email and website.

Therefore the paper is a corroboration of the inverse Faraday effect at visible frequencies, and a demonstration of eqn. (1). While valuable, it does nothing to refute $\mathbf{B}^{(3)}$ as claimed, because the authors clearly do not yet understand relativity theory or gauge theory in sufficient depth.

Non-Scientific Comments: Background

For the sake of historical scholarship I give a few notes as follows. Work on the inverse Faraday effect at UNCC was initiated in about April 1992 shortly after my interview lecture there on $\mathbf{B}^{(3)}$, to an audience of about 150. As recorded on the website

www.europa.com/~rsc/physics/b3/evans

Raja, Youssaf and Allen failed repeatedly to detect the inverse Faraday effect and gave me the impression that the work had ceased. Judging from the date of publication of the letter (1995), work had restarted with the help of a newcomer called Sisk at the time of my enforced dismissal (Dec. 1994), and it appears that they managed at last to see the inverse Faraday effect with the crystal sample I had procured for them from Dr. Triboulet of Meudon in France. Incidentally, Triboulet *et al*. have detected a non-linear optical Faraday effect and have reported it as described in *Modern Nonlinear Optics*. Predictably, this book is ignored again by Raja *et al*. The paper tries hard to give the impression of my non-involvement, and has all the elements of a show trial.

At one point Raja had persuaded me against my better judgment to draft a MS for *Phys. Rev. Lett*. on the non-existence of the inverse Faraday effect. Profs. Shen and van der Ziel may remember telephone conversations I had with them on this claim of Raja's, and their incredulous response. My wife had to do the literature search for the UNCC colleagues, one which showed the existence of several corroborations of the effect.

It now seems that Sisk was recruited without my knowledge to finally see the effect, either just prior to my removal or just after. Clearly, these people have made no serious attempt to read the recent literature on $\mathbf{B}^{(3)}$, in particular the reply to Rikken. Their conduct makes the events at UNCC that much more repugnant, and raises questions of ethics, collegiality and the denial of the right of reply.

This episode is an intellectually dishonest face-saving exercise, but does succeed in providing a corroboration of the inverse Faraday effect, and of eqn. (1). If these authors would now read the recent literature, and carry out the RF ESR and RF NMR experiment, or the relativistic IFE experiment, they would prove Dirac right once again. They would not even have to give me any credit, because these effects arise from the Dirac equation itself.

All in all, a dismal display of subjective bias in the face of clear corroborative evidence for $\mathbf{B}^{(3)}$. I can see no trace of concern for my present situation, and no sign of editorial impartiality.

M. M. W. Evans

$\mathbf{B}^{(3)}$ Debate

The protracted debate about the existence of $\mathbf{B}^{(3)}$, while flattering, is indicative of a surprising slowness among the critics to

grasp the fact that $\mathbf{B}^{(3)}$ is defined in standard, textbook, gauge theory. It is a simple matter to show that it is defined by the covariant eqn. (3.169) of Ryder with $a, b, c = (1), (2), (3)$ in that order. Here ((1), (2), (3)) is a complex O(3) basis. Even more surprising is the claim that $\mathbf{B}^{(3)}$ does not obey Maxwell's equations. It obeys them, quite obviously, in their O(3) gauge form, given by Ryder's (3.173).

This may be slightly unfamiliar because of the covariant derivatives, but straightforwardly gives the appropriate vacuum equations for $\mathbf{B}^{(3)}$, equations which state that its curl and time derivative are zero, and that its divergence is also zero. Ryder's eqn. (3.169) also shows that the correct and only way to develop the interaction of $\mathbf{B}^{(3)}$ with a fermion is through the interaction of $\mathbf{A}^{(1)} \times \mathbf{A}^{(2)}$ with the spinor. Here $\mathbf{A}^{(1)} \times \mathbf{A}^{(2)}$ is observable in the inverse Faraday effect. Failure to realize or accept this will result in erroneous claims such as those of Rikken.

If a subjective decision is made to use the U(1) gauge, none of these properties will be evident, and the considerable confusion will arise which has already saturated the critical literature. I wish to express my gratitude for this opportunity to produce a special issue not only on $\mathbf{B}^{(3)}$, but on the work it has catalyzed among able colleagues who contribute here. This work has led to other types of longitudinal solutions *in vacuo* of the ordinary Maxwell equations.

These are also solutions of the O(3) Maxwell equations provided only that we superimpose the indices (1), (2), (3) on the familiar U(1) forms.

Myron Evans

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