Non-Locality, Copernicus' Principle, the Density of CMBR, and a Quantitative Relation between the Hubble Rate, the Planck Length and Ground State Dynamics. *

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Abstract

The theory of the Bohr-Dirac universe spanned between a one-dimensional momentum observer and a space-like separated non-local observer is expanded: 1) The non-locality in this geometrical construct is given by $Y = r^2$. 2) The Copernican principle is proved quantitatively from the uncertainty of location of an electron within a giant Rydberg atom stretching to the relativistic horizon of the universe. 3) A form of the Schroedinger equation compatible with the geometrical construct allows $\hbar$ to be eliminated leading to a better understanding of the physics involved: A curled non-local electrical current is associated with the possibility of a fluctuation of magnetic charge at origo, a process driven by the vacuum instability of the apparent cosmological expansion. The geometry also yields a mathematical form equivalent in many respects to electrostatic and gravitational force. Therefore, the results are discussed in terms of disc-shaped astrophysical objects equipped with an axial bi-directional thrust.

1 Introduction

The geometry of space and time is the fundament of the universe and the source of a correct understanding of cosmological problems. It is the purpose of this paper to show that classical cosmology may have started from an erroneous conception about what are the essential components of space and time. Classical physics was built on the 3 space dimensions of a Cartesian coordinate system. Here, the important thing is the right angle, which allows the construction of the 3-dimensional world and its extension into Hilbert space. However, this geometry is inert since the right angle is not a characteristic feature of any known physical process. From 3-space, people went on to find out that the results of measurements of space and time coordinates are significantly altered by to and fro velocities in the direction of observation. SR[1] and GR add stretching, contracting and bending to

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[1] SR = special relativity, GR = general relativity

the Cartesian coordinate system which allows measurements under extreme conditions, but neither of these operations anticipate any ubiquitous physical processes. The Cartesian coordinate system with added SR and GR remains inert in this sense. Actually, even the pre-relativistic concept of a time axis is counterintuitive to the fact that all observations are made at present time only. Intermingling a time axis with the spatial axis along which measurements of coordinates take place (like in SR) does not improve this situation. From the point of view of all known physical processes a time axis is just as inert as the spatial axes are. However, by assigning all observations to the instant of observation the concept of time becomes more viable since it turns into a realistic framework for measurements and observations, which are examples of actual physical processes.

The notion that the observer performing a measurement is part of the observed system came from quantum mechanics. Measurements are, of course interpreted in the widest sense as being done by experimentalists, or by atoms for example. In quantum mechanics the notion of non-locality is introduced in the form of a probability measure that a particle is located somewhere in its rest frame. SR and GR lack any notion of non-locality even though it is easily realized by looking backward in time that classical non-locality also exists since astrophysical objects are not located now where they were when signaling their presence by sending out light rays several millions of years ago. Furthermore their current location is not determined by their previous motion but rather certain to be uncertain because of the unpredictability of motion of even three bodies subject to mutual gravitational interaction. All these things were known at the time when SR and GR emerged. Gradually, this forgotten classical non-locality is likely to turn into quantum non-locality closer to the cosmological horizon. A probability measure with $\Sigma p = 1$ like in quantum mechanics is not the only way to apprehend and define non-locality. A more absolute kind of non-locality that appeals to the intellect emerges by reducing the number of dimensions accessible to the observer. For example, if the observer is confined to 2 spatial dimensions only, anything that happens in the 3:rd dimension is undefinable and hence non-local from the point of view of this observer. The mathematical operation of group contraction yields from 3 dimensions 2 dimensions at very long radii suggesting that the existence of 3 dimensions is merely a local phenomenon [1] [2]. These are warning signs for physics built on a fixed number of dimensions, like in the classical case, 3, or 3+1. As soon as the number of dimensions is altered, non-locality comes into play intuitively, and the non-locality of any material observer in the universe must be ascertained quantitatively or, otherwise, the universe might be anisotropic. It turns out, therefore, that the notion of non-locality, totally ignored in SR and GR and still poorly understood in the mathematics of quantum entanglement must be part of any space-time geometry embedding real physical processes.

