. . . 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 Transmision. *

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Abstract

A model of the universe and its contents is presented constituted by a local one-dimensional frame of observation and a perpendicular, non-local frame. The non-local frame is previously only known from the atom's electron cloud but several other quantitative examples are demonstrated here, including galaxies with the so called 'dark matter', the solar system and quantitative relations between the proton and Bohr radii and the universe's relativistic horizon. Reevaluation of some 17:th century founding bricks of science reveals that Kepler's 3:rd law is advantageous in the present context and that the acceleration may be regarded as an operator from the non-local to the local frame rather than the derivative of velocity. For example, the proton radius emerges by contraction from the universe's non-local horizon. The numerous implementations of the 1-D *versus* non-local model that are found suggest that it can be generalized to describe the rest-frame of the universe, its contents and physical processes as opposed to relativistic signal-observations thereof. This view is underlined by a critical evaluation of relativity theory as a foundation of cosmology.

1 INTRODUCTION

In this paper a new theory of gravity will be presented based on elements of the 'one-dimensional universe' a theoretical concept with quantitative applications developed previously ([1] [2] [3] [4] [5] [6] [7]). A three-fold approach to the subject will be taken. First, the fragile foundations of contemporary standard cosmology will be exposed rather frankly, secondly a brief survey of relevant literature will be made, and thirdly, the author's own previous theory bearing on the subject will be further developed.

It is becoming increasingly clear that contemporary cosmology based on classical relativity theory has reached an impasse where it is necessary to lean on various speculations, especially the so called 'dark matter' (DM), which is nothing but a name quantifying the extent to which known physics fails to explain the observations. No one has yet been able to demonstrate that there is such a substance as DM. It is of course special and general relativity theory (SR and GR, RT) that are at the root of

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these failures and not the real world.

SR theory was developed in the beginning of the past century as an extension to the discovery that a velocity-dependent contraction of length proper [1] could explain the empirical observation that the velocity of light has the same value in all directions irrespective of the observer's movement. However, it was later proved that such a length contraction can not be observed ([8] [9]), a forgotten discovery that casts doubt over the foundations of SR. In SR, velocities are rendered in the form of a quotient having the velocity of light (c) in the denominator and the measure of time is usually multiplied by c and shortened to the distance $1m$ in order to make the scale of the length and time coordinates equal both having the unit m (meter). This simplifies the mathematics but unfortunately there are no important phenomena or things in nature that display such an equal pitch of time and length scales. SR may be regarded as a correction to the Cartesian right-angle system of coordinates of three space dimensions (later expanded to the 'Hilbert' space) which it approaches at slow velocities. This sounds good but in fact very few things or phenomena in nature adhere even to the Cartesian coordinate system. So by reference to Nature, SR is a dubious correction to a dubious framework. Even though SR quantitatively takes care of the constancy of the velocity of light in all directions it does not explain why that is so.

If one can find a mathematical framework that naturally embeds real phenomena in Nature to scale, as many as possible, then one is on the right path to a correct description of the real world. One must make a distinction between the real world and various relativistic distortions thereof. The real world in its proper-time rest frame is distinct from observations of other things. The bending and twisting and boosts of the surroundings as seen by the observer that is prescribed by SR are merely an aspect of the measurement. It is possible to convince one-self that this is so by searching for physical processes in the four-vector concept of SR.

Surely, the four-vector concept describes a lot of things, but how much of that is true representations of real physical processes or physical objects? The four-vector concept fails at the most fundamental level since neither time nor length is a physical process or a physical object. The invariant space-time interval in SR is merely a convenient tool for making measurements so that one can find space and time coordinates in the object's rest frame from any other frame of observation or *vice versa*. The four-vector space-time interval does not describe the physical processes taking place at the object or at the observer-measuring device or particle. The same applies to the four-velocity, which is not any kind of physical process or object either. The rest mass energy and momentum of the four-velocity are tangible physical properties but the four-vector concept does not explain how they are sensed. The momentum transfer, Δp, which is a genuine physical process, can be obtained by subtraction but it is not inherent in the geometry of SR. One can go on and scrutinize many other implementations of the four-vector concept and always arrive at the same result, that no physical process or object is *represented* by that concept. The four-vector is merely a mathematical 'object'. The very nature of relativity theory proves that this must be so in that physical objects are seen from various frames of observation and a physical object can not be every possible apparition of itself at the same time, its true nature only resides in its 'rest frame'. This conclusion holds in the widest sense, also in cosmology.

Anyone who tries to understand what is going on in the real world and turns to SR-GR is immediately stuck in a barbwire of coordinates, relativistic distortions and ambiguity regarding viewpoint, all emanating from the shortcomings of SR described above. Instead of the flexible and versatile relativity theory of *measurement*, a geometry in which the pitch of the time scale in comparison with that of the length scale conforms with something real found in nature might provide a clue to a theory of the robust *constituents* of the world.

[1] Lorentz-Fitzgerald contraction after its discoverers

2 RESULTS

In

$$\frac{m^3}{(sec)^2\ r_p} \approx \alpha c^2 \Rightarrow r_p = \frac{m^3}{(sec)^2}\ \frac{1}{\alpha c^2} \tag{1}$$

where m is meter (sec) is the SI-unit of time, r_p is the radius of the proton measured by neutron scattering, and α is the fine structure constant, there are elements of a rearranged Kepler's 3:rd law reverse-engineered from Newton's law of gravitation,

$$\frac{GM_s}{r} = \frac{r^2}{T^2}4\pi^2 \Rightarrow r = GM_s\frac{T^2}{4\pi^2 r^2} \tag{2}$$

where G is the gravitational constant $[G] = m^3/s^2\ kg$, M_s is the sun's mass, r is the orbital radius of the planets and T is their time period of orbit.

