The Irresistibly Interesting World of Equal Number Proton - Neutron Resonance Cavities. *

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Abstract

The consequences of enforcing a physics world picture constituted by a local observer of linear momentum interacting with a perpendicular non-local observer are investigated. It is shown, i.a., that 1) some features of relativity theory can be replaced by concrete physical processes taking place at the electromagnetic wave - matter interface, 2) deBroglie matterwaves can be interpreted as rotations of the type seen in superfluid helium-4 and their dependence on atomic weight of the constituent element can be explained, whereby 3) the stationary atom in the ground state is surrounded by a matterwave arising in the charge shadow of its orbiting electron, stabilized by frequency resonance in the range of soft X-rays, further discussed in terms of a possible bench-top 'Tokamak'-replacement 4) signal absorption can be followed in detail by reference to the orbiting electron whereby the wave persists until absorption is complete, and 5) based on the concept of non-locality the universe is modeled as an inverted black hole with its center spread out on the cosmological horizon, which solves the cosmological 'closure' problem and 6) the 'dark matter' halos of galaxies are interpreted as Stokes curl boundaries of baryonic matter waves.

1 Introduction

In the previous papers in this series it was shown that disentangling Maxwell's equations from the Faraday tensor discloses a local emitter and a non-local absorber of the signal. Furthermore the absorption could be followed as a wave until it has taken place whereby momentum is transferred from the wave to the matter in the form of a $\pi/2$ phase shift of its electrical field and 'relativistic effects' are explained by wave-matter interactions taking place during absorption. The velocity of light being constant, $c = 1$, is merely a necessity in order to avoid phase mismatch in the wave so that faster than light velocities naturally are accommodated in a non-local frame which also carries the kinetic energy of the wave hidden in the everywhere canceling Stokes curl at the wave nodes. In the present paper these ideas will be carried further, focussing on the velocity of light itself shown here

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to have been unjustly marginalized to merely a reference (like the number 1 or zero in multiplication and addition respectively) in RT but having a fundamental physical importance revealed by hinging on the fact that it does not at all obey the velocity transformation 'laws' of RT.[1]

2 Results

According to [1] a moving material particle is associated with a wave of wavelength[2]

$$\Lambda_{dB} = \frac{2\pi\ \hbar}{m_e\ v_e}\sqrt{1-\frac{{v_e}^2}{c^2}} \rightarrow \tau = \frac{1}{\nu} = \frac{2\pi}{m_e}\ \frac{\hbar}{{v_e}^2}\sqrt{1-\frac{{v_e}^2}{c^2}} \rightarrow \frac{h}{\Lambda^2} = \frac{m_e}{\tau} \tag{1}$$

where the indices 'e' denote the particular case of the electron. The equation to the left was first derived by equating the known energy of an electromagnetic wave packet, $h\nu$, with the relativistically distorted mass of the electron seen by an observer at rest. For non-relativistic ($v \ll c$) and relativistic ($v < c$) velocities respectively it yields

$$\Lambda_{dB} = \frac{2\pi\ \hbar}{m_e\ v_e}\ \ and\ \ p_e = m_e\ v_e = \frac{h\nu}{c} = E/c \tag{2}$$

and the electron itself, in its rest frame, has a self-oscillation [1]

$$\nu_0 = \frac{m_e\ c^2}{h}. \tag{3}$$

In RT the existence of a rest frame where $v = 0$ would imply by eq. 1 (left) an infinite wavelength whereas the electron is known to have point-like extension when measured in the laboratory frame based on its static charge. This contradiction raises the question if really *all* velocities are governed by RT. For example, based on the concept of a rest frame as defined in RT it is possible to define some velocity, not by reference to another frame of observation, but by reference to the object's own co-moving rest frame. Sufficient conditions for this is that this rest frame harbors a physical process that 1) has a internal clock and 2) has a certain extension in one direction which can be measured or is known. Then one can move this spatial extension end-to-end in a looper-like fashion defining a unit advancement per unit time (a velocity) in the object's own co-moving rest frame. The problem is how the physical process verifies that one unit advancement has taken place. Whether one tries to solve this by punting the object forward or adding labels to it that are rotated in order to verify-visualize the unit displacement one ends up in a Gordian Knot of relativistic effects. However, a fundamental procedural difference between Quantum Physics and Relativity Theory immediately comes to rescue. Namely, in RT one meticulously measures everything and ties everything to coordinates whereas in QPh one waits in superpositions until the very last moment to perform a measurement. The lesson learned is that it is not necessary to perform measurements to verify the unit displacement in this case since one is dealing with a step-wise occurring quantum process and the 'Gordian Cut' presents itself: *It is sufficient that an object or a physical process has a certain extension, an internal clock, and a velocity defined by moving its extension end-to-end in its own rest frame in order to define a velocity that escapes the frame referral rule of RT.* Searching the mathematics archives for ways to refute this statement is wasted time since it is widely known that light -electromagnetic radiation

[1] RT= relativity theory, QPh = Quantum Physics

[2] Λ_{dB} = deBroglie matter wavelength; m = mass; v = velocity; $\hbar$ = the 'reduced' Planck constant, $h/2\pi$; c = velocity of light; p = momentum; ν = frequency; τ = period of the wave's oscillation, E = energy

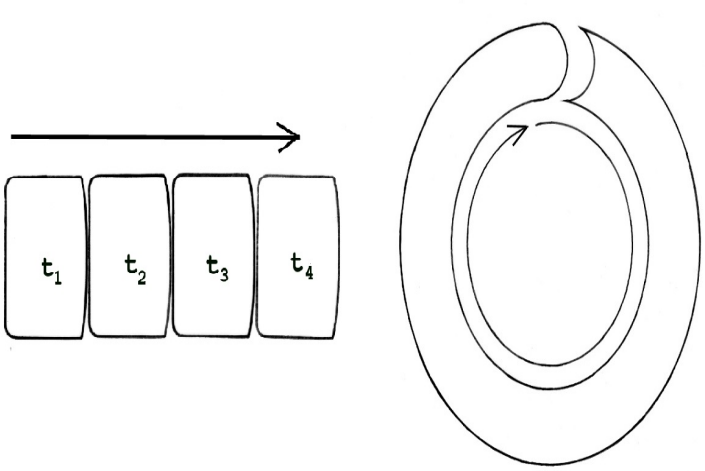

Figure 1: Illustrations of how a velocity can be defined by moving a spatial extension at regular time intervals in some rest frame where the corresponding physical process takes place. To the left a 'block' representing a physical process is moved linearly rightwards, to the right the physical process with some spatial extension in its rest frame is rotated periodically onto itself. As a result, 'absolute' velocities are defined solely by reference to the physical object's own rest frame.

provides an example of such a velocity. In the case of light the unit extension is its wavelength, its internal clock is its frequency-period and the velocity defined is c, which always escapes the velocity transformation rules of RT. Then it is easy to imagine, for example, that the wave nature of light manifested in its interference patterns in the laboratory frame at v=0 corresponds to the waves' electric field amplitudes (detectable with polarization filters) in a frame which may be considered at rest but is moving at $v = c$ relative to the laboratory frame. One need not bother about relativistic frequency distortions either since these may arise when the undistorted wave interacts with the absorbing matter [2]. The description just made agrees well with illustrations of electromagnetic wave packets found in any textbook. The construction of a velocity without relying on a separate reference frame as discussed above is illustrated in the general case in Fig. 1, refuting the RT-dogma that 'all velocities arise because of relative motion' . In the example just given the velocity instead arises because of a not yet measured end-to-end extension of a spatial length in which a physical process takes place combined with the period of time this extension takes. This is very different from the dull 'natural geometry' of RT since it spurs to finding out more about these physical processes.

