

Curvilinear Cosmology

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Abstract

In comparison with the former cosmologies, from some ancient scripts up to the modern science, a cosmic model composed of the four circularly closed axes, forming the super-spherical 3D space and cyclic time, is presented. Instead of the arbitrary speculative theses, all the ideas are founded on the empirical facts and the strict logic of their relations, thus giving a consistent and systematic theory. Transverse to the curve spatial axes, the lapse of time is related with a cosmic process, as the real motion of matter from the past into future. The speed of this process appears equal with that of light propagation. Projected into 3D, it is manifest by the temporary expansion already known. The accelerated expansion, concluded from the habitual red shift formula applied to the newer astronomical data, is substituted by the cosmic pulsation. And finally, a structural dimension, as the fifth, just concerns matter, as the third natural category. Alike the former four axes, this one may be also conditionally closed into itself, by conjunction of its two terminals.

Keywords: Space, Time, Cosmos, Dimension, Curvature

Introduction

The form of space and nature of time are the two crucial cosmological questions. The space closed into itself and cyclic time can be extracted from some ancient mythological scripts. As being somehow related with the Ptolemaic astronomy, already disproved by Copernicus, these attitudes have in principle been renounced forever. In the newer ages, Bruno and Galileo were advocating Euclidian flat geometry of space and time, formalized by the infinite straight axes of Descartes. The logical inconsistency of this cosmic model had been already noticed by an Arabic philosopher from 12th century, more known by the Greek name Averreos. This criticism has been taken over by Immanuel Kant (Ref 1). In the form of logical antinomies, he speculatively showed equally unacceptable the finite or infinite straight axes, as well as the limited or eternal cosmic duration.

Without any explanation, Nicolas of Coosa advocated some finite space, but without any terminals. Taking over this sentence, Einstein related it with Riemannian closed frame, composed of the three circular axes. The flat frames of Descartes are thus restricted to the local application. However, even Einstein did not offer any convincing physical argument for his model, therefore not being widely accepted. Unlike some authors following this model (Ref 2), the majority renounces it and understands the cosmos limited by a closed surface, with the background behind it (Ref 3). The background radiation is ascribed to the reflection from this surface or the cosmic outside. Even the other cosmoses are expected in the surroundings.

As will be presented in continuation, this cosmology mainly originated from EM theory (Ref 4), or is closely related with it (Ref. 5). The curve 3D space with closed axes, developing radially at the speed of light propagation, is thus obtained. The cyclic time

appears as the consistent supplement, founded on the newer results, also formerly obtained from EM theory (Ref. 6). And finally, relying on Poynting's continuity equation, from the same theory, a structural dimension, as the fifth, is here introduced. It concerns cosmic matter, as the third natural category expressed by the energy, apart from 3D space and time. It may be also circularly closed, at least conditionally.

Extended Space

A set of n axes of the same or distinct natures forms nD -space, with the subsets of kD -subspaces, where $k \leq n$, presented in the table. The subsets sum gives 2^n subspaces of each nD -space. The addition of a new axis does not disturb the former subspaces, but forms with them the same numbers of higher ones. Each new row is thus obtained by the addition of the successive factors from the above row. The ascending column of units, presenting points, is followed by the axes, planes, etc. up to the index k reaches the number n .

Table 1.

| | | | | | | | | | | | | |
|-----|---|---|---|---|----|---|----|---|---|---|---|-------|
| n | | | | | | | | | | | | 2^n |
| 0 | | | | | | 1 | | | | | | 1 |
| 1 | | | | 1 | | 1 | | | | | | 2 |
| 2 | | | 1 | | 2 | | 1 | | | | | 4 |
| 3 | | | 1 | | 3 | | 3 | | 1 | | | 8 |
| 4 | | 1 | | 4 | | 6 | | 4 | | 1 | | 16 |
| 5 | 1 | | 5 | | 10 | | 10 | | 5 | | 1 | 32 |

The dimensions of a formal frame concern some essential features, expressed by the linear axes. These perpendicular axes point to mutually independent features. The derived features are expressed by respective diagrams. Substituting one linear axis by the angle, a straight frame turns into polar one. Such 2D frame consists of a linear radius and azimuth angle. The addition of the perpendicular linear axis gives the cylindrical 3D frame. The elevation angle instead gives the spherical 3D frame. The curve subspaces of polar frames are taken as the frames with the curve axes. The polar 3D frame, as a subspace of 4D space, exceeds human experience and imagination.

