© ***M.Shulman***

shulman@dol.ru

ON THE TIME, MOTION AND MATTER PHYSICAL MEANING

PACS 98.80.H

A new physical World Concept based on the Modification of the Special and General Einstein's Relativity Theory and some additional Statements is exposed in a very short Form (without Formulas). Limits of Relativity Principle, Equivalence Principle, and Energy Conservation Law are discussed. A physical Meaning of the cosmic Constant is defined. All Set of mechanical Motions in the Universe is reduced to the universal Process. The Nature of Relations between Space and Matter Properties is revised. The problem of Irreversibility is touched upon.

1. Introduction

An origin of the time is not yet enough clear for natural science, although it is strongly used in the humanity scientific and practical activity.

In the Newton mechanics the time is presented as some universal formal parameter. Its value rises steadily and at every point of the Universe. Each physical process occurs in the space in correspondence with the time currency.

In the Special Relativity the opposition of the space to the time is not such considerable because they are integrated to the common 4D continuum. However, in this concept the time component having imaginary factor seems also a little "exotic". In this concept the increase of the time is also implied in any coordinate system.

The General Relativity allowed link the time properties with gravitational fields and the space geometry. But it didn't clarify a meaning of this parameter for our intuition, and may be made it more mysterious. Together with that the implied time currency started being associated with a spatial extension of the Universe.

So, the theoretical physics traditional approach to the processes description is based upon the time currency using as primary (as original). They are also some attempts to deduce the time concept as secondary from different fundamental (microscopic) concepts in the modern physics [1]. However, the third way (inverse to the first one) is possible and presents the base of this paper. The starting point of this way is the following question: "Does any universal process exist which could ***generate*** the physical time?"

Such fundamental cosmic process exists really and is well known in science. It presents the Universe extension opened at the first third of the 20^{th} Century by American astrophysicist E.Hubble and other scientists. [2]. It means general increase of distances between all bodies, not moving off from any common centre. A good image of this process presents a "points running off" on the surface of some spherical balloon during air incoming. The centre of this sphere does not belong to the surface, all points of the sphere (the Universe) are equivalent.

Some time before the theoretical physics came to the same results. As is well known, the Einstein's General Relativity Theory was published in 1916. After that Friedmann (1922) proposed the concept of the expanding Universe. For example, in the book [3] a description of the basic cosmic model is given. I will hereinafter call this model "Einstein-Friedman model", or "EF-model". This model corresponds with a 4D space having central symmetry, but its curvature depends on the distance from the centre (radial lines correspond with world lines of immobile bodies).

2. Original ideas of the Spherical Expanding Universe Theory (SEUT)

When the scientific concept have to be replaced, often an old final result is selected as new starting postulate. An attempt is made in the present paper to build a new physical concept of the World. This is one is based upon the 4D-sphere model close to EF-model.

I call this new model “The Spherical Expanding Universe Theory (SEUT)”. The full text is presented in my little book [4]. In the very short form the basic statements of SEUT are:

Our World (from the global space and time point of view) presents 4D-sphere in a 4D ***Euclidean*** continuum (hence, whole continuum can contain some “external” parts which do not belong to our World). Our (spatial) Universe presents a 3D-hyperspherical surface of the 4D-sphere. The time axis is oriented normally to the tangent 3D-space at each point.

The 4D-sphere radius is increasing, therefore the curvature at each point of the Universe is changing. Just this space ***curvature changing*** presents a primary, objective, and universal ***time currency measure*** reaching by any kind of clock. A global curvature changing due to 4D-sphere radius evolution corresponds with a global time currency in the Universe. However, while a local curvature changing occurs, then a local time currency deviation appears.

3. Mechanical motion, maximal velocity, and physical laws invariance in the SEUT

The SEUT states, there is no infinite set of independent mechanical motions in the Universe. The World lines of “moving” bodies exist only, which are inclined at some angle to the time axis – the normal to the hypersurface of 4D-sphere. ***The inclination angle just defines a spatial motion velocity*** (in the relativistic meaning). While the 4d-sphere radius increases, a point of a current hypersurface intersection by a word line just “moves” like the modern physics predicts.

Particularly, ***immobile*** in the space objects (stars) having ***zero inclination angle*** to the time axis are “running off” with Hubble’s law velocities. These velocities are proportional to the mutual distance. If this angle is different from zero, then it has to be less than or equal to 90° , so a ***maximal motion velocity*** (velocity of light) appears by natural way. Three types of motions are shown on the fig. 1.