Hence, along these lines of thought additional spatial dimensions inaccessible to the Terrestrial observer might harbor non-local processes. The usual way of dealing with extra dimensions is to compactify them to extremely small size, but this is not the approach taken here. Instead the classical 3 dimensions are reduced to a single one, a momentum axis along which resultant vectors of any direction align at the moment of interaction between observer and the world and the same applies to axial vectors resulting from components of curl. In the quantum world such resultant vectors are often replaced by probabilities that a pure quantum transfer takes place. This one-dimensional geometry lifts to the foreground the quantal interaction *per se*, a real physical process free of the geometrical clothing of classical physics. Furthermore, it inherently creates for the quantum observer a non-local dimension from the remaining 2 spatial dimensions known to the Terrestrial observer. In the quantitative realization of this (next section) it turns out that the extra 2 dimensions are not only perpendicular to the momentum axis but also space-like separated, which reinforces the notion that they are non-local.

The ultimate locality in contemporary physics is, of course, the Big Bang, having the entire universe emerging from one point in space, which leads to the prevailing raisin cake world picture. The raisin cake world literally expands with each and every observer descending from the center of the universe and remaining at its center while any other observer makes the same judgement because of the principle (read: opinion) that the universe is isotropic and its large scale appears the same to any observer irrespective of location. The problem of the radial extension of the universe is not solved in the raisin cake picture and neither is it known whether or not it expands forever, collapses, or its components are torn apart in the future. Since it is held together by gravity acting against the thrust of the big bang, the recent discovery that its constituents seem to accelerate apart casts doubts on the correctness of current understanding of gravitational laws. These and other impasses ([3]) justify that alternative models are evaluated.

During the past 20 years an alternative world picture has emerged based on a different geometry that solves many of the problems associated with the conventional 3-dimensional world picture. Here, the physically inert 90 degree rigging of n-dimensional space is replaced by a viable line increment along the axis of observation, leaving irrelevant geometrical components in ignorance. Instead of relying on the physics of the extreme (like in SR and GR), this new world picture relies on the easily verifiable physics of well-known objects like the hydrogen atom and the Hubble expansion rate. This new way of interpreting the physics of the universe will be expanded and some of its merits compared to the classical approach will be explained in the next section.

2 Background

The space-time geometry most relevant to physical processes in the present model of the universe is given by[2]

$$(q_0, t_0) = \Big(\frac{\sqrt{1-v^2/c^2}}{v}\frac{m^2}{s},\ 0\Big);\quad (\overline{q_0}, \overline{t_0}) = \Big(\frac{1}{v}\frac{m^2}{s},\ -s\Big) \tag{1}$$

$$(q_r, t_r) = \Big(\frac{\sqrt{1-v^2/c^2}}{v}\frac{m^2}{s},\ s\sqrt{1-\frac{v^2}{c^2}}\Big);\quad (\overline{q_r}, \overline{t_r}) = \Big(\frac{1}{v}\frac{m^2}{s} - vs,\ 0\Big)\ . \tag{2}$$

which is, mathematically, a Lorentz-transformation of the inverse of the x_1 component of the four-velocity at two discrete time coordinates, -1 and 0 in the barred frame of observation whereby s denotes the geometrized unit of time and m the unit of length. Line increments and time intervals are given by

$$\overline{\Delta q} = -vs, \qquad \overline{\Delta t} = \overline{t_r} - \overline{t_0} = 1 \tag{3}$$

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

The right angle n-dimensional space embedding physical processes in most classical descriptions is not present here. Instead, the line increment, $\overline{\Delta q}$ and its inverse, $\overline{q}$

$$\overline{\Delta q} = -m^2/\overline{q} \tag{5}$$

with

$$\overline{\Delta q} = -vs \tag{6}$$

[2] m = meter, s = geometrized second, non-standard notation

are seen as more fundamental to physical processes and therefore chosen as a geometrical framework. The observer in the barred frame is primarily a quantum observer, ignorant of anything except the momentary interaction that takes place with the surroundings. The interaction is a linear momentum transfer, a resultant vector, a resultant axial vector or a pure probabilistic quantum transfer and the quantum observer resides in one spatial dimension only. Since a time axis is irrelevant to any single interaction with the surroundings, time is defined only through $\overline{\Delta t} = 1$. The line increment along the axis of observation is seen as indicative of the physicality of this geometrical construct since a line increment is typical of the apparent cosmological Hubble expansion as well as of the signaling Bohr atom ([4] [5]), in the latter case the radius of the Rydberg atom undergoes a length change.

