The Problem of Observation and Regional Ontologies

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Abstract: the problem of observation should be solved differently depending on whether the Universe or multiverse exists. This problem has epistemological features in the case of existence of set regional ontologies. Recognition of the idea about regional ontologies conducts to philosophical interpretation of observation as a semiotic representation. The analysis of process of observation depends on distinction between "exterior" and "interior" observation. Meaning of this distinction for interpretation of some models of the Universe is shown.

In the modern science an idea of a multiplicity of the worlds is actively used in different contexts and meanings. The philosophical meaning of that idea is not clear till now. The problem of a multiplicity of the worlds is discussed from antiquity times [1]. In the modern natural science necessary backgrounds for philosophical reflection of the given idea have appeared. Terminologically it is expressed differently: "parallel universes", "multiverse", "many worlds", "meta-universe" [2]. In philosophy we find such terms as "regional ontology" and "disciplinary ontology".. The concept of "regional ontology" was used by E. Husserl. After T. Kuhn the term "disciplinary ontology" has become current. Both concepts of "regional ontology" and "disciplinary ontology" have only epistemological meaning (W.. Quine's ontological relativity). However, many physicists interpret the term "multiple worlds" ontologically. It is connected with projects of making of uniform theories of matter. String theory operates multi-dimensional physical space. In the modern cosmology there are interpretations which are based on belief about multiplicity of the worlds. So according to Max Tegmark a belief about existence of other universes is the direct consequence of observations of the Universe. Our Universe consists of four hierarchical levels which are distinguished by different fundamental laws, fundamental constants, initial states, allocation and composition of a matter, and dimensionality of space and time. Since physicists discuss the existence of many different worlds it is important to understand whether interpretation of observation depends on existence of many worlds, or not. The purpose of this paper is to substantiate the affirmative answer to that question.

The idea of regional ontology forces us to speak about "interior" and "exterior" observation. "Interior" observation is cognition inside ontological region. "Exterior" one is an observation of one world from another one.

First of all I shall consider "interior" observation. I think each regional ontology has following characteristics: (1) particular structure of spatial and temporal relations, (2) a certain set of laws which describes and explains all objects and processes belonging given ontology, (3) a relation between an observer and observable is symmetrical, that is, if "A" observes "B", then "B" can observe "A", (4) any existing should not have being and non-being simultaneously. The first assumption means that spatial and temporal transformations of an object do not output it outside the given world. In this sense the world is closed. For example, dot mathematical objects exist into the nil-dimensional world; linear ones are into the one-dimensional world. Two-dimensional essences existence into the two-dimensional world even if they are observed as moving into the three-dimensional world. The third dimension does not exist for two-dimensional creatures. The second assumption means *what* can exist in the present region. A law also shows what is impossible in this world. It is a principle of interdiction for some objects and processes. As to the third requirement it can be explicated with the help of belief about "active" and "passive" points of view concerning any transformations.

A change of an object state may be interpreted by two different ways. There are so-called active and passive standpoints. According to the active point of view a change of an object state is represented as own change of an object concerning the same framework. Usually in physics such change is described by means of equations of a corresponding physical theory. In classical mechanics that change is described by Newtonian second law. A change of a quantum state is described by Schrцdinger equation. According to the passive standpoint a change of an object state can be presented as a result of transition from one framework to another one. In this case we compare representations or descriptions of the same object in two different frameworks. Here a change of the description of an object state is a result of a change of attitude to an object. The mathematical theory of groups, the theory of invariants proceeds from the assumption that the active and the passive standpoints are equivalent. This assumption means that a real transition of an object from one state to another one concerning the same framework is equivalent to a change of a relative state of an object during the transition from one framework to another one. It is possible that both an object and a framework submit to the same laws. In physics however it is not always so. I would like to remind Eugene Wigner's the essential distinction between initial conditions and laws of Nature. Initial conditions and laws of Nature are different ways of the description of reality. Physical laws describe things considered them only under certain conditions and provide quite much freedom outside of these conditions. The elements of events, which are not determined by laws of Nature, are initial conditions [3]. Between different initial conditions there are not any fixed relations, which would be defined by laws of Nature. Wigner's idea has important methodological meaning. There is the language by which we describe changes of object states concerning any framework. Another language is used for the description of changes of framework conditions. Are these two languages equivalent? It is the question for experience, not for theory. In classical mechanics there is the uniform language. However we don't have the uniform language, when the question is the description of relativistic phenomena and quantum phenomena. >From the active standpoint laws of Nature are invariant concerning transformations of object states. Initial conditions change may not submit to laws of Nature and occur even contrary to these laws. From the passive standpoint an object state is considered as constant, fixed, but the description of an object changes. But there are such transformations (for example, reflection), which may be made with a framework, but they may not be carried out directly with physical object. Einstein's theory of relativity is based on the postulate of constancy of the light speed. Light movement concerning framework is meaningful. But the postulate of constancy of the light speed makes meaningless framework movement concerning the light. In quantum mechanics equivalence of the active and the passive standpoints is expressed mathematically by equivalence of descriptions of quantum states in Schrцdinger's and Heisenberg's representations. However this statement is not reliable. In his recent researches professor V. Belavkin has shown, that some macro events (for example, birth and annihilation of particles) are unobservable from quantum microcosm [4]. It is the essential argument indicating limitation of quantum mechanical description of physical reality. I guess *equivalence* of the active and the passive standpoints is the feature of observation inside the same ontological region, and their non-equivalence is the certificate of existence of ontologically different worlds.