Being inaccessible by sensory experience, the relations from nD space are comprehended by generalization of 3D relations. In the opposite sense, these relations are projected from the higher into lower spaces, thus enabling or helping at least their interpretations. The projection from 3D into a plane, with the three overlapping images, demands a considerable imagination. Such overlap on the drawings is substituted by the projection into the separate sheets. The number of needed projections is reduced at symmetric phenomena.

Curvilinear Space

Let us present an interesting antinomy of the electric field distributions around the two typical material carriers: evenly charged spherical and flat surfaces. Though well-known, the former case is presented on Fig. 1. The radial electric field out of the sphere declines by the second degree, and approximately

equals to naught – inside it. As the negative field integral, the static potential declines by the first degree – out of, and is nearly constant inside the sphere.

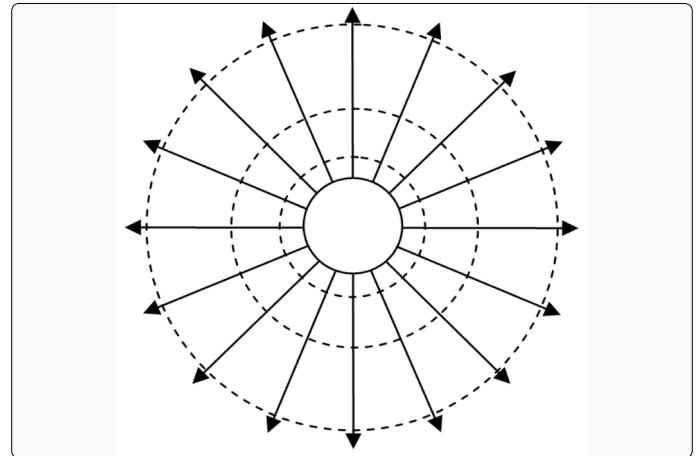


Figure 1. Explicit field distribution

The field around the plane, divided between the two sides, seems to be homogeneous. With the same surface charge, it is a half of that near the sphere. However, the potential is here problematic. As the negative field integral, it would be a declining linear function, cutting the abscissa at a distance!?

On the other hand, if its radius grows into infinity, the sphere turns into a plane. There arises the question of the instant in this process when the field has to be distributed between the two sides, and of the reason for this event. The problem is exceeded by the implicit field distribution, Figure 2.

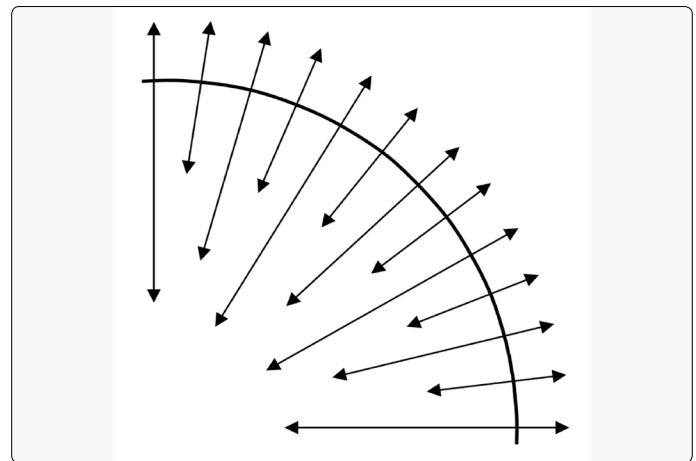


Figure 2. Implicit field distribution

The primary electric field is also equally divided into the two halves, but is locally distinctly superimposed. The field fractions add outside, but subtract inside the sphere, up to the full annulment in the center. The final result thus accords with the phenomenal distribution, Fig. 1. Let us present its global form in the curve coordinates. The globe meridians represent the field lines, around the carrying surface projected on a parallel. Alike the equator dividing a globe into two equal hemispheres, the phenomenal plane thus divides the supper-spherical space into the two halves, exceeding human imagination. Respective fields look alike that inside the sphere, Fig. 2, with respective potentials tending asymptotically to their minimums.

Alike the parallels and meridians on a globe, the circles or semicircles represent the three spatial axes. The cosmos could be entered or exited along the transverse temporal axis only, as the fourth. Light is thus infinitely circulating inside the closed cosmos. As a circular line is not limited by any terminals or spherical surface by any lines, the supper-spherical space has neither a boundary surface nor the back-ground behind it. The background radiation is not produced on, nor reflected from any surface, but is an internal cosmic phenomenon. Being nearly equal in the frequency and intensity from all sides, it may be taken as the local oscillations of the standing waves.

