Information Dynamics in the Universe

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ABSTRACT

In the present paper a general method is proposed for description of human and cosmic thinking as well as some other kinds of processes in the Universe without uses the concepts of time and space. Thus, one can get rid of the assumption that the bases of the Universe must be without fail a certain continuum, *e. g.,* 4D space-time of special or general relativity, and consider processes in the Universe possessing much more general structure. The proposed method can be applied, in particular, to the interaction of human thinking and thinking of the Universe as the whole, as well as that of its parts. In particular, it could check whether a kind of Mach principle exists for the human thinking.

Key Words: cosmic thinking, information process, information dynamics, space-time substitute

1. Introduction

In (Temkin, 2012) the *Universe* was considered as built of information quanta, their clusters and their clusters. In Temkin (1999) and Mensky (1990; 1991) was argued that the quantum character of a system, in which incompatible subsets of measurements exist, makes it able to think, to possess of the mind which, generally speaking, should be the quantum one. The purpose of this work is to approach to study the mechanism of thinking processes in the Universe as occurring between subsets of information quanta.

The set of all information quanta consists of many types of their combinations, so it is important to search for ways and mechanisms of the information transfer between its subsets of various types. Then the next step must be to find how to characterize effectiveness of these ways and mechanisms of the information transfer. In this respect it would be very important to consider the information transfer from and to subsets that are thoughts. In Temkin (1982; 1999) is considered the way of the information transfer by something like de Broglie waves. The velocity of the information transfer by this way is not limited by the light velocity, which is very important for the information transfer in the Universe. Possibly, the velocity of de Broglie waves depends on concrete situation, *e. g.*, what is the source of them and the processes responsible for their radiation, as well as what are objects with which they may interact at their propagation *etc*. Thus, an important task is to clarify the conditions of de Broglie wave propagation.

Let us concentrate our attention on the *Activated Chain Relation* (ACR) propagation in the Universe. If all its parts propagate with the same velocity, this ACR will reach the destination not being distorted. In other words, the corresponding thought (Temkin, 1999), transferred from one place of the Universe to another one, will not be

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distorted. It must emphasize that this condition should be fulfilled during all the way, no matter whether this velocity remains unchanged or is changed during this "travel", important is that such changes would be coherent for all parts of the considered ACR.

Changes of an ACR propagation velocity arise from the considered ACR (or its parts) interaction with information objects (according to our approach (Temkin, 2012) material objects are also the information ones by their nature) contained in the Universe. For the simplicity, *we shall call the set of such objects able to interact with the ACR, the way of the considered ACR propagation.* However, it is to keep in mind that *this is not a way in a space* because the concept of the space was not yet defined. If during its propagation from the source to the destination a certain $ACR_{l'} \in A = \left[\forall l \in \left[l_1, l_{\max} \geq l_1 \right] \in \mathbb{N}, l' \in \left[l_1, l_{\max} \geq l_1 \right] \right]$ $\{ACR_l\}$ does not interact with any object, *we shall call this way the empty one for $ACR_{l'}$* , no matter whether other $ACR_s \neq ACR_{l'}$ can or cannot detect information objects that do not interact with the $ACR_{l'}$. In other words the way can be empty for $ACR_{l'}$, but, at the same time, to be not empty for $(\forall ACR_s) \neq ACR_{l'}$. Let be $\forall \{ACR_l\} \subseteq A$ a subset of a sentence propagating from the source to the destination along those ways that are empty for all $\forall ACR_{l'} \subseteq [\forall l] \{ACR_l\}$. Then the sentence will reach the destination remaining unchanged. Another possibility for an ACR, or of a whole sentence to reach the destination remaining unchanged is that interaction of all parts of an ACR, as well as $\forall ACR_{l'}$ representing the sentence, with Universe objects provokes only coherent changes. Note that it is only a necessary, but not sufficient condition. It would be interesting with this connection to consider the separation of the useful signal from the noise arising from the $ACR_{l'}$ of the message interactions with different objects in the Universe.