The problem with light in RT is that it is allotted the yoke of being just a reference, like 'zero' in addition or the number '1' in multiplication. Relieving it of this burden leads to the discovery a rich variety of physical processes that it mediates [2] [3] [4] (cf. 'Introduction' above). RT also invents dogmas on behalf of light such as its purported lack of rest frame mentioned above and having an absolute limited value which can not be exceeded (even though many examples to the contrary are now known). Also the non-locality of superpositions (their famous 'spookiness') invoking superluminal velocities seems to be contrary to the foundations of RT and its statement that there is no velocity greater than that of light. However if there are laws in Nature then any geometry will reflect them in one way or another and here RT resorts to the so called 'wormholes' of GR to solve the non-locality problem. A simpler approach, robustly supported by empirical observations, is to assign

the non-localities to the Stokes curl at the nodes of the electromagnetic radiation's wavefront [4] . The Stokes curl cancels everywhere in the wavefront, resulting in a dark (=invisible) 'node' which redistributes the radiation's (kinetic) energy non-locally in the 2-dimensional wavefront so that its intensity empirically decreases with distance, r, as $1/r^2$. Hence, time-travels in wormholes are not required in order to understand intuitively the physics of non-locality but the latter was not a hot topic when RT became fashionable and the Stokes curl taking place in the nodes was neglected. The subject of non-locality of superpositions and superluminal phase velocities can be followed in the academic literature gradually recovering somewhat from its pre-1950's purge of anything non-relativistic. As a matter of fact, the constancy of c may be taken as strong evidence of non-locality since it is at the center of the Lorentz transformations that allow the world to be seen from anywhere (making c a non-local point of reference, that allow the Lorentz transformation to move about just like 0 in addition and 1 in multiplication, without affecting the physical process *per se*, just its measures). Another questionable dogma of RT is the purported absence of any kind of preferred frame of observation, such a frame would be unique in comparison with other reference frames having arbitrary velocities and the existence of any such unique frame is explicitly rejected in RT. This is not true, as will be shown below.

Now, having found one velocity that unequivocally escapes relativity, that of light, the question arises, are there more? What makes light's velocity a unique template in the search for additional ones is that it has 1) an internal clock, namely the wave's period, τ, and 2) a precise extension in the momentum direction, namely its wavelength and 3) by repetitively applying these measures it defines a velocity, c. No matter what the inveterate relativist says it 4) has a rest frame that the observer sees moving at speed $v = c$ where these processes repetitively take place exhibiting the undulating antinodes of the electric and magnetic fields extending in the forward direction like in any textbook representation of electromagnetic radiation, and verifiable by polarization filters. So the 'conjecture' is: *There exists a class of fundamental velocities that are linked to certain physical processes and that can be defined uniquely by reference to a rest frame where these processes take place.* Of course, various relativistic perspectives may be overlaid onto these fundamental velocities but the characteristic physical process involved nevertheless has *some* particular and irreplaceable rest frame which is not just any arbitrary frame chosen among whatever RT has to offer but a rest frame with a *Charter*.

First, take a closer look at eqs. 1 and 2, which were derived by equating the energy of a wave packet emitted in a Bohr transition, $h\nu$, with the equivalent relativistic mass of a hypothetical 'light particle' and then generalizing first to the electron and then to any massive particle. Putting $v = \alpha c$ into these equations yields a value for the wavelength which is equal to one round in the electron's orbit around the proton in the ground state of the hydrogen atom. This velocity, αc, is a fraction of c, to which RT does not apply as argued above by which argument αc too is a fundamental velocity escaping the rules of RT. Also in this case is it possible to define the velocity in the rest frame of a physical process (Fig. 1) namely by reference to the length of the electron's orbit, λ, and its orbit period, τ, rediscovering that the orbiting electron 'is in phase with itself ' [1]. Furthermore, like in the case of light, the same velocity can be defined in the observer's rest frame, which is where the stationary atom is sitting, a rest frame with a 'Charter', in disregard of any 'relativistic' to-and-fro velocities of the measuring physics laboratory. These two examples of velocities defined by reference to the moving frame itself, alternatively an 'absolute' rest frame with a physical significance of its own, are illustrated schematically in Fig. 1: Linear or rotational extension of the spatial measuring rod can be imagined, in the drawing by moving a 'block' but effectuated in practice as exemplified above by the impossibility of a sustained phase mismatch in a wave as it progresses.

Hence, from its causality-prison in RT where light serves as just a reference, by these simple arguments it has risen to the role as a fundament of some of the most important physics in Nature, signal transmission and the atom: The sequel is that wherever c occurs as a co-factor fundamental processes supported by velocities that are defined in the proper rest frame of these same processes (and not by relativistic frame referral) may be waiting to be panned clean from RT. One more such example, though at best 'hypothetical' from the viewpoint of Standard Cosmology, is the cosmological expansion rate:

The cosmological expansion rate (the Hubble rate) has dimension rate per unit length. It has a very prominent linear component such that its value per unit length may be added repetitively until one reaches a relativistic cosmological horizon where its numerical value reaches c. This line of extension has as its endpoints one observer so far away that, because of time dilatation at increasing velocities, nothing seems (from here) to have happened there yet and another observer at present time (us, that is) who certifies that (regrettably?) almost everything has already happened. And, one observer claims to be local, at the center of all the universe's gravity whereas from his perspective, the other observer is non-local (moving perpendicularly to the axis of observation at velocity c), smeared out over the entire surface of the cosmological horizon[3], echoing the structure of the atom with its heavy nucleus surrounded by the non-local electron cloud. In line with this analogy it is possible to derive a numerical value of the Hubble rate from the primordial Bohr atom in its ground state, $7.714 \times 10^{-27}\ m^{-1}$ [5] [6] [3]. This numerical value, which corresponds to 71.36 km/second/Mparsec, agrees very well with most astrophysical observations of the local universe [7], Hence, in the context of the present paper, where fractions of c are examined, one gets

$$\sum_{1}^{r_u} \overline{\Delta q} = 1m/s \tag{4}$$

(s = geometrized second, non-standard notation) with the radius of the universe, r_u, stretching to its relativistic horizon where the non-locality is maximal $0 - 360^o$ (1-D case) $\rightarrow 4\pi$ (2-D case) at $1.296 \times 10^{26}\ m$ and its age being 13.7 billion years. This cosmological model is much simpler than the Standard Model of Cosmology. The only hypothesis needed is, by reference to the deBroglie wave concept [1], that the Universe is everywhere in phase with itself and is everywhere the same thing. In contrast, the Standard Model comprises many speculations intended to puff up (rescue) RT. Notably, it yields lower values for the very remote expansion rate (whereby it is difficult for the non-expert to assess where the values are becoming model-dependent instead of based on pure observations). However, if there are laws in Nature then any geometry will reflect them in one way or another so the Standard Model is worthy of a chance also from our layman perspective: Namely, in astrophysics one has now the well established concept of 'spagettification'. What about 'popcornification' or 'omelet collapse' to describe what might happen when the gravitational forces left behind during cosmological 'inflation' catch up with the speed of light and join the observable geometrical gravitation? Such effects might contribute to the apparent nonlinar radius-dependence of the Hubble rate (in terms of standard cosmology, that is), however difficult such far away observations may be[4] The Standard Big Bang Model of cosmology has further headwind to expect, for example confronting the evidence of super-large dynamical structures in which entire galaxy clusters appear small like specks of dust driven forward uniformly in a cork-screw-like manner [8] and it cannot explain by its stochastic processes of star and galaxy formation why galaxies obey rules relating to their rotational

[3]to be explained in Section 4

[4]This terminology is intended to hint at a 'God's Kitchen' to go with the so called 'God particle' and the purported God's Creation, the 'Bang', not to mention the various holly 'natural geometries'.

velocity and baryonic mass [9]. (Actually, having cork-screw -like properties can be anticipated from the herein promoted geometry, cf. [6], as discussed below in this paper). As shown in Section 4 the biggest problem with contemporary cosmology is the stunning impact of the palpable world on the human intellect which treats 95% of the universe as a 'remainder' in the extension of various 'natural geometries' in physics, calling it 'Dark Matter', alt. 'Dark Energy'.

Besides the examples above, where light's velocity is a factor, rotational velocities in general like in the second example above can be interpreted to be angular velocities moving a phase and phase velocities, known to escape causality bounds in RT, are generally set to avoid any phase mismatch whatsoever in the long run. By reference to Fig. 1 (right side) the requirement of a phase match on rotation leads to a measure of the spatial displacement while the orbit period provides a time measure. These measures allow the definition of a velocity without relying on a separate reference frame in a relativistic sense. Furthermore, rotational velocities always have a privileged frame of observation, namely the one where the sequential velocity contributions from all directions cancel, refuting once again the RT dogma that there are no privileged frames of observation. This was exemplified above by the important case of the hydrogen atom in its ground state but additional interesting examples can be found, for instance the flux vortices observed in liquid helium-4 below some critical temperature [10] that sustain a circulation velocity of[5]

$$\kappa = h/m_{He-4} \approx 10^{-7} m^2/sec \tag{5}$$

where h is Planck's constant and m_{He-4} is the mass of the helium atom in question and [11] $v = \kappa/2\pi R$ is the particle's true velocity (R=radius from the origin of the vortex) [12] [13]. Such rotations were predicted by theory and have been confirmed by microscopy to take place [13]. Like in the case of matter-waves their velocity depends on their elemental constituent, the atom (its mass) and not on any multiatomic condensate. This raises the question how the tiny individual atom gives rise to multi-atomic and macroscopic processes in these cases[6] and why it chooses sinusoidal forms of displacement as described by a rotation. To find the answer to these questions consider again Eq. 1 using that $\lambda_e \nu = v_e$ proceed and write it in the form

$$m_e v_e = \frac{h\nu}{c} \frac{c\sqrt{1 - {v_e}^2/c^2}}{v_e} \tag{6}$$

where ν is the frequency of the undulating wave of electron(s) corresponding to its deBroglie wavelength λ and the middle factors, $h\nu/c$, contain a momentum, E/c $(= p)$. Above, the momentum (-transfer), $\overline{m_e v_e}$, is a physical process taking place in the local frame (barred factors) and is written on the left side, cf. [6]. Then, proceed to identify the non-local physical process(es) hidden in the right side of these equations by using the frame assignment of physical units, cf. [3][7]. This is not trivial since neither h nor ν are physical processes and velocities are also ambiguous, which is known from RT. The denominator of the factor containing the square root is dimension-less so one can write by indicating frame assignments in brackets whereby $[\hbar] = -\ -$:

[5] *sec* is the SI unit of time herein, s is reserved for geometrized time.

[6] The same problem exists in cosmology-astronomy in that large scale rotations of galaxies depend on baryonic mass which keeps the much heavier so called 'dark matter' at bay and inert [9]

[7] In the present theory all physical units can be assigned to either the local frame or the non-local one as indicated by a bar and a tilde respectively over the symbol with certain rules regarding their conversions (here, $- = \sim\ \sim$ is used). With the help of the frame assignment true physical processes involving the local and non-local frames can be identified.

$$\overline{m_e v_e} = \frac{2\pi\hbar\nu}{c}\left[\frac{--}{\tilde{}\ \{-/\tilde{}}\right]\ \frac{c\sqrt{1-{v_e}^2/c^2}}{v_e}. \tag{7}$$

and simplify the dimensions using the prescribed rules, cf. [3] Then both sides have dimensions $^{-}$ and in the present geometry the non-local frame is perpendicular to the local one so its dimension is written $^{-}\rightarrow\ ^{\sim}\ ^{\sim}$, which can be interpreted as a cross product between two perpendicular non-local vectors (like the electric and magnetic fields of a wave). In the present geometry [3] [6] the local momentum frame is characterized by a displacement, $\overline{\Delta x}/\Delta t$ which is equal to the perpendicular velocity in the non-local frame, v. Hence, the non-local frame inherently produces momentum in the local frame by way of a non-local rotation (similarly to the case of the 'Poynting vector'). The factor containing the square root, inverted from $v_e/c\sqrt{1-{v_e}^2/c^2} = tan\ \alpha = sin\ \alpha/cos\ \alpha$ contains a velocity-dependent scaling factor for the interplay between the local and the non-local frames, which can be written