Linear Time

Alike the cosmic entrance and exit – possible in the fourth direction only, the cosmic development can be also directed along the temporal axis only, just as a 2D balloon is expanding radially. Of course, this process is also projected into 3D space, similarly as that of 2D balloon – to its own surface. Though the cosmologists relate temporal beginning with the starting point of expansion, they do not continue this relation into the cosmic development, as the motion of all the matter from the past into future, during the permanent cosmic process.

The speed of this process follows from the comparison of the electric (1) and magnetic (2) forces between two charges (q) moving side by side at speed v . These forces also depend on the two constants ($\epsilon\mu$), as the medium features

$$f_e = q_1q_2/4\pi\epsilon r^2 \tag{1}$$

$$f_m = -\mu q_1q_2v^2/4\pi r^2 \tag{2}$$

The radial electric force is determined in the full 3D space, but magnetic one – in the transverse plane at least, perpendicular to the path. Nevertheless, with respect to the Maxwell's relation, $\epsilon\mu c^2 = 1$, giving the speed of light propagation, the former force is the special case of latter one, at the common imaginary speed of the two charges: $v = ic$. The imaginary unit (i) concerns the transverse temporal axis. Alike the light propagating through 3D space, matter moves at the same speed in the fourth direction, thus performing the cosmic process.

As a relic of the Euclidian thought, supported by the Christian theology, the temporal axis seems to be a semi-straight line, starting from the cosmic center up to uncertain terminal. In the supper-spherical space, expanding at the speed c along t -axis, we observe two celestial bodies separated by the arc distance (l) against the central angle (α). Its temporal derivative gives the speed of the mutual motion away (v).

$$l = \alpha r = \alpha ct \tag{3}$$

$$v = \partial l / \partial t = \alpha c \tag{4}$$

Hubble's ratio of these two quantities gives the cosmic age, or the absolute time: $t = l/v$. With respect to the two mutually proportional related quantities, this time does depend neither on the body pair, nor on the cosmic process

speed. Despite analogy of the fourth with the former three axes, human view is restricted to 3D space, alike in the analogous Plato's cavity. This conclusion also obeys the kinematical relations.

Cosmic Process

The cosmic process speed can be further confirmed by the function (5) of mass variation owing to its own spatial motion. H. A. Lorentz obtained it from the balance of the two forces (1,2). Irrespective of this derivation, it has been accepted as a good description of Kaufman's experimental results. The elementary rearrangement of it gives Pythagoras' theorem (6) relating three linear momentums, as the vectors, Fig. 3.

$$m^2 = m_0^2 / (1 - v^2/c^2) \tag{5}$$

$$(m_0c)^2 + (mv)^2 = (mc)^2 \tag{6}$$

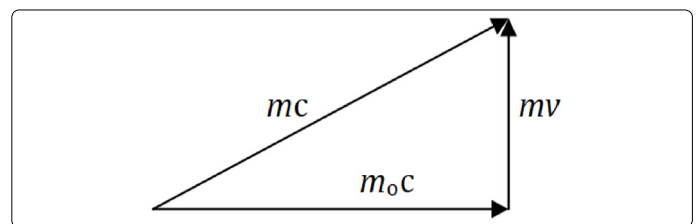


Figure 3. Linear momentum triangle

The spatial and temporal momentums, as the catheti, give the vector sum, on the hypotenuse. Respective kinetic energy, as the known Einstein's difference (7), indirectly depends on the spatial speed, via the variable mass (5).

$$w - w_0 = (m - m_0)c^2 \tag{7}$$

Here c is the process speed along the temporal axis, at the spatial rest or motion of the mass. However, the two terminals of this semi-straight axis, as the thesis and antithesis, undergo the critiques of Kant's temporal antinomy.

Cyclic Time

The similar triangle need be also valid for the three related speeds, as the vectors. Of course, this is impossible in the flat geometry, but is obvious in the spherical one. The two temporal speeds, as the equal parts of two meridians, start from the apex at a globe pole, irrespective of the basis, as the spatial speed along a globe parallel. The cosmic process thus keeps the constant speed value. Apart from the speed of this process, the (semi)-circular temporal axis is affirmed.

