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"6K" Post-non-classical Epistemology

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***Abstract*—In the course of the global evolution of world science, there was a consistent change of its six cultural and historical types: ancient Eastern science, ancient science, medieval European science, classical modern European science, non-classical science and post-non-classical science. The formation of modern science, the first stage of development of which was called the classical science, occurred in Europe during the Renaissance and Modern Times. It was based on an experimental study of knowable objects at an empirical level and a mathematical description of the laws of these objects at a theoretical level. In the late 19th and early 20th centuries as a result of the global scientific revolution, non-classical science came to replace classical science with its ontology and new epistemology, and in the late 20th and early 21st centuries, the same fate befell non-classical science. It was replaced by a new cultural-historical type of science, called "post-non-classical science". The article carries out a rational reconstruction of the conceptual core of post-non-classical epistemology against the background of its comparison with the principles of classical and non-classical epistemology. The result of this reconstruction is the proposed in the article understanding of the core of post-non-classical epistemology as a set of "6 K" principles: constructivism of scientific cognition, contextuality of scientific awareness and knowledge, like scientific cognition (its basic conventionality and metaphorical character), cultural dependence of the dynamics of science and scientific cognition, communicative the nature of the process of scientific cognition, the consensual nature of scientific truths (their social and expert nature).**

Keywords*—*cultural-historical type of science; classical epistemology of science; non-classical epistemology of science; post-non-classical epistemology of science

I. INTRODUCTION

The history of world science over the 30 centuries of its existence in the course of its evolution undergoes six qualitatively different stages or states: ancient Eastern science, ancient science, medieval European science, classical science, non-classical science and post-non-classical science. The formation of modern science is associated with the Renaissance and the New Age (16-17 centuries). Her first stage was called classical science. It lasted more than three hundred years (17-19 centuries) [1]. The main difference of the classical modern European science from all previous stages of world science development was the new technology of scientific cognition, including two mandatory conditions for awareness of any objects in science: 1) their experimental research at the empirical level of knowledge, and 2) mathematical description of their laws at the theoretical level. However, in the late 19th and early 20th centuries, as a result of global revolutions in two main areas of science: mathematics (creation of non-Euclidean geometries) and physics (creation of the theory of relativity and quantum mechanics), classical science has been replaced by non-classical science with a new ontology (new scientific world view) and the new epistemology (new theory of scientific cognition). The development of the non-classical stage of science continued throughout almost the entire 20th century. However, gradually in the depths of non-classical science, a new type of science was formed — post-non-classical science, with ontology and epistemology qualitatively different not only from classical science, but also non-classical. Their ontological difference consisted primarily in the type of knowable objects. If for classical science macroobjects were the predominant type of objects, and for non-classical — micro-objects, for the postnonclassical supercomplex natural-social systems (from man to artificial intelligence, and from the technosphere to the biosphere and ecosphere). An equally significant difference existed between classical, non-classical and post-non-classical science and in epistemology, in understanding the nature of scientific cognition, the methodology of scientific cognition and the laws of the dynamics of science. The main difference between classical, non-classical and post-non-classical epistemology can be formulated in this way. Classical epistemology is the unequivocal determinism of the content of scientific cognition by the properties of knowable objects. Non-classical epistemology is the probabilistic determinism of the content of scientific knowledge using the objects content. Post-non-classical epistemology is the creative constructivism of researchers in the process of creating models of the objects, which resulted in the inevitable pluralism of scientific hypotheses and theories in the studying of the same objects.

II. CONCEPTUAL CORE OF CLASSICAL AND NON-CLASSICAL EPISTEMOLOGY

Within the framework of the epistemology of classical science, two alternative concepts of the nature of scientific cognition were proposed. This is empiricism (F. Bacon, I. Newton, J. Locke, O. Comte, J. St. Mill, E. Mach, and others) and rationalism (R. Descartes, G. Galileo, G. Leibniz,

I. Kant, G. Hegel, and others.). Supporters of empiricism (positivism) believed that the basis, source and criterion of the truth of scientific cognition should be only experience, only data of observation and experiment (Bacon, Comte, Mill, Jevons, Mach, etc.). Representatives of rationalism proceeded from the fact that the basis and source of true scientific cognition, especially scientific theories, can and should be only thinking. The latter has as its task not only the description of theoretical reality, but also its critical analysis using such powerful cognitive means as methodical doubt, intuition (a means of establishing the truth of the initial statements of scientific theories), and logic as the only reliable means of unfolding the true content of scientific cognition (Descartes, Leibniz, Kant, Hegel, and others) [2]. However, neither the empiricist nor the rationalist paradigms of classical epistemology could stand the test of the real history of science. In addition, the main such verification was the global scientific revolutions that occurred in all areas of science in the late 19th and early 20th centuries. The main events of the global scientific revolution in mathematics were, firstly, the creation of Lobachevsky, Bolyai and Riemann of non-Euclidean geometries, which contradicted many provisions of the former Euclidean geometry, which existed almost unchanged for about 2000 years, and, secondly, the discovery of logical contradictions in the theory sets, which by the end of the 19th century became the foundation of all classical mathematics. These facts clearly did not correspond to both the empirical and purely aprioristic interpretation of the nature of mathematical knowledge. Markers of no less global character of revolution in natural science became, firstly, the creation of non-classical theories in the foundation of physical science theories (building the theory of relativity and quantum mechanics), and, second, the creation of new fundamental theories in biology and chemistry, alternative to their classical theories (genetics , molecular biology, structural chemistry, etc.). In the late 19th - early 20th century, a similarly large-scale scientific revolution took place in the development of social and human sciences (creation of alternatives to classical theories in economics — Keynesian economics, sociology — a concrete empirical study of various social structures and laws of their functioning, psychology — behaviorism, the theory of the unconscious, engineering psychology, sociocultural determination of the psyche , linguistics - historical linguistics and structural linguistics, logic - mathematical logic and other sciences).

