Some Fascinating Consequences of Replacing Special Relativity With a Concrete Physical Mechanism Using Maxwell's Relativistic Equations[1]

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Abstract. Maxwell's relativistic equations are evaluated in a geometrical framework composed of two observers connected by Lorentz transformations whereby one 'non-local' observer only measures time and not space intervals. In this geometry the signal maintains its wave properties and frequency until it is processed by the non-local observer. Since the local observer sends the signal along the line of sight in a one-dimensional frame of observation the geometry explains why the source can be located whereas the signal strikes randomly. These results are obtained by examining the retardation of the electric field acting at a distance as seen by the non-local observer when at a wave node. The results relate quantitatively to multi-photon absorption in terms of field gradients and rates of change of the fields and for interpreting intensities at relativistic velocities and cosmological distances. Furthermore, super-luminal velocities distinct from the actual momentum transfer are found and evaluated. It is shown that the local observer is connected to the past and the non-local one to the future.

1. Introduction

Previously, the set of equations

$$(q_0, t_0) = \left(\frac{\sqrt{1-\frac{v^2}{c^2}}}{v} \frac{m^2}{s}, 0 \right); \qquad (\overline{q}_0, \overline{t}_0) = \left(\frac{1}{v} \frac{m^2}{s}, -s \right) \tag{1}$$

$$(q_r, t_r) = \left(\frac{\sqrt{1-\frac{v^2}{c^2}}}{v} \frac{m^2}{s}, s\sqrt{1-\frac{v^2}{c^2}} \right); \qquad (\overline{q}_r, \overline{t}_r) = \left(\frac{1}{v} \frac{m^2}{s} - vs, 0 \right) \tag{2}$$

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$$\overline{\Delta q} = -vs \ , \qquad \overline{\Delta t} = \bar{t}_r - \bar{t}_0 = s \quad \Rightarrow \frac{\overline{\Delta q}}{\overline{\Delta t}} = -v \tag{3}$$

$$\Delta q = 0 \ , \qquad \Delta t = t_r - t_0 = s\sqrt{1 - \frac{v^2}{c^2}} \quad . \tag{4}$$

has been investigated, where m is the unit of length, s the geometrized unit of time and $m/s = c = 1$ [2]. This system of equations defines two observers located at the origin (un-barred) and at radius distance from the origin (barred observer). Observations in this geometry are defined by time intervals, $\Delta t = t_r - t_0$ and $\overline{\Delta t} = \overline{t_r} - \overline{t_0}$. The barred observer is capable of observations along the radial momentum axis, $\overline{q}$, and of measuring the unit of time while the observer at the origin only is aware of time and recognizes a tangential velocity v. Therefore, the un-barred observer at the origin is non-local as judged by the barred observer, which is trivial considering that the frames are perpendicular. The space-like separation of time and space coordinates yields a quantitative proof that the observers are non-local by reference to each other.

The two observers are related by Lorentz transformations like in Special Relativity (SR) distinguished from SR however by the absence of spatial measurements in one frame of observation ($\Delta q = 0$ in eq. 4). Spatial measurements are redundant or even 'unphysical' in a non-local frame of observation harboring fields and waves that have not yet been 'observed' in the sense of quantum physics. Above, observations are instead performed in the barred 'momentum frame' by way of the line increment $\overline{\Delta q}$. In the momentum frame everything is Euclidean-linear and one-dimensional whereas time distortions and Lorentz contractions known from SR are instead assigned to the un-barred frame. The term $m^2\sqrt{1 - v^2/c^2}/vs$ in eq. 1 is better known as its inverse component $v\gamma/c^3$, the tangent of the angle by which an orbiting point seems to be delayed by an observer at origo [1] as in stellar aberration, so eq. 1 encodes a rotation. The barred observer however, *via* the line increment, $\overline{\Delta q}$, encodes a boost. Therefore, it is not surprising that the two frames are obtained form each other by way of Lorentz transformations since the latter are known to be decomposable into a rotation and a boost [2]. Accordingly, the above equations are potentially useful in that many known physics phenomena can be understood as concrete rotations around a point, oscillations around a mean value or fluctuations around a vacuum zero point.