On the other hand, acting in analogy with the consideration of the mind – brain relationship (Temkin, 1999) one must find sets of objects in the Universe that can be put in correspondence with the mathematical objects such as ACRs, which means that the Universe (or some of its parts) are considered as a kind of brain, *cosmic brain*, as one can call it.

Other possibilities could be that there exist such parts of the Universe each of which could be considered as a cosmic brain able to its own thinking. It would be interesting to clarify how such cosmic brains can exchange of the information between them and, using such

exchange as communication, to organize "cosmic thinking societies". In view of this hypothesis it would be desirable to check whether the astrology is not a kind of false-science, but has the real meaning based, for example, on the influence of cosmological brains and their societies thinking the human thinking and life, *i. e.*, the existing of Mach principle for human thinking (*cf.* Temkin, 2003).

2. Chains of relations and activated chains of relations in the Universe

Chains of relations (CRs) and activated chains of relations (ACRs) on a set were used in the book (Temkin, 1999) for the information processing representation. It is to choose sets of elements that exist in the Universe and to establish the isomorphism between these sets and the abstract mathematical sets A, A_s, V, M *etc.* (Temkin, 1999; Ch.1). Then the mathematical formalism proposed and developed in this book can be applied to the problem under consideration. In particular, *the mathematical definition of the mind (Temkin, 1999) can be formulated for the Universe and its parts.*

In our article (Temkin, 2012) was established that the Universe is built of information quanta. So we define that the set $A = \{a\} \neq \varnothing$ is a finite or infinite (countable or continuum) ordered set of elements $a = \{a_u\}$, each of which is a set of elements a_u each of them, in its turn, could be *information quanta or their clusters and other combinations.* Following (Temkin, 1999; Ch.1), we define $V = \{v_a\} \neq \varnothing$ as a set of elements v_a of arbitrary nature, such that $V \cap A = \varnothing$. Then put a subset $V_a \subseteq V$ in correspondence to an element $a \in A$ and call V_a *properties of element a* . Now it is to find what are physical properties of information quanta and their combinations (sets) in the Universe. Following (Pagliani & Chakraborty, 2005a,b), but using our notations, we can define that the status of an observation system at a certain element of the substitute of time (Temkin, 1999) (hence possibly partial) is essentially a triple $\mathbf{P} = \langle A, V, \Vdash \rangle$ that we call a *property system*, $\Vdash$ being the symbol of *entailment*, and $\Vdash \subseteq A \otimes V$ is intended as *fulfillment relation* (Pagliani & Chakraborty, 2005). Using the notations written above, one can apply the theory (Temkin, 1999; Ch.1, pp.1-15) to the consideration of the information processing in the Universe by different sets of its elements such as information quanta and their sets (clusters *etc.*).

3. Substitute of Time

The concept of space-time continuum was not yet defined and it is not clear whether concepts of time as well as of space can be defined for the Universe and each of its parts. We shall begin from the definition of the notion "*substitute of time*" which can be used instead of time throughout the whole Universe or a part of it. It could facilitate the consideration of the general case (see Sec. 4). To prepare it we begin this Section from reproducing a part of written in (Temkin, 1999; Ch. 1).

Let there is a complete metric space M of dimension $\dim(M) \in [1, \infty)$ and

$$\left[H \cap A = \varnothing, \dim(H) = 1 \right] H \overset{def}{=} \{h\} \subseteq M$$

be an ordered unbounded single-connected subset of this metric space (Temkin, 1999; p.5), while $A = \{a\} \neq \varnothing$ be a finite or infinite (countable or continuum) ordered set of elements $a = \{a_u\}$ (Temkin, 1999; p.2). We shall call the subset $\left[H \cap A = \varnothing \right] H = \{h\}$ *axe* in the considered metric space *identifying its ordering with its direction*.

Denote $H_Y^{(k)}$ homomorphism keeping the order of a certain well-ordered single-connected set Y, e. g., $Y \subset A$, to a certain well-ordered single-connected subset $H^{(k)} \subset H$, where $k \in \mathbb{N}$. Here $\mathbb{N}$ is the set of all natural numbers. The set $H = \{H_Y^{(k)}\}$ of considered maps is well ordered as a consequence that the set H is well ordered. It, evidently, remains valid also when maps of different Y, e. g., $Y^{(1)}$, $Y^{(2)}$, …, to these subsets of the set H are considered. In real situations $H_Y^{(k)}$ corresponding to different values of $k \in \mathbb{N}$, correspond to different measurements made by the observer.