The fourth requirement says that any essence should not have simultaneously being and non-being in the same region. A clear illustration of that requirement is well-known Einstein's thought experiments. Let image that the light enters horizontally into a lift through a left window and in a short time reaches the opposite side in the point *A*.. "Exterior" observer thinks that the lift is accelerated. The "interior" observer thinks that the lift rests in a gravitational field and so the light ray should fall to the opposite wall in the point *B*. Two observations give identical results ($A=B$), if the light ray has a mass and its trajectory is bent in a gravitational field. In such way Einstein constructed the uniform world in which the above mentioned results of the experience are equivalent. The described thought experiment shows that both observers are in the same world. If the results are different ($A \neq B$), then the both observers live in different worlds!

The idea of existence of unique universe assumes implicitly existence of one "exterior" observer, transcendental subject. If the world is unique it is intensional set, which is not an element of any other set. Subsets of that set are extensional, so we can compare one of them with another. According to that we put difference between more or less general theories. That is a basis for the known N. Bohr's correspondence principle. Thus, the ideology of a fundamental theory is based on the extensional theory of sets for the universe..

I believe that the idea of multiverse is possible only for the "interior" observer who is the "exterior" one with regard to other worlds. When we describe process of observation inside the world we use laws of this world. So process of observation is interpreted as objective physical process. Whether it is valid in a situation of "exterior" observation? How we can interpret "exterior" observation? For the answer to these questions we shall consider a problem of observation in relativistic and quantum physics.

Einstein's relativity theory has raised the question about existence different physical realities. From the classical physics point of view the world is uniform. In its different areas there are the same fundamental laws, everywhere there is a uniform space and time. The theory of relativity claims impossibility of some classical existences and events. First of all it concerns the absolute simultaneity and the action at a distance. At the same time the theory of relativity admits a new absolute (velocity of light). Between classical mechanics laws and relativistic mechanics ones there is so-called relation of correspondence under condition of limiting of light velocity to infinity. Therefore relativistic mechanics is considered as more general than classical mechanics. Formally it is so, but basic beliefs and principles of less general theory cannot be considered as a special case of principles and concepts of more general one. The notion of more or less general theory is not rather clear. Let theory TG is more general than TP. What does it mean? Obvious interpretation is based on an analogy to logic relations between notions. Then TG should describe and explain *all* phenomena, which concern to the sphere of competence of TP, and the opposite is not true. However the problem is that a phenomenon in TP is not a phenomenon TG. As Einstein noted what we observe depends on a theory. Therefore, it is impossible to speak about the same phenomenon in different theories.

The same problem arises concerning a relation between classical and quantum mechanics. The argument that quantum theory is more general than classical mechanics is not quite correct. The principle of correspondence N. Bohr used for build-up of quantum atomic theory. Heisenberg used an idea of correspondence between physical values and operators in his search of quantum equations. According to later interpretation of Bohr's principle classical mechanics is a particular case of quantum mechanics under condition of aspiration of Plank's constant to zero. It means that quantum mechanics is capable to describe any phenomenon of the classical world. But it is not so [5], [6]. Though there are well-known macro quantum phenomena (superconductivity, for example), we have to recognize that the classical world is partly closed for the quantum description.