A particularly useful relation obtained from the equation system above is

$$\frac{\overline{\Delta q}}{s} = -v \Rightarrow \overline{\Delta q} = -\tilde{v}\ \tilde{s} \tag{5}$$

where local terms appear to the left and non-local ones to the right of the equal-sign. A tilde is used to emphasize the non-local character of a term. Hence eq. 5 tells that some measured quantity in the momentum frame is numerically equal to some non-local factors linked to the tangential velocity. The following frame-assignment rules hold;

$$\overline{A} = \overline{[BC]} = \widetilde{B}\ \widetilde{C} \quad , \qquad \frac{\overline{A}}{\widetilde{B}} = \widetilde{C} \tag{6}$$

such that, for example in the cases of length, l, time, t, velocity, v, momentum, p and mass, M,

$$\frac{\bar{l}}{\tilde{t}} = \tilde{v}; \qquad \overline{p} = \widetilde{M}\ \tilde{v}. \tag{7}$$

[2] using non-standard notation, s, for the purpose of distinguishing the two units

[3] $\gamma = 1/\sqrt{1 - v^2/c^2}$

From the latter, a comprehensive assignment of various physical units and constants to either the local or non-local frames can be made [3].

Eq. 5 has previously been tested in various physics contexts [5] [6]. For example, in the case of the thermal Planck distribution [5] [6], placing local factors (momentum, $h\nu$) to the left and non-local ones to the right,

$$h\nu\ exp\Big(\frac{-h\nu}{kT}\Big) = \frac{c^3}{8\pi}\ U(\nu)d\nu^{-1}\ \tau^2\ \Big(1 - exp\Big(\frac{-h\nu}{kT}\Big)\Big)\ , \tag{8}$$

with the usual well-known symbols, added τ, the oscillation period of the electromagnetic radiation, the form of eq. 5 encodes an actual physical process, the quantum transfer (of momentum) on the left side in equilibrium with the field on the right side. Furthermore, the Schrödinger equation for a free particle, at left in

$$\frac{p^2}{2M_e}\ \Psi = -i\hbar\frac{\partial}{\partial t}\Psi \quad \Rightarrow \quad \frac{\hbar}{2}\ \Big(\frac{\partial}{\partial x}\Big)^2\Psi = -iM_e\frac{\partial}{\partial t}\Psi\ , \tag{9}$$

yields the form at right where local terms (length measures) are on the left side and non-local ones (electron cloud and time) on the right side, cf. eq. 5, [5] [6] [7]. Furthermore, the imaginary term, $-i$, makes the non-local terms perpendicular to the momentum frame in agreement with the geometry of eqs. 1 - 4. Using the substitution

$$\sqrt{\hbar} = \frac{2\overline{\Delta q}}{\pi\ Ampere}\ \frac{ec}{2\alpha} \tag{10}$$

inserted into the right-hand side form of eq. 9 above,

$$(\overline{\Delta q})^2\ \Big(\frac{ec}{2\alpha}\Big)^2\ \Big(\frac{\partial}{\partial x}\Big)^2\ \Psi = i\ 2M_e\ \frac{\partial}{\partial t}\ \Psi\Big(\frac{\pi}{2}Ampere\Big)^2 s^{-2}\ . \tag{11}$$

Here the non-local right side has a circular ($\pi/2$) electric current carried by a pair of electrons surrounding on the left local side a squared magnetic charge[4] (possibly two charges of opposite sign separated so that they create the measured magnetization). In the above equation, the numerical value of $\overline{\Delta q}$ is $7.714 \times 10^{-27} m^{-1}$ which is interpreted as the apparent cosmological expansion in the current epoch of the universe's evolution (Hubble constant) so that the geometry can be given a robust implementation in cosmology and high energy physics (cf. next section). Then one can leave the quantum world and find additional examples of the validity of eq. 5 on a macroscopic scale, for example rearranging Kepler's 3:rd law added the gravitational constant (T = orbital period, r = orbital radius = an oscillating length with period T, M = mass) into

$$r = G\ M_{sun}\ \frac{T^2}{4\pi^2 r^2} \tag{12}$$

where local factors like r = radius (length) appear to the left and non-local ones to the right. Furthermore, writing Galilee's acceleration (L = length displacement at the observed velocity, a = acceleration, t = time passed, s = unit of time) as

$$L = a\ t\ s\ . \tag{13}$$

allows one to proceed even to the ultimate macroscopic system, the universe, and write

$$m = \frac{\overline{\Delta q}}{s^2}\ \Big(\frac{r_{universe}}{m}s\Big)\ s\ , \tag{14}$$