Statement

A set H *can be used as the generalization of time, iff subsets in brackets possessing neighbor values of* k

$$S_{k-1,k,k+1} \overset{def}{=} S(H_Y^{(k-1)}, H_Y^{(k)}, H_Y^{(k+1)}) \overset{def}{=}$$
$$(\forall k)\left\{ \exists \left[H_Y^{(k-1)}, H_Y^{(k)}, H_Y^{(k+1)} \right] \right\} \quad (1)$$

are neighbor subsets. For the detailed consideration see (Temkin 1999, Sec. 1.2 & 1.3). How one can represent this *substitute of time* elapsed between two measurements will be considered below.

One of possible ways to introduce an analog to the duration of time between two events is to choose the set H such that it is a normalized space, *e. g.*, Hilbert space. Then the distance between two points of this space could be defined and considered as the analog of the time duration. If the nature of the considered events does not allow such a choice, one can use the metric space (Kaplansky, 1977; Spanier, 1955; Temkin, 1999) with the same purpose.

Now the problem of the time concept generalization (*i. e.*, to find a *substitute of time*) is reduced to the search for convenient choice of *natural objects* that can be represented by elements of the set $A = \{\forall a\} \neq \varnothing$. After the fulfillment of this step all mathematical consideration described above becomes at the same time the one with corresponding sets of natural objects or natural events. Therefore, the *necessary and sufficient condition* of the "time-like description" validity remains the same, but in which all elements of mathematical sets correspond to *natural objects or natural events*. If the considered natural objects are of the quantum nature, it must demand that they are distinguishable. Any subset of not distinguishable natural objects must be considered as one object. If such an object decays into a number of distinguishable objects, it creates a new subset of distinguishable objects. It opens the way to consider extra short pulses with the participation of elementary particle interacting, appearing and disappearing.

Let us consider the case of metric space. Consider now the set $A = \{\forall a\}$, which is a metric space. Let $a_c \in A$, $a_{c'} \in A$, and $\rho_A(a, a') \geq 0$ is the distance between these two points of the considered metric space $A = \{\forall a\}$. Let $H = \{\forall h\}$ be a well ordered set of power $\mu(H) = \aleph$, or $\mu(H) = \aleph_0$, or $\mu(H) < \aleph_0$ where $\mu(\{b\})$ is the power of the set $\{b\}$. *We denote by* $< \aleph_0$ *power of a finite set*. As it was shown in (Temkin, 1999), the set H can be used as a substitute of time, when the time can be defined as well as when the time cannot be defined. Consider these problems with more details.

Now map the subset $A_{1,2} \overset{def}{=} \{a_1, a_2\} \subseteq A$ to a subset $H_0 \subseteq H$. Denote it $\langle \hat{M}_0 A_{1,2} | H_0 \rangle = A_{1,2|0}$, where $\hat{M}$ is the operator of the mapping. Let the second mapping be $\langle \hat{M}_1 A_{1,2} | H_1 \rangle = A_{1,2|1}$ and $\rho_{A|0}\{a_{1|0}, a_{2|0}\} \leq \rho_{A|1}\{a_{1|1}, a_{2|1}\}$.

Then one defines that the considered two elements did not move one with respect to the other, if the sign is =, and moved, if it is <. The opposite case can exist when the sign < is replaced by >. The conclusion is the same. We shall define the subset $H_{0,1} = H_1 \setminus H_0 \subseteq H$ as the

substitute of time elapsed between two considered events.