Using the value 1/128 for α cf. [10][2] in eq. 1 the proton radius becomes $1.424 \times 10^{-15}\ m$ which is near the value 1.37×10^{-15} obtained by extrapolating linearly to one nucleon from the radii of several other nuclei [11][3]. On the right-hand side of left eq. 1 there are two velocities, that of light (c) and that of the electron in the first Bohr radius (αc) configured at right angles such that the electric field vector of the electromagnetic wave is parallel to the electron's path. On the left-hand side of the left equation, there is a one-dimensional line element, r_p (or its inverse).

Eq. 2 (left equation) is similarly constructed with a line element, r, on the left side (G and M_s are preliminarily regarded as constants) and the product of two equal angular velocities $(2\pi r/T)$ to the right. These velocities may be interpreted as contributions from two perpendicular directions, which completes the analogy with eq. 1.

As will be explained below, the right forms of eqs. 1 and 2 conform to a geometrical interpretation of Appendix I, a context which validates the numerical fit in eq. 1 to something more than a coincidence.

Recall now in a nutshell the ongoing present research: On the one hand there is a mathematical construct with a geometrical interpretation that fits well to some important and well understood physical processes ([1] [2] [3] [4] [5] [6] [7]). On the other hand, each new example that is discovered to fit to the geometry strengthens the case that the physical world is an implementation of that geometry.

Brief Summary of the Mathematical Construct and Its Geometrical Interpretation.

The mathematics is contained in a set of equations given in Appendix I: A length q is defined proportional to the inverse of the x_1 component of the four-velocity and Lorentz-transformed from discrete time $t = 0$ and from discrete time $t = s\sqrt{1 - v^2/c^2}$ to a barred frame of observation. As a result, the observer in the barred frame defines a length $\overline{q}$ associated with a length increment $\overline{\Delta q}$ seen during an interval of time $\overline{t} = 1$ in his frame of observation. An examination of this construct shows

[2]The constant α may run from 1/137 to 1/128 because of more charge screening from vacuum fluctuations at shorter distances.

[3]Reportedly, the value 1.37 may reflect some transparency of nuclei to neutrons so that the actual radius may be longer. On the other hand, measurements based on electron-proton interactions give much lower values for the proton radius, which probably is due to charge attraction. The experimental determination of both the proton radius and the fine structure constant are long discussed problems in physics.

that the two observers are space-like separated and that the length seen by the barred observer may be interpreted as the radius of a circle. The line increment seen by the barred observer during an interval of time justifies that his frame may be regarded as a local frame of transfer of linear momentum in one dimension, along the radius. The velocity is perpendicular to the momentum frame but has the same numerical value as $\overline{\Delta q}/s$ along the radius. In contrast, the unbarred observer is unable to perform measurements on the spatial axis and can only measure time increments during the interval of observation. Therefore and since the two observers are space-like separated (and by other criteria too, [3]) the unbarred observer is non-local[4] from the point of view of the barred observer. This mathematical construct preserves the time dilatation of SR but transfers the Lorentz-Fitzgerald contraction (of the apparent radius, that is) to the 'yonder', non-local frame of observation (see Appendix I). Further analysis of the construct yields that time is non-local (Appendix I, [12] [13]) [5] and is inferred by the local observer *via* the time-interval that defines the line increment ($\overline{\Delta q}$). The non-locality of time provides a key to classifying all physical units in the present geometry according to whether they are local or non-local or combinations thereof ([12] [13]) and it turns out that mass, which transforms like time in SR ([14]) also is non-local. If one denotes a local entity by a bar over its symbol and a non-local one by a tilde (cf. [12]) then[6] $\overline{p} = \widetilde{M}v = \widetilde{M}\overline{m}/\widetilde{s}$ so momentum is local in agreement with the geometrical assignment discussed above. Besides defining a local and a non-local observer the geometry provides the numerical value of the line increment as being equal to the inverse of the radius. These are the most obvious features one should keep in mind when looking for implementations of the geometry in the real physical world.

It may seem somewhat radical in contemporary cosmology's exciting world of relativistic multiverses to claim that nature only has one spatial dimension but a couple of thought-worthy arguments can actually be raised that this is a good starting point. Firstly, one is dealing with momentum transfer at the particle level and the macroscopic world is just a collection of particles. At the particle quantum level, a weaker an impact than required is no impact at all and the maximum impact is always head-on. Rather than calculating the resultant from three spatial dimensions of environmental influences, the particle prefers to accept the appropriate quantal impact only, substituting any vector addition of velocities for a probabilistic, nevertheless perfect fit. One may therefore take the viewpoint that the particle determines in which direction (as seen by the experimentator only, but not by the particle ever) its 1-D axis will point at the moment of impact. In other words, it defines its 1-D axis via the interaction, again and again by each new interaction. An interesting recent finding in this connection is that angulons define a magnetic monopole at the moment of interaction with the environment [15], and the monopoles are known to be one-dimensional [16] (also in [12]). This suggests that even notoriously rotating things are confined to a 1-D world of momentum transfer adding to the viewpoint that any rotation can be represented by an axial vector. Hence, there *is* some circumstantial and empirical observational evidence of a one-dimensional world at the particle level whereas multiverses are merely a mathematical construct. In fact, what has just been described is not very much different from the law of inertia in 17:th century physics save that momentum transfer is quantized along the only possible axis. This discussion will be continued in the context of 'acceleration' below.