It was a challenge not only to the classical ontology of science, due to the substantiation of the concepts of properties and laws of various kinds of objects, alternative to classical science, but also classical epistemology, the basic idea of which was the belief in the ability of scientific cognition to receive absolutely true and absolutely objective knowledge of the world. By the very fact of its existence, the global scientific revolutions have empirically proved, so to speak, the falsity of such epistemological faith. There was an urgent need to create a new epistemology, on the basis of the principles of which one could, first, explain not only the possibility but also the inevitability of scientific revolutions as a completely natural phenomenon in the development of science and scientific cognition. Moreover, secondly, to abandon the ideal of classical epistemology, which clearly contradicts real science, about the possibility (and practical necessity) of attaining absolutely true, absolutely proved and absolutely objective knowledge in science.

In place of classical epistemology in the 20th century non-classical epistemology came. It is based on the following principles, which are largely alternative to the core of classical epistemology: 1) the recognition of the hypothesis as not only the main form of development of scientific cognition, but also its existence; 2) recognition of the fact that experience, as well as the method of induction based on it, in principle, cannot be methods of proving the truth of scientific laws and theories; 3) recognition of probabilistic scientific knowledge in science as just as legitimate as necessary and universal knowledge; 4) the denial of the existence in science of a certain universal method of cognition and the recognition of methodological pluralism in science as a completely natural state (recognition of the lawfulness in science of a variety of cognitive means depending on the content of the object being studied, types and levels of knowledge, cognitive goals). Categorical markers of non-classical epistemology are such new categories as scientific pluralism, relative truth, openness to change, scientific revolutions, potential falsifiability and real refutability of scientific knowledge, competition of scientific theories and research programs, non-cumulative nature of the development of scientific cognition, multi-component nature of assessment and truth criteria various units of scientific knowledge [3] [4]. The main contribution to the development of non-classical epistemology was made, first of all, by the scientists themselves — leaders of non-classical science (Lobachevsky, Riemann, Hilbert, Poincaré, Einstein, Bor, Heisenberg, etc.), and, secondly, representatives of a number of new philosophical epistemological concepts, such as pragmatism, instrumentalism, logical positivism (Russell, Carnap, Nagel, Reichenbach, and others) and postpositivism (Popper, Lakatos, Polany, Toulmin, etc.) [5].

III. BASIC PRINCIPLES OF POST-NON-CLASSICAL EPISTEMOLOGY

By the end of the 20th century, the alternative paradigm of post-non-classical epistemology replaced the epistemology of non-classical science. The new paradigm better corresponded to the latest stage in the development of science, its goals, objectives and opportunities. This stage was named in the modern philosophy of science “post-non-classical science”. Its main ontological difference from classical and non-classical science was that post-non-classical science radically changed the type of its subject orientation. In the post-non-classical science, priority is given to the study of not purely natural or social systems, but complex socio-natural, biosocial, technical, and human-information systems. The study of the structure and laws of such highly complex objects of reality as the biosphere, hydrosphere, atmosphere, geographic environment, space, man as a biosocial system, his brain, artificial intelligence, robots, computers, medicine, geopolitics, environmental issues, technology, culture, super-complex physical,

chemical and information systems with nonlinear dynamics, etc. came to the fore. It turned out that all similar objects and systems require for their research a fundamentally new interdisciplinary research methodology (V.S.Stepin) [6]. But this type of methodology is possible only within the framework of a new epistemology, a new philosophy of scientific cognition, the conceptual core of which must be based on qualitatively different principles, compared with both classical and non-classical epistemology.

The main contribution to the content of post-non-classical epistemology was made by representatives of the following modern concepts of the essence, structure and dynamics of scientific cognition and knowledge: 1) the sociology of scientific cognition (Malkey, Gilbert, etc.) [7] [8]; 2) the theory of scientific communications (Latour et al.) [9] [10]; 3) the pluralistic methodology of scientific cognition (Feyerabend and others) [11]; 4) paradigm theory of the dynamics of scientific cognition (Kun and others) [12]; 5) radical constructivism (Maturana, Watslavik, Glaserfeld, etc.) [13]; 6) poststructuralism and postmodernism (Foucault, Lyotard, Deleuze, Baudrillard) [14] [15].

