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A Logical Reconciliation of Einstein and Newton
or
A Synthesis of Relativity and Quantum Theory

by

Viv Pope

ABSTRACT

Many now believe that Relativity is a permanent theory. We agree, but not in the format given to it by Einstein. Einstein's relativity remains based on his own entirely idiosyncratic interpretation of the distance-time constant *c* as the propagational velocity of delayed-time electromagnetic field-processes *in vacuo.* We argue that this interpretation of *c* is unnecessary. The fact that all velocities are distances divided by times does not logically entail that all distances divided by times are velocities. The latitude this leaves for interpreting *c* in a different way is explored in this paper, in which *c* is taken as no more than a dimensional constant relating units in one dimension (*i.e.*, conventional metres) to units in another dimension (*i.e.*, conventional seconds). This in no way changes either the value or the dimensions of *c*, so the formulae in which it appears remain unaffected. What does change is that the present state of suspended irresolution between Relativity and Quantum Theory, with its conflict over instantaneous *versus* delayed-time action-at-a-distance (the so-called EPR controversy) simply vanishes and gives place to a full-scale philosophical relationism of the sort promulgated by Mach. The repercussions of this conceptual 'flip-over' for practical physics are profound. Relieved of the idiosyncratic rationale of 'electrodynamics', the theory becomes, as in the end all permanent theories must, the province of plain commonsense.

Introduction

The following illustration is from *Patterns of Discovery*, by Norwood Russell Hanson (CUP, 1965), p. 13:

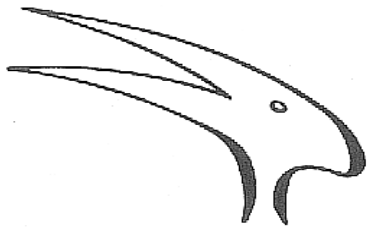

Figure 1

What is this a picture of? Some may see it as a bird, others as an antelope. Looking at it, the mind naturally switches back and forth, indecisively, from the one to the other.

Now try, if you will, to see the picture as a representation of both animals at the same time. With our psychological need to impose structure on what we see, we find this impossible.

Similarly with our scientific ways of thinking about the world. In modern physics we find ourselves caught between our habitual need, on the one hand, to see the world in the way Galileo and Newton taught and, on the other hand, the radically different way introduced by the likes of Einstein and Lorentz. This suspended state of irresolution between the two views causes consternation. It is as though, in this transitional stage in its history, Physics was trying to teach us that the world is both flat and round at the same time. Was Newton right or was Einstein right? Physicists continually war over this as inconclusively as they might dispute over whether the picture in Figure 1 is that of a bird or an antelope.

How is this situation to be resolved? Clearly, the picture of nature that Modern Physics presents needs to be filled-out in such a way as to remove the logical ambiguities. Unfortunately, in conferences on the subject, there is about as much experimental evidence presented for the one way of thinking as for the other, so that the issue remains chronically unsettled. In this paper, some suggestions are offered as to how, from a purely logical, commonsense point of view, such a resolution may be obtained.

1. The Need for a Physics Without 'Fields'

In its inception, Relativity, as published in 1905, was a personal and altogether idiosyncratic insight on the part of the mathematical genius, Einstein. It had to do with technical considerations of electrodynamics based on the no less personal and idiosyncratic theories of Michael Faraday and James Clerk Maxwell. From that time until the end of the century, Relativity has remained in that original, idiosyncratic format, a preserve of physicists and mathematicians concerned with the way in which these geniuses imagined atoms interact. That was in terms of what was conceived as 'electric' and 'magnetic' forces and associated 'force fields'.

