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The Mathematical Justification of a Possible Wave Nature of the Time Flow of Kozyrev

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Abstract

In this brief note we do not prove or disprove the existence of the so-called time flow in the conception of time offered by N.A. Kozyrev, here we merely give the mathematical justification of the presumable wave nature Kosyrev's time flow in the case of the physical existence of the mentioned flow.

Keywords: Kozyrev's substantial time, chronometry, time waves

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When we first got wise to the ideas and experiments of N. A. Kozyrev, we were amazed by Kozyrev's idea about the existence of the so-called *time flow* which is a new entity, possessing "active properties" and coinciding with neither matter, nor field, nor space-time in its usual understanding.

N. A. Kozyrev, the well-known Russian astrophysicist, worked at the problem of distant influence of irreversible processes on physical systems. His works in this field are important for the understanding of the "time" phenomena. Unfortunately, the great majority of his works was published in Russian (see, e.g., [1]). For readers lacking a knowledge of Russian we adduce here in short the essence of various works published in [1]:

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The Nature of Star Energy on the Base of Analysis of Observational Data

(Published first in 1991).

The conclusion from astronomical observation was made about star energetics: any star is some machine that transforms incoming energy in heat radiation. There is not an inner source of energy inside of the star. The possibility to use incoming energy flow exists in all space-time. It was proposed that in strength of some active properties the time can influence over matter energetics to be the source of life in the Universe. The density and other parameters of star matter was calculated in the mode of transformation "time flow energy-to-heat energy". It was concluded that the output energy depends on the volume of matter. It was proposed that the time is not being spread but it is being created in all the Universe at the moment and by this reason, telecommunications by means of the time properties can be instant.

Cause or asymmetrical mechanics in linear approximation (Published first in 1958).

N.A. Kozyrev calculated the conditions for matter of stars if it is working as a transformer of time-form energy into heat energy. It was concluded that the transformation is several electrodynamical processes but in general any closed mechanical system can produce energy also if it is an asymmetrical system. The asymmetry for mechanics by Kozyrev is cause-effect principal asymmetry and if the mechanical system includes the non-reversible cause-effect connection, it can take the energy from the time flow. It is the theoretical base for any kind of perpetual motion system. In this work, the Cause and the Effect notions are defined. 5 properties of the Cause-Effect connections are postulated. There is definition and formula for velocity of the time flow. It was proposed and experimentally demonstrated: the time introduces paired equal and opposite forces into the system. N.A. Kozyrev demonstrated in gyroscope experiments facts: the time energy can be transferred to the experimental system. The other possibility was proposed also: the energy of the system can be transferred to the time energy. In other words, the time flow can be accelerated or decelerated by means of energy exchange with a special asymmetrical mechanical or electrodynamical system.

In this work N.A. Kozyrev described two extreme cases for mechanics: for velocity of time that is equal to zero there is quantum mechanics of atom world where there are no cause-effect connections. For velocity of time equal to infinity there are only stable cause-effect connections for any processes and it is Newton mechanics. Real world exists for some real velocity of time between zero and infinity.

Some vibrational gyroscope in weight machine experiments were described in the work. An important conclusion was made about the possibility to increase vital anti-entropy processes in biological systems.

Cause mechanics and possibility for experimental investigation of the time properties (Published first in 1962).

In this paper N. Kozyrev wrote about matter and time connection, described three cause-effect axioms, determined physical sense of the velocity of time flow, and published important experimental data. In his experiments the weight of gyroscope is changing when the weight machine is connected with the gyroscope with a vibrational system. Weight changes were detected about 100 mg. This weight changes depend on frequency by some discrete law.

Unknown World (Published first in 1964)

In this work organic matter possibility was demonstrated to get free energy for vital processes by means of transformation of time-form energy. There is definition for "density of time". Experimental data for measurement of the density of time was published in different places of the planet.

It was claimed that the density of time can be changed: near any Cause it is rarer and near any Effect it is denser. N.Kozyrev wrote about the possibility to use the physical properties of time for a biological kind of telecommunication, i.e. for telepathy. This telecommunication cannot be screened and it is instant. In this paper it was proposed to screen the time by means of certain process, in other words: it is possible to create in some local area the compensation of the natural time flow by a corresponding physical process.

The way to space (Published first in 1969).

N. Kozyrev wrote about the irrational rocket method of space exploration and he proposed to use his theory to find a connection between gravitation and time to built an antigravitation spacecraft. The force that will move the spaceship in this case should be produced by means of changes of physical properties of time. In other words it is the warp drive.

On possibility for experimental investigation of time properties (Published first in 1971).

N. Kozyrev wrote about the biological system possibility to use the time flow as the source of the vital process energy, the life energy. He described experiments with a gyroscope and several methods to introduce cause-effect asymmetry in a mechanical system . The value of the velocity of time flow was calculated. Seasonal changes were detected of the density of time produced by vital processes in nature.

