

The Concept of Elementary Reality on the Horizon of the Unity of Scientific Knowledge

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Abstract

Science at the present stage of its development is characterized by a number of features. And although different authors formulate the list of these features in different ways, nevertheless, almost all, one way or another, agree that one of these features, among others, is the transition of modern scientific knowledge to the knowledge of complexly organized developing objects. This, one might say fundamental, feature, in turn, finds its expression in what is usually called the "crisis" of the concept of elementarity. We took the term crisis in quotation marks because we are actually talking here about a crisis or collapse of the former metaphysical or mechanistic concepts of elementarity, which faithfully served natural science at least since the time of I. Newton. Further, this "crisis" has more than half a century of history behind it. With a certain degree of conventionality, it can be attributed to the beginning of the 30s of our centuries, when Dirac developed the relativistic theory of the electron and theoretically predicted on its basis the existence of an "antielectron" - the positron, which was soon discovered experimentally by Anderson. Here is what V. Heisenberg writes about this – one of the most sensational consequences of Dirac's discovery (meaning Dirac's theoretical prediction of the existence of a positron) was, therefore, the complete collapse of the old concept of an elementary particle. An elementary particle turned out to be no longer elementary.

Currently, there is no more or less unambiguous and generally accepted definition of the concept of "scientific view of the world", as well as its relationship with such more special concepts as, for example, "physical view of the world". However, it can be stated that the scientific view of the world is a certain form of systematization of knowledge in a specific form reflecting reality on a particular historical material of scientific knowledge. The fundamental relationship between the "scientific view of the world" and the elementary objects of theories indicates that the elementary objects are the initial images of the theory for constructing theoretical models of all phenomena in the area under study. Such methodological significance, as images of the essences of the basis of reality, also acts as the basis for the program of all cognitive activity, acting as a function of the strategy of cognitive theoretical and practical activity. This article tries to show the methodological significance of this fact.

Keywords: simplicity, theory, concept, system, element, essence, theoretical model, view of the world

Концепція елементарної реальності на горизонті єдності наукового пізнання

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Анотація

Наука на сучасному етапі свого розвитку характеризується низкою особливостей. І хоча різні автори по-різному формують перелік цих ознак, тим не менше майже всі, так чи інакше, сходяться на думці, що однією з цих ознак, серед інших, є перехід сучасного наукового знання до пізнання складно організованих об'єктів, що розвиваються. Ця, можна сказати, фундаментальна особливість, у свою чергу, знаходить своє вираження в тому, що зазвичай називають «кризою» поняття елементарності. Термін «криза» ми взяли в лапки, тому що насправді мова йде про кризу або крах колишніх метафізичних або механістичних концепцій елементарності, які вірою і правдою служили природознавству принаймні з часів І. Ньютона. Крім того, ця «криза» має понад півстолітню історію. З певною часткою умовності його можна віднести до початку 30-х років нашого століття, коли Дірак розвинув релятивістську теорію електрона і на її основі теоретично передбачив існування «антиелектрона» - позитрона, який незабаром був експериментально відкритий Андерсоном. З цього приводу В. Гейзенберг зазначав, що одним із найбільш сенсаційних наслідків відкриття Дірака (мається на увазі теоретичне передбачення Діраком існування позитрона) став, таким чином, повний крах старої концепції елементарної частинки – частинка виявилася вже не елементарною.

В даний час не існує більш-менш однозначного та загальноприйнятого визначення поняття «науковий погляд на світ», а також його співвідношення з такими більш спеціальними поняттями, як, наприклад, «фізичний погляд на світ». Проте можна констатувати, що науковий погляд на світ є певною формою систематизації знань у специфічній формі, що відображає дійсність на конкретному історичному матеріалі наукового знання. Фундаментальний зв'язок між «науковим поглядом на світ» і елементарними об'єктами теорій свідчить про те, що елементарні об'єкти є вихідними образами теорії для побудови теоретичних моделей усіх явищ у досліджуваній області. Таке методологічне значення, як образи сутностей основи дійсності, також виступає основою програми всієї пізнавальної діяльності, виступаючи функцією стратегії пізнавальної теоретичної та практичної діяльності. Ця стаття намагається показати методологічне значення цього факту.