A closer examination of this geometrical construct reveals that the barred observer is located at the periphery of an apparent sphere or circle while being space-like separated from the other observer, who is only capable of measuring a velocity in the perpendicular direction ([4] [5], Eq. 6). These directions can not be determined by the barred observer, who sees only the momentum axis. However, the Lorentz transformations that determine the time interval show that whenever there is a line increment in the momentum frame there is also a tangential velocity defined in the not-barred frame. Hence, the barred observer can obtain signal-free information about the yonder frame through calculations, bypassing the light cone, and a physical process in the momentum frame always corresponds to a process in the yonder frame. This can be written:

$$\overline{\quad\quad} \quad = \quad | \tag{7}$$

where the left side represents the momentum frame and the right side the non-local frame, suggesting that a description that can be given in this form is a mathematical representation of a true physical process taking place in this geometry. Such a strong constraint for a description to represent real physics is noteworthy and not to be seen in the ambivalent classical descriptions that are based on n perpendicular dimensions. Some quantitative examples will be given in a subsequent section.

3 Non-Locality

Putting the material observer at the periphery of some non-local object like in Eqs. 1b and 2b leads to a different world picture than the currently widely accepted one. Instead of looking outwards towards an indefinite re-ionization horizon of visibility followed by a relativistic horizon and then by some vaguely defined cosmological horizon the material observer examining the universe looks inwards towards a non-local frame existing at a fixed distance given by the inverse of the line increment. This apparently agrees with established cosmology wherein the origin of space and time coordinates is spread out over the entire cosmological horizon and the universe appears spherical. In the established raisin cake universe however, one is dealing with a mirage wherein the contemporary non-locality is caused by the expansion of 3 space dimensions which all lead back to a singularity. In the present model the mathematically defined non-locality of the not-barred frame as judged from the barred one takes effect at the radial distance $\overline{q} = 1/\overline{\Delta q}$ and causes the universe to appear spherical: The characteristic velocity in the yonder frame defined by Eq.6 takes any perpendicular direction since it is non-local and this causes the universe to appear spherical. Furthermore, the non-locality was, is, and remains maximal at the cosmological horizon to distinguish from the raisin cake cosmology.

The non-locality of the yonder (not-barred) frame of observation appears in four distinct ways. First, as has already been mentioned, the fact that it is perpendicular to the one-dimensional momentum frame makes it non-local, and secondly, it is space-like separated from the momentum observer. Then, since the universe is isotropic, each unit length has associated with it a line increment and adding all along the radial distance results in a remote unit length line increment at the cosmological horizon, which is equivalent of a radial translation at the speed of light. But classical physics teaches that light has no rest frame so this unit length line increment is non-local. The fourth approach is to quantify the Copernican principle and show that the location of an electron here or at the edge of the universe is equivalent (subsequent section). If one assumes that there is only one (material) universe with one radius determined by its inverse (the contemporary Hubble rate, prior different Hubble rates being caused by observational distortions) the third approach above allows an absolute non-locality to be defined at the cosmological horizon. Since a man-made measure of non-locality is not a physical process [3] some arbitrariness appears when defining it at intermediate distances:

It was argued in the Introduction that the uncertainty of location of remote astrophysical objects increases with radial distance. A measure of non-locality might therefore be proportional to radius, radius squared or even some relativistic function of radius. Either way is compatible with a world in which an observer looks inward in every direction since it is intuitively clear that in all cases there is a radial increase of non-locality until any coordinate smears out over the entire horizon, which is the case here. Because of

$$\overline{q_0}^2 = {q_0}^2 + m^2 \tag{8}$$

obtained from Eq. 1 the local radius $\bar{q}$ is made non-local (q) through the line increment m at the horizon (equivalent of c there) by a Pythagorean geometrical construction, suggesting quite simply that the the radial length squared is a good measure of non-locality, Y, (as opposed to locality, L) in this geometry,

$$Y = r^2 \tag{9}$$

This is also the measure chosen by nature, for example in the intensity of a receding electromagnetic wave-front, in gravitational force between two masses, or in electrostatic force between two charges. The relativistic energy of any mass $E = \sqrt{p^2c^2 + M^2c^4}$ with $p = Mv = M dx/dt$ also conforms to Eq. 8 if the former is rearranged to

$$\frac{E^2}{c^2\ dx^2} = \frac{M^2}{dt^2} + \frac{M^2\ c^2}{dx^2} \tag{10}$$

This suggests that the baryonic energy (in the 3:rd term) is less than the total energy (in the 1:st term) and the not-barred observer who can only measure time (2:nd term), bypassing any signaling, computes the mass in the form of Mc.[4]

Whether or not there is relativistic reciprocity between the two observers in the present geometrical construct, such that the not-barred observer coexists with a barred observer at the edge of the universe remains an open question. This possibility seems to be refuted by the Copernican principle as explained in the next section in that an electron must choose to exist at either location only. Once having chosen one location over the other, that other location is no longer valid or both locations may be regarded as

[3]The question whether or not a description that has turned out to be of value in classical physics is or is not a physical process in the present geometry arises frequently, for example in dealing with later developments of the Schroedinger equation or various four-vector constructions. The answer is either that the geometry advocated here allows for considerable conceptual simplification or that current shortcomings of it may be remedied by future theoretical development.

[4]In another, more specific, context (paper # 35 in this series) a similar Pythagorean construction applies to the masses of the Z and W bosons and the squared line increment;

$$ {M_Z}^2 = {M_W}^2 + \overline{\Delta q}^{\,4} \quad , $$

which may be regarded as a special case of Eq. 10 but the latter is rather unspecific and has been used preferentially to support other theories.

equivalent. The asymmetric (relativistically non-reciprocal) mass distribution has been chosen by the atom wherein the electron exists in the form of a wave whereas most matter is concentrated at the center. Why this is so remains a hard nut to crack for GR while it appears natural in the present geometry.

Furthermore, enforcing relativistic reciprocity by placing another barred observer at the edge of the universe causes the non-locality of Eq. 8 to break down. Non-local events in the barred frame may instead refer to shorter distances than those that build up the entire universe whereby any perpendicular vectors in the non-local frame may collapse into a local event visible in the barred frame. This, of course, turns the focus to the linear Schroedinger equation.

4 Theory

The line increment applicable to physical processes was solved quantitatively from the ground state Bohr atom in 2001 ([6]). Briefly, the terms a_0 and αm_e are factorized out leaving

$$4\frac{e\ c}{2\alpha}\ \overline{\Delta q} = \sqrt{\hbar}\ 2\pi\ Ampere\ s \tag{11}$$

which is of the form of Eq. 7 and therefore a representation of a real physical process in this geometry. The equation can be interpreted as a Dirac particle (left side expressing magnetic charge) surrounded by a curl (right side) which is indeed how the magnetic monopole was first found theoretically ([7] [8]). Furthermore, the line increment, $\overline{\Delta} q = 7.714 \times 10^{-27} m^{-1}$ is interpreted as the Hubble expansion rate in the current epoch and its inverse (cf. Eq. 5) yields the radius of the universe, $1.296 \times 10^{26} m$, its age 13.7×10^9 *years* and, using geometrized units, its density, $1.719 \times 10^{-9} Joule/m^3$ ([9]). Since its radius r_u is known it is possible to proceed and determine the uncertainty that an electron occupies either the center of the universe or its edge using the Heisenberg uncertainty relation of momentum, p, and position, x; $\Delta p \Delta x = M \Delta v \Delta x = \hbar/2$. First, Δv is calculated:

$$M_e\ \Delta v_{e,ru}\ \Delta r_u = 6.764 \times 10^{-58} \Delta v_{e,ru}\ 1.2296 \times 10^{26} = \frac{2.612 \times 10^{-70}}{2} \quad \Rightarrow \tag{12}$$