In this paper some function was determined between density of matter that is used in experiments and density of time.

Astronomical observations by means of physical properties of time (Published first in 1977).

In the paper N. Kozyrev determined from experiments the value and the sign of the time flow: it is positive in clock-wise coordinate systems. The changes in density of the time were experimentally proved: In an area of entropy processes (dissipation, heating of matter, melting of ice, evaporation of liquids, fading of plants) the “radiation of additional time” was detected by N. A. Kozyrev. In an area of opposite processes (cooling of matter, freezing of water) the "absorption of time" was detected by N. A. Kozyrev.

There is a description for mechanical and electromagnetic detectors of the density of time changes that N. A. Kozyrev used in his experiments.

On time to matter influence (Published first in 1982).

The paper is about N.Kozyrev's experiments to detect the production of additional time flow by means of special detectors in an area of dissipation and evaporation processes.

It was assumed that the Sun is not an only time absorption system but a time flow production system also. This small component of the time structure is very important since it is ordered and it introduces the anti-entropy organizing effect in any natural process. It was proposed to use this organizing-life effect to increase the vital processes of biological systems.

On possibility to reduce mass and weight under active properties of time (Published first in 1984).

Experimental data was published to demonstrate the weight changes in a material system when some non-reversible deformations or heating were created. The nature of time and matter-time interaction was investigated by this way.

Nevertheless an interested reader can find the brilliant work by N. A Kozyrev published in English in [2]. In this paper N. A. Kozyrev wrote about matter and time connection, described three cause-effect axioms, determined physical sense of the *velocity of time flow*, and published important experimental data.

Time is one of the most fundamental ideas in hard sciences generally and in Physics particularly. Physicists know two essentially different conceptions of time (see, e.g. the brilliant selection of précis articles on the topic in [3]), the *relational* one and the *substantial* one (the latter is based on Kozyrev's "Causal Mechanics" [2], [4], [5]). According to the former there exists no time "per se" in nature, and time is no more than a relation between physical events. That is, time is a specific manifestation of the properties of physical bodies and changes occurring in them. The latter, the substantial one, assumes, vice versa, that time is an independent phenomenon of nature, a specific kind of substance, coexisting with space, matter and physical fields [5]. The relational conception of time is associated with the names of Aristotle, Leibnitz and Einstein. The most ardent adherents of the substantial conception of time are Democritus, Newton and Kozyrev [5].

Nowadays Physics is chiefly based exclusively on the relational conception of time. It means that only matter and physical fields are regarded in all physical theories as material objects, without any time substance of a "specific kind" involved.

With such an approach it is impossible to determine purely logically, whether a time substance exists or not in reality, since it is impossible to prove the presence or absence of something which is not defined.

N. A. Kozyrev demonstrated in gyroscope experiments facts: the time energy can be transferred to the experimental system. The other possibility was proposed also: the energy of the system can be transferred to the time energy. In other words, the time flow can be accelerated or decelerated by means of energy exchange with a special asymmetrical mechanical or electrodynamical system [1]. Kozyrev's works was experimentally verified in investigations, carried out by a group of researchers at the Institute of Mathematics of the Siberia Branch of the USSR Academy of Sciences. The results have partly been published in Doklady AN SSSR (the Reports of the USSR Academy of Sciences) during 1990-1992 (Lavrentyev et al) [6-9].

N. A. Kozyrev imagined time as a mighty flow embracing all material processes in nature and that all these processes are sources feeding that flow [3]. Kozyrev wrote about the intensity or density of the time flow, the energy which it carries, its *emission* and *absorption*, the rectilinearity of its propagation, its *reflection* from obstacles and its *refraction* by matter [10]. All these processes and phenomena observed and detected in Kozyrev's experiments [2-10] permit us to consider Kozyrev's time flow to be the flow of some *substance* [10], having wave properties, in other words, they point out that Kozyrev's time flow can or must have a *wave nature*. However, from where can time mathematically have a wave nature, if time (at least, *relational* time) is not a function of (x, y, z, t), that is, space coordinates and itself, to be a non-trivial solution of the wave equation? So we should look for some kind of known entity keeping the time dimension which could personate such *substantial time* [10].

Unfortunately, N. A. Kozyrev did not provide a rigorous mathematical formulation of the notion of time *substance* in his papers. It should be noted that he did not use the term "substance" with respect to time at all and merely spoke about time as a "phenomenon of nature" which through its "active properties" may *affect* the course of events. Taking into account the absence of a clear definition of time substance in works by N. A. Kozyrev and by his disciples [1-10] dedicated to the substantial concept of time, we must not neglect the fundamental difference between the hypothetical time substance and any other physical substances like fields and matter.