As the spherical analogy observed on the two curve axes, let us imagine a planet fully covered by water. A meteor fallen on one its pole would initiate the wave along the meridians, thus propagating via the equator towards the other pole. There being reflected from, or crossing through itself, this wave continues the opposite propagation. The flat projection of this process can be observed in a round container with water. A drop fallen in the center substitutes the meteor, and the circular peripheral walls reflect the equatorial wave. Respective kinematical cosmological relations, Fig. 4, are described by (8-11).

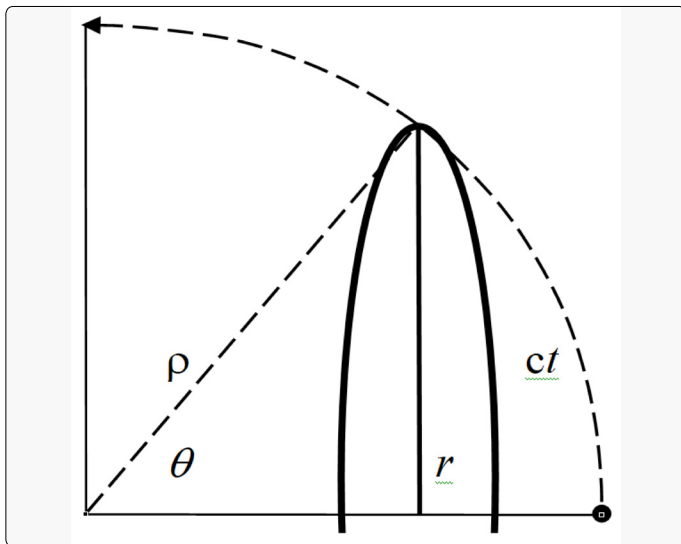


Figure 4. Curvilinear cosmological relations

$$l = \alpha r = \alpha \rho \sin \omega t \tag{8}$$

$$v = \partial l / \partial t = \alpha c \cos \omega t \tag{9}$$

$$l/v = (\rho/c) \operatorname{tg} \omega t \tag{10}$$

$$\omega t = \theta = ct/\rho \tag{11}$$

The dashed arc presents a fourth of the temporal circle, and the bold one – a half of the expanding cosmos. The cosmic radius is thus rising from the naught up to the maximal value (ρ), where the decelerated expansion turns into accelerated contraction – towards the naught. The arc distance (l), proportional with the cosmic radius (r), gives the mutual speed (v). Hubble’s ratio (10) thus depends on the two unknown values: the temporal radius and phase of the development (11) or the cosmic age. In one cycle quarter, this age is unique. However, with respect to tg -function, it may be greater or smaller from the ratio. Even in the frames of one quarter, this age is uncertain.

Red Shift

Instead of the alleged accelerated expansion, the sine-function (8) understands decelerated expansion or accelerated contraction only. Where is the mistake? In the aim of the answer, let us formerly present the two Doppler’s effects, as the ratios in the pairs of the three frequencies: *emitted* (u), *propagating* (c) and *detected* (v). The former function (12), concerning the moving emitter, compares the propagating and emitted frequencies. The latter of them (13), concerning the moving detector, compares the detected and propagating frequencies. The particular speeds refer the medium, whatever it may be. Unlike the *absolute* speed through the medium, the two *relative* ones, of the emitted or detected signals, refer respective devices.

$$n_c/n_u = c/(c - u) \tag{12}$$

$$n_v/n_c = (c - v)/c \tag{13}$$

Fig. 5 presents the two diagrams, the former – as hyperbola, and latter – as the straight line. These two distinct functions are mutually symmetric for the small speeds only,

near the crossing point. The former of them announces the *wave wall* – near the asymptotic speed of propagation (c), but latter one – the *event horizon* – after the same speed, without any detected signal. Their product (14), with the two variables, describes the simultaneous independent motion of the two devices. In the case of their common motion ($u = v$), these two effects compensate each other. The same result would also appear at the opposite motion of the medium of propagation.