$$\Delta v_{e,ru} = 1.489 \times 10^{-39} \tag{13}$$

Then, reference is made to the Bohr-Rydberg theory of the hydrogen atom (e.g. [10]), using that $x^2 - y^2 = (x+y)(x-y) = x^2 - 2xy + y^2$, $a_k = a_0 k^2$, and $k^{-1} = v_k/(\alpha c)$ where a_k is the k:th radius and v_k is the k:th velocity, colorblue $v_0 = \alpha c$, $a_k = r_u = 1/H_0$[5] and $\lambda^{-1} = Ry({k_0}^{-2} - k^{-2})$:

$$\frac{1}{{k_0}^2} - \frac{1}{k^2} = \frac{a_0}{a_0} - \frac{a_0}{a_k} = 1 - \frac{a_0}{a_k} = \frac{{v_0}^2}{\alpha^2 c^2} - \frac{{v_k}^2}{\alpha^2 c^2} = 1 - \frac{{v_k}^2}{\alpha^2 c^2} = 1 - \frac{2v_k}{\alpha c} + \frac{{v_k}^2}{\alpha^2 c^2} \approx 1 - \frac{2v_k}{\alpha c} \Rightarrow \tag{14}$$

$$\Rightarrow \frac{a_0}{a_k} \approx \frac{2v_k}{\alpha c} \quad : \tag{15}$$

$$v_k = \frac{a_0 \alpha c}{2 r_u} = 1.489 \times 10^{-39} \tag{16}$$

These results show that the two locations in Eq. 12 are equivalent[6] and provide further evidence that the universe is finite in size, reaching only as far as the unit length line increment. Hence, a quantitative proof is obtained that the Copernican principle (the Terrestrial observer does not have a

[5] r_u = radius of the universe, H_0 = Hubble's (local) constant = line increment in the present theory

[6] Some theory claims that the uncertainty principle just is a measure of accuracy at the atomic level, however accuracy depends on the scale of what is measured.

unique position in the solar system) is valid in the entire universe.

As shown previously [9] [11], the above unit length oscillation at the cosmological horizon is related through $E = h\nu$ to the energy density of the radiation:

$$\frac{h}{2\pi} \frac{r_u H_0}{2a_0\ \alpha} = 3.382 \times 10^{-58} = 0.256\ eV/cm^3 \tag{17}$$

and the radiation is normalized to the quantal atomic length increment, a_0, in matter coupled to radiation via the coupling constant α[7]. The published value of cosmic microwave background radiation is 0.260 eV/cm^3 [12]. These results suggest that the CMBR in the present epoch is generated by oscillations in primordial matter located at the relativistic horizon. Apparently hotter CMBR in earlier epochs relate to the quantitative geometry of those epochs or may constitute observational distortions. The radiation's thermal distribution as well as its being largely isotropic and isothermal should be expected if generated in a non-local environment lacking rest frame.

Another interesting conclusion from Eq. 17 is that there is a stoichiometric relation between the quantum that generates radiation at the horizon (the atom) and the local energy density of the radiation it generates. This relation is 1:1 if the entire diameter contributes and 1:2 if only the radius, a_0, contributes. In the latter case half of the matter at the horizon is out of sight at the moment the CMBR appears. Since the electron is a massive particle it may have to convert fully into radiation at the speed of light at the horizon. In such a case, half of its energy, $6.764 \times 10^{-58}/2 = 3.382 \times 10^{-58}$ appears as CMBR in the 1:2 stoichiometry case, which agrees with Eq. 17. This would require some mechanism to preserve neutrality, perhaps positrons. Such mechanisms are not far fetched considering how matter and antimatter diverge in equal amounts at the relativistic horizon of black holes. These results show that there may be other explanations for the CMBR than its being a thermal residue after an explosion, like in the Big Bang Standard Model[8]. Even within the framework of that model, there are other unexplored possible explanations, like for example a 'light bang' reminiscent of a 'sound bang'.