[4] The magnetic charge monopole was originally identified as a one-dimensional entity [8]

where, tentatively, $\overline{\Delta q}/ms = H_0$ (m = meter, r = radius) and the universe accelerates onto the local unit length,. As is well known, the linearity of the (apparent) Hubble expansion rate prevails over quite long distances before the measures are obscured by relativistic effects and by the long time intervals ΔT between astrophysical observation and actual event which leads to cosmological model-dependence. This is further discussed in the next section. Also the baryonicTully-Fisher law for galaxy rotation can be rearranged into a form that conforms to eq. 5 [9]

This lengthy introduction serves to demonstrate that the geometry described by eq. 1 to 4 is pertinent to physical processes, in other words that it has 'physicality'. This is important to show before proceeding into the next session where Maxwell's equations will be analyzed from the perspective of these equations with some squeaking and creaking against SR. As a good start, the Poynting vector,

$$\mathbf{S} = \mathbf{B} \times \mathbf{E} \tag{15}$$

with momentum to the left and non-local factors perpendicular to the momentum axis to the right of the equal-to sign perfectly conforms to eq. 5.

2. Results and Discussion

Maxwell's relativistic equations have been taken from the textbook [1][5] in the form applicable to plane-polarized waves,

$$B_y = \frac{1}{\sqrt{1-\beta^2}}\left(\overline{B_y} + \beta\overline{E_z}\right), \quad E_y = \frac{1}{\sqrt{1-\beta^2}}\left(\overline{E_y} - \beta\overline{B_z}\right) \tag{16}$$

$$B_z = \frac{1}{\sqrt{1-\beta^2}}\left(\overline{B_z} - \beta\overline{E_y}\right), \quad E_z = \frac{1}{\sqrt{1-\beta^2}}\left(\overline{E_z} + \beta\overline{B_y}\right) \tag{17}$$

with the usual notations for the field components the barred observer in a rest frame and the un-barred observer actually seeing the relativistic distortions that depend on the relative speed of the two observers and, as usual,

$$\beta = \frac{v}{c}, \tag{18}$$

Picking one polarization from eq. 16 and trying to rearrange aiming at obtaining the form of eq. 5

$$E_y = \frac{1}{\sqrt{1-\beta^2}}\left(\overline{E_y} - \beta\overline{B_z}\right) \Rightarrow \frac{c\,\sqrt{1-\beta^2}}{v}E_y = \frac{c}{v}\,\overline{E_y} - \overline{B_z} \Rightarrow \tag{19}$$

$$\frac{c}{v}\,\overline{E_y} = E_y\,\frac{c\,\sqrt{1-\beta^2}}{v} + \overline{B_z} \tag{20}$$

where, last in eq. 20, save $\overline{B_z}$, local terms are to the left and non-local ones to the right as in eq. 5 ($\overline{B_z}$ encodes the Lorentz force at the receiving end of the radiation). Local terms are characterized by the factor $1/v$ and non-local ones by the factor $\sqrt{1-\beta^2}/v$ conforming to eq. 1 - 2.

[5] This reference has an exhaustive description of relativistic phenomena in electromagnetism

Proceeding to identify the local and non-local magnetic components of the chosen polarization from the left side of eq. 17 one gets,

$$B_z = \frac{1}{\sqrt{1-\beta^2}}\left(\overline{B_z} - \beta\overline{E_y}\right) \Rightarrow \frac{c\,\sqrt{1-\beta^2}}{v} B_z = \frac{c}{v}\,\overline{B_z} - \overline{E_y} \Rightarrow \tag{21}$$

$$\frac{c}{v}\,\overline{B_z} = B_z\,\frac{c\,\sqrt{1-\beta^2}}{v} + \overline{E_y}, \tag{22}$$

where the last form is analogous to that of eq. 20. If it were not for the geometrical interpretation of eq. 1 - 4 and its successful implementation as outlined in the Introduction then the above would be just another wrench or twist to Maxwell's equations as has happened many times during the past 100-150 years. However, when asking the question where the physical mechanisms take place that are responsible for the observed relativistic distortions it turns out that may not be the case any longer as evaluated now from eq. 20:

In SR, relative motion of two observers leads to the notion that their measurements of light-signaling events in each others' frames of reference are connected by Lorentz transformations and consequently, that their positions are interchangeable by Lorentz transformations and thus indistinguishable. However, once a light signal has been sent from one observer to the other the emitter of the signal and the receiver are not equivalent any more since emission and absorption of radiation are distinct physical processes. In SR, the absorption of a signal by any observer moving at any arbitrary velocity relative to the emitter and its arbitrary relativistic distortion are concealed in that geometry as if the emitter knew ahead of time the receiving end's velocity. Consequently, it is impossible in SR to pinpoint a physical mechanism responsible for the relativistic distortion. This problem is resolved in the present case of eqs. 1 - 4 by the presence of well-defined and well-characterized local and non-local frames of observation. First, note that the left side of eq. 20 corresponds to the right-hand side equation 1 (the local observer, that is) while the right side of eq. 20 encodes the non-local observer (the left-hand side equations of 1 and 2). Let the emitter, $\overline{E}$, in eq. 20 represent the local frame. Its signal is transmitted at its original frequency until it reaches the absorber who is emerged in a non-local environment, $c\sqrt{1-v^2/c^2}/v$. Eq. 20 tells that E compensates for the effect of the field by the inverse factor $v/c\sqrt{1-v^2/c^2}$ (as seen in eq. 19) and by the Lorentz-force factor $\overline{B}$. In effect, these square-root 'velocity factors' cancel because the field and the receiver adapt to the originally emitted frequency causing the velocity to appear similar to gauge-fixing (as enforced by the emitted frequency, *any* velocity factor is cancelled by its inverse velocity factor, that is). This physical interpretation of the form 20 of Maxwell's equations is illustrated in Fig. 1.

One may also insert the right eq. 16 in eq. 20 and the left eq. 17 in eq. 22 to get the mathematically trivial

$$\overline{E_y} = \frac{c\sqrt{1-v^2/c^2}}{v}\left[\frac{v}{c\sqrt{1-v^2/c^2}}\;\overline{E_y}\right] - \beta\overline{B_z} + \beta\overline{B_z} \tag{23}$$

and

$$\overline{B_z} = \frac{c\sqrt{1-v^2/c^2}}{v}\left[\frac{v}{c\sqrt{1-v^2/c^2}}\;\overline{B_z}\right] - \beta\overline{E_y} + \beta\overline{E_y} \tag{24}$$

which is not necessarily trivial when searching for a physical process encoded by these equations.

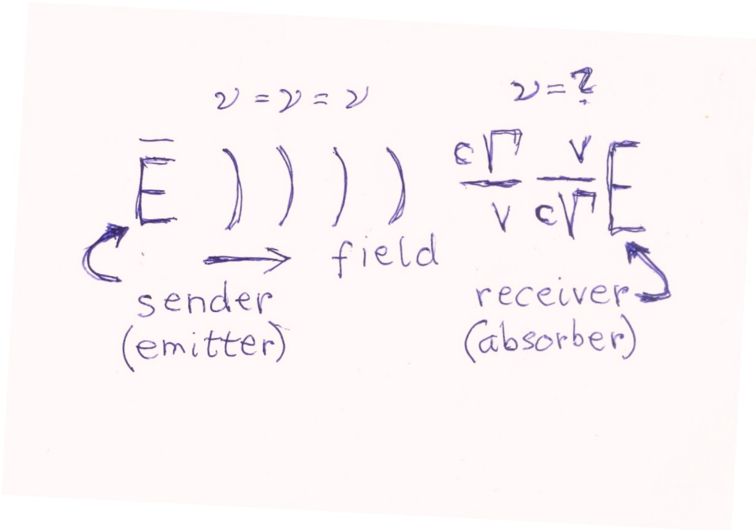

Figure 1. The local observer $\overline{E}$ in its rest frame sending an electromagnetic signal to the observer E who is moving relative to $\overline{E}$ and who is immersed in a non-local field. The observer 'E' has one 'inherent' velocity factor interpretable as the physical mechanism to be described in the text.

Note that since the original frequency is preserved until it is processed and then absorbed the un-barred observer is allowed to take it into account as illustrated in Fig. 1 and in eq. 20 (the factor $\overline{B}$, that is), which makes a difference from SR. Furthermore, the un-barred observer who defines the velocity v is allowed to compensate for it as it appears in the numerator of the right side of eq. 20. However, even though v appears in the numerator to the left in eq. 20 like in eq. 1 - 4, the barred observer (the emitter) is not allowed to measure the velocity of the receiving end to tell the velocity on absorption that takes place in the future. In conclusion, preserving the emitted frequency until it is received opens many clues to physical processes taking place during signal absorption at the receiving end.