Ключові слова: простота, теорія, концепція, система, елемент, сутність, теоретична модель, погляд на світ

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Introduction.

Somewhere around the end of the 40s of the twentieth century, in addition to the already known protons and neutrons, new strongly interacting particles, π mesons, were discovered. Then, in the 50s, with the advent of new powerful accelerators designed to obtain higher and higher energies, a whole stream of discoveries of new elementary particles began - hyperons, k -mesons, p -mesons, the so-called "strange" particles - in short, a whole "zoo" of particles, the number of which clearly expressed a tendency to unlimited growth. All these strongly interacting particles received the common name "hadrons", which meant strong, heavy, dense. Most of them, however, turned out to be highly unstable, rapidly decaying into other more stable hadrons. The very fact of this multiplication of subatomic particles looked very mysterious from the point of view of the epistemological and methodological principles adopted in physics. Although, we note that the attitudes were not always formulated in any explicit and distinct way, their meaning in one way or another came down to the conviction that nature at the fundamental level should be simpler, and not more complex. Belief in some primordial simplicity of the universe was largely shaken. A quite natural question arose: "Why, then, are the meson, proton and other particles called elementary? After all, they are arranged so complicated. Is there really nothing simpler, really elementary in the world." and at the present time, as V. S. Barashenkov, "particles are traditionally called elementary, but physicists are aware that each such "element" is a complex material system (Barashenkov, 1992, p. 19-20).

The purpose of the research. The scientific and theoretical interpretation of the concept of elementarity is the main object of study in the article. Referring to the works of foreign authors, the author used the method of analysis, synthesis, and precise grouping.

The result of the research.

If we make a comparative analysis with other fields of science, we can note that the first aspect of the problem of existence is a chain of ideas about existence, each of which gives rise to the next question: What exists? Where does the world exist? Here and everywhere. How long is it available? Now and always. How long do individual things, organisms, people exist? They are finite and transitory. That is, they arise, develop, and die after a certain period of time, but they do not disappear, they take new forms and turn into other objects. The root of the problem, its meaning, lies in the contradictory unity of the impermanent existence of nature with the existence due to the various states of things. The existence of the world as a whole is inseparable from the existence of all things that exist in the world. The second aspect of the existence problem is that nature, man, thoughts, ideas, society, which are different according to their forms of existence, exist equally, and above all, by their existence, they form the whole unity of the infinite,

non-transitory world. The third aspect of the problem of existence consists in the fact that each person in his practical activity accepts existence, which constitutes the precondition of the unity of the world. It also accepts the idea not only of the existence of the world as it is, of its constant existence, but also of the existence of the world in itself in the unity of different bodies.

The category of "being" and its synonyms "real" and "reality" occupy a special place in the system of concepts that allow a person to understand the processes of the world. In order to understand the essence of the category of existence, which is the broadest concept of ontology, and to characterize it as a philosophical category, we must look at the concepts of reality and reality. This is because the content of the category of existence is revealed and made concrete through the concepts of reality and reality (Agosheva, & Novoselov, 2013).

However, does this mean that in modern scientific knowledge the concept of elementarity is a kind of relic of the past development or even, moreover, is completely meaningless, like the caloric or phlogiston of physics of past centuries? The answer to this question, apparently, can only be negative. It can be said that the classical concept of elementarity has lost its significance, which faithfully served classical natural science from the very moment of its inception. However, even this statement looks too categorical. The dialectic of real scientific knowledge is more complicated: new concepts and ideas do not arise here from scratch and not due to complete destruction and rejection as completely false, old ideas and concepts. In scientific knowledge, for all the revolutionary nature of certain stages of its development, the principle of continuity, the correspondence of its theoretical models, categorical systems, various methodological principles, and concepts justified in practice are fully realized. Among them is the concept of elementarity - a concept that has fully preserved its fundamental ideological and methodological significance in the natural sciences of our days. It is another matter, of course, that we now perceive this concept more dialectically, without absolutizing it to the extent that it was characteristic of the classical natural science of past centuries. Of course, such statements about dialectic in themselves, taken in isolation from the real practice of modern scientific knowledge, especially physical knowledge, will inevitably look purely declarative. And one of the main goals of this work, in fact, is precisely to show that in modern scientific knowledge, the main feature of which, as it is rightly believed, is the transition to the knowledge of complex systems, the orientation towards the search for elementary objects of the universe in no way has not lost its leading role (Leibniz, 1980).