Namely, the time substance, if it exists, is necessarily an entity of the fourth dimension, incommensurable with the three-dimensional space, embracing all matter and all fields. Just this conclusion concerning the properties of the time substance undoubtedly follows from Kozyrev's experiments.

But, which from known entities, keeping the time dimension, could be a non-trivial solution of the D'Alembert equation (the wave equation)

$$\frac{\partial^2 t_s}{\partial t^2} = c_s^2 \left(\frac{\partial^2 t_s}{\partial x^2} + \frac{\partial^2 t_s}{\partial y^2} + \frac{\partial^2 t_s}{\partial z^2} \right) ? \tag{1}$$

Here our (Kozyrev's) substantial time we denote as t_s and a velocity of t_s-waves as c_s. In order to find this kind of time appearing as the substantial time in Eq. (1) one can advert to implicit function of x, y, z, t

$$t_s = f(x, y, z, t), \tag{2}$$

where t_s and c_s mathematically (as it will be clear below) are obviously t' and c from Eq. (63.1) in [11]), respectively,

$$t' + \frac{R(t')}{c} = t. \tag{3}$$

Indeed Eq. (3)[2] is used in [11] to calculate the electromagnetic fields produced by an arbitrarily moving charge at the point of observation $P(x, y, z)$ at time t as functions of t', and only through the relation (3) as implicit functions of x, y, z, t, where the field at the point of observation $P(x, y, z)$ at time t is determined by the state of motion of the charge at the *earlier* time t', and $R(t')$ is the distance from the charge to the point P, c is the velocity of an electromagnetic signal (the velocity of light). The time of observation t apparently cannot be a non-trivial solution of Eq. (1) and so it cannot represent the *substantial* time t_s from the wave equation (1).

[2] Eq. (63.1) in [11]

So let us substitute t_s and c_s for t' and c into Eq. (3), respectively, and introduce the function

$$F(x, y, z, t, t_s) = t - t_s - \frac{R(t_s)}{c_s} = 0. \tag{4}$$

The relation (4) represents the *implicit expression* of the functionality (2). In order to make sure that our t_s

$$t_s = t - \frac{R(t_s)}{c_s} \tag{5}$$

is a non-trivial solution of Eq. (1) we merely have to substitute (5) into the wave equation (1). In our case, following [11], $R(t_s) = \left|\mathbf{r} - \mathbf{r}_p(t_s)\right|$, where $\mathbf{r}$ and $\mathbf{r}_p(t_s)$ are the radius vectors of the point of observation and the point of location of the particle, respectively. Performing this substitution we must take into account the method of evaluating the derivatives (the first order and the second one) of the implicit functions (see, e.g., [12] Chapter 15 §1 and [13] p. 195). For example, to evaluate the second derivative of t_s with respect to t we must apply the following formula [12]

$$\frac{\partial^2 t_s}{\partial t^2} = \frac{2\frac{\partial^2 F}{\partial t \partial t_s}\frac{\partial F}{\partial t}\frac{\partial F}{\partial t_s} - \frac{\partial^2 F}{\partial t^2}\left(\frac{\partial F}{\partial t_s}\right)^2 - \frac{\partial^2 F}{\partial {t_s}^2}\left(\frac{\partial F}{\partial t}\right)^2}{\left(\frac{\partial F}{\partial t_s}\right)^3}, \tag{6}$$

where F is defined by Eq. (4). Analogous evaluating we must perform for the second derivatives of t_s with respect to x, y and z. Having made all calculations we find that t_s from Eq. (5) converts Eq. (1) into the identity. Thus one can see that our t_s (2) or (5) is the non-trivial solution of the wave equation (1) and therefore Kozyrev's time flow (or *substantial time flow*) has or can have a *wave nature*.

N.A.Kozyrev described two extreme cases for mechanics [4]: for velocity of time that is equal to zero there is quantum mechanics of atom world where there are no cause-effect connections. For velocity of time equal to infinity there are only stable cause-effect connections for any processes and it is Newton mechanics.

Real world most likely exists for some real velocity of time between zero and infinity. Just our finite velocity c_s is the case.

And so, from whence we conclude that the *earlier* time t_s (or t' from [11]) of a certain process A (e.g., an arbitrary motion of a particle) inducing another process B at the point of observation $P(x,y,z)$ at time t at the distance $R(t_s)$ from A to B has wave nature. Let us adduce the words of Einstein in a certain sense explaining why we still have not got a rigorous mathematical formulation of the notion of the *substantial time flow* but notwithstanding, we have a general idea about its properties from Kozyrev's experiments [2], [3]: "*Pure logical thinking can give us no knowledge whatsoever of the world of experience; all knowledge about reality begins with experience and terminates in it. Conclusions obtained by purely rational processes are, so far as Reality is concerned, entirely empty… Experience of course remains the sole criterion of the serviceability of mathematical construction for physics*." [14].