Consider two single-connected subsets

$$\left[\Omega_1 \overset{def}{=} \left\{ a_{\Omega_1} \right\} \subset A, \Omega_2 \overset{def}{=} \left\{ a_{\Omega_2} \right\} \subset A, \left| \Omega_1 \cap \Omega_2 = \varnothing \right. \right] \quad (2)$$

such that the state of each of them can be defined by a number of parameters β

$$\Omega_1 = \left\{ a_{\Omega_1} \middle| \beta_{\Omega_1} \in \mathbb{N} \right\}, \Omega_2 = \left\{ a_{\Omega_2} \middle| \beta_{\Omega_2} \in \mathbb{N} \right\}, \quad (3)$$

Define the mutual position of Ω_1 and Ω_2 as

$$\left\langle \Omega_1 \middle| \Psi_{1,2} \middle| \Omega_2 \right\rangle \overset{def}{=} \left\langle \forall \beta_{\Omega_1} \middle| \Phi_{1,2} \middle| \forall \beta_{\Omega_2} \right\rangle \quad (4)$$

Let at the initial measuring the observer found that

$$\left\langle \Omega_1 \middle| \Psi_{1,2}(0) \middle| \Omega_2 \right\rangle \overset{def}{=} \left\langle \forall \beta_{\Omega_1}(0) \middle| \Phi_{1,2} \middle| \forall \beta_{\Omega_2}(0) \right\rangle \quad (5)$$

And at the next measurements the observer found

$$\left\langle \Omega_1 \middle| \Psi_{1,2}(1) \middle| \Omega_2 \right\rangle \overset{def}{=} \left\langle \forall \beta_{\Omega_1}(1) \middle| \Phi_{1,2} \middle| \forall \beta_{\Omega_2}(1) \right\rangle \quad (6)$$

Following the written above, map $\Psi_{1,2}(0)$ to $H(0) \subset H$, and map $\Psi_{1,2}(1)$ to $H(1) \subset H$:

$$\left\langle \hat{M}(0) \Psi_{1,2}(0) \middle| H(0) \right\rangle \overset{def}{=} \left\langle \Psi_{1,2} \middle| 0 \right\rangle \overset{def}{=} \Psi_{1,2|0} , \quad (7)$$

$$\left\langle \hat{M}(1) \Psi_{1,2}(1) \middle| H(1) \right\rangle \overset{def}{=} \left\langle \Psi_{1,2} \middle| 1 \right\rangle \overset{def}{=} \Psi_{1,2|1} \quad (8)$$

In this case we shall also define the subset $H(0|1) \overset{def}{=} H(1) \backslash H(0) \subseteq H$ as the substitute of time elapsed between two considered events.

Now we can define the substitute of the *average* velocity of the two subsets relative movement as follows:

$$\Xi_{0,1} = \left[\left\langle \Psi_{1,2}(1) \right\rangle - \left\langle \Psi_{1,2}(0) \right\rangle \right] \rho_H^{-1} \left(H(1), H(0) \right) \quad (9)$$

and velocity

$$\Xi(H) = \lim_{H(1) \to H(0)} \Xi_{0,1}$$
$$= \left[\left\langle \Psi_{1,2}(1) \right\rangle - \left\langle \Psi_{1,2}(0) \right\rangle \right] \rho_H^{-1} \left(H(1), H(0) \right) \quad (10)$$

In Eqns. (9) and (10) we did not use ρ_A in the left-hand side because the expression in brackets contains more information on the considered system change (between two measurements) than $\rho_{0|A|1}$, *i.e.*, the change of the

distance between two positions of the considered subset that are denoted A_0 and A_1 (no matter how it was defined).

These definitions can be generalized and applied to the case of more than two subsets. Then one can formulate an analog of the hydrodynamics occurring inside a set of abstract mathematical elements. For this purpose it is to begin from the generalization of our consideration to the case of any final number of subsets. Let be

$$\Upsilon \overset{def}{=} \Upsilon \left(\Omega = \left(\forall l \in [1, n] \subseteq \mathbb{N} \right) \right) \left\{ \Omega_l \subset A \right\}, \quad (11)$$

where $\forall \Omega_l$ are single connected. Then, instead Eqn. (4) one can write the generalized equation:

$$\left((l \neq l') \in [1, n] \subseteq \mathbb{N} \right) \left\{ \left\langle \Omega_l \middle| \Psi_{l,l'}(0) \middle| \Omega_{l'} \right\rangle \right\} \overset{def}{=}$$
$$\left((l \neq l') \in [1, n] \subseteq \mathbb{N} \right) \left\{ \left\langle \forall \beta_{\Omega_l}(0) \middle| \Phi_{l,l'}(0) \middle| \forall \beta_{\Omega_{l'}}(0) \right\rangle \right\} \quad (12)$$

instead Eqn (5) one can write

$$\left((l \neq l') \in [1, n] \subseteq \mathbb{N} \right) \left\{ \left\langle \Omega_l \middle| \Psi_{l,l'}(0) \middle| \Omega_{l'} \right\rangle \right\} \overset{def}{=}$$
$$\left((l \neq l') \in [1, n] \subseteq \mathbb{N} \right) \left\{ \left\langle \forall \beta_{\Omega_l}(0) \middle| \Phi_{l,l'} \middle| \forall \beta_{\Omega_{l'}}(0) \right\rangle \right\} \quad (13)$$

instead Eqn (6) one can write

$$\left((l \neq l') \in [1, n] \subseteq \mathbb{N} \right) \left\{ \left\langle \Omega_l \middle| \Psi_{l,l'}(1) \middle| \Omega_{l'} \right\rangle \right\} \overset{def}{=}$$
$$\left((l \neq l') \in [1, n] \subseteq \mathbb{N} \right) \left\{ \left\langle \forall \beta_{\Omega_l}(1) \middle| \Phi_{l,l'}(1) \middle| \forall \beta_{\Omega_{l'}}(1) \right\rangle \right\} \quad (14)$$

instead Eqn (7) one can write

$$\left((\forall l, \forall l', l \neq l') \in [1, n] \subseteq \mathbb{N} \right) \left\{ \left\langle \hat{M}(0) \Psi_{l,l'}(0) \middle| H(0) \right\rangle \right\} \overset{def}{=}$$
$$\left((\forall l, \forall l', l \neq l') \in [1, n] \subseteq \mathbb{N} \right) \left\langle \Psi_{l,l'} \middle| 0 \right\rangle \overset{def}{=} \Psi_{l,l'|0} \quad (15)$$

instead Eqn (8) one can write

$$\left((\forall l, \forall l', l \neq l') \in [1, n] \subseteq \mathbb{N} \right) \left\{ \left\langle \hat{M}(1) \Psi_{l,l'}(1) \middle| H(1) \right\rangle \right\} \overset{def}{=}$$
$$\left((\forall l, \forall l', l \neq l') \in [1, n] \subseteq \mathbb{N} \right) \left\langle \Psi_{l,l'} \middle| 1 \right\rangle \overset{def}{=} \Psi_{l,l'|1} \quad (16)$$

instead Eqn (9) one can write

$$\left((\forall l, \forall l', l \neq l') \in [1, n] \subseteq \mathbb{N} \right) \overline{\Xi}_{l,l'}(0,1) =$$
$$\left((\forall l, \forall l', l \neq l') \in [1, n] \subseteq \mathbb{N} \right)$$
$$\left\{ \left[\left\langle \Psi_{l,l'}(1) \right\rangle - \left\langle \Psi_{l,l'}(0) \right\rangle \right] \right\} \rho_H^{-1} \left(H_1, H_0 \right) \quad (17)$$

and instead Eqn (10) one can write

$$\left((\forall l, \forall l', l \neq l') \in [1, n] \subseteq \mathbb{N} \right) \Xi_{l,l'}(H) \overset{def}{=}$$

$$\lim_{H(1)\to H(0)} \overline{\overline{\Xi}}_{0,1} \overset{def}{=}$$

$$\lim_{H(1)\to H(0)} \left(\left(\forall l, \forall l', l \neq l'\right) \in [1,n] \subseteq \mathbb{N}\right) \qquad (18)$$

$$\left\{\left[\langle \Psi_{l,l'}(1)\rangle - \langle \Psi_{l,l'}(0)\rangle\right]\right\} \rho_H^{-1}\left(H(1), H(0)\right)$$

Let

$$\rho_{H,\min} \overset{def}{=} \min \rho_H\left(H_1, H_0\right) \qquad (19)$$

be *the smallest distance* in the set H between any two its subsets that *could be measured by the* chosen observer, in other words, when *these two subsets still remain distinguishable*. Let there is a perturbation in the set A depending on the set H.