Another thing is that it is no longer considered as some kind of only correct, only possible, scientifically justified, but rather as reflecting a certain understanding of nature. N. Stepanov, in particular, draws attention to this circumstance, noting that the methodological

orientation towards the search for elementary objects has lost its absolute, universal status in modern science. This attitude is now more and more realized associated with a certain understanding, a vision of nature, but not as something the only possible one. "In the works of a number of modern physicists," writes N.I. Stepanov, such as D. Bohm, J. Chu, and others, an attempt is made ... to realize the opposite anti-elementarian attitude, according to which the Universe is considered as a which does not exist isolated and fundamental units. If this attempt succeeds, then physics will enter into a dialogue with an even more ancient tradition of thinking and understanding nature " (Stepanov, 1981, p. 68-69).

At the same time, we emphasize that the entry of physics into a dialogue with this tradition will in no way cancel the elementary attitude but will only limit its reductionist claims. In turn, this limitation brings to the fore the question of the criteria of elementarity, their objective content in specific scientific knowledge at the present stage of its development. Special attention is paid to this circumstance in the works of V. S. Barashenkov. He discusses the problem of formulating such a definition of elementarity, which would provide us with an effective criterion for the unambiguous selection of elementary objects. A detailed analysis of the complex epistemological and methodological issues arising from this connection, as well as other points of view presented in scientific literature on this problem, leads to the conclusion that the mass defect criterion is fundamentally important as the most objective criterion for distinguishing the level of elementary objects (Mamzin, 2013).

So, for example, the mass of virtual particles formed during the dissociation of the π -meson (nucleon and antinucleon) is an order of magnitude greater than the mass of the π -meson itself. This gives grounds to assert that the π meson is more elementary than, say, the deuteron, whose mass defect is only about one thousandth of its mass. That is why we can consider the deuteron to really consist of a proton and a neutron, since its components - a proton and a neutron - as part of a single physical system, which is the deuteron, do not change in any significant way, while the above components of the π - meson are completely lose their self-identity in the process of their interaction, the intensity of which is ultimately characterized by a mass defect (Stepin, 2003).

So, the mass defect criterion allows, in accordance with the modern level of development of scientific knowledge, to single out a class of elementary particles. These particles, firstly, cannot be considered as excited states of other particles and, secondly, the possible decays of these particles occur with a mass defect comparable in magnitude to the masses of decaying particles (Barashenkov, 1992, p. 65-67).

However, the mass defect criterion, for all its fundamental nature, does not give us a completely satisfactory solution to the problem of elementarity. A very important question here is how to combine the

concept of elementarity with the concept of the structural complexity of an object. It was noted above that, in the modern sense, an elementary object is not at all devoid of any structure whatsoever. Currently on the agenda in physics is the question of the possibility of the existence of an even deeper (or "lower") level of the structural organization of matter than the level of quarks - the level of the so-called prions, rishons, aplons, more elementary than quarks. And this question, in turn, very sharply raises the problem of elementary criteria. Indeed, if we, for example, assert that the above-mentioned prions are more elementary than quarks, then on what basis is this done, on the basis of what specific criteria.