$$m_e\ v_e\ sin\ \alpha = h\nu\ cos\ \alpha: \tag{8}$$

The interacting local and non-local frames are perpendicular to each other but when the non-local frame (or its relevant physical process) rotates it sees only the *sin* α contribution of the local frame (left side) and the local momentum frame sees only the *cos* α contribution from the non-local frame or its relevant physical process (right side). This extraordinarily simple and 'physical' re-interpretation of matter waves takes the magic out of relativity theory in that *it assigns the 'relativistic effect' to a plane perpendicular to the local frame, in other words the wave-matter interface.* The nature of the substance undergoing rotations in the non-local frame is not known since not very much is known about matter anyway, just that it can be weighed, causes gravity and turns up evidence of being composed of various particles when bombarded with other particles at high velocities. The properties of this rotating matter in the context of the present theory will be further explored in Section 4. Meanwhile, an unequivocal interpretation of Eq. 8 can be found when applied to electromagnetic radiation as described in Fig. 2. In the present geometry [3] [6] the transverse rotations in the non-local frame inherently push the local frame forward (like in the case of signal propagation etc.).This provides a 'natural' geometry to the observational evidence of spiraling motion of galaxy clusters [8] as opposed to 'Big Bang' stochastic general relativistic cosmology. Furthermore, the present geometry inherently explains the matter waves as an interplay between the momentum frame and the non-local frame since any component of transverse rotation implies some forward component as well (like in a spreading wave-front). The mystique of the wave-particle duality is gone since the wave relies on momentum for spreading and momentum relies on the wave for appearing due to the interplay of the local and the non-local frames. Therefore, particle and wave are the same thing. This geometry also inherently explains why helium superfluids are seen empirically to convey rotations cf. [10] [11] [12] [13]. These rotations are directly or indirectly visible (local), it is true, but they occur at an interface towards genuine superfluidity which many regard as equivalent of a vacuum, cf. [14] [15]. In the present geometry the rotations seen in a microscope are evidence that the superfluid state is non-local in which case the well documented absence of drag viscosity characteristic of a superfluid seems natural (the latter would be equivalent of the 'healing' of a laser beam passing an obstacle, save the rotating material substance has not been characterized). The geometry also naturally explains by the above described projections onto *perpendicular* axes the classical all-or-none momentum transfer from an electromagnetic wave (easily accommodating the recently discovered photonic quantum -breaking attosecond absorption as well). Easily inferred from Fig. 2B it is the electron that is at play, first rotating in order to correct any phase mismatch, then undergoing a boost when it absorbs the electric

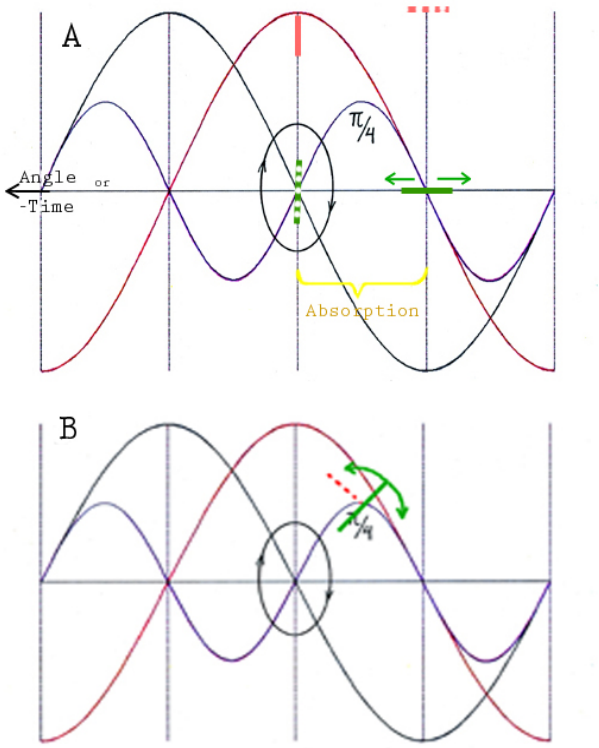

Figure 2: Schematic illustration of the appearance of the local and non-local frames in an electromagnetic wave (A) and the observer in the wave at the angle $\pi/4$ when the wave's velocity is c (B). A: The kinetic contribution to the wave of non-local Stokes curl, invisible at the nodes of the radiation, is illustrated by the red sinusoidal curve while the classical electric field (with potential energy) is shown in dark green phase-shifted by $\pi/2$ from the red curve. The blue sinusoidal curve represents their product, the kinetic times the potential energy of the wave. This curve is phase-shifted by $\pi/4$ from the other two curves, an angle corresponding to where the deBroglie matter wave described by Eq. 1 turns into the momentum of light, Eq 2. The colored transverse and longitudinal bars in the drawing represent events in respectively the non-local and the local frames. *Solid* bars contribute to the absorption whereas *dashed* bars do not. Hence, the wave is caught from the non-local wave front by the absorbing matter and processed *via* $\pi/4$ until it is absorbed at maximum field strength. The electric field will then plausibly be capable of continuing its rotation to produce forward momentum (by charge-pulling the heavy atomic nucleus). In (B) is illustrated how a local observer in its rest frame may compensate phase mis-matches caused by the emitter's receding or approaching velocities (these contribute unequally to the transverse and the longitudinal components of the electromagnetic wave) by changing its angle relative to the wave front as the latter progresses leftwards in the drawing. A rotation clockwise in the drawing stretches the pitch in the direction of the incoming radiation while a rotation counter-clockwise contracts it. However, by reference to the original orientation (the actual absorbing object, that is) the x-axis is contracted in both cases so the unit circle is squeezed onto the non-local y-axis (harboring time) which means the local observer may see a time dilatation in both cases. Using similar logics like in Eq. 8; $\overline{\Delta t}(v/c) = (v/c)\widetilde{\Delta\tau}/\sqrt{1-v^2/c^2} \rightarrow c\Delta\tau\, sin\alpha = \overline{v\Delta t}\, cos\alpha \rightarrow \widetilde{x_c}\, sin\,\alpha = \overline{x}\, cos\,\alpha$: (time, a mirage, is measured using space intervals anyway, like the hands of a clock, interference fringes, particle momentum etc.). The non-local observer (perpendicular in the drawing, y-axis) sees the projection of a velocity onto the momentum axis (naturally enough, being non-local) while a local observer (x-axis) sees the projection of the signal phase onto the perpendicular y-axis. In (A) this takes place in the interval $0 \rightarrow \pi/2$. The plausibility of these concrete wave-matter interface mechanisms replacing RT space-time geometry is corroborated by the *identical* half wave period of the (ionizing) Lyman series and electron orbit period in hydrogen in its ground state, $0.152 \times 10^{-15} sec$, as discussed in [4].

field. Rotations and translations with embedded physics are served on a plate in the present geometry whereas it took many decades to find them in the merely mathematical context of relativity theory.