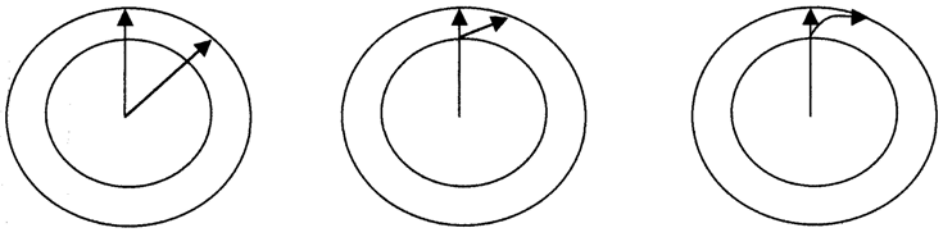

Figure 1. The effect of point “moving” on the hypersphere surface for immobile objects (at the left), an inertial motion (at the centre), and an accelerated motion (at the right)

While the 4D-sphere radius value is considerable, we come to the approximate ***velocity transformation formulas of Special Relativity*** and usual mechanical laws. The whole hypersphere surface of the 4D-sphere presents an analogue of the Special Relativity light cone (see fig. 2). This analogue is not complete, because in the SEUT the absolute remote area degenerates into 3D-hypersurface.

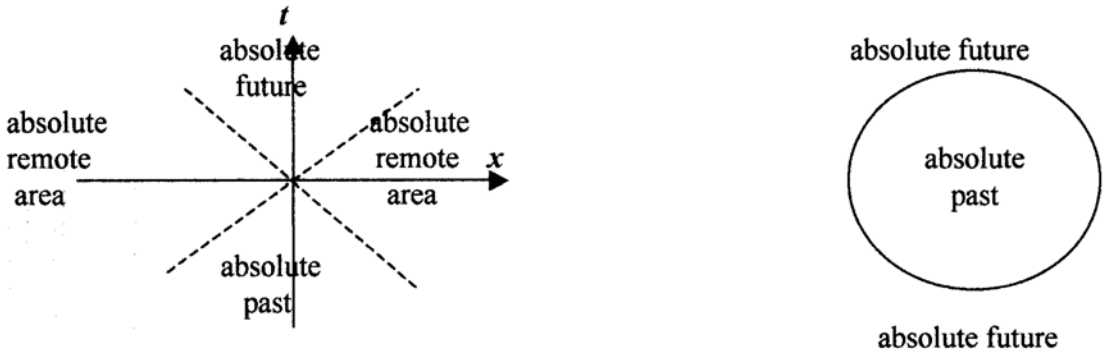

Figure 2. Areas of the 4D-cntinuum in the Special Relativity (at the left) and in the SEUT (at the right)

However, ***in the SEUT a maximal velocity existence does not result in covariance of the physical laws***. Contrary, a selected coordinate system appears inevitably, where the time axis coincides with the normal to the 3D (spatial) Universe. And this theoretical fact is confirmed strikingly by experimental phenomena – the background cosmic radiation anisotropy. I selected correspondent topic into the separate paper on the Internet site [5], because it is very important and interesting for the modern science.

4. The SEUT, and the General Relativity. The limits of the equivalence principle and the energy conservation law applicability

Now we encounter some difficulties. The SEUT postulates the ***linear*** Universe extension in time. On other hand, the EF-model known solutions (the General Relativity) are ***not linear***. How can we conciliate these alternatives? It turned out, that the answer is income related to the applicability limits of the equivalence principle.

Once Einstein introduced forcedly in his equation so-called cosmic constant, because there was no any solution for the stationary (early) model. This constant corresponded with a ***negative pressure*** of matter, Einstein couldn't find its meaning. The non-stationary model tolerates a number of solutions without cosmic constant, therefore it is usually suggested being zero, and. kinetic pressure ***only*** is considered in this model. In fact any (static) pressure absence in Einstein equations is due to the equivalence principle formulation. It states, a gravitation field can ***ever*** be replaced by accelerated coordinate system.

However, it was incorrect to thing that ***every*** field may be considered as (locally) uniform (see fig. 3). If a gravitational radius of a particle-source or/and a probe particle have a value ***near*** to (or more than) the mutual distance, then Einstein's equation linking geometrical spatial features in a gravitational field with physical matter properties is turned out ***not complete***. More precisely, it is incorrect to put zero the static pressure in the density-energy tensor, we have to introduce its (not equal to zero) value accounting ***the matter deformation energy***. I believe, only such jump from the classical Newton gravitation theory to the General Relativity may be just equivalent.

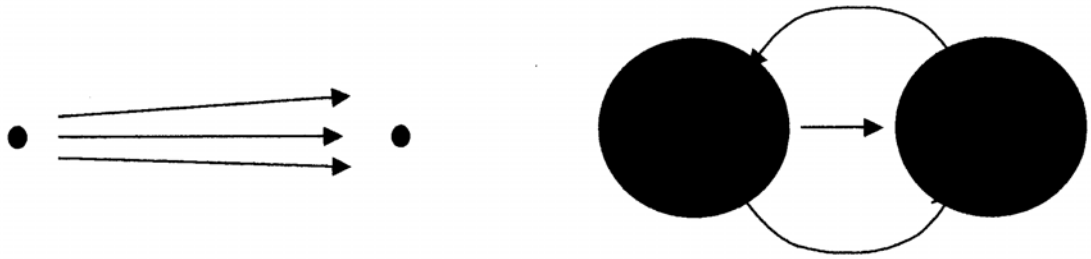

Figure 3. At the left – a locally uniform gravitational field, at the right – a field, which can not be considered as uniform one, even locally

Are the proposed amendments important? The astrophysicists know a gravitational radius of a cosmological object is really near to its real size. In addition, it is possible demonstrate in the SEUT that the Universe radius is 3π times ***less*** than its gravitational radius.