Condition of a Perturbation Existence

This perturbation exists inside the set Υ of subsets

$$\Upsilon \overset{def}{=} \Upsilon\left(\left(\forall l \in [1,n] \subseteq \mathbb{N}\right)\{\Omega_l \subset A\}\right), \qquad (20)$$

If the chosen observer is able to detect the distance change of, at least, between any two subsets

$$\Delta \rho_{A|\Omega_l,\Omega_{l'}} = \rho_{A|\Omega_l,\Omega_{l'}}\left(H''\right) - \rho_{A|\Omega_l,\Omega_{l'}}\left(H'\right) \qquad (21)$$

during

$$\Delta \rho_H = \rho_H\left(H''\right) - \rho_H\left(H'\right) \geq \rho_{H,\min} \qquad (22)$$

For example, laser pulse propagated through a certain medium, in particular, cosmic medium, can be considered as a perturbation described above on the mathematical set theory level. Then, the next step must be to choose the set of physical objects being in this medium, to map it to the mathematical set, to construct *on the physical level* the set of subsets

$$\Upsilon \overset{def}{=} \Upsilon\left(\left(\forall l \in [1,n] \subseteq \mathbb{N}\right)\{\Omega_l \subset A\}\right),$$

and thereupon to apply the consideration written above to the corresponding set of physical objects.

4. Substitute of Space - Time Continuum

In this Section we shall repeat the consideration of the Sec. 3 with necessary generalizations to include space into consideration, exactly, to construct the "substitute of space" and, thereupon, the *"substitute of space – time continuum"*.

The expected results should be relevant to situations arising at the description of the

information processing by the Universe and its parts including the cosmic mind.

Let there is a complete metric space M of dimension $\dim(M) \in [2,\infty)$ and $\left[H \cap A = \varnothing, \dim(H) = 1\right] H \overset{def}{=} \{h\} \subseteq M$ be an unbounded single-connected ordered subset of this metric space M (Temkin, 1999; p.5), while $A = \{a\} = \{\{a_u\}\} \neq \varnothing$ and three cases are possible: $\mu(\{a_u\}) = \aleph$, or $\mu(\{a_u\}) = \aleph_0$, or $\mu(\{a_u\}) < \aleph_0$ (Temkin, 1999; p.2). Denote $H_Y^{(k)}$ homomorphism of a certain single-connected set Y, e. g., $Y \subset A$, to a certain single-connected subset $H^{(k)} \subset H$, where $k \in \mathbb{N}$. Here $\mathbb{N}$ is the set of all natural numbers. Let us consider the case when the set $H = \left\{H_Y^{(k)}\right\}$ of considered maps is single – connected. It, evidently, is valid when all $\left[\forall k \in [k_{\min}, k_{\max} > k_{\min}] \subseteq \mathbb{N}\right] Y^{(k)}$ are the neighbor ones. In real situations $H_Y^{(k)}$ with different values of $k \in \mathbb{N}$, correspond to different measurements made by the observer.

If one wants to build a substitute of 4D – space – time - continuum, it is to find ordered sets that would be a substitute of time (one) and space (three). Then the Cartesian product of these 4 substitutes will be the substitute of 4D – space – time – continuum. Then, the propagation of information throughout the whole Universe or through a/some part/s of it can be considered as the one through the *substitute of space – time continuum,* if it can be defined there.

The same can be done, if the substitute of the n>3 dimensional space is constructed. Then, in the general case, *the substitute of (n+1) dimensional continuum should be constructed.*

It can be written as follows

$$M_{n+1} \overset{def}{=} \prod_{k=1}^{n+1} \otimes H_k \ , \qquad (23)$$

where $\left[\dim(M_{n+1}) = n+1\right] M_{n+1}$ is the metric subspace strained on $n+1$ axes mentioned above.