The above takes care of the waves and the rotations. Then turn to the single-atomic matter generating them in order to find some plausible explanation how atoms may give rise to large scale structure. For this purpose it is important to evaluate the radius of the proton. In modern spotlight physics [16] [17] [18] [20] it is mostly the proton's charge radius neatly probed by its interaction with a negatively charged particle that is intended. Such investigations yield about 0.88 femtometer. Another approach, based on nuclear particle dynamics [21] yields estimations of its mass radius at 0.67fm. However, it is also possible to estimate its radius by extrapolating to $A = 1$ from neutron scattering off nuclei of various sizes [22] [23]. Such investigations yield a linear dependence of radii on mass numbers, A, as $R = 1.37\ A^{1/3} \times 10^{-15}\ m$, a value that arguably can be estimated to be somewhat higher [3]. Nuclear radii can also be estimated from α-particle decay of unstable nuclei using expressions of radius-dependent thresholds for their release [24], $R = 1.48\ A^{1/3} \times 10^{-15}\ m$. which implies a proton radius of $1.48 \times 10^{-15} m$. It seems that the proton does not merely have clean-cut electric and magnetic radii and mass radii and scattering radii that depend on the choice of probe-particle but also functional radii that depend on the process taking place when the radius is measured. The latter values above happen to be close to the proton radius, r_p, favoured in the previous papers in this series, e.g. [3], based on pure geometrical beauty[8],

$$\frac{a_0}{\pi\ 1m} = \frac{\pi\overline{\Delta q}}{r_p}; \tag{9}$$

where a_0 is the Bohr radius, $1m$ is the unit length, $\overline{\Delta q}$ is the local spatial line increment (Hubble's constant, that is, and $r_p = 1.439 \times 10^{-15}\ m$ which will continue to be used in the present paper. Then, the mass number (A) -radius (R) dependence can be calculated (Table I, column 1 and 4).

Although the nature of 'matter' is not known it is clear that it may express itself as substance (particles, astrophysical objects etc.) or bulk (gravity, matter waves etc.). Both manifestations are contained in Eq. 1. The mystery is how the tiny atoms dictate the large scale structure, in the case of room temperature - matter waves even ignoring thermodynamic random motion. In order to find out what happens in Eq. 1 a general principle of self-organization often observed in Nature called 'elementary reductionism' is applied. This principle [27] [28] states that when smaller units containing dynamically interacting sub-elements are joined into larger units the sub-elements spread over the larger structure while maintaining their characteristic manner of dynamical interaction. In the case of atoms it is of course the quarks (and gluons) that are of interest in such a case. It has been shown previously (and herein re-documented in Fig. 3) that an electromagnetic wave is capable of stabilizing the charge contribution of quark dynamics of a particle composed of one proton, one neutron, and one pion [6]. At the most elementary level this stoichiometry defines a hydrogen atom (recalling its possible proton-neutron interchangeability), a deuterium atom and a He-4 atom. In order to find a plausible mechanism of self-organization it is sufficient to focus on these simple cases. As documented in Fig. 3 one expects some kind of resonance between the electromagnetic wave and the matter.

[8]The present geometry yields inverse lengths (in Eq. 9 interpreted here as the atom's Bohr radius and the radius of the atomic nucleus, which interact respectively with electromagnetic radiation (having velocity 1m/s) and, herein, cf. e.g. [4], the apparent expansion rate, $\Delta q/s$. This means that the radii are counted per contribution of a process taking place on their circumferences (the factor π, that is, cf. [25]), so the beauty persists.)

A	Eq. 3 ν	Eq. 3 λ	Radius (r)	$2\pi r$	Velocity	λ (deBr)	ν (c)
1	2.27×10^{23}	1.32×10^{-15}	1.439×10^{-15}	9.04×10^{-15}	59.5 m/sec	6.7×10^{-9}	0.45×10^{17}
2	4.54×10^{23}	6.6×10^{-16}	1.813×10^{-15}	11.4×10^{-15}	75.0 m/sec	2.6×10^{-9}	1.14×10^{17}
3			2.075×10^{-15}	13.0×10^{-15}			
4	9.07×10^{23}	3.30×10^{-16}	2.284×10^{-15}	14.4×10^{-15}	189 m/sec	5.2×10^{-10}	5.77×10^{17}
5			2.460×10^{-15}	15.5×10^{-15}			
6			2.614×10^{-15}	16.4×10^{-15}			
7			2.752×10^{-15}	17.3×10^{-15}			
8			2.878×10^{-15}	18.1×10^{-15}			

Table I. Some calculated measures of interest while searching for resonance phenomena involving matter and electromagnetic radiation: Using results from Fig. 3 the tabulation focuses on measures of atoms that have an equal number of protons and neutrons. The atom's mass number is given in Column 1, its nuclear radius using Eq. 9 and the relation $r = 1.439 \times A^{1/3}$ in Column 4, its nuclear circumference in Column 5, its possible deBroglie frequency of self oscillation using Eq. 3 in Column 2 and the corresponding wavelength of possible self oscillation -resonant electromagnetic radiation in Column 3. In Columns 6-8 is examined the possibility that the orbiting electron, by projecting its charge on the nuclear circumference, brings about resonance of the type anticipated from Fig. 3. These calculations are based on the classical Bohr orbits of hydrogen-like atoms, for example as described in [26]. The atomic radius is inversely proportional to charge, the velocity of the orbiting electron proportional to it (p. 74 in [26]). The radius of the ground state Bohr orbit is 5.3×10^{-11} m (its circumference is 3.3×10^{-10} m) whereas the known radius of the helium atom is around 3.3×10^{-11} m (mostly due to its additional charge number, $Z = 2$). Hence, in helium the velocity of the projection of the orbiting electron's charge on the nucleus will be only 62% of the value shown above but its anticipated effect on the nuclear surface will be 2.6 times as great as in the Bohr atom due to the proton and the electron being closer (,their charge attraction $\propto r^{-2}$).