In our opinion, purely structural criteria alone (in the sense of "consists of") are not enough to solve the problem of elementarity. This does not mean that we consider the search for structural criteria unnecessary. The idea of the structural levels of matter, the search for the fundamental components of matter lying in the foundations of the universe, still retains its heuristic value. At the same time, we believe that the "structural" direction of the search for elementary objects should be organically combined, comprehended from the angle of ideas of development, formation, qualitative change, process. In our opinion, it is to this approach to considering the problem of elementarity that the whole course of development of modern scientific knowledge leads us, which more and more actively assimilates such ideas as the idea of evolution, self-organization, irreversibility, nonlinearity, internal activity, dynamism of the studied objects.

From the point of view of the question of elementarity that interests us, in methodological terms, the informational approach becomes important: in particular, the idea put forward by I. A. Akchurin about the exponentially growing information capacity of elementary objects of modern natural science knowledge (Akchurin, 1974, p. 41-53). This idea, in our opinion, throws a bridge from a purely structural approach to the problem of the elementary to a functional or, more precisely, its structural-functional consideration. It is on this path that opportunities open up for the synthesis of two mutually complementary approaches to the development of a modern understanding of elementarity, synthesizing in itself traditional ideas about the stability and variability of a thing and a process.

In other words, the transition to a new, deeper level of knowledge of matter, although still associated with the discovery of new elementary objects, but no longer understood in the sense of the traditional "bricks" of the universe, but as interrelated processes.

In this regard, it should be emphasized that the study of each level of matter organization requires its own experimental technique, its own research methods, its own theoretical ideas, among which one of the main ones is the idea of the existence of a deeper level. Cognition is characterized by the desire to break down already known "elementary objects" into more fundamental entities and

reveal the nature of their interaction. This analytical trend of human thinking can be called fruitful if it is combined with a general worldview orientation towards synthesis, towards the search for unity in the laws discovered by fundamental sciences. The idea of a single beginning carries a great heuristic potential. Elementarity performs special epistemological functions that are revealed specifically within the framework of a certain physical theory, but at the same time expressing their general worldview attitude to physical reality as a whole. And this circumstance is important for understanding the integrating role played by the principle of elementarity in scientific knowledge.

This integrating role of the principle of elementarity in scientific knowledge is manifested in different, but internally interconnected aspects.

As already noted, its concept of "elementary object", being a historically relative concept, is traditionally associated with the idea of the structural units of matter, which fix the essential properties of the studied fragment of reality. At the same time, ideas about elementarity are also associated with specific features of cognitive activity, which can only take place within the framework of a fairly stable and each time limited system of concepts - the theory is precisely ideas about elementary objects that make it possible to establish the simplest, initial structure of connections in the corresponding theoretical systems. However, these representations themselves are not the simplest elements of theoretical systems. And this is not only because the elementary objects in modern theoretical systems are obviously not elementary but have a very complex structure. Since the initial connections between concepts are established on the basis of ideas about elementary objects, it already follows from this that in the theoretical systems themselves, concepts are elements. A scientific theory in this case can be defined as a stable system. Ideas about an elementary object enter the theory not as something decomposable, but as a basis, a basis for the synthesis of concepts.

Thus, the concepts of elementary and complex functioning in scientific knowledge act as one of the most important methodological guidelines in the search for the fundamental laws of nature, indirectly pointing at the same time to the relative limits of our knowledge of material reality. The problem of elementarity acquires an essentially ideological and historical character. It can be attributed to the category of eternal problems in the sense that it is inexhaustible both in terms of volume and depth of philosophical and special-scientific issues covered by it. Hence the need to consider the problem of elementarity in a historical perspective. The natural starting point for such consideration is ancient atomism.

Ancient atomistics gave a certain method to natural science, characterizing the movement of knowledge from the study of properties to the explanation of these properties on the basis of the idea of structures composed of elementary objects. At the same time, she tried to establish

the criterion of elementarity - indivisibility (qualitatively - quantitatively), immutability, irreversibility. The idea of the immutability of the constituents of matter played a decisive role in the development of physics as a science, opening up the possibility for a scientific explanation of natural phenomena.