All this was couched in the language of differential equations, which is as remote from the man-in-the-street as the Latin of the priests was from the serfs of the Middle Ages. However, a differential equation is essentially a device invented by mathematicians for describing quantities assumed to be continuous, *i.e*., quantities supposed to vary in infinitesimal amounts. The use of these differential equations therefore implies a belief in these underlying continuities, whereas quantum physics affirms that on the fundamental levels of physics all quantities are discrete and discontinuous. The obligation, among professional physicists, to be conversant with differential equations ─as a 'badge of office', as it were─ therefore signifies an arbitrary and unsupported decision that there are, in nature, physical quantities which are continuous and determinate as opposed to quantised and indeterminate (*i.e., stochastic*). This dogma has inhibited our understanding of both relativity and quantum-physics to the extent that they have become commonsense by-words for obscurity. Soon, however, these theories must come into their own, within a new

paradigm of common knowledge which will be as familiar as the fact that the earth is round and that it is the sun, not the earth, that is the centre of the planetary system. The reason for this is as follows.

First, let us consider how Relativity might have been discovered by someone other than Einstein on the basis of pure commonsense logic. Informed by astronomers that distances in space are times in the ratio of units *c*, anyone might reason that a pair of observers, A and B, watching each other in their respective telescopes as they travel apart in space would each observe a corresponding slowing in the time-rate of the clocks and living-processes of the other in the manner commonly known as the Doppler effect. This slowing would be the same for each observer relatively to each other, right up till the time that one or the other of them, let's say A, stopped his outward motion and reversed its direction. From that precise moment on until the moment of their reunion, A would observe in his telescope an increase in the frequency of the events in B's time, such as the rates of his clocks, heart-beats. breathing-rates, cell-divisions and so on. Meanwhile, that reversing action of A would not be seen by B until the lapse of time incurred by the distance from there to himself. Plainly, then, the number of life-events which takes place in the one observer's time relative to the other, during this out-and-back motion, cannot be the same for both. As measured by the ticks of their respective clocks, there will be more fast ticks than slow ticks of B as seen by A, and more slow ticks of A as seen by B. In view of this obvious asymmetry in the time-rates of the two observers relatively to each other, their living times, if we think of these as synchronised prior to the motion, are no longer so either during of following that motion. The result is unavoidable. And it was this same unavoidable commonsense consequence of the fact that light takes time to travel that was established in the altogether more esoteric terms of the electrodynamicists,, Hendrik Lorentz and Albert Einstein.

Behind all the vestigial mumbo-jumbo, then, of its historical beginnings, the fact that time is relative is just plain commonsense. Given that distances and times are related in the constant ratio of units *c*, the living-times of different observers in asymmetric relative motion cannot possibly be the same. This plain logical fact makes all the usual esotery of 'electrodynamics', with its infrastructure of 'field-equations' and so on redundant. In understanding relativity, we have no more need of those complications than for the theoretical and mathematical contrivances of pre-Copernican cosmology.

Redundant also, in the same way, are our modern preoccupations with 'gravitation' in the context of General Relativity. Physicists are still rewarded for offering the most original explanations, in terms of the obligatory 'differential equations', as to how these inscrutable 'gravitational' processes are supposed to take place in the void separating bits of matter. This esotery, like that of 'electrodynamics', was created by a quirk of reasoning which began in the mind of Isaac Newton and was perpetuated by Faraday and Maxwell ─and, of course, Einstein. Newton thought that all bodies, left to themselves, with no external forces acting upon them, either remain stationary in space or else travel in straight lines. The fact that no free-moving bodies behave in that way he then explained as due to a universal and invisible 'force of gravity' accelerating bodies away from that ideal 'state of rest or of uniform motion in a straight line'. Logically, however, he could have disposed of both these assumptions in favour of the plain empirical statement that all free motion is essentially cyclic or orbital. His imagined straight-line momentum *mv* would then be an ideal special case of an *angular* momentum *mvr* with an infinite radius *r*, which is,

of course, an infinite angular momentum. All real (*i.e.* finite) angular momentum would then be orbital, with a finite radius *r*, in the way Aristotle described.