The natural question is whether the shortest distance between two points in the substitute of (n+1) dimensional continuum should be a direct line segment or not, in other words, whether it is the substitute of Minkovski space-time, or that of the General Relativity. Of course, the concept of line should be defined for this substitute.

Note that in this paper we used one of two approaches proposed by the author (Temkin, 1999; 2007) for the treatment situations when time and space cannot be

defined. We used here the method proposed in (Temkin, 1999). The second method proposed in (Temkin, 2007) is based on the *Theory of Types* of Bertrand Russell (1908).

5. Information Propagation through the Universe and Its Parts under Different Conditions

Now we can consider the information propagation through the Universe and its parts when there is the substitute of 4D-space-time continuum as well as when it cannot be defined.

On each of 1D space $M(k)$ define one element as zero and denote it $\left[k \in [1, n+1] \right] 0_{M(k)}$, where k is the number of the considered 1D space $M(k)$. Thereupon define the position of an element $x_k \in M(k)$ as follows

$$x_k \overset{def}{=} \rho_k \left(\xi_{M(k)}, 0_{M(k)} \right), \tag{24}$$

where ρ_k is the distance between two elements of $M(k)$ and x_k is co-ordinate of $\xi_{M(k)}$.

Define the position of an element

$$\xi \in M_{n+1} \overset{def}{=} \prod_{k=1}^{n+1} \otimes H_k$$

in this metric space as follows

$$\rho_{M(k)}(\xi) = g^{kk'} x_{k'k}, \tag{25}$$

Where

$$\xi = \left\| \begin{matrix} \xi_{M(1)} \\ \vdots \\ \xi_{M(n+1)} \end{matrix} \right\| \tag{26}$$

In Eqn (26)

$$\left[\forall k \in [1, n+1] \subseteq \mathbb{N} \right] \xi_{M(k)} \overset{def}{=} \min \rho \left(\xi, M(k) \right), \tag{27}$$

where

$$\min \rho \left(\xi, \left[\forall k \in [1, n+1] \subset \mathbb{N} \right] \{ M(k) \} \right) \overset{def}{=} \\ \min \rho \left(\xi, \forall \zeta \in \left[\forall k \in [1, n+1] \subset \mathbb{N} \right] \{ M(k) \} \right) \tag{28}$$

Let the considered information is represented by a function $\Phi^{(0)}(\xi)$ at the first observation by an observer. Our task is to determine the function $\Phi(\xi)$ representing the considered information in the $(n+1)$D space at any observation under the condition

$$\Phi(\xi) = \Phi^{(0)}(\xi) \tag{29}$$

at the first observation. Note that other kinds of problem are possible as, for example, in the theory of the wave propagation (for example, Courant & Hilbert, 1989).

The function $\Phi(\xi)$ can represent wave (*e. g.*, some kind of De Broglie wave) propagation as well as the one of an information quant, a number of information quanta, a cluster of information quanta or a number of such clusters. Some of them can be considered as those which we call now elementary particles. Thus, the approach proposed above could be fit to the consideration of the extremely HEP processes with elementary particles when the concepts of time and space cannot be defined.

Notice that sometimes waves may only play role of information carriers being not information themselves, *e. g.*, human de Broglie waves (Temkin, 1982; 1999). Another example is that some constructions of information quanta and their clusters may play role of information carriers. However, in many cases information can propagate through the Universe and its parts without use any carrier.

6. Conclusions

In the present paper is formulated and developed formalism that can be used when conditions in the Universe, *e. g.*, created by extra high energy of elementary particles do not allow defining the concepts of time and space. This is only one example, while our consideration and the developed formalism allows one to consider problems of information generation, processing, transformation, interaction between information objects where the Universe is built from (Temkin, 2012), the thinking of the Universe and its parts (*cosmic brains*) and its influence human thinking (Temkin, 2003) *etc*. The continuation of this research should be focused, first of all, on the consideration of various situations of the information existence and dynamics in the Universe built from the information (Temkin, 2012).

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