The proposed approach permits to find out the new solution of Einstein's equation, which is ***linear*** in the time. Moreover, it permits also to define the gravitation pressure as ***function*** of 4D-sphere radius. By the way, this (negative!) variable is expressed like this one for a non-relativistic sphere (a pressure at the centre of a star or a planet). Also, it is interestingly to note that pressure-radius dependence finding in the SEUT is exactly corresponding with this one so-called ***critical*** of EF-model.

At that two very important circumstances became clear. First, the Universe mass turned out as 4D-sphere radius linear function, not constant value. So, the Einstein's dream was realised unexpectedly in the SEUT as a matter property (density) has reduced to a space feature (curvature). In other words, the necessity to introduce a mass distribution in the equation externally ("by hand") to define a spatial metrics evolution is eliminated.

Second, the apparent paradoxicality of the Universe mass (and energy) non-conservation forces to reflect on conditions of the energy conservation law satisfiability. It seems being evident, energy can conserve strictly only in such physical system (or in whole Universe) where space properties (partially, the curvature) are exactly ***constant in the time!*** As modern physics and the SEUT issue from the different concept, hence, this law may hold true approximately only, in according with a very small ***relative*** value of the curvature evolution velocity. This one is near to 10^{-10} per year for the modern Universe.

5. The SEUT considers a mass as a quantum number

As was noted, according with the SEUT the places of a material mass localisation in the Universe present the points of intersection of the hypersurface by the world lines. So, these world lines have a real physical meaning, not abstract illustrative this one.

We may expect this physical meaning being more essential than simple word expression. Particularly, while the Universe global analysis is making, we may suppose that such fundamental particle feature as its mass at rest presents some ***relative*** value. Such relation (some kind of a quantum number) may include, for example, 4D-sphere (the Universe) diameter and some characteristic size. This size should correspond with a particle mass like De Broglie wave parameter. If a wave parameter is constant, and the Universe size increases with the time, then we come again to mass increasing proportionally to the Universe age and size (see fig. 4).

Figure 4. If the space properties ***are not changing*** in the time, a closed system energe is ***constant*** (at the left). If the space properties ***are changing*** in the time, a closed system energe is ***not constant*** (at the right)

I shall note my results are strongly like these ones of N.Kozyrev [6], although his theoretical constructions are very different and I don't share them. However, I began to reflect about the time nature after reading his papers.

6. The SEUT and the irreversibility problem

In my opinion, the irreversibility phenomena of the Universe processes should be revised in three interconnected directions. First, it is the important tendency to increase a complexity and order (for example, on a cosmic scale and in live systems). Second, it is a well known opposite tendency to a relaxation in the closed (conservative) systems, to a degradation and degeneration. At last, a mechanism of equilibrium structures self-sustaining should be studied.

An analysis of two last cases could take us out of the SEUT limits. At the same time, the defined in the SEUT increase of the Universe energy leads to explanation the first tendency. In fact, while the energy increases (but elementary energetic cell volume stays constant), the possible state amount rises too, hence the Universe entropy decreases. Moreover, a mass and energy ***absolute increase*** must appear at the mass concentration places (for example, stars). So, we have to observe just such energy sources and negative entropy flows, which exist really.

.

BYBLIOGRAPHY

1. **Ю.С.Владимиров.** *Реляционная теория простра-времени и взаимодействий. Часть 2. Теория физических взаимодействий.*Москва, Издательство МГУ, 1998.

2. **А.С.Шаров, И.Д.Новиков.** *Человек, открывший взрыв Вселенной. Жизнь и труд Эдвина Хаббла.* Москва, Наука, 1989.

3. **А.Эйнштейн.** *Сущность теории относительности.* Москва, ИЛ, 1955.

4. **М.Х.Шульман.** *О физической природе времени.* Москва, ИРЦ РАО "Газпром", 1997.

5. **М.Х.Шульман.** *Об экспериментальном доказательстве существования во Вселенной выделенной системы отсчета* (см. на этом же сайте) Москва, 1999.

6. **Н.А.Козырев.** *Избранные труды.* Ленинград, Издательство ЛГУ, 1991.

7. **С.Д.Хайтун.** *Механика и необратимость.* Москва, Янус, 1996.