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TIME IN THE PHYSICAL PICTURE OF THE WORLD

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Science in Russia is at present in a difficult position. The fate of many scientific schools and even research trends is under threat. This is fraught with most hard consequences for Russia's future. It is necessary to save the key branches of Russian science, especially those where our scientists always played pioneering roles, recognized worldwide. The primary attention should be paid to basic research, whose core is, in my view, fundamental theoretical physics, the basis of natural science as a whole.

Being a Russian businessman and feeling my own responsibility for Russia's future, I believe it to be my duty to make a contribution within my powers to the preservation and development of fundamental theoretical physics. One need not be a professional in order to understand that this is just the field where the keys to many mysteries of the Universe must be found. And in theoretical physics itself a central place is held by the problems of physical space-time theory. The history of physics of the 20th century has clearly demonstrated that all basic achievements of modern physics were connected with radical changes of the views of the essence and properties of space-time. This is above all the case for the "three whales" of theoretical physics, whose triple jubilee is celebrated this year: 90 years of special relativity (born in 1905), 80 years of general relativity (Einstein's equations were written in 1915) and 70 years of quantum mechanics (the Schrödinger equation was suggested approximately in 1925).

In the course of support for fundamental theoretical physics, I took a decision to finance the work of the first School-Seminar on Foundations of Physical Space-Time Theory, conducted in K.D. Ushinsky Yaroslavl State Pedagogical University. The main attention was received at the School-Seminar by

- problems of principle in general relativity and its most promising generalizations;
- the relational conception of space-time and its place among other conceptions;
- the relations of space-time theory and quantum physics.

The School-Seminar invited leading Russian scientists working in the field of fundamental theoretical physics, possessing viewpoints of their own upon the essence of physical space-time and developing the corresponding programs in this branch of physics. The School was aimed at uniting the effort of Russian researchers in this important direction of modern physics, strengthening their working contacts, discussion and comparison of their research programs.

In connection with the problems discussed at the School-Seminar, I would like to suggest some considerations on the essence and role of the time concept in the physical picture of the world. They can seem disputable and I would not have dared to bring them to a discussion by specialists, had I not found some views close to mine in spirit, uttered by outstanding theorists of the 20th century.

I believe that time should play a key role in the future physical picture of the world. Recall that even modern general relativity may be called, by J. Synge's expression [1], chronogeometry. It can be formulated on the basis of clock readings. Synge wrote: "For us the only *basic measure is time*. Length, or distance, as long as it appears necessary or desirable to introduce it, will be treated as a strictly derivative notion" [1].

I would like to suggest the following hypothesis to the judgement of specialists. The whole world is a single "particle" existing and spreading in time. Let us call it a *chronon*. All that we perceive as space and see in space as an enormous number of particles that form our world, is just an illusion connected with the comprehension of the chronon by an observer. This illusion is, however, so natural and habitual that it is with no doubt perceived as the reality. We live and, accordingly, operate in this reality. The very idea that the reality is something different, that the evident is not the probable, excites our strongest protest. Such things happened repeatedly in the history of science. For instance, the basic ideas of relativity and quantum mechanics were at first rejected even by professionals.

It is a good place here to mention A. Poincaré who likened our Universe to a certain grandiose system performing periodic pulsations, quantum transitions from one state to another. He wrote in his "Last Thoughts" that "one cannot claim now that 'Nature makes no jump' ('Natura non facit saltus): in reality it does just the contrary. And, maybe, not only matter reduces to atoms, but even world history and, I would say, even time itself, since two instants, confined in an interval between two shocks, cannot be distinguished since they belong to the same state of the world" [2], (p. 497

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of the Russian translation).

The suggested hypothesis excludes the simultaneity concept as a non-existing one and actually introduces a non-simultaneity principle. As there is only one chronon, all the hierarchy of particles, their masses, energies, positions in "space", etc., is determined by solely the number of chrono-quanta between the observer and the "trace" of the chronon perceived by the observer. The world diversity is explained by the fact that an observer gets information from different chronoquanta of the past.

One can easily imagine the reader's protest or even indignation about the word "observer". Indeed, how can one help protesting if it has been announced at the outset that there is only one particle, a chronon, in the whole world and all the rest is mere illusion. Where might an observer come from? The point is that an observer is the chronon that perceives itself in the past. And it can be added that both the chronon itself (the observer) and the same chronon in the past (the object of observation), interacting with other states of the chronon and the time scale, form the whole fantastic diversity, the whole vastness of the world around us.

In this approach space is a secondary concept, derivative of time. The manner of its emergence may be likened to the emergence of a picture on a TV screen, from the one-dimensional electronic beam sweep. As the electronic beam gets to different points of the screen with different intensities, our eye perceives that as a two-dimensional image on a plane. I suppose that different objects, such as particles, bodies, even constellations, can be imagined as "flares of the chronon beam" on the screen of the Universe.

For a long time I matured those ideas, trying to build on this basis a physical picture of the world. But I could not dare promulgate my ideas as not to lose the reputation of a sane person. But having read Richard Feynman's Nobel Prize lecture [3], my attitude to my own ideas changed radically. Feynman's lecture contained the following paragraph: "*Once Wheeler called me on at Princeton University. Our conversation was a by-product of the same reflections: 'Feynman, I know why all electrons have the same charge and the same mass'. — 'Why?' — 'Because all of them are one and the same electron!'* "

As a result, I strengthened my opinion that even a non-professional, in his reflections on the construction of the world, can arrive at pictures of some interest for professionals. I would like to add a very little-known fact that the ideas of a non-Euclidean geometry were independently formulated, apart from widely known N.I. Lobachevsky, C. Gauss and J. Bolyai, in the twenties of the 19th century "*by Prof. F.K. Schweikart (1780–1859), a lawyer by education, who taught law at Kharkov University in 1812–1816 and in 1827 went to Germany, where discussed his ideas with Gauss. In 1824 Franz Taurinus (1794–1874), Schweikart's nephew, also a lawyer, in his letter to Gauss presented similar ideas*" [4].

Realizing that a physical theory can be developed only by professionals, I announce my being ready to render financial support to theoretical physicists who would like to develop the above ideas. In my opinion, the following problems should be studied for such a progress:

1. Development of the chronogeometric view s upon modern physics, in particular, the chronogeometric formulation of general relativity in the spirit of J. Synge.

2. Studies of the problem of time direction, that is conventionally called, after A. Eddington's figurative expression, "the arrow of time".

3. The problem of time quantization, or discreteness. Of special interest are here the questions of introducing the "chronon" and establishing the value of a time quantum.

4. The problem of a relationship between the concepts of time and space. In the light of what was outlined above, the point is to elaborate a "mechanism" of sweeping the one-dimensional time into a three-dimensional classical space (or a higher-dimensional space as that used in Kaluza-Klein type theories).

5. The problems of time variation of the properties of matter, such as the values of the fundamental physical constants, the proportions of different forms of matter in the Universe, the problems of observed matter "creation", etc.

6. The problem of time in quantum mechanics. Here I mean above all the problems of describing quantum-mechanical laws in the frames of the conception formulated.

The conditions and forms of material support for such studies will be announced in of the numbers of the journal "Gravitation and Cosmology".

References

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