The purpose of the insert above was to prepare for the following. The experimentator knows that there are two perpendicular spatial axes at right angles to the momentum axis but the particle doesn't. Furthermore, before the impact the particle is unaware of the mutual orientation of the

[4]There is some ambiguity regarding the definition of locality *versus* non-locality in physics. Some regard all time-like separated events as local, some all entangled events as non-local etc. Then present conception of local *versus* non-local has been discussed in [3] and can be described as locally tangible by momentum transfer *versus* not so in a quite wide and multifaceted sense.

[5]which explains why all physical processes take place at present time and furthermore, only present time may be experienced by the senses

[6]p = momentum, M = mass, m = meter

axes perpendicular to the momentum axis. This conceptual rift between the experimentator's and the particle's perspectives invokes *a fourth spatial dimension, the non-local dimension.* One realizes immediately that the propagation, absorption and emission of electromagnetic radiation fits very well to this geometry (cf. [2]). In this case, the momentum axis is parallel to the head-on propagation of the radiation (cf. [17] [18]) while the non-local axes are parallel to the electric and magnetic fields. Only at the moment of momentum transfer is the particle (an atom or a molecule) aware of the momentum axis. At that instant, the energy of the field materializes from non-local whereabouts into the material local frame of observation. It is a matter of routine to equate some energy transferred via momentum with the corresponding energy of the field. Such an equation would have the following very general form:

$$— = | \tag{3}$$

where the left side represents the local factors and the right side represents the non-local ones. Hence, a successful but rather trivial, nevertheless important implementation of the geometry described above has been found [7].

A time interval framing an event might *appear* local as in the present case (since it can be defined in both the local and the non-local frame, Appendix I) but the passage of time, a time axis, is intuitively non-local. A velocity is intuitively non-local too and justly appears perpendicular to the momentum axis in the present case ($[v] = \overline{m}/\ \widetilde{s} =\ ^{-}/^{\sim} = ^{\sim}$ cf. Appendix I). This suffices to recognize that both eq. 1 and eq. 2 conform to the general case of eq. 3 and that the latter, which is a representation of the present mathematical construct, cf. [19], Appendix I, is *the* 'natural' geometry. Namely, signal transmission, the atom, as well as the solar system all conform to it. Especially the right forms of these equations agree strikingly. In addition, an instance of the inverse of the radius, in the general case ($\overline{\Delta q} = -m^2/\overline{q}$, Appendix I, $\overline{\Delta q}$ is the line increment during the interval $1s$ in the barred frame [8]) can be identified, here as

$$\frac{r_p}{\pi \overline{\Delta q}} \approx \frac{\pi m}{r_B} \ . \tag{4}$$

The Bohr radius emerges as the inverse of the proton radius, the former taken per unit meter curl and the latter per unit curl of the apparent cosmological expansion. In geometrized units $c = m/s$ so the Bohr radius interacts with electromagnetic radiation (both non-local) while the proton radius interacts with the (local) 1-D line increment. The line increment ($H = \overline{\Delta q}$) has been shown to be a possible vacuum energy reservoir for the resonance bosons, implicating the proton [4]. This form of the equation is not quite satisfactory as will be discussed below but the important thing for the moment is that the adopted geometry inherently embeds quantitative relations between real objects in nature in their rest frame (eqs. 1, 2, 4) without any relativistic distortions at all. And what is even better, one can start from these physical objects and arrange them to their natural scale so that the adopted geometry emerges.

Based on the results above one can make the 'ansatz' that true physical processes in general are identified by rearranging terms such as to conform to eq. 3, which is a stronger criterion than previously in mathematical physics where any configuration of terms around zero suffices in order to claim 'physicality' (cf. [20]). It is also noteworthy that in the present case, in contrast to RT, the geometry naturally embeds the time and length scales of real physical objects (cf. eqs. 1, 2, 4). Hence, a possibility to achieve a mathematical true *representation* of a physical process arises by properly factorizing

[7] Additional deliberations on this theme might focus on dipole interactions and the special case of laser beams, molecular quadrupoles etc.

[8] In the present theory, $\overline{\Delta q}$ corresponds to the apparent cosmological expansion rate in the current epoch, H, while its inverse is the radius of the universe stretching linearly to its relativistic horizon.

and rearranging terms instead of just placing terms at will to the left and to the right of the equals sign. Before recalling how this line of research has been pursued in the past a little focus on physical 'acceleration' serves to expose the distinction between pure mathematics and physics in this context:

In GR, acceleration is a property of matter more fundamental than charge and has units m^{-1} [21]. In the present theory, having units m/s^2 with dimension ('frame signature') $[\,\bar{}/\,\tilde{}\,\tilde{}\,] = [0]$ it is composed of ingredients of both the local (m) and non-local ($1/s^2$) frames such that a high numerical value indicates that the local frame is dominant while a low value indicates that the non-local frame is. Here, a mere inspection of the units provides a hint about the physical processes involved. This is different from SR and GR where the information contained in the units is truncated and sacrificed for the sake of mathematical simplicity. In GR, a body in free fall towards a gravitational sink will become elongated and squeezed from the sides [22] which agrees with the present assertion that it approaches a local, one-dimensional physical state. In GR however, it approaches a region of more curvature, and curvature is really the opposite of the actual physics that takes place in this case[9], which can be verified by anyone inspecting the free fall of water in nature. This shows clearly that GR does not *represent* the physical process of a free fall in spite of its giving reasonable numerical results in many cases. Furthermore, the same arguments and interpretation as to acceleration only, apply to the expression[10] $v/t = a$ where the local factor (length, L of $v = L/s$) increases as a function of continuous time, t. Acceleration, which is no more than the derivative of velocity in mathematical physics now instead acquires the active role of a weighting factor between quantities in the local and the non-local frame,

$$\overline{L} = a\widetilde{t}\widetilde{s}\ . \tag{5}$$

In other words, acceleration turns into something similar to an operator, acting from the non-local to the local frame of observation.