The endeavor to find this resonance is documented in Table I. First, the possible applicability of Eq. 3 is examined making the assumption that the proton too like the electron has a self oscillation. Its self-frequency is first calculated (Column 2) and then the wavelength of electromagnetic radiation possibly at resonance is calculated (Column 3). This gives the noteworthy result (first lines in Column 3 and 4) that the electromagnetic radiation at resonance may be wrapped up on or close to the proton's circumference by the effect of the latter's deBroglie self-oscillation just like the electron's matter wave precisely covers the circumference of the Bohr atom in its ground state. This result was anticipated from Fig. 3 herein in [4]. It is more interesting, however, to examine the consequences of the looked-for process on the atomic nucleus' surface being entrained (enslaved) to the orbiting electron[9]. This is a reasonable assumption since the electric attraction between electron and proton in the atom is known to be significant. The results of these calculations are shown to the right in Table I. First, in Column 5, are tabulated the calculated circumferences of the nuclei that might precisely embed a deBroglie wavelength (Column 7) in each case like the Bohr orbit embeds the matter wave of the electron. Then, in Column 6, the charge shadow velocity of the looked-for process given by Eq. 1 is calculated and finally the frequency of the radiation at resonance using $\lambda\nu = c$ (Column 8). This radiation falls in the soft X-ray regime. The most noteworthy result, however, is that in He-4 the presumed matter wave of the nuclear mass falls at or somewhat exterior to the electron

[9]The intended meaning of this is that as the electron orbits it casts a shadow of charge onto the surface of the atomic nucleus; the shadow's velocity can be calculated from the quotient of the radii.

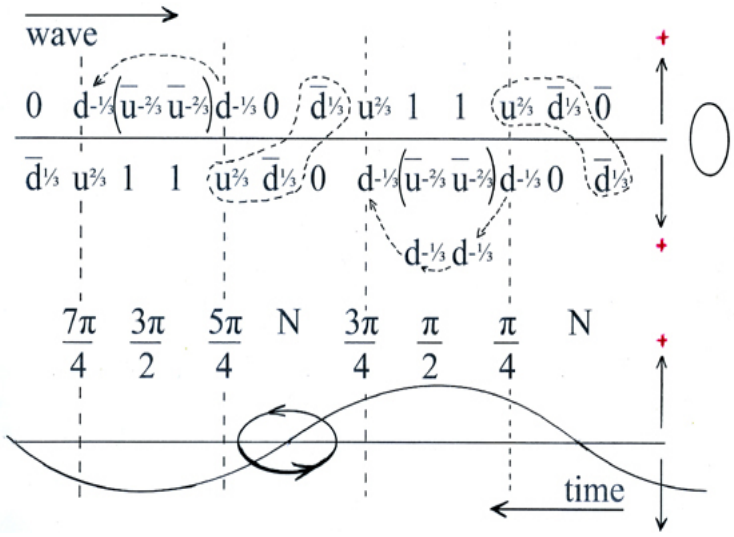

Figure 3: From [4] illustrating how a proton, a neutron and a pion may be stabilized by quark dynamics (top) in the presence of the electric field of an electromagnetic wave (bottom). This drawing has been commented on in [4].

cloud of the Bohr atom in its ground state (keeping in mind that the helium atom is somewhat smaller and its *two*-electron ground state not accounted for). Nevermind the approximations, the result is what could be expected. It means that rotating superfluid He-4 (the most notoriously prone to superfluid element known) can be explained in terms of a deBroglie matter wave. Implicitly, one has identified the process by which atoms generate large scale structure in matter waves: They set a circular matter wave just outside of the atomic electron cloud offering adjacent identical atoms a handle to form the large scale structure by hiding the matter in some kind of Stokes curl. Gone is the mysterious wave-particle duality, originally a polite concession to the elusive photon nowadays turned awkward by the discovery of attosecond absorption.... And, since the orbits of valence electrons generally have similar radii as that of the ground state - Bohr atom this mechanism may be general too. Noteworthy, however, (Table I) that a larger mass than that of He-4 may shrink the radius of the elemental matter wave to within the valence electron cloud and what happens in the case that larger molecules turn into matter waves remains to be elaborated. At some point it may be rewarding to consider the possibility that the atomic nuclear matter is chopped into units of 2 protons and 2 neutrons, cf. [24]. Furthermore, the precise soft X-ray frequency at resonance with the matter wave (roughly estimated in Table I) must be established in order to find some way to entice the nuclear matter out of its shell and aim at a bench-top Tokamak following the original recipe in [29].

The just presented results extend the consequences of the velocity of light escaping relativity transformations as discussed on top of this paper since not only is it joined in this by the orbiting electron (by way of its fundamental velocity αc) but the looked-for process on the surface on the nucleus, being entrained to the orbiting electron, also escapes these relativity transformations. As a consequence one has a robust rest frame in the particulate matter, which consolidates regarding 'relativistic effects' as processes correcting phase mismatches at the electromagnetic wave -matter interface (cf. Fig. 2).

3 The Physics of Relativity in Society[10]

Although it has been shown that RT indeed embodies dubious mathematical features [30] [31] it is its non-physicality, most of all its lack of notion of non-locality in space-time, that counts. As shown in this paper also the fundamental notions of relativity (of velocities) and lack of preferred rest frame can be challenged.

How is it possible that such an un-physical construct like relativity theory could have been dubbed *the* natural geometry of the world in the academic scientific literature? Perhaps the answer has nothing to do with science. - Psychology and even politics may provide a better framework in which to find it.

In order to find the answer, a cross-disciplinary study starting in the 17:th century will provide a good perspective: The 17:th century brought the idea of systematizing living creatures into the 'Plant Kingdom', and the 'Animal Kingdom', where each individual is more or less related to other individuals, like in the branches of a common household family. This idea then got 200 years to peacefully mature but it contained a hidden time bomb - biological evolution. Against the background of 200 years of consensus, first saying the word 'evolution' in the mid 19:th century and proposing that species evolve (changing like generations in common household families, and are not created) was perhaps nothing but a Sunday stroll seen from the perspective of the preceding 200 years. It is rather obvious that merely the concept of 'evolution' could not have merited the attention this idea got in the 19:th century. It must rather have been the attempted explanation of evolution, namely the so called 'survival of the fittest by natural selection' that was met with resonance in the society at that time. This idea contained a seed of supremacy likely to have been well received by some contemporary political ideologists and besides, seemingly justifying the geopolitical dominance by the world's (Terra, that is) political management at that time. So there should have been ample motivation to pull 'The Origin of the Species' into the spotlight since doing so would serve political purposes.

The problem is that explaining evolution by the idea of 'the survival of the fittest' as originally formulated has not stood the test of time. Anyone can now challenge this idea just by referring to daily news. For example deadly epidemics with species preferences now appear likely drivers of evolution. In the case of the current major pandemic, genetic evidence of species specificity (relating to 'archaic' genes and/or geographic location) has already been found. Whether or not national differences in pandemic outcome may also be ascribed to tiny genetic differences or to healthcare efficiency remains to be studied. The ecological niche itself with its dynamics of co-existing constituent species now appears more important than its individuals against the background of entire ecological niches undergoing metamorphosis (like in the case of the plastics on the ocean floors). Any catastrophic event that disturbs the equilibrium in an ecological niche (like deforestation) is certain to have a stronger impact on evolution than the slow mutual adaptation of the species.