In general, any science, any section of science includes a certain group of objects and processes that are elementary within the given theory. "These fundamental concepts and laws," writes A. Einstein, which cannot be further reduced, form an integral part of the theory, which cannot be rationally interpreted. The most important goal of any theory is to have as few of these basic irreducible elements as possible and to they were as simple as possible, but in such a way that this did not exclude an accurate reflection of what is contained in experience (Einstein, 1934, p. 18). Elsewhere he also notes that "... the highest duty of physicists is the search for those general elementary laws, from which, by pure deduction, one can obtain a picture of the world" (Einstein, 1934, p. 40).

The history of the development of knowledge shows that there has always been a search for the "Principles of all things" as the basis for a theoretical explanation of material processes, as the basis for constructing initial theoretical systems. These goals were served by "water", Thales, "Air" by Anaximenes, "apeiron" by Anaximander, "Fire" by Heraclitus, "earth" by Xenophanes, "remeomeria" by Anaxagoras, "atoms" by Leucippus and Democritus, "ether" by Aristotle, "monads" by Leibniz. Elementary objects intuitively seem to be something "internal", something like that, penetrating into which one can explain and understand the "whole" "In a simple substance," Leibniz wrote, "a plurality of states and relations must necessarily exist, although it does not have parts". On this path, an explanation of the "whole" is built.

Various theoretical systems, as already noted, are characterized by their elementary objects. With the development of science, there is a change, the development of ideas about new elementary objects. As noted by N. F. Ovchinnikov, "... A new naga in the theoretical knowledge of the structure of matter is impossible without the discovery of new forms of indivisibility of its structural elements. The discovery of the divisibility of objects that were previously considered indivisible means only the first, descriptive step in the cognition of the structure. The next, deeper step is the discovery of new forms of indivisibility, new structural elements" (Ovchinnikov, 1977, p. 21).

According to M. A. Markov, "the search and, finally, the discovery of the next "atom", "elementary particle", etc., is not a pursuit of ghosts. The next "atom" in the broad sense of the word is real evidence of the discovery of a qualitative jump in the property of matter" (Markov, 1970, p. 5). Elementary objects enable us to imagine the objects of study, its stable aspects and are a kind of tool for cognition. A limited number of

them makes it possible in the process of cognition, as it were, to "remove" an inexhaustible variety in the field of knowledge, to obtain an ideal picture of the complex objects under study. The deepest problem of all in the face of the whole variety of particles is to find out what is the criterion of elementarity. Even if elementary particles do not consist of other smaller particles, then it can still be concluded that each of them contains some kind of "pramatter". This is what M. A. Markov, stating: "If indeed all particles are necessary to build the image of each of them, then it is natural to look for some other "material", more elementary in the sense that it would be common to the entire list of elementary "particles" (Markov, 1970, p. 5).

Conclusions.

As we can see, the development of physical knowledge has always, in one way or another, been correlated with the principle of elementarity, orienting primarily on the search for elementary objects and ways of explaining the observed phenomena on their basis. So, if we try to briefly summarize what has been said, then we can say with confidence that the principle of elementarity will retain its heuristic integrating role in scientific knowledge in the foreseeable future. However, such a forecast will look like a trivial, almost tautological conclusion, if we leave aside questions relating to those

real worldview and methodological problems that are associated with the functioning of the principle of elementarity in modern scientific knowledge, where this principle always appears not by itself, but in unity with other methodological regulators such as the principles of simplicity, correspondence, mathematization, invariance, observability, etc. We will limit ourselves to only one example illustrating the relationship between elementarity and mathematization in its form as it is interpreted in the works of I. Akchurin. As he emphasizes, one of the central moments in the construction of any new fundamental theory is the identification "... among the whole variety of natural and artificial (caused by man in a natural science experiment) material processes of such a special - extremely simple and at the same time absolutely universal, which could be played by the role of an always effective rule, which makes it possible to completely unambiguously and unambiguously correlate some elementary material object with a completely definite element of the chosen abstract mathematical space" (Akchurin, 1983). It is on the basis of elementary representations that the choice of a method for the theoretical description of a complex system is determined and knowledge about complex multilevel objects is recreated.

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