The reasoning above can be applied to the apparent cosmological expansion (postponing a discussion of relativistic distortions when interpreting look-back epochs): Hence, by analogy (using $v = Ht$; $v = m/s\ H = a$), $m = Ht_1s$ suggests that there is a local frame where the velocity of light can be defined ($3 \times 10^8 = L >> 1$) at the present epoch, t_1 located at the relativistic horizon as seen from the beginning of time, t_0. On the other hand, $0.77141 \times 10^{-26}m = Ht_0s$ suggests that there is a non-local frame ($L << 1$) at the origin of time. By reading the numerical value of H in these two ways, one is led to the conclusion, just by inspection, that the world is composed a local part, which evolves visibly on a time axis and a non-local part that has not changed since the beginning of time.

This is of course different from contemporary 'big-bang' cosmology, which is fundamentally and one-sidedly macroscopic-mechanistic since it has its roots in the 19:th century before any of the subatomic particle dynamics known today or even matter waves were known. Sub-particle dynamics and the vacuum energy in GR-cosmology are playing a role of corrections to a basically macroscopic-mechanistic theory. And what is worse, since SR-GR basically deal with signal transmission they aim at showing what things seem to be, not what they are, thereby obliterating unbiased thinking about the phenomena themselves. For example, black holes were described by the Schwarzschild solution with an event horizon that seemed to be discontinuous until the Kruskal-Szekeres coordinates were discovered (a correction to a correction to yet another correction to the Cartesian 3-D space). Then everything could keep on falling smoothly towards more curvature so that the mystery of the singularity could be established. In contrast, a theory based on the actual physics taking place instead of

[9] In GR, there are also corrections to make the equations divergence-free [23] even though gravitation, charge flux and electromagnetic wavefront intensity are typically divergent processes.

[10] v=velocity, t=time, a=acceleration, L=length, s=geometrized second, (sec)= SI unit second H=apparent cosmological expansion in the current epoch

distorted coordinates, like the present one in which a free fall constitutes a transition from non-locality to 1-D locality, really doesn't need any singularity, or a boundary. Such a theory might be more adaptable to observations indicating that black holes have poles where even heavy matter escapes the event horizon (seen as 'jets') and thermal radiation emerging from the horizon against the gravitational field.

The importance of acceleration in GR is that it makes possible defining a frame of freely falling objects where everything looks like in the case of SR [21] which makes GR too sensitive to the same arguments that were used against SR above. GR has a very wide scope - in GR any event is a valid event [21] This stems from that SR-GR are based on signal transmission, i.e. light signals coming from visible objects, emphasizing the measurement process rather than the nature of things. For example, Einstein pondering on the dusty windowsill in Bern while Leakey had still not found Darwin's missing link are all perfectly valid events in the physics of GR. This is not so in the present case. Here instead, the ansatz is that only representations of physical processes that conform to eq. 3 or to some other characteristics of Appendix I are valid. Because of this strong constraint not only may SR and GR be discarded, but also some other mathematical descriptions and even some physics units of measure (which, of course, does not exclude that all of that may be useful for calculations in its proper context).

Similarly to Darwin's missing link, a term that expresses an attitude of stubborn criticism against evolution that hung on for a 100 years, non-locality connecting events in physics is still described as 'spoky', not the least in pop-science literature. But even in academic literature the 'Lorentz gauge' of electromagnetic wave propagation is still widely called the 'natural gauge' because it conforms to RT. The Coulomb gauge is considered by many as unnatural because of instantaneous action in the scalar potential cf. [24] , forgetting that, exactly therefore, it might be possible to explain the phase velocity sometimes exceeding the signal velocity, spatially separated superpositions of states that behave as if they were interconnected, teleportation, etc. The common argument for the Lorentz gauge that all laws of physics should look the same for any observer (*of light signals*) could be exchanged for a claim that present (*non-local*) time must exist everywhere in the universe[11]. Reinterpreting the physical meaning of the scalar potential [24] or exploiting relativistic length contractions in the non-local frame or the physics of the number π (cf. [4]) might be workable approaches to a better understanding of Maxwell's equations in a relativistic context. Choosing between the Lorentz gauge and the Coulomb gauge is a too little explored moment of truth with respect to RT and Maxwell's equations might be hiding from sight a better solution. Another moment of truth arises when dealing with magnetic charge.

Just like particle number and electric charge, magnetic charge is expected to be invariant under relativistic transformations. The magnitude of magnetic charge was originally not known [16] but recently, experiments have been performed in order to determine it [25] [26]. There is also a possibility that magnetic monopoles always appear in pairs of opposite polarity, which could make an experimental determination difficult. In the meticulous treatise ref. [27], which strictly follows the SI system of units, the magnetic charge is given as $ec/2\alpha$ and this value has been used for the present purposes [4] [5]. In the SI system of units electric charge is defined as Ampere $\times$ second [27] so the unit of time in c already set. The point of interest in the invariance of magnetic charge under relativistic transformations is that when one uses geometrized numerical values and encounters the factors $ec/2\alpha$ in an expression one has to choose between either keeping the proportionality between electric and magnetic charge or geometrizing the value of c. The outcome of that choice (and one's preference of magnetic charge quantity) represents the moment of truth in this case.