The axioms of post-non-classical epistemology are the following principles:

- Structural pluralism of scientific cognition. The system of scientific cognition is a super-complex pluralistic system consisting of qualitatively different areas, levels, types and units of scientific knowledge, different not only in content but also in logical form and functions performed in an integrated system of scientific cognition [16] [17].
- Pluralism of methods of scientific cognition. Different fields of science, separate sciences, different levels of scientific knowledge in each of the disciplines, different types of scientific cognition differ significantly from each other not only in content, but also in their methods of obtaining and substantiating.
- Pluralism of scientific truths. The system of scientific cognition in general and of any individual science consists of qualitatively different types of scientific truths, including the opposite in content (alternative concepts, theories and research programs) [18].
- Pluralism of truth criteria of scientific cognition. In science there is no universal, uniform for all units of knowledge of the criterion of truth. For qualitatively different, either in content or in form or in function of units of knowledge, there are special criteria of truth. As a rule, all truth criteria are multi-component and include a consensual component or the consent of the scientific community.
- Any truth in science has an object-subject nature and constructive nature.
- The process of scientific cognition, the activities of scientists for the production and justification of knowledge has a social character [19];
- The main subject of scientific cognition is such a social system as a disciplinary scientific community [20] [21].
- The communication component of the process of scientific cognition is no less important than the subject-object interaction of scientists with knowable objects. Moreover, the latter type of relationship is always mediated by communication links between members of the scientific community. Effective scientific management (effective management of research and development) is one of the important factors in the productivity of scientific research and the dynamics of scientific cognition [22].
- Scientific revolutions are a natural and necessary stage in the development of scientific cognition. In general, the development of scientific knowledge is non-cumulative in nature [23].
- The new fundamental theories replacing each other not only deny each other, but are only partially comparable with each other. Therefore, there is no purely rational criterion for the preference of one of them. The choice between them is based on the cognitive will of the scientific community and scientific consensus [24].
- Despite the creative nature of scientific cognition at all its levels, as well as the fundamental pluralism of the structure, methods and criteria of the truth of scientific cognition, the system of scientific cognition and knowledge in general is internally interconnected, where some elements influence others. Therefore, the slogan of the anarchist concept of the post-non-classical methodology of science “Everything goes” (P. Feyerabend), which asserts the value of absolute freedom of cognitive activity in science, contradicts real cognitive practice, abstracting from the social and systemic nature of scientific cognition [25].
- On the other hand, such a concept of post-non-classical methodology of science as post-structuralism, whose representatives absolutize the interrelation of various elements of scientific cognition and, as a result, the contextual nature of scientific cognition and the subjective nature of scientific truths, is equally flawed [26]. The interrelation of various elements of scientific cognition among themselves does not negate the fact of their discreteness, relative independence and dependence of their content on the content of knowable objects.
- Each of the various concepts of the post-non-classical methodology of science has in its content a certain rational grain. The synthesis of these rational grains is a necessary condition for creating a post-non-classical methodology that is sufficiently complete and adequate to modern science.
- All the dichotomies of the methodology of science (theoretical-empirical, axioms - theorems, a priori - a

posteriori, analytical-synthetic, natural scientific - social, intuitive-discursive, explicit-implicit, text-context, probable-reliable, conditional - unconditional, etc.) have a strict distinction only within the framework of the methodological theory. However, when applied to real scientific cognition, they are all relative [27].

Generally, the core of post-non-classical epistemology can be characterized as "6K epistemology": 1) constructiveness of scientific cognition and knowledge (scientific cognition is a special kind of artifact reality created by scientists); 2) contextuality of scientific cognition (any unit of scientific cognition is always an element or part of more a vast system of knowledge - its context, which is never fully defined); 3) cultural studies of real scientific and cognitive activity and its results (scientific knowledge and scientific knowledge are always part of the existing type of culture and therefore depend on it) [28]; 4) the communicative nature of scientific cognition (communication between scientists is the most important component of the process of scientific cognition, affecting both the production of scientific knowledge and the evaluation of the results); 5) "as if " scientific cognition (scientific knowledge is essentially metaphorical and conditional); 6) the consensus of scientific truths (making a decision about the truth of a given unit of scientific cognition always has a consensual-expert character, being prerogatives d disciplinary scientific community as the main subject of scientific activity). The essence of post-non-classical epistemology is the idea of scientific cognition as a super-complex, pluralistic, developing, social and integral system.

IV. CONCLUSION

The paradigm of post-non-classical epistemology is qualitatively different from the core of both classical and non-classical epistemology. But it is better for them to meet the needs and possibilities, ideology and ontology, as well as the practical tasks of post-non-classical science.

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