This would dispense with Newton's 'gravitational force', making his 'inertial motion' naturally cyclic or orbital. All freely moving bodies are then balanced, by the law of moments, in such a way that in the absence of external forces acting upon them, the motion of each body is correlated, or paired, with that of each and every other, in an overall-conserved or universal angular momentum relation. This is the sort of relation which has come to be known as non-local, or instantaneous, *action-at-a-distance*. In this connection, any pushes or pulls we exert on freely moving bodies in order to change their motion will both affect and be affected by the motions of all the others in accordance with Newton's third law of instantaneous and reciprocal action and reaction. This explains why our attempts to change the motions of bodies in their natural courses meets with that force of opposition that is classically called *inertia*. (As reported by Tom Phipps, Ernst Mach once stated: 'When the subway (train) jerks, it's the fixed stars that throw you down' [1]).

But, says an objector, if everything is connected in this way, how is it possible for anything to move at all? The answer is that angular momentum is quantised, so that at the ultimate microphysical level it is unsharable in amounts less than that of a fundamental quantum, of angular momentum (ℏ) (i.e. bar-h) which is Planck's action-constant *h* divided by 2π. These quanta are the paired masses into which all angular momentum analyses. (The fact that tradition has named these masses 'electrons' and 'protons' should not, in this present context, compel us to think of them as possessing any properties more esoteric than pure mass ─and, of course, angular momentum.) The reason, then, why bodies are able to move, albeit against the opposition that is called inertia, is because their ultimate parts and their interrelations with one another are discrete and unconnected. They therefore have freedom to move in the same way that in a monetary currency, within the limits set by the value of a single coin, we have the freedom to buy and spend as we please, in a way which would be impossible if the Treasury were to mint nothing but a single, multi-billion pound coin or banknote.

The magnitude and dimensions of this ultimate 'coin' of angular momentum are (ℏ) = 1.05456×10^{-34} kg m^2 s^{-1}. Because these quanta are irreducible, changes in atomic angular momentum can take place only in whole numbers (integer multiples) of these units. And since angular momentum is an overall-conserved quantity, no such change in angular momentum in one atom can take place without there being a compensatory change in another atom somewhere else. There can be no question as to *how* that interaction takes place, far less by the mediation of any kind of 'field' or 'ether'. Every such transfer has to be immediate, complete and consummate. And because it is unsharable, there is no question of that quantum (as in the imaginary form of a 'photon') being detected or even 'existing' in space between the one place and the other. Any question of what that quantum is 'doing' in the space between the emitter and absorber is therefore meaningless. Nor is there any meaningful question of mechanical causality concerning this microphysical process. Causality is essentially a macrophysical process involving statistical numbers of quantum events. The flows of these events are governed by laws such as the second law of thermodynamics (entropy), and are couched in terms of purely probabilistic functions

[1] Phipps, T.E., : 'Should Mach's principle be taken seriously?' *Speculations if Science and Technology*, Vol.1, p.499 (1978).

of the sort described by de Broglie and Schrödinger. Quite obviously, such purely statistical considerations cannot apply to single quantum events, the occurrences of which are therefore, in themselves, completely indeterminate or 'probabilistic' in the manner described by Werner Heisenberg and information theorists after Claud Shannon.

What is conveyed (if that is the word), in these instantaneous quantum transitions is not angular momentum, replete with its constituent masses, but *action* in whole units of Plank's action-constant h (= 6, 626 × 10^{-34} joule second). These quantum interactions are of the sort manifest in the light spectrum. The only difference between these light-interactions and those we call 'gravitational' is that whereas the light-interaction involves extremely high-frequency transactions between resonant atoms, the interactions we call 'gravitational' involve the comparatively low-frequency transactions between macrophysical bodies like the sun and the earth. The quantum discontinuities at the inter-atomic level are, of course, not noticeable on the macrophysical level, where everything appears to move smoothly and continuously in the manner described by Galileo and Newton.