[11] An alternative dogma is really not necessary however since the above statement is blatantly wrong as soon as a 3:rd observer enters into the picture. Namely, one can imagine that an electron can see the proton and *vice versa* and that they can compute each others' coordinates and adjust each others' influences in a relativistic fashion but the investigator, the 3:rd observer, concludes that the electron obeys fermion wave mechanics whereas the proton obeys boson particle dynamics. And only one rotates about the other. So the laws of Nature are different for the two as seen by the investigator.

Accordingly [5] [28], the Bohr atom in the ground state is re-factorized after removing redundant local versus non-local terms that cancel (r_B-line increment and non-local mass) and the remaining terms are rearranged into

$$\hbar = \frac{(2g_0)^2}{(\pi\overline{q}Ampere)^2\ m^4} \tag{6}$$

where g_0 is the magnetic charge, $ec/2\alpha$, and $\overline{\Delta q} = -m^2/\overline{q}$ is the line increment ($1/\overline{q}$ equal to $\overline{\Delta q} = 7.71410^{-27}m^{-1}$. This line increment corresponds to H = 71.36 km/second/Mparsec, a reasonable choice for the local Hubble expansion rate (cf. [29] [30], most recent measurement gives 73.24 +/- 1.74).

Subsequently, eq. 6 is inserted into the linear Schrödinger equation for a free particle cf. [3], yielding

$$\overline{\Delta q}^2\ \left(\frac{ec}{2\alpha}\right)^2\ \left(\frac{\partial}{\partial x}\right)^2\ \Psi = i\ M_e\ \frac{\partial}{\partial t}\ \Psi\ (2\pi\ Ampere)^2 s^{-2} \tag{7}$$

which conforms perfectly to eq. 3 above. Namely, eq. 7 expresses a circulating charge in the non-local frame (right side) that is balanced by the product of two monopoles (presumably with opposite polarity) in the local frame (left side, magnetic charge is 1-dimensional, cf. [16], which can be verified in the present context by its 'frame signature' $[ec/2\alpha] = {}^{-}$). This interpretation of eq. 7 fits well to the primordial hydrogen atom and places the latter in a cosmological context *via* $\overline{\Delta q} = H$. Furthermore, eq. 6 and eq. 7 suggest that the apparent cosmological expansion in the current epoch (present time anywhere in the universe, that is[12]) plays a role in the internal dynamics of the atom, hinting at the possibility of vacuum energy at a much higher level than the commonly known Heisenberg-style fluctuations. (Other thinking along these lines has already been presented [14] deliberating on the whereabouts of point-like particles in matter-waves, whereby possibly 'very high energy' is made local by confinement in a 'tube' [13]). In the present case, some quantitative evidence of involvement of vacuum energy was obtained based on the assumption that the resonance particles, the Higgs, the Z, and the W bosons are manifestations of H_0 [4]. These particles appeared in the non-local frame, the heavier one balancing the others in a seesaw-like fashion jointly with the apparent cosmological expansion. The Higgs particle does not contribute to any particle dynamics in the Standard (particle) Model but is instead considered to belong to an earlier epoch in the universe's evolution. In the present theory however, its equivalent energy may even today reside in the non-local frame (cf. [4]). These calculations were based on presumed resonance at 1/3 -tuples of H and for the first time provided numerical predictions of the Higgs mass that were linked to reasonable dynamics-scenarios.

In order to find an astrophysical implementation of the present theory another approach will be taken. First, the favorite toolbox will be opened again, namely that of finding local and non-local terms in already known and well-established quantitative relations, and rearranging. This time, thermal radiation is in the focus. The fundamental mechanism of thermal radiation is still not known as reflected by that its frequency distribution has been obtained in so many contexts, including thermodynamics, electron energy band excitation-relaxation, plain statistics, and black hole radiation (some references dating back about 100y can be found in [31]). The following treatment will hardly add to the ambiguity that already exists regarding the equation's physical interpretation. Here, the frequency distribution of thermal radiation, the well-known Planck equation (eq. 365 in [32]), is rearranged as previously described, e.g. [33] [19] (Appendix I), and written in the form

[12] and present time probably didn't look very different to a particle at the origin of a time axis, notwithstanding the macroscopic evolution of astrophysical objects and the relativistic distortions involved in observations from here

[13] Similarly in the present theory, local particles are confined to one dimension and by Lorentz-transformations related to a non-local dimension. The ideas are similar but the generating theories are different.