First, turn to the justification of the factor $c\sqrt{1 - v^2/c^2}/v$ at the receiving end. Remember first that SR claims its justification from being *the* natural geometry because it is compatible with several observations. Some advantages of the present geometry over SR are that it *encodes* many physical processes as reviewed in the Introduction while still preserving the time dilatation of SR and hiding away any length contractions in the non-local frame. (The latter have been shown to be questionable [10] [11].) Several qualitative and quantitative justifications for the factor can be found. One of them deals with the phase of the emitted radiation. The magnetic field caused by a rate of change of the electric field depends on the relative velocity by the factor β whereas the electric field of eq. 20 does not have such a rate-dependence so there is a phase shift from antinode to node built into such a plane-polarized wave packet. As for the velocity factors canceling each other, phenomena such as force-counterforce, a charge balancing another charge at equilibrium, oscillations between potential and kinetic energy etc. are commonplace in physics and it shouldn't be difficult to apply this to the oscillating electric and magnetic fields here. Similar phenomena are found in other disciplines like e.g. the 'induced fit' in enzymology. The problem here is finding out which ones of the plausible physical mechanisms apply and in which order. Then one could specify exactly how eq. 1 - 4 can be used to resuscitate Maxwell's equations from having been stuck in the Faraday tensor for more than a hundred years.

A promising starting point is to maintain the velocity factor embedded in the receiver's field conception, E and keep (ignore, that is) the velocity in the numerator at the emitter $\overline{E}$ who is not supposed to be aware of any velocity, at least in the framework of SR. Such an outset is justified by the geometry of eq. 1 - 4 where the factor $1/v$ is ubiquitous. Then, since the velocity factor embedded in the absorbing matter (cf. Fig. 1) is cancelled by the velocity factor in the adjacent field one has gauge freedom to chose any velocity as a proxy for the actual velocity. This leads to the interesting case when $v = 1/\sqrt{2}$ and the velocity factor equals one. Suppose the observer is a point in space or a point in matter (for absorption of electromagnetic radiation, that means the electron cloud of an atom or molecule). Since it is known [1] that the factor $v/c\sqrt{1 - v^2/c^2}$ expresses the tangent of the angle an orbiting point seems to be delayed as seen from origo (= the observer) the case that $v = 1/\sqrt{2}$ corresponds to a phase shift of the angle $\pi/4$ between the electric field and the magnetic field. The observing point is then capable of perceiving both the electric and magnetic fields at their maximal combined strength since the electric field acts like a potential whereas the magnetic field adds most to that potential when its rate of change is highest, which is at the wave node. The wave node is the place where the curls are maximal and the orbiting point-analogy is most likely to hold. Therefore, let the observing point in space make the observation of the field component $\mathbf{E}$ that acts like a charge pulling from a distance at the moment when the point is permeated by the maximal rate of change of the magnetic field producing its greatest impact. Arguments have previously been found that the node harbors the non-local observer [4] and this agrees with the well-established notion that absorption takes place in a non-local electron cloud. Furthermore the time interval is shorter by $1 \rightarrow \sqrt{1 - v^2/c^2}$ for the non-local observer so that by choosing the velocity $1/\sqrt{1 - v^2/c^2}$ above one has actually chosen $c = 1$, the velocity of light, which is what one actually is dealing with here. This suggests that the absolute value of c is related to an optimization of the electric and magnetic field contributions at an arbitrary point in space. Since the absorbing end is non-local one expects by symmetry that the emitter is local. This is indeed the case in the present geometry where the momentum is parallel with the line of sight. Hence, *the geometry explains why a source can always be located whereas the signal strikes randomly*, a previously unsolved (perhaps not even posed) problem in physics. This perspective is, of course, lacking in SR, which excels in observer equivalence and local coordinates. From what has been described one arrives at the conclusion that the photon maintains its wave properties until the very last moment when it is absorbed and acts on the electron cloud *via* field gradients and rates of change in the fields, something which could easily accommodate multi-photon absorption (especially of lower than expected energy), which is a phenomenon difficult to explain in the one-energy-level photon-particle picture[6]. What has been said applies to eq. 20 but one could apply similar arguments to eq. 22 and then one would be talking about spins and perhaps the 'displacement current'.

These results raise the issue of how much the electric and magnetic fields contribute to the probabilities of absorption and the apparent 'intensity' of the radiation. In standard SR using a 'photon' particle density approach, the intensity transforms like the cube of the frequency [13] disregarding wave phase. On the other hand, the Poynting vector, a measure of intensity, is constructed as $\mathbf{S} = \mathbf{E} \times \mathbf{B}$ where the phase is accessible through the time delay of perceiving the electric field at the moment when the rate of change of the magnetic field is maximal (when the latter's effect on the E-field component is maximal, that is) as discussed above. This is illustrated as a function of velocity in Fig. 2. It can be seen that there is a maximum around when the field components contribute equally at $v = 1/\sqrt{2}$. If *cos* v and *sin* v represent respectively the electric field and the magnetic field, their combined contribution to the intensity levels off from

[6] By tracking actual physical processes encoded by the present geometry an alternative to the energy level-based derivation of Planck's equation has been found [12] [6] [7], which is relevant in this context

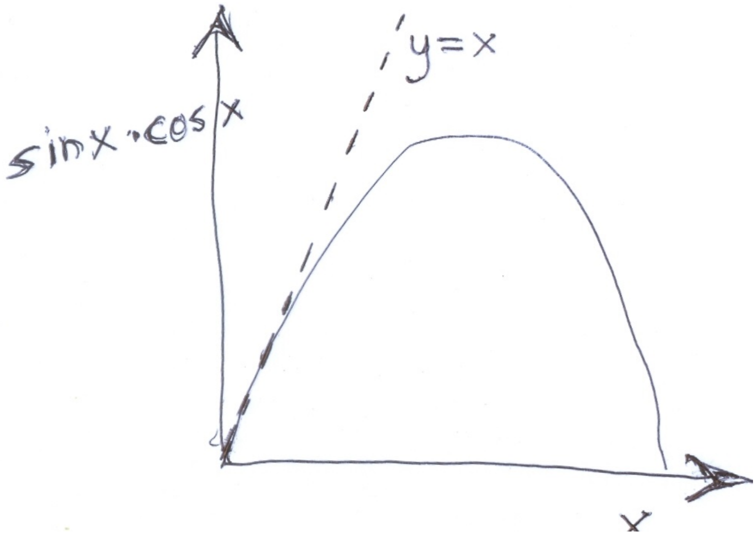

Figure 2. Schematic illustration of the function $y = sin\ x \times cos\ x$ taken as a proxy for the intensity of perceived radiation around a phase shift caused by relative velocity $v = x$ of emitter and absorber.

linearity as the relative velocity increases from zero. Any uneven contribution of the electric and magnetic field components to the intensity might be possible to investigate experimentally using particle accelerators equipped with lasers. In cosmology, the leveling off of intensity as a function of velocity (Fig. 2) might be relevant to the apparent so called 'acceleration' of the universe[7]. Like in the case of temperature [14] little is still known about the relativistic effects on the intensity of radiation, which is a difficult and ignored topic experimentally.

In eq. 1 - 4 the chop-off of a time interval of an event is different for the local and the non-local observer. Using the same instant $\bar{t} = t = 0$ on the cyclical clock the local observer anticipates the event to start at $\bar{t} = -1$ and end at $\bar{t} = 0$ whereas the non-local observer sees the even start at $t = 0$ and end at $t = \sqrt{1 - v^2/c^2}$. *This conforms with the well-established notion of forward causality in the local frame* and one would anticipate from symmetry that the non-local observer has access to the future. However, chopping off a signal in the future in a measurement process does not seem to make sense so one can try and move the non-local observer one time-interval back in time on the ticking clock represented by the oscillating time intervals in order to co-reside with the local observer. Then, suppose the now turned local E -observer anticipates the **B**-component of the wavelength at time $t = 0$ to occur simultaneously with the **E** -component that has been delayed from $t = -1$. The non-local observer, having been moved back one unit of time, will see the same wavelength component from a position in the past relative to the local observer. *Hence, either the wave is not fully accounted for (seen in the future, that is) or the non-local observer moves on a time axis towards the source of the signal.* Either way, the geometry causes the non-local observer to 'drive' any process from the past into the future , which agrees with the empirical properties of a light signal. This forward-directed time is different from the so called 'arrow of time' in the context of entropy.

This actualizes the still unresolved problem of how a signal communicates with its own wave

[7] as expounded by others it is possible to interpret a weaker than expected intensity of farther off astrophysical objects as an 'acceleration' of the universe

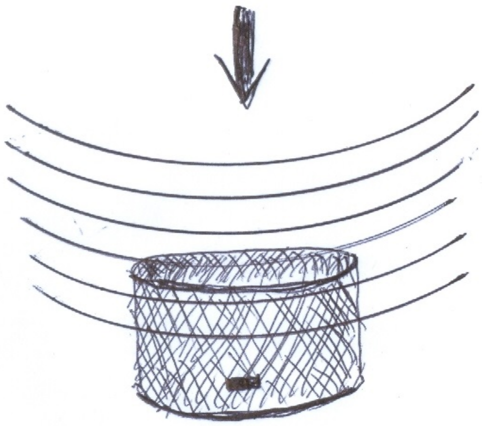

Figure 3. A 'thought experiment' arranged such as to distinguish between transverse and longitudinal super-luminal communication velocities within electromagnetic waves, as described in the text.

like in entanglement, teleportation, etc. In the present geometry one may ask if it is possible for a physical process to jump on the wave crests almost back to the source of the signal and communicate the state of its wave. It is well known that phase velocities may be super-luminal and any such back-and-forth communication would have to be super-luminal. An alternative might be that the signal communicates with its wave in the transverse direction, which is not bound in 2D-SR by the condition $v < c$. A realizable 'thought experiment' intended to clarify this problem is illustrated in Fig. 3. Here light signals originating from single, time-separated excitation-relaxation events in an atom are passed to a detector surrounded by a metal meshwork constructed to absorb transverse communication. The detector could be a light-sensitive film and the signals could have bee passed through a double-slit in order to create an interference pattern on the film and their wave properties could be made visible using prisms. Then the appearance of interference patterns on both sides of the meshwork would indicate back-and-forth communication in the wave unless a) the signal is just a stream of particles thrown randomly forward and b) Maxwell's equations is a hoax or, alternatively, particles are created and annihilated in the field all the time and thrown forward randomly except at the moment when the film (prisms) are stricken at which time the wave properties are maintained. Since one expects an interference pattern on both sides it is most appealing to think in terms of back-and-forth super-luminal communication within the wave.

In the present case, eq. 1b and 2a provide superluminal velocities,

$$\overline{q_0}/\overline{t_0} = -c^2/v \tag{25}$$

and

$$q_r/t_r = c^2/v, \tag{26}$$

respectively. These velocities are not associated with the observed event, $\overline{\Delta q}$, but rather with the coordinates themselves in eq. 1b and 2a. Like in the case of the time interval mentioned above *the signs indicate that the local observer has access to information from the past and the* *non-local one to the future.* Thus, any signal received from the past can, in principle, be reflected from present time as defined by the time interval here, into the future. This holds especially at the cosmological level where there is an ongoing flow of signals passing the local observer, for example the cosmic microwave background radiation (CMBR).

The cosmological arena affords an opportunity to evaluate these super-luminal velocities numerically, switching now for the purpose of theory corroboration from plain electromagnetism to cosmology. The velocity c^2/v can be evaluated for the value $v = H_0$, the apparent cosmological expansion in the current epoch, yielding the result that the local observer has instant access to the universe's relativistic horizon located at the radial distance of $1/H_0 = 13.7$ billion years. Two different approaches provide the numerical evidence: One is to look for (and find! [7]) evidence of the presence of the heavy bosons in resonance oscillations involving H_0, assuming that such resonance stabilizes local baryonic nuclear matter. This, of course, relies on the Standard Model in cosmology stating that such heavy bosons only existed at the beginning of time, at the cosmological horizon of the time-axis of 4D-space-time, that is. The other numerical approach [15] [7] employs that the density of the CMBR (emanating from the edge of the universe even in Standard Cosmology) is just about half of the energy of the electron [8] while other arguments indicate that there is half a proton per cubic meter in this model of the universe. Hence, the density of the CMBR corresponds to about half a primordial atom per cubic meter. Finding numerical evidence of the presence of a primordial atom originating at the edge of the universe, fetched from the past into local present time and released into the future during the interval of observation defined in eq. 3 and 4 with the help of eq. 25 and 26 is not surprising. Even SR, because of its time dilatation, yields the result that as the apparent cosmological expansion rate increases towards the relativistic horizon of the universe one ultimately reaches a point where nothing has happened yet (seen from here) and that is exactly where on expects to find the primordial atom. The latter use of SR does not invoke the cosmological closure dilemma or the dark matter - dark energy failures of Standard Cosmology for which the present geometry offers an alternative in terms of 'heavy fields' defined by analogy with the non-local fields of thermal radiation [9]. This excursion into the distant corners of the universe just served to gather more evidence of instant communication on the axis of observation added that expected in electromagnetism from the experiment in Fig. 3 so that it now is possible to proceed to the implications of the results.

Clearly, if SR prevents a correct interpretation of 'multi-photon absorption' and look-back intensity distortions from the universe's past then it is obsolete. However, that does not mean that SR should be regarded as the phlogiston theory of the past 100 years. As science evolves, only the most palatable theoretical building blocks are preserved. SR evolved from the length contractions that solved the mystery of the constancy of the speed of light while the present theory keeps the useful time dilatations of SR. The concept of energy arose from phlogiston, the substance thought to be released wherever one now instead interprets some form of energy. Actually, the ambiguous phlogiston substance is still alive in general relativity (GR), which builds on accounting for all various forms of energy as one thing only.

[8] $\rho_{CMBR} = 3.44 \times 10^{-58} m^{-2}, \quad M_e/m^3 = 6.764 \times 10^{-58} m^{-2}$

References

[1] R. Becker F. Sauter (1959, 1963) Theorie der Elektrizität. Erster Band B. G. Teubner Verlagsgesellschaft, Stuttgart

[2] S. Baskal, Y. S. Kim, M. E. Noz (2017) Photons in the quantum world arXiv:1711.09210v1 [quant-ph] www.arXiv.org

[3] E. Cerven (2006) Exploring the physicality of physical units in a one-dimensional universe. Proceedings of scienceandresearchdevelopmentinstitute.com ,Paper No. 8 and a separate updated (as ongoing) Table available at the same location at http://www.scienceandresearchdevelopmentinstitute.com/cosmoa.html Please note that the author's own work in this reference list still mostly is unedited with some known errors remaining.

[4] E. Cerven (2011) Two worlds in one - new physics on old pillars. Proceedings of scienceandresearchdevelopmentinstitute.com, Paper No. 16 http://www.scienceandresearchdevelopmentinstitute.com/cosmoa.html

[5] E. Cerven (2018) the literature has not been accepted - A critical account of the foundations of contemporary cosmology and an alternative quantitative model of the universe, galaxies, the solar system, the atom and signal transmission. Proceedings of scienceandresearchdevelopmentinstitute.com, Paper No. 22 http://www.scienceandresearchdevelopmentinstitute.com/cosmoa.html

[6] E. Cerven (2019) Physics in one dimension with perpendicular non-locality. Paper No 25

[7] E. Cerven (2016) Characteristics of a one-dimensional universe spanned between a local and a non-local observer. Proceedings of scienceandresearchdevelopmentinstitute.com Paper No. 21 http://www.scienceandresearchdevelopmentinstitute.com/cosmoa.html (also at www.vixra.org)

[8] P. A. P. Dirac(1948) The theory of magnetic poles Phys. Rev. 74(7) 817-830

[9] E. Cerven (2018) How the Planck distribution could once again turn a page in physics by addressing instant communication and the dark matter enigma as a 'Hubble field' of vacuum energy. Proceedings of scienceandresearchdevelopmentinstitute.com Paper No. 23, http://www.scienceandresearchdevelopmentinstitute.com/cosmoa.html

[10] J. Terrell (1959) Invisibility of the Lorentz contraction. Phys. Rev. 116(4) 1041-1045

[11] R. Penrose (1958) The apparent shape of a relativistically moving sphere Proc. Cambridge Phil. Soc. 55(1) 137-139

[12] E. Cerven (2008) Rethinking thermal radiation by using its mathematical form in gene kinetics, cognitive psychology, and economics. Proceedings of www.scienceandresearchdevelopmentinstitute.com, Paper No. 10 http://www.scienceandresearchdevelopmentinstitute.com/cosmoa.html

[13] M. H. Johnson and E. Teller (1982) Intensity changes in the Doppler effect. Proc. Natl. Acad. Sci. USA 79, 1340

[14] C. Farias, V. A. Pinto and P. S. Moya (2017) What is the temperature of a moving body? Nature 17657 1-9, DOI:10.1038/s41598-017-17526-4

[15] E. A. Cerven (2015) Geometry and particle number of the Bohr-Dirac universe. Proceedings of scienceandresearchdevelopmentinstitute.com Paper No. 15, http://www.scienceandresearchdevelopmentinstitute.com/cosmoa.html