Also the idea that the individuals forward their inherent advantageous traits by reproduction can now be challenged. For example, In molecular biology the discovery that some portions of the DNA have resemblance to viral sequences raises the question how they arrived there. If reverse transcriptases are involved then the idea of 'natural selection' turns dubious. And, furthermore, plain genetic instability embedded in the genome may change it anytime. With so many still unexplored possibilities how biological evolution really takes place, the original idea of the 'survival of the fittest by

[10] Alt. Headline: How to Make Sure Not to be Quoted, Ver. 1.0

natural selection' is forced to redefine its relevance. Of course there are many documented examples in support of the original idea (caution is advised however since, like in the case of RT, a flawed theory motivated these academic studies) but there are also some truly perplexing problems still to be solved within its theoretical framework, for example how did flying butterflies evolve out of a puppy spun by a a caterpillar adapted to a life on and in ground?

In fact, the mutual adaptation of the species to each other may play the role of stabilizing the ecological niche rather than the other way around. The same applies to the emergence of sex-specific traits within the animal kingdom, for example ant and bee queens *versus* the worker-individuals supplying for them and various fearsome 'alpha-male' -mammals. Such differentiation is not likely to affect very much how the species interact with a changing environment, on the contrary, they may stabilize some specific role that the species plays in its ecological niche by stabilizing the social structure of its individuals.

From here, refreshed by having pushed a century-old academic dogma into a corner in the paragraphs above just by using common sense and media news broadcasts, return to RT: One has to go back to the 1920:ies from where its contemporary apparent invincibility reverberates. Remember one of its architects purportedly having been asked if it is true that only 3 people in the world understand RT and answering: 'Who is the third?'. This short dialogue in a nutshell exposes RT; too complicated to understand; easier to focus on its people.....so started a century of trying to understand the Lorentz transformation, which could explain mathematically why the velocity of light appears the same from any corner of the world. Soon however, the miracle of the technical success of RT was confronted with the real world since it was struck at its heart, the constancy of c, by the non-locality of the signal. By that time, in the 1920:ies, it had become so popular and believed in that it was necessary to once again talk about a miracle; an academic discussion about non-locality that continues to this day. Meanwhile, since any theory will describe the laws of Nature in one way or another RT came to engulf many interesting discoveries in physics that lost their gist by being generalized, the ultimate generalization is of course that $1 = 1$ or $X = X$ which would apply to any physics. The discovery of $E = mc^2$ mentioned above is one example which, in its original setting [29] is conceptually related to black hole radiation, matter-wave particle duality, cosmology, etc., possible even Tokamak frustrations. The mathematical 'geometrization' of units to arrive at a so called 'natural geometry' also leads to loss of valuable information about the world, for example, space and time do not behave in the same manner in the real world. In RT, the distinction between space and time is not upheld and they are made 'too complicated to understand'. Many additional examples can probably be given, it suffices here to mention the rearrangement of the Faraday tensor [2] [4] which led to this paper being written.

4 Conclusions

This paper describes quantitatively how the atom, the most fundamental element of the universe, builds an abstract framework, a robust absolute local rest frame, where it can prosper without having to worry about the distortions of the surrounding world. That it does by catching on to the velocity of light, entraining both its electrons and nuclear matter to that velocity, thus escaping relativistic effects since c is a constant for any local observer. What the surrounding world regards as relativistic space-time geometry it, the atom, manages by adjusting signal phase mismatches at the signal-matter

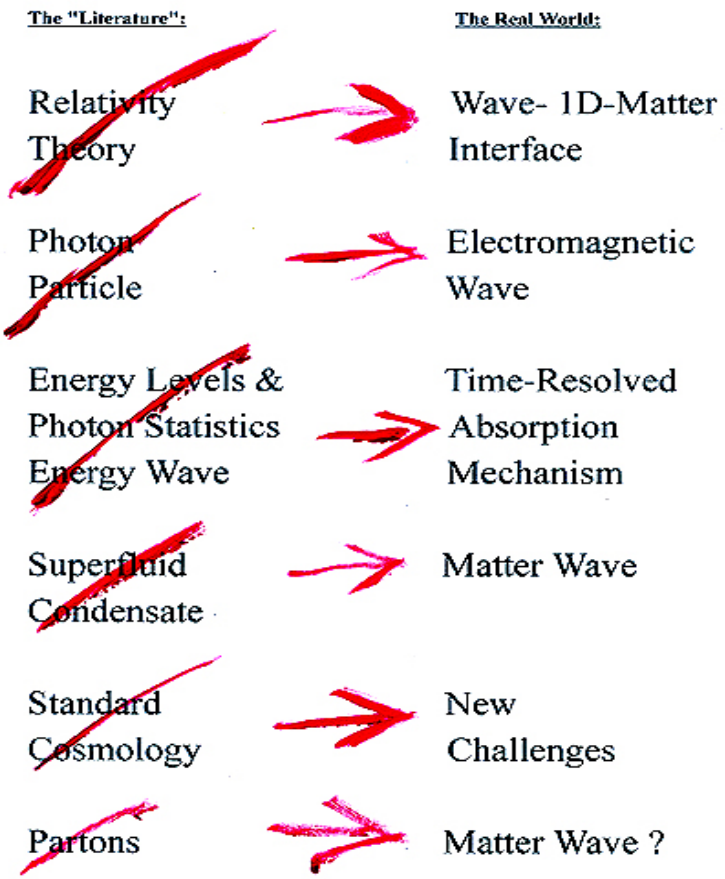

Figure 4: A list of descriptions in physics that may be complemented by the one presented herein (commented on in the main text).

interface knowing that it, the atom, is local on the momentum axis whereas the rest of the world communicating *via* the signal, is non-local - perpendicular to momentum. It transfers its mass to its surface using the concept of matterwaves so that it may sense mechanical momentum and dictate the shape of the non-local large scale structure that it is capable of creating.

More generally, the atom and its matter-EM-wave interface, by providing a constructive alternative to the 'relativity theory' of published scientific literature, doubles down on occasionally found 'RT-bashing' (like in the present paper), not in the narrow sense of RT only but, as illustrated in Fig. 4, in a very wide sense with far-reaching implications for the correct interpretation various phenomena in physics. First of all, as laid out in detail in the present paper and previously [4], it favors signal absorption from a sustained electromagnetic wave at the expense of the photon particle concept (see also [4]). By doing so it invites investigations into exactly how and when this happens (cf. Fig. 2); it is known, for example, that the electron has some internal structure or that it may even be two particles, something which is likely to be of significance during absorption and emission. In anticipation of detailed knowledge about how this takes place the miracles of energy levels and photon statistics become obsolete. Even though the Bohr energy level concept and Hylleras-Schrödinger equations are technically important neither of them can explain exactly when and how the electron performs its work of managing the incoming (or outgoing) radiation. Further down the list in Fig. 4, the proposed

geometry of a one-dimensional local and a non-local dimension offers a common ground for interpreting matter waves and helium-superfluidity since the latter has been shown to involve rotations and transverse rotations at velocity $v = \overline{\Delta x}/s$ in the non-local frame are a key feature of the proposed geometry (cf. [6] [32] [33]). The deBroglie matter waves can be interpreted in terms of the geometry as clarified in the results section herein. This leads to the conjecture that matter waves and helium superfluidity are two manifestations of the same thing. However, the most spectacular consequences of applying the geometry is expected in theoretical cosmology - our 'world picture'.