Guided by Eq. 7 the linear Schroedinger equation for a free particle is rearranged,

$$\frac{p^2}{2m}\Psi = i\hbar\frac{\partial}{\partial t}\Psi \tag{18}$$

$$\frac{\hbar^2\nabla^2}{2m}\Psi = i\hbar\frac{\partial}{\partial t}\Psi \tag{19}$$

$$\frac{\hbar}{2}\left(\frac{\partial}{\partial x}\right)^2\Psi = mi\frac{\partial}{\partial t}\Psi \tag{20}$$

[7] According to NIST (physics.nist.gov/cuu/Constants/alpha.html) α is viewed as the square of an effective charge screened by vacuum polarization and seen from an infinite distance' or 'it is a measure of the strength of the electromagnetic force that governs how electrically charged particles, e.g. the electron, and photons interact. It is 'the amplitude for a real electron to emit or absorb a real photon'

[8] In paper # 35 in this series (cf. footnotes on p. 5) the entire universe is modeled as an inverted black hole with a mass-generating unit constituted by five Z bosons rotating around the corners of a double tetrahedron, which yields the gravitational constant in terms of the Z -mass. Since $F(\text{orce}) \propto G \times M_1 \times M_2$ an unaccountably strong force may be caused by additional mass (like 'dark matter' in Standard Cosmology) or too high a value of G. Herein,

$$0.0493\ G\ 2 = H_0/5M_Z$$

indicating that G must be multiplied by the fraction 0.0493 in order to balance the baryon-forming mass of those five Z bosons. This is reasonably close to the baryon fraction of the universe's mass calculated in Standard Cosmology. However, if one of the five Z-bosons is an antiparticle facing the black hole the baryonic mass fraction becomes $0.8 \times 0.0493 = 0.03944$. This fits well with the value obtained in paper # 31 in this series, 0.03947, which is1/3 (3.6 GeV) of 10.8 GeV or (3.6 GeV/91.2 GeV) where 10.8 GeV is the mass lost from a Z boson when transitioning to a W boson in the Standard Model -purported symmetry-breaking processes of the early universe. So, if the proton is generated at the boundary of a black hole one expects the electron too to be involved in some process there, tentatively, like in Eq. 17.

where the last equation has the form of Eq. 7. Further substituting $\hbar$ using Eq. 11 yields

$$(\overline{\Delta q})^2 \left(\frac{ec}{2\alpha}\right)^2 \left(\frac{\partial}{\partial x}\right)^2 \Psi = m\ i\ \frac{\partial}{\partial t}\ \Psi\ (2\pi\ Ampere\ s)^2 \tag{21}$$

revealing the right (non-local) side to be composed of a mass and a circular electrical current, possibly (because of the square sign) in two perpendicular directions, while the left side has the signature of angular momentum, A,

$$[A] = [mvr] = \bar{\ }\ \bar{\ }\ . \tag{22}$$

The angular momentum appears as a result of sequential influences of perpendicular components of circular velocity as opposed to resultant vectors. Similarly, in Eq. 21, $\overline{\Delta q}$ acts to promote from a fraction of two magnetic monopoles a dipole along the momentum axis, which would accompany the circular electric current were the latter not non-local. Hence, substituting $\hbar$ using Eq. 11 adds the specifics to the Schroedinger equation that the wave function involves charge ($Ampere\ s$) circulating (2π) around two fluctuating magnetic monopoles ($\overline{\Delta q}\ ec/2\alpha$). This dynamics is driven by $\overline{\Delta q}$ the numerical value of which is known. Furthermore, any phase shift between the local process (the atom) and the non-local one (the vacuum instability) is interpreted as potential energy (cf. [13]) whereby a unit volume may harbor an arbitrary number of atoms, energy conservation being guaranteed on a large scale only, by Eq. 1a and Eq. 2a. Finally, in Eq. 21 the complex plane of the original Schroedinger equation remains in a manner consistent with Eq. 7.