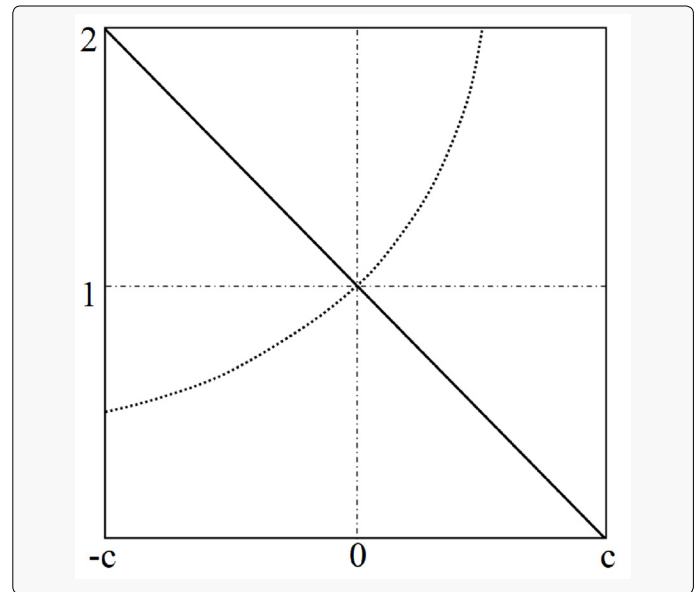


Figure 5. Doppler’s effects

$$\begin{aligned} n_v/n_u &= (c - v)/(c - u) = \\ &= (1 - v/c)/(1 - u/c) \end{aligned} \tag{14}$$

At mutual motion away of the two devices, caused by the cosmic expansion, none of these three functions is adequate. Though resting in their local surroundings, the two devices are moving away, carried by the expansion. As an arbitrary solution, the average of the functions (12) & (13) has been used. It equals to the square root of (14), with the single speed and plus in the nominator – due to the motion away.

The application of such formulas is usually limited. In particular, this one had been giving the acceptable results up to its application to the distant supper-nova stars, when it gave the greater distances from those estimated by the luminosities of these typical stars. This result has been ascribed to the former slower expansion, lately permanently or occasionally accelerated, owing to some unknown reasons, neither practically confirmed nor theoretically explained. During its long application, this formula has been so habituated that nobody tries to reexamine it.

There is the obvious distinction between all Doppler’s effects and cosmic red shift. The former three effects arise locally, on the moving devices, but last one develops in the expanding medium, along the whole path of the light. This fact clearly points to the exponential function: $\exp(-v/c)$. Alike radiating matter dissolved to its half for some time, the frequency is halved on a light path. The two diagrams are compared on Fig. 6.

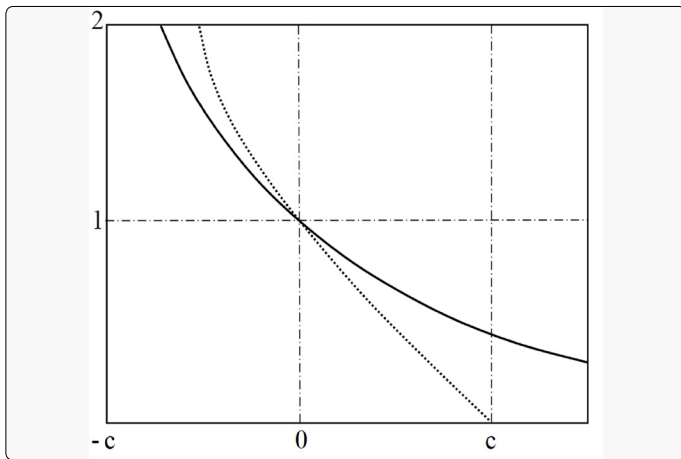


Figure 6. Red shift diagrams

The punctual line presents the former traditional function. Its naught (at $v = c$) points to the event horizon, and the asymptote (at $v = -c$), to the wave wall – at possible cosmic contraction. Not only that the new function escapes both these two effects, but the smaller shift – in relation to the central unit line – may be sufficient to avoid the problematic accelerated expansion. Of course, even the proposed function does not pretend on the final form. Owing to various reasons, some its modifications, more or less essential, may be expected.

Structural Dimension

In analogy with the temporal axis, T. Kaluza predicted a fifth dimension, but without any physical interpretation. Renewing the same concept lately, O. Klein proposed a circular fifth axis, closed into itself in the elementary structure, also without reasonable interpretations. However, apart from the two linear strait axes – longitudinal and transverse ones, a cylindrical frame operates by the azimuth angle, in the transverse plane. Along the radial axis, the circular arc is proportional with the azimuth angle. Such the fifth circular axis would restrict or call in question the radial linear axis. With respect to the known four unrestricted dimensions, this concept is problematic at least.

A better model of the fifth axis is founded on the structural zooming. Apart from space and time, physical processes depend on the *structural levels*, with respective spatial references and measuring units. Unlike planetary orbits – in the solar reference, satellite ones still obey respective planetary orientations. Moreover, chemical and nuclear processes develop in parallel – nearly independently, in the same material. The valid references and measuring units more distinguish in the microstructure – on one, and cosmology – on the other side. The sequence of such *relevant* domains, arranged in the ascending raw, form the continual semi-straight fifth dimension.

It can be supported by Poynting's continuity equation (15), consisting of the *spatial*, *temporal* and *substantial* terms. The first term expresses the spatial sources of energy current ($\mathbf{S} = \mathbf{E} \times \mathbf{H}$), second – variable energy density, and third – power ($P = \mathbf{E} \cdot \mathbf{J}$) of the energy transfer between the structural

strata, turning it into the other energetic forms, as warmth is. The semi-straight line, from the smallest up to greatest structural elements, expresses respective stratification along the new axis.

$$\nabla \cdot \mathbf{S} + \partial W / \partial t + P = 0 \tag{15}$$

The logarithm turns the semi-straight structural axis into a symmetric line, with the two infinite legs. The zero position is determined by the convenient unit of length. Restricting to the matter, from the smallest particles – up to whole cosmos, all the intermediate strata are distributed along thus limited axis. Owing to the cosmic process, consisting of the elementary particles moving side by side along temporal axis, these two terminals concern the same process, and may be connected to each other, thus also circularly closing the new axis.

Discussion

Though good sounding, the motion from the past into future is abstract and scientifically problematic. With the time taken as the metrical axis, or the product with the process speed, the past and future represent its two legs.

What determines the number of physical dimensions? Why just five, but not ten or eleven, as in the string theory? Alike time being problematic due to its incomplete perception, the abstract additional dimensions are implausible.

Only one 3D subspace of 4D space is explicitly manifest. What is the case with the remaining trinity? The abstract mathematics concerns the general formal relations, which sometimes exceed the physical facts practically restricted.

Why gravitation does not influence the cosmic process speed? As the attraction of the parallel flows of matter, gravitation may be the consequence of the cosmic process. Directed through 3D space, transverse to the flows, it curves the temporal axis, as the direction, saving the process speed.

The cosmic process speed, equal to that of light propagation, cannot be practically reached by any single particle. The greater speeds are especially excluded. Namely, the spatial speed (v) of mass is limited by its temporal speed (c).

What is the advantage of this cosmology in relation to the majority of the modern concepts? It is more consistent, simpler and accessible by the readers. Without any hypotheses, it exceeds the classical cosmological antinomies.

Why the standard cosmology is here ignored? Referring to each other, the mainstream texts are limited by the same frames, thus leading into the common blind alley.

Which wider context can be had in view? The elaborated classical physics, continual and deterministic, initiated by EM theory and reduced to a unique natural law.

With a sequence of the crucial U-turns, why this article is not classified as research? There was no serious research; the known facts are only mutually compared. The presented text exposition may be taken as the main contribution.

Even as such, it deserves the review status at least. Its conclusions do not pretend on the final truth.

Conclusions

Curve space and cyclic time, exceeding Kant's antinomies, are supported by the convincing physical arguments. The spatial axes circularly closed exclude any cosmic background and the other cosmoses – in the surroundings.

The cosmic process is developing along t -axis, at the speed of light propagation. Its projection into 3D space gives the cosmic pulsation and cyclic time, manifest by the temporary expansion, already indirectly empirically predicted.

The sine pulsation understands the decelerated expansion or accelerated contraction only, unlike the accelerated expansion, predicted by the traditional formula. Moreover, Hubble's ratio cannot strictly determine the cosmic age.

Not only that time is related with the cosmic process, but is strictly determined by it. Instead of its subjective bases, or the doubts about its reality, this is the crucial natural notion. All the physical processes are compared with it.

Unlike the linear momentums, as the local quantities added in the tangential 4D flat space, respective three speeds, as the global quantities, add in the hyper-spherical space. These facts accord with the theory of the frames.

With respect to the energy continuity (15), the stratification of matter, by zooming of its structure, gives the interpretation of the fifth axis, instead of its alleged local curvature, without any palpable empirical or theoretical bases.

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