$$\left[\frac{h\nu}{U(\nu)d\nu^{-1}}\right] e^{\left(\frac{-h\nu}{k\Theta}\right)} = \frac{c^3}{8\pi}\left[\tau^2\right]\left(1 - e^{\left(\frac{-h\nu}{k\Theta}\right)}\right), \tag{8}$$

where τ is the inverse of the radiation frequency, its period or cycle, ν and $U(\nu)d\nu^{-1}$ is the energy density of the radiation at that frequency, h is the non-reduced Planck's constant, k is Boltzmann's constant and Θ is the absolute temperature. The purpose of eq. 8 is to collect local terms to the left and non-local ones to the right as in eq. 3. The following arguments serve to convince that this has been done: Starting with the right hand side, since time is non-local in the proposed geometry of the real world, so is the period τ. c^3 is a scaling factor like in eq. 2. On the left hand side, there is an energy package, $h\nu$, that transfers momentum to and from the matter which is involved in the thermal radiation. These arguments suffice to show the compliance with eq. 3 but one can go into a more controversial discussion about the physical meaning of all the terms in this revised form of Planck's equation. The assertion is then that the terms to the left describe what happens in the local matter and those to the right apply to what happens in the electromagnetic field. The excited matter to the left, $h\nu$, will loose energy to the field as an exponential function of $-h\nu/k\Theta$ scaled by $U(\nu)$. As for the right hand side, it is known that the intensity by which a wave interacts with matter is proportional to the square of a probability measure that follows its sinusoidal period, τ. Therefore, the right side expresses the 'materialization' of the wave onto the matter and its intensity, which one obtains by moving the energy density from the left to the numerator at right. The asymptotically increasing exponential term is the only remaining term required to get back Planck's original equation and one can assume that it expresses that more energetic radiation heats the matter more. In conclusion, one can reasonably assert that the left side describes local 1-D phenomena and that the right side describes non-local phenomena (possibly at right angles) as required in eq. 3. Then one has a new standard for identifying local and non-local phenomena, the form of eq. 8, which has been investigated for interdisciplinary applications previously [33].

Accordingly, the radial velocity distribution in rotating galaxies can be evaluated for local and non-local contributions of matter, as follows. Using observational data and notations in [34], rearranging eq. 11 in that reference using that the baryonic acceleration $g_{bar} = {v_{bar}}^2/R$ and the observed acceleration $g_{obs} = {v_{obs}}^2/R$, furthermore using that $v_{obs} \propto GM_{obs}/R$ = gravitational potential, and defining the mass discrepancy M_{total}/M_{bar} as $M_D = {v_{obs}}^2/{v_{bar}}^2$ one arrives at

$$-\,{v_{bar}}^2\; e^{-{v_{bar}}^2/Rg^{\dagger}} = \frac{{v_{obs}}^2}{{v_{bar}}^2}\; v_{bar}\;[v_{bar}]\;(1 - e^{-{v_{bar}}^2/Rg^{\dagger}})\;. \tag{9}$$

Here, the local mass, ${v_{bar}}^2$ falls into its proper place on the left (local) side of the equation whereas it is compounded by interaction with the non-local mass expressed by the quotient M_D at the right hand side, corresponding to the field energy in eq. 8. On the right side one may substitute $[v_{bar}]$ for the gravitational potential which shows that the gravitational constant acts on the compounded (local+non-local) mass. Similar results have been obtained previously [4] in that the universe's missing mass, compounded with local mass, could be numerically accounted for based on plain geometrical considerations within the framework of the present theory. Now, a little tidying up of eq. 4 widens the horizon from just galaxies to the entire universe, in writing

$$r_p = \frac{\overline{\Delta q}}{s^2}\;\frac{ssm\pi^2}{r_B}\;, \tag{10}$$

which is of the same form as eq. 5. Here, $\overline{\Delta q}/s^2$ acts on two perpendicular non-local dimensions at the universe's relativistic horizon, taken per Bohr radius, to generate r_p on the left side. In the radial dimension of the present theory the number π, which is equivalent of Wallis product [4], signifies a transition from non-local at the horizon to local in the laboratory based on linear reiteration of line increments. π closes a line around a point in the direction of observation.

Eq. 9 is different from RT-GR-BH where DM is being plugged in *ad hoc* wherever the established equations do not give the right results without any logic other than referring to the cosmological constant. Not only does the non-local matter appear where it should here, to the right of eq. 9, in being *defined* as non-local in the present geometry it hints at the difficulty of encountering it in the form of particles. Rather than being based on a consistent theoretical framework like in the present theory, wherever a red mark in the margin appears in RT the errors are projected onto somebody else's admitted mistake in the most pusillanimous and simplistic fashion (λ, that is). And what is more, DM is not the only somber item that GRT has in its baggage. Matter jets spewing out of relativistic event horizons, instantaneously interconnected superpositions, weighted implicitly non-local path integrals, and teleportation are a few other examples. Not to mention empirical evidence to the contrary within GRT's own cosmological scope, for example refs. [35] [36][37]and [38] including the ambiguous origin of the cosmological redshift [39] and the non-measurement of the local cosmological expansion in a laboratory [40]. Obviously, there are a lot of things to sublimate[14] if one insists on the moss-grown relativity theory. In contrast, the present new model of the universe is easy to grasp, especially eq. 1 and other verified numerical results. New exciting research tools and ideas have been provided in this paper and a better understanding of the universe and the potential of its only known techno-intelligent beings might become possible.