Using the inverse of $\overline{\Delta q}$, Eq. 21 can be written

$$\bar{q}^{\ -2} \left(\frac{ec}{2\alpha}\right)^2 \left(\frac{\partial}{\partial x}\right)^2 \Psi = mi\ \frac{\partial}{\partial t}\ \Psi\ (2\pi\ Ampere\ s^{-1})^2 \tag{23}$$

which is similar to Coulomb attraction

$$C \frac{Q_1\ Q_2}{r_2} = F \tag{24}$$

and gravitational force,

$$G \frac{M_1\ M_2}{r_2} = F, \tag{25}$$

the latter in the present theory rather

$$G \frac{(M^2)_L}{r^2} = M_Y\ \frac{dv}{dt} \tag{26}$$

whereby $F = dp/dt = M_Y dv/dt$ makes the above conform to Eq. 7. The classical field lines are known to be different from Eq. 23 in the case of Eq. 24 and Eq. 25 but there are also similarities. There is attraction (repulsion) between two factors in the numerators and this decreases inversely proportional to $Y = r^2$. However, in the case of Eq. 23 the value of $\bar{q}$ is fixed and determined by the geometry whereas in Eq. 24 and Eq. 25, r is arbitrary and related to a classical time axis as can be seen by comparison using the free fall case $v = v_0 + at$:

$$v = a\ t \tag{27}$$

$$2v = a\ 2t \tag{28}$$

$$3v = a\ 3t \ldots \tag{29}$$

$$\ldots \frac{\Delta x}{dt} = \frac{dx}{dt\ dt} \Delta t \neq \tag{30}$$

$$\neq \frac{\Delta x}{s} = \frac{dx}{ms}\ x \tag{31}$$

where $\Delta x/s = m/s$, dx/ms is Hubble's constant and $x = \bar{q}$. Geometrizing the unit of time here in order to make the last two lines equivalent yields for example that the acceleration 9.81 $m/(sec)^2$ corresponds to a radius of 1.03 ly. No such object, orbit, or physical interpretation are presently known although it is not a trivial number to be sought for in the present geometry.

Besides, geometrizing hides the fact that any time-like separated space coordinate can be reached *via* adjacent space intervals whereas future and past time can not be reached from present time since the latter constitutes a prerequisite for any observation. The content of time (the character of its clock, the process chosen) is more ambivalent than a spatial coordinate reached using a measuring rod. For example, if light itself is chosen as the clock, the location of the photon in the wave-front becomes more uncertain in the future. The time given by a light ray is ignored by any quantum observer until the photon is detected at which moment that clock stops. Any such or similar information about the peculiarities of time in comparison with space may be lost by geometrizing.

5 Discussion

The purpose of this paper was to consolidate the physicality of a 1+0 -dimensional world spanned between a momentum observer and a space-like separated non-local observer as described previously. Three main results were obtained. 1) The non-locality of remote objects could be quantified in a manner consistent with the proposed geometry and with known physical processes. 2) The Copernican principle that a Terrestrial observer does not have a privileged position in the universe could be exemplified quantitatively for the first time using Heisenberg uncertainty applied to the location of an electron within a Rydberg atom-like universe reaching to its relativistic horizon. 3) Planck's constant could be eliminated for the first time in favor of a more profound understanding of the physical processes taking place. More precisely, a non-local circulating electric current co-exists with the possibility that a magnetic dipole is generated from monopoles, the dynamics of which is driven by the vacuum energy of the apparent cosmological expansion. This result is based on rearranging the Bohr atom in the form of a Dirac particle and substituting $\hbar$ in a Schroedinger equation-derived mathematical form that is consistent with the proposed geometry.

Alternatively (Eq. 21), each and every (hydrogen) atom is 'held' by the non-locality of the entire universe in a mathematical form similar in many respects to the Coulomb force or gravitational force. These results suggest that disc-shaped astrophysical objects equipped with an axial though bi-directional thrust (flying saucer-like objects) like quasars and radiogalaxies, possibly spiral galaxies also and some 'microquasars' derive their shape from the geometry of quantum-physical processes rather than thermodynamics. Some recent results indicate that the axes of such objects may be aligned within large-scale structures [14], suggesting perhaps that the similarity between the above equations is not a coincidence. If the proposed vacuum interaction that drives the electron in its orbit could be made beneficial or if $1+1 = 3$ [9] is wrong, then some really 'new physics' might happen in the future.

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[10] Most of the author's own references are still unedited, some errors and shortcomings of presentation are evident.