The long history of discussion concerning a role of an observer in quantum process, since a problem of a reduction of a wave function, has shown that there are no sufficient bases to use consciousness of observer in quantum mechanical description of a measuring act.. In that situation there are two approaches. One of them is to search for more complete physical theory. The other one is to interpret it as the representation relation between different objects belonging to ontologically different worlds. Such relation is not a physical reality. Observation is a cognitive process based on physical interaction of an object with measuring instrument. All changes of object state are fixed in measuring instrument state. It is very important that a representation is a sign situation, because in it one reality is given by means of another one. Just a sign situation provides information about an object for an observer.

The fact that conditions of observation (the "exterior" observer) and observed object states should belong to different ontological structures is clearly shown by the theory of gauge fields by H. Weyl. His general idea consists in the assumption that physical laws may be invariant in respect to local gauge transformations on condition if there is some physical field for compensation of changes from point to point. Thus the theory of local gauge transformations gives the geometric description of physical forces and fields. Weyl has assumed that there are absolute ideal measures of physical values. These measures are distributed throughout Weyl's space, or the space of gauge transformations. This space has a wonderful property; transference of a real physical value in Weyl's space results in a change of its scale. Ideal measures are absurd objects. If the ideal scales were real physical objects, they would change their own scale during transfer along Weyl's space. However, this fact would conflict with the epistemological status of the ideal scales as means of measurement, because they do not depend on the properties of the space. At the same time if the ontological status of the above-mentioned ideal scales as identical to one another is not assumed, it is impossible to speak about the existence of gauge transformation of real physical values. The ideal scales as physical essences belonging to the other ontological region. Although ideal measures are impossible existences in the observable world, but through the attitude to these a being of an observable physical reality can be defined. It is important that impossible existence in one world is possible in the other world. Therefore we can speak, for example, that calibration of ideal scales might be changed arbitrary, but this fact cannot be found in real physical experience by the "interior" observer and that changes do not affect the physical processes [7]. But the "exterior" observer knows and notices about calibration change. The "exterior" observer has a priori knowledge. That a priori knowledge presets the interpretation of the observable world, for example, that knowledge testifies to simultaneous change of scale of all ideal measures in the gauge space. Thus, impossible existence concerning the "interior" observer determines the meaning of physically observable object change, which is in the other regional ontology.

Rejection of universal unitary ontology puts the question on whether physics can describe what occurs on boundaries between ontologically different worlds.

So, my approach to the observation problem is based on the following reasons. Natural phenomena in themselves show nothing. The knowledge as a process of getting new knowledge supposes difference between a subject and an object.. Each of them belongs to ontologically different worlds. One world can be always given in forms of being of the other world. The world of classical physics has been given in subjective forms of consciousness, sensuality, and practice. For instance, absolute simultaneity is represented by the act of thinking of two events. The world of non-classical physics is given already in objective forms of the classical world, and not just in forms of human subjectivity. Conditions of observation and observed objects should be described by different terms and physical theories. This statement is expansion of Bohr's rule according to which quantum mechanical measuring results should be described by the language of classical physics.

The idea of distinction between "interior" and "exterior" observations is quite often and fruitfully used by physicists. S. Hawking has offered exotic model of the Universe in which time is imaginary quantity [8].

Hawking writes that in the classical gravitation theory using the real space and time only two types of behaviour of the Universe are possible. Either the Universe exists during the infinite time, or its beginning is a singular point at any moment in the past. In a quantum theory of gravitation there is the third opportunity according to which the space-time is finite and there are not singularities. Hawking claims that the boundary condition of the Universe is boundless.. Then the Universe would not depend on what occurs outside. If the Universe develops in imaginary time, then singularities do not exist. The God is not necessary! Hawking's hypothesis demands interpretation of imaginary quantity sense. I would like to pay attention to the idea proved by P. Florensky [9]. He has shown that imaginary quantities exist as points on the reverse of a surface of two-dimensional figure. Transition from real to imaginary quantity corresponds to operation of turning inside out of figure. That transition is a break on the other side of a world. Hawking's point of view is the one of the "interior" observer. For the "exterior" point of view singularities exist, that is, the beginning and the end of the Universe. The back of the world is given to only "exterior" observer. Then the real time is a time for the "exterior" observer, and imaginary time is for the "interior" observer.

So, the idea of regional ontology becomes the working tool in some modern scientific theories. It is interpreted differently. I think that it allows to prove ontologically the opportunity of knowledge of the world. A person is a special sort of reality, one is capable to transcendence and consequently to knowledge and self-knowledge. Comprehending a role of observation in astronomy, we should take into account, that models of reality depend on whether an observer is "exterior", or "interior".

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