3 Appendix I (from [19])

The instant of observation has a special significance in the quantum world since it accommodates the processes that cause the quantum observer to change from the ignorant state to the observed state. One approach to characterizing the instant of observation is to perform a Lorentz transformation of the inverse of the number-flux vector at discrete time coordinates -1 and 0 defining an interval of observation:

$$(q_0, t_0) = \left(\frac{\sqrt{1-\frac{v^2}{c^2}}}{v} \frac{m^2}{s}, 0 \right); \qquad (\overline{q}_0, \overline{t}_0) = \left(\frac{1}{v} \frac{m^2}{s}, -s \right) \tag{11}$$

$$(q_r, t_r) = \left(\frac{\sqrt{1-\frac{v^2}{c^2}}}{v} \frac{m^2}{s}, s\sqrt{1-\frac{v^2}{c^2}} \right); \qquad (\overline{q}_r, \overline{t}_r) = \left(\frac{1}{v} \frac{m^2}{s} - vs, 0 \right) \tag{12}$$

$$\overline{\Delta q} = -vs \ , \qquad \overline{\Delta t} = \overline{t}_r - \overline{t}_0 = s \quad \Rightarrow \frac{\overline{\Delta q}}{\overline{\Delta t}} = v \tag{13}$$

$$\Delta q = 0 \ , \qquad \Delta t = t_r - t_0 = s\sqrt{1-\frac{v^2}{c^2}} \ . \tag{14}$$

Here, m is the unit of length and s the *geometrized* unit of time [15]. This system of equations defines two observers located at origo (un-barred) and at radius distance from origo (barred observer). The latter observer is capable of observations along the momentum axis, $\overline{\Delta q}$, and of measuring the unit of time while the observer at origo only is aware of time and recognizes an angular velocity v. The two observers are space-like separated.

The directions of the axes is defined by analogy with the unit circle, $(\cos x)^2 + (\sin y)^2 = 1$, as

[14] the meaning of this term in chemistry is not intended here

[15] using non-standard (not SI) notation for the purpose of distinguishing the two units

$$ {q_r}^2 + \frac{1}{c^2}\frac{m^4}{s^2} = \frac{1}{v^2}\frac{m^4}{s^2} = {\overline{q}_r}^2 \tag{15} $$

or

$$ (\frac{\Delta t}{s})^2 + (\frac{\overline{\Delta q}}{m})^2 = 1 \tag{16} $$

so that line increment and time interval are perpendicular. The time interval measured by the momentum observer is also perpendicular to the momentum frame where it defines the tangential velocity as shown in eq. 13c.

The sign of the line increment (cf. eq. (13) shows that the radius of the observed object decreases. This corresponds to the observer at origo computing a contracted radius $\overline{q}_0$ similarly to the Fitzgerald case, $q_0 = \overline{q}_0\sqrt{1 - v^2/c^2}$. Hence, the geometry can be understood as a circle space-like separated from a peripheral observer who detects it in the form of a line increment in the direction of observation (equivalent of a contraction of its radius) after the passage of one unit of time. Furthermore, the axis of linear momentum may also be thought to harbor axial vectors. In physics, line increments in the direction of observation are known from the Bohr atom and the cosmological expansion.

For observations towards origo along the radius, the magnitude of the line increment is amplified from $\overline{\Delta q}$ per unit radius to the unit length, m (this may also be seen from eq. (11b) and (13a)),

$$ \frac{-\overline{\Delta q}}{m} = \frac{m}{\overline{q}_0} \quad , \tag{17} $$

which yields

$$ \overline{q}_0\ \overline{\Delta q} = -m^2 \approx \overline{q_r}\ \overline{\Delta q} \quad , \tag{18} $$

whereby the velocity of light, m/s, limits the radial extension of the geometry to $|\overline{q}_0|$ ($v \leq c$ as required by $\sqrt{1 - v^2/c^2}$). Because of eq. (13) and (14), observations can only be made from the laboratory frame at the periphery towards the origin of space and time coordinates. The observer at origo is non-local in the sense of performing all observations solely on the time axis (eq. (14b)) and can only access the observation *via* eq. 16.

References

[1] E. Cerven (2001) On the physical contexts of Lorentz transformations around zero time. In Proceedings of the Seventh International Wigner Symposium, Baltimore. Ed: M. E. Noz, 2001 http://ysfine.com

[2] E. Cerven (2004) Space-time dimensionality of plain physical observation Proc. of www.scienceandresearchdevelopmentinstitute.com , Quantum Physics and Cosmology No. 2, The author's own items in this reference list are all unedited unless indicated on the web-site.

[3] E. Cerven (2014) Non-Locality, Copernicus' Principle, the Density of CMBR, and a Quantitative Relation Between the Hubble Rate, the Planck Length and Ground State Dynamics. (Version 2) Proc. of www.scienceandresearchdevelopmentinstitute.com , Quantum Physics and Cosmology No. 19, (also published under another title).

[4] E. Cerven (2014) Characteristics of a 1-dimensional universe spanned between a local and a non-local observer. Proc. of www.scienceandresearchdevelopmentinstitute.com , Quantum Physics and Cosmology No. 21, The author's own items in this reference list are all unedited unless indicated on the web-site.

[5] E. Cerven (2004) Factorization of the Planck length in terms of a line increment of the order of Hubble's constant and magnetic charge. Proc. of www.scienceandresearchdevelopmentinstitute.com , Quantum Physics and Cosmology No. 3,

[6] E. Cerven (2010) Quantitative analysis of atom and particle data yields the cosmological expansion rate in the form of a vacuum instability. Proc. of www.scienceandresearchdevelopmentinstitute.com , Quantum Physics and Cosmology No. 13,

[7] E. Cerven (2016) Geometry of the universe and the hydrogen atom. Proc. of www.scienceandresearchdevelopmentinstitute.com , Quantum Physics and Cosmology No. 21,

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

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

[10] W. D. Ramsay (for the Qweak Collaboration, 2007) The Qweak experiment - A search for new physics at the TeV scale by measurement of the proton's weak charge. arXiv:hep-ph/0702283v1

[11] S. Fernbach, R. Serber, T. B. Taylor (1949) The scattering of high energy neutrons by nuclei. Phys. Rev. 75, 1352