Angular momentum also includes *spin*, which, in astronomical bodies is negligible in comparison with their orbital angular momentum. This, however, becomes significant at the level of microphysical particles. In this way, with the spin-angular momentum added, the Newtonian angular momentum equation, which is

$$L = mvr = 2K_O r/v = GmM/v \qquad (1),$$

where K_O is the orbital kinetic energy, becomes:

$$L = mvr = 2(K_O + K_X)\, r/v = (G)\, mM/v \qquad (2),$$

where K_X is some extra-orbital kinetic energy due to spin, and (G) (called 'curly gee') is a constant which is equivalent to the usual 'gravitational constant' G, for $K_X = 0$. When K_X is made equivalent in mechanical units of joules to the so-called 'electron charge' in coulombs (*i.e.*, 1.601 × 10^{-19} coulomb becomes 2.18 × 10^{-18} joule), (G) becomes G_Q, which is 1.514 × 10^{29} kg m^2 s^{-1}, and the orbit becomes that of the 'electron' around the 'proton' in the Bohr model of the hydrogen atom [2].

The so-called 'gravitational' and 'electrical' connections between bodies need not therefore be regarded as qualitatively different but as angular momentum connections of essentially the same kind with different orbital parameters.

It should by now be perfectly plain that there are no 'fields' to be considered of any 'gravitational', 'electric', 'magnetic' or any other sort. The disappearance of those 'fields' also removes any obligation of having to employ the usual differential equations in describing the interactions of particles. At the quantum level, atomic interconnections take place as in a movie, where one instantaneous interconnection,

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[2] See N,V, Pope, 'The *Complete* Physics Heresy', *Galilean Electrodynamics*, vol. 10. Special Issues 2, Fall 1999, pp 23-31. Also N.V. Pope & A.D. Osborne, 'Instantaneous Gravitational and Inertial Action-at-a-Distance, *Physics Essays*, Vol. 8 , No, 3, September pp 384-397.

called a ‘still’ or ‘frame’ follows another at some finite delayed-action rate. In the quantum ‘movie’, this space-time rate is the constant $c = s/t_R$. where s is the instantaneous distance in metres over which the interaction takes place and t_R is the time of that interaction relative to the observer ─the movie-goer, as it were. This constant observational relation c is, of course, what is measured on the macroscale as the ‘propagational velocity of light’.

From this, Einstein’s formula for relative time-dilation follows in a very simple way. For instance, the phenomenon of the relative motion of material particles is defined by three time-dimensions. One is the time t_P registered by the particle in travelling the instantaneously extended (Newtonian) distance s (the so-called *proper time* of the motion). Next is the *relative time* t_R of that same motion as measured by the observer of the motion. The third dimension is that same distance s divided by the dimensional constant c, which is another measure in seconds. The relation between these three inter-dependent time-measures is that t_R is the resultant, by Pythagoras, of the other two co-exclusive (*i.e.,* rectangular) dimensions, *viz*.:

$$t_R = \sqrt{(s/c)^2 + t_P^2} \qquad (3).$$

This is the time-dilation formula of Einstein and Lorentz as it might have been derived, under different historical circumstances, by any precept-unencumbered commonsense thinker on the basis, simply and sufficiently, of Olaus Römer’s determination of the distance-time relation c and the geometrical theorem of Pythagoras. Einstein’s more complicated formula could then be deduced by substituting for s in this equation the equivalent expression vt_R, where v is the relative or observed velocity s/t_R. Simplification then produces:

$$t_R = t_P/\sqrt{1 - v^2/c^2}) \qquad (4),$$

which is, of course, the familiar Einsteinian formula for relativistic time-dilation.

