

Vladimir Vernadsky's Contribution to the Origin of the Global Trend in Science

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The present paper analyzes in what way Lomonosov's ideas about the interconnection between some processes on the Earth have influenced Vernadsky's scientific pursuits and contributed to the development of a global worldview. Vernadsky paid major attention to the formation of scientific worldview where globalism and evolutionism play the crucial role. The authors argue that Vernadsky laid the foundation for the further investigation of global processes and can be regarded a pioneer of global research. At present these investigations are formed as a separate scientific cluster with globalistics as its core, and also involving global evolutionism, separate global disciplines, investigations of globalization and a number of other spheres of scientific search. The noosphere theory combines the evolution of noosphere and globalism. Noosphere genesis as a process of humankind survival is the core objective for the present and future civilizational development, which implies a transition to global sustainability, formation of information civilization, globalization and other positive processes of global development. Vernadsky anticipated the coming of a new stage of scientific research – global noospheric revolution in science.

Keywords: *globalization, globalization of science, global noospheric revolution in science, global worldview, global disciplines, global problems, global processes, globalistics, global research, global cluster of knowledge, interdisciplinary sections of globalistics, nooglobalism, noosphere, evolutionary globalistics.*

Mikhail Lomonosov and Vladimir