[12] E. Cerven (2006) Exploring the physicality of physical units in a one-dimensional universe. Proc. of www.scienceandresearchdevelopmentinstitute.com , Quantum Physics and Cosmology No. 8,

[13] Table of Dimensionality of Physical Units. (Link provided under ref. 12 above at that URL)

[14] L. de Broglie, Interpretation of quantum mechanics by the double solution theory. Annales de la Fondation Louis de Broglie Vol. 12 (4) 1987 p. 1-23

[15] E. Yakaboylu, A. Deuchert, and M. Lemeshko, Emergence of non-abelian magnetic monopoles in a quantum impurity problem arXiv 1705.05162v1 [cond-mat.quant-gas] 2017

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

[17] M. Partanen, T. Häyrynen, J. Oksanen and J. Tulkki (2017) Photon momentum and optical forces in cavities arXiv:1707.04505v1 [quant-ph]

[18] J. Liang, C. Ma, L. Zhu, Y. Chen, L. Gao, L. V. Wang (2017) Single-shot real-time video recording of a photonic Mach conen induced by a scattered light pulse Sci. Adv. 2017;3:e1601814

[19] E. Cerven (2016) From atom to universe in a 1+0 -dimensional world. Proc. of www.scienceandresearchdevelopmentinstitute.com , Quantum Physics and Cosmology No. 20

[20] E. Schrödinger, Space-Time Structure. Cambridge University Press, Cambridge, London, New York, New Rochelle, Melbourne, Sydney 1950, 1985

[21] R. Geroch, General Relativity. 1972 Lecture Notes. Minkowski Institute Press, Montreal, Quebec 2013 http://minkowskiinstitute.org/mip/

[22] J. C. Baez and E. F. Bunn (2006-2015) The meaning of Einstein's equation. arXiv:gr-qc/0103044v6

[23] mathpages.com (2010-11-07): Maxwell's Displacement and Einstein's Trace http://www.mathpages.com/home/kmath103/kmath103.htm

[24] V. P. Dmitriyev (2004) On vector potential of the Coulomb gauge. arXiv:physics/0309029v2 [physics.ed-ph]

[25] D. J. P. Morris, D. A. Tennant, S. A. Grigera, B. Klemke, C. Castelnovo, R. Moessner, C. Czternasty, M. Meissner, K. C. Rule, J.-U. Hoffmann, K. Kiefer, S. Gerischer, D. Slobinsky and R. S. Perry (2009) Dirac strings and magnetic monopoles in the spin ice Dy2Ti2O7. Science 326, 411-414

[26] S. T. Bramwell, S. R. Giblin, S. Calder, R. Aldus, D. Prabhakaran and T. Fennell (2009) Measurement of the charge and current of magnetic monopoles in spin ice. Nature 461, 956-960

[27] A. M. Portis (1978) Electromagnetic Fields: Sources and Media. John Wiley Sons N. Y. Chichester Brisbane Toronto Singapore

[28] E. Cerven (2010) Quantitative analysis of atom and particle data yields the cosmological expansion rate in the form of a vacuum instability. Proc. of www.scienceandresearchdevelopmentinstitute.com , Quantum Physics and Cosmology No. 13,

[29] P. A. R. Ade *et. al.* Planck 2013 results. XVI Cosmological Parameters. www.arxiv.org , astro-ph/1303.5076v3 average of 8 determinations of H_0 in Fig. 16

[30] A. G. Riess *et. al.* (2016) A 2.4% determination of the local value of the Hubble constant. www.arxiv.org 1604.01424

[31] E. Cerven (2005) The first arbitrary event. Proc. of www.scienceandresearchdevelopmentinstitute.com , Quantum Physics and Cosmology No. 5,

[32] M. Planck (1921) Vorlesungen über die Theorie der Wärmestrahlung. Barth, Leipzig, 1921

[33] E. Cerven (2008) Rethinking thermal radiation by using its mathematical form in gene kinetics, cognitive psychology, and economics. Proc. of www.scienceandresearchdevelopmentinstitute.com , Quantum Physics and Cosmology No. 10,

[34] F. Lelli, S. S. McGaugh, J. M. Schombert, and M. S. Pawlowski (2017) One law to rule them all: The radial acceleration relation of galaxies. arXiv: 1610.08981v2 [astro-ph.GA]

[35] J. T. Nielsen, A. Guffanti and S. Sarkar (2016) Marginal evidence for cosmic acceleration from Type Ia supernovae. arXiv:1506.01354v3 [astro-ph.CO]

[36] R. Mackenzie, T. Shanks, M. N. Bremer, Y.-C. Cai, M. L. P. Gunaawardhana, A. Kovacs, P. Norberg and I. Szapudi (2017) Evidence against a supervoid causing the CMB cold spot. arXiv:1704.03814v1 [astro-ph.CO]

[37] D. Kocevski and V. Petrosian (2011) On the lack of time dilation signatures in gamma-ray burst light curves. arXiv:1110.6175v1 [astro-ph.HE]

[38] O. M. Littlejohns and N. R. Butler (2014) Investigating signatures of cosmological time dilation in duration measures of prompt gamma-ray burst light curves. arXiv:1408.6525v1 [astro-ph.HE]

[39] E. F. Bunn and D. W. Hogg (2009) The kinematic origin of the cosmological redshift. arXiv:0808.1081v2 [physics.pop-ph]

[40] E. Wiens, A. Y. Nevsky and S. Schiller (2016) Resonator with ultra-high length stability as a probe for equivalence-principle-violating physics. arXiv:1612.01467v1 [gr-qc]