2. Quantisation or The Demise of ‘Infinitesimals’

In principle, then, the relativity of Einstein and Lorentz could have been deduced by just about anyone, without any involvement whatsoever with the ‘electrodynamical’ theories of Faraday and Maxwell. The same goes for our traditional explanations of atomic spectra. For instance, Johann Balmer, seeking a formula to rationalise the sequences of lines in the spectrum might have noticed that formula (4) was the one which suited his purpose. In that formula the relative time t_R is some number times the proper time t. Now in microphysics there is no continuum of numbers as there is in pure mathematics. If real physical quantities formed a continuum, then since the ultimate units of that continuum would be infinitesimals, the sum of those infinitesimals would always be zero, so that there could be no non-zero physical measures. In natural non-zero physical measures, then, there are no infinitesimals. In that case, multiples of some fundamental non-zero physical measure t_P, whether those multiples be whole or fractional, may be represented by a ratio of whole numbers n

and N (pace Diophantus [3]). Starting with the fraction $1/N$ of t_P, therefore, (4) becomes

$$t_R = n(t/N) = (t/N)\,(1 - v^2/c^2)^{-½} \qquad (5).$$

Let t_P in this equation now be the non-zero period $1/cR$, where cR is the frequency-coefficient of the spectrum of hydrogen (R is the well-known Rydberg number for the hydrogen spectrum). Substituting accordingly in (2) produces:

$$t_R = n/NcR = (1/NcR)\,(1 - v^2/c^2)^{-½} \qquad (6),$$

from which may be derived the following frequency equation:

$$(v^2/c^2)\,N^2cR = N^2cR(1 - 1/n^2) \qquad (7).$$

For intermediate values of n and with the frequency-term on the left of the equation signified here by f, we now have:

$$f = N^2cR[(1 - 1/n_2^2) - (1 - 1/n_1^2)] \qquad (8),$$

where n_1 is the fixed term of the series and n_2 is the running term, equal to or greater than n_1. By simplification we then obtain

$$f = N^2cR[(1/n_1^2 - 1/n_2^2)] \qquad (9),$$

which is the standard generalised formula for the frequencies of hydrogen-like atoms (ions) of atomic number N, as determined empirically by Balmer and Rydberg.

What we have here, of course, is, so far, no more than the bare principle of a whole new logical approach. To compare it for practicality, at this prototype stage, with the classically evolved body of *ad hoc* explanations of intricacies such as line-splitting and so on of the spectra of higher-order atoms, would be, as someone has said, as unfair as to compare a revolutionary new automobile engine at its design or bench-testing stage, with the reliability of the thoroughly road-tested and approved standard models. Another mistake would be to suppose that the relevance of this logical deduction is simply to reproduce Einstein's results in a novel but trivial way. The relevance is, in fact, to produce a veritable paradigm shift in relativistic thinking, with consequences for physics radically different from those of the Einsteinian theory. For instance, there is no conflict between instantaneous and delayed action-at-a-distance,

[3] Diophantus, a Greek mathematician, *circa* A.D. 270. Equations such as these, expressing relations between whole numbers are called, by mathematicians, Diophantine.

as alleged by the notorious 'EPR' controversy. As can be seen from the Pythagorean time-formula (3*), viz*:

$$t_R = \sqrt{(s/c)^2 + t_P^2} \qquad (3),$$

when the proper-time t_P of the transition of a light-quantum is zero (*i.e.*, instantaneous) the relative or observer time t_R of that same transition is the finite period s/c, as measured by Römer, Bradley, Michelson, *et al.* This fact that 'instantaneous' and 'delayed' can occur together in nature is also supported by the example, as we have seen, of the movie model.

Far from being contradictory, then, the instantaneous and the delayed-action connections between a distance-separated source and sink can be thought of without logical contradiction as components of the same action, as in the action of a movie. Moreover, the angular momentum nexus on which this synthesis is based restores to physics, in quantised form, the universal reference-frame of Galileo and Newton, which Einsteinian Relativity is alleged to have dispatched. There is also the consequence that the conceptual flipover the synthesis entails, from rectilinear to naturally orbital free motion disposes of the absurd implication, in Einsteinian General Relativity (by the so-called 'principle of equivalence'), that the earth's surface is accelerating upwards under our feet at 32 ft per sec^2. The reason why we weigh what we do on the earth's surface is not that the earth is expanding exponentially but simply that the relatively small angular momentum our bodies possess due to the earth's diurnal rotation, even at the equator, is not sufficient for us to orbit freely at that distance from the earth's centre. The resistance, therefore, which is set up by that surface against the tendency of our bodies to orbit where they should is therefore the *real* (*i.e.*, directly measurable) force we customarily call the force of gravity.