Finally, we also would like to adduce the words of J. L. Synge "*There are many things in Physics which are simple when you look at them the right way, but terribly involved if you look at them the wrong way*." written in the paper "A plea for chronometry" [15], where he endeavoured to invite attention to studying of the time aspect of the physical reality. He proposed to introduce the special appellation "chronometry" for such region of science which deals with conceptions of time with the same loose meaning of the word that we read into the appellation "geometry".

The fact that our *earlier* time $t_s = f(x,y,z,t)$ personating the *substantial time* is the non-trivial particular solution of the wave equation (1) conveys the suggestion that D'Alembert equation (1) has or must have other solutions for t_s. For example, one can consider the wave equation in infinite space

$$\nabla^2 t_s - \frac{1}{c_s^2}\frac{\partial^2 t_s}{\partial t^2} = 0 \qquad (7)$$

and can search for its solution for the following initial conditions:

$$\left.\begin{aligned} t_s(x,y,z,0) &= \varphi(x,y,z), \\ \frac{\partial t_s}{\partial t}(x,y,z,0) &= \psi(x,y,z) \end{aligned}\right\}. \tag{8}$$

It is interesting to note that according to [16] (pp 457-459) a solution of Eq. (7) with the conditions (8) as the propagating wave of t_s in the three-dimensional space has *sharply outlined* leading and rear fronts. Note also that one can find the particular solutions of Eq. (7) inside some volume T, bounded in the closed surface S, satisfying the additional conditions

$$\left.\begin{aligned} t_s(x,y,z,0) &= \varphi(x,y,z), \\ \frac{\partial t_s}{\partial t}(x,y,z,0) &= \psi(x,y,z) \end{aligned}\right\} \text{ inside } T, \tag{9}$$

$$t_s(x,y,z,t)\Big|_S = 0 \quad \text{when } t > 0 \tag{10}$$

and representing by themselves *standing waves* of the substantial time t_s which may exist inside a bounded volume T (see [16] Chapter 5 § 3).

The fact that modern physical theories are fairly successful in describing the properties of matter and fields, without addressing to a *time substance* forming them, does not mean that such a substance is absent. Nevertheless, experiments by N. A. Kozyrev [1-5] and experiments by researchers verified and confirmed Kozyrev's results [6-9] claim that the *substantial time flow* can or must exist. Besides G. Hayasaka and S. Tekeuchi [17] discovered certain effects, similar to Kozyrev's ones (probably they were not aware of the results of their Russian colleague).

Experimental and theoretical investigations of solutions of Eq. (7) with the corresponding conditions (8)-(10) can be fairly promising. Kozyrev's results concerning the properties of time and that of the present paper constitute just an initial stage in the development of the substantial model of space-time; however, even they testify that this model has a rich potential [5].

Finally, we have to say that the *substantial conception* of time [18] implies that time is an independent phenomenon of nature existing side by side with matter and physical fields, and it may somehow affect objects and processes of our world (a reverse action of the objects and processes on the properties of time is not ruled out either). The opposite, *relational conception* of time, by contrast, denies time as an independent essence and treats it as a specific property of physical systems and changes happening with them. Modern Physics is built on the basis of the relational conception of time. However, the use of this conception has not so far resulted in resolving all the problems related to time. Moreover, so far even an essential definition of time has not been formulated in Physics, there are only operational definitions indicating different methods of measuring time intervals. The adherents of the substantial conception of time, including N.A.Kozyrev, for their part, have not answered all the questions concerning time and have not given a rigorous mathematical formalism describing the time substance. Hence one can state that nowadays both the relational and substantial conceptions of time are certain points of view rather than physical hypotheses developed in detail. Each of them has its own positive aspects. The positive feature of the substantial conception lies in that it gives the researcher carte blanche for creative search, which may promote a successful resolution of the problem of the time phenomenon.

In conclusion, we would like to adduce here the idea expressed in [18] by L. S. Shikhobalov that the substantial conception of time "is a reasonable working hypothesis, since a theory assuming that time has some additional properties along with duration, cannot turn out to be erroneous but only risks to be superfluous. Indeed, if the real time possesses no property other than duration, then setting all the parameters corresponding to the additional properties in the equations of the theory, equal to zero, we obtain a theory which assumes that time has a single property, namely, duration. *The contrary is not true*: any theory, based on the idea that time lacks properties other than duration, will be unable to describe the reality correctly if in fact time does possess other properties. It should be mentioned that N.A.Kozyrev in his theory never revised the conventional notions concerning time duration and used the concept of time interval in his considerations and calculations in the same way as was done by everybody." In our brief note we merely made an attempt to substantiate mathematically the possible *wave nature* of Kozyrev's time flow.

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