Just like the proposed geometry provides a constructive alternative to RT in that it replaces the mystique of the latter with concrete wave-matter interface interactions it can be applied to cosmology and leads to a fundamentally different picture of the surrounding universe compared to Standard Cosmology. Recall first what Standard Cosmology is: In the beginning there was the 'Big Bang', all the energy of the universe concentrated in one point. Then, a fraction thereof (while sweeping the antimatter under the carpet), in a being baked-raisincookie like fashion[11], rushed apart with superluminal velocity, (carried by the pure general-relativistic geometry, that is, in order to save the universe from the embarrassing heresy of violating $v_{max} = c$) and still is, limitlessly to infinity, even accelerating against its own gravity in the process. -Doesn't fit with observations even within GR's own theoretical framework so'd better invent some new particles (dark energy & dark matter) or the century-long compiled *'Literature'* is wrong. What is this? It is, in a nutshell, a century of advances in physics being used for defending the mechanistic world picture of the dawn of science and being used for mending relativity theory.

Instead of holding on to obsolete 'stone age' perceptions of the world - the universe why not admit that there has been a hidden elephant in physics for some time and its name is no less than 'non-locality'. The Stokes curl is an easy way to convince oneself that there is such a thing. Anyone can draw those circular arrows on paper and see that the arrows cancel at their boundaries. Anyone can infer from this that the circular curls arising around the rapidly changing electric and magnetic fields of an electromagnetic wave must be the reason why the nodes of the radiation appear invisible while the radiation spreads in the wavefront diminishing in intensity as $\propto r^{-2}$. So the non-locality exists in the real world, not just on paper. And, with respect to a line of momentum, another, perpendicular line is invisible, non-local from the perspective of an observer watching in the direction of the line. So an observer on the *cos x* -axis of a unit circle will not be able to see its *sin x* -axis. Then proceed and define locality as anything that can be reached and made palpable on the momentum axis in any chosen direction. Is the rest of the universe non-local then? Yes, because even though the stars and galaxies in the night sky appear fixed, their current location is not known and the further away they are the more uncertain their present location is. So by choosing one point on the circumference of the unit circle as its local home (momentum axis, that is), the observer automatically concludes that the rest of the world is non-local. The non-locality increases by degrees as one traces the circumference of the circle from the point of locality to an angle $\pi/2$ at which latter point the non-locality is so prominent that it distributes itself all the way back to the local observer: The observer mirrors itself in the edge of the universe, always putting itself at the center like watching one's own mirror image in a glass ball. Now it's time to contemplate applying some advanced physics.

Consider therefore again the simple geometry in [6] [32] [33]. It can be illustrated with an even simpler drawing, Fig. 5: The linear momentum observer lands up outside of the circle, however not knowing that the confronted circle may have convex (possibly concave?) curvature. This fits well

[11] remember 'Gods Kitchen' ?

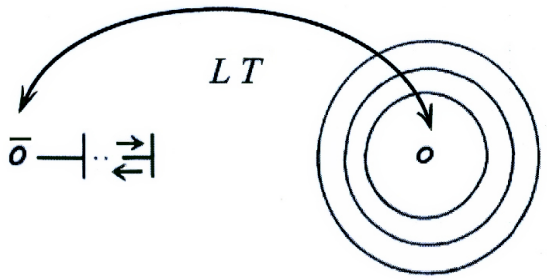

Figure 5: Schematic illustration of the geometry described in the present text. The local observer sensing the line increment - momentum is to the left and the non-local observer to the right. 'LT' = Lorentz transformation

with the wavefront of a signal and has gained some additional credibility by the finding herein that the matter wave of the stationary atom reaches out external to the electron cloud. The geometry only allows observer coordinates at the origin and at the circumference [6] so the local observer is allowed to record events at the origin. By reference to Standard Cosmology this implies that the local observer is allowed to be sustained by particle dynamics taking place at the center of mass at the origin of (local) time. This is a special case of the setting in the preceding paragraph where non-locality at the edge of the universe became spread out and mirrored from a perpendicular axis onto the momentum axis. In other words, the non-local observer has nowhere to go to distribute its non-locality except to the local observer. Can this really be so at a more concrete level than by equations on paper? In order to become convinced that it can consider the matter waves that are generated by Eq. 1 herein in the context of the very remote high redshift galaxies in the universe. These were (apparently) receding at considerable velocities already several billion years ago so where are they now and what has happened to their ever increasing momentum? The answer is that as their matter wavefront (presumably generated by atoms or ions) spreads in the transverse direction they become more non-local as seen by a Terrestrial observer and so does their mass. Ultimately their non-local mass reaches the edge of the universe where it spreads out over the entire horizon of the universe. - The horizon becomes heavy enough to form the center of a massive black hole towards which everything accelerates, and that takes care of the 'Closure Problem' in Standard Cosmology: The universe is an inverted black hole supported by non-locality - the hidden elephant in contemporary physics, and the question about its space-time extension beyond its radius looses any sense. Furthermore, the surface of the black hole harbors the local observer, who is being scattered in 4D-space-time. Surely, the stars and galaxies appear local along the signal direction, but that is just the mass-less signal, and beneath the surface of all gravitating matter in the universe, there is rotation going on, like the orbiting electron, the orbiting nuclear mass (Fig. 3), solar systems, galaxies etc. So the universe as seen by a local Terrestrial observer is once again comparable to an atom, in this case from the viewpoint of an electron 'watching' the atomic nucleus rotating fast enough that it spreads out on its Bohr radius wherever it senses. This model of the universe appears to leave few

technicalities to desire like for example 'non-linearly added coordinates of a traveler'.

Another interesting problem is whether or not or how much a matter wave senses and contributes to gravity. Since elementary particles reaching the Earth at high velocities are time-dilated they would be, in terms of the present theory, accompanied by a ghost matter wave from where the 'relativistic' distortions may take place. The same would apply to any particles in the universe, for example all baryons in galaxies surrounded by 'dark matter' halos cf. **??**. If atoms are surrounded by matter waves like discussed in connection with Table I, then such halos might be interpretable as the baryonic Stokes curl reaching a boundary.

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