Conclusion

What, then, shall we say is the anticipated new paradigm? In the allegorical language of Figure 1, is it an 'antelope' or a 'bird'? The answer is, neither. It is a situation in which our classical and relativistic views of nature are, as it were, the full-face and profile of a single unambiguous object. This 'object' is as shown in Figure 2, below. It

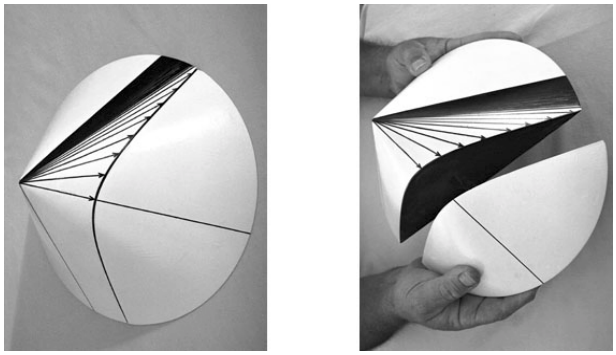

Fig. 2: A Model of the unified Classical-Relativistic graph of motion

is the full three-dimensional graph of motion obtained by plotting the three variables in the Pythagorean time-formula, each in turn against the others [.4]

The surface so obtained represents the true, three-dimensional, conical graph of motion which, in the usual depiction is taken as a flat representation of, exclusively, *either* the Newtonian speed-unlimited *or* the Einsteinian speed-limited accounts of motion ─that is, either the 'antelope' depiction, as it were, or the 'bird'. The end-elevation (or full-face) projection of that conic surface (Figure 3(a)) gives the Newtonian graph of motion, in which all velocities s/t_P tend towards the natural limit of infinity, and the adjacent, side-elevational projection (Figure 3(b)), gives, in terms of the dimensions s/c and t_R (the conic section) the Einsteinian, 'hyperbolic' graph in which those same motions are limited to the finite speed $s/t_R = c$.

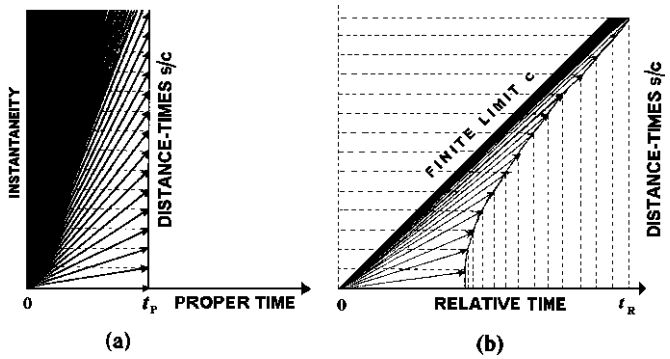

Fig. 3 The Classical and Relativistic plane-projections of the combined motion-graph

The currently ambiguous situation presented by the 'antelope' of relativistic physics and the 'bird' of classical and quantum physics is therefore, as it turns out, entirely specious. The resolution of the ambiguity ─the 'paradigm flip'─ is to see those two representations, with some simple logical adjustments to both, as no more nor less than different-dimensional aspects of the same natural situation, both being equally valid for the purposes of physics. This means that instead of wallowing where it now is, in doldrums of indecision, Modern Physics, with its charts sorted out and a breeze of commonsense logic in its sails, may soon resume its true course of natural philosophy. ■

[4] From the Pythagorean formula (3) we obtain $t_R^2 - t_P^2 = (s/c)^2$ which is the formula for an equilateral hyperbola (see 'Hyperbola', *Encyclopædia Britannica*, 1961 ed., Vol. 12, p. 20c). The relevance of the perspective view in Figure 3 is that the hyperbola may lie anywhere in the surface of the cone, depending on the radial direction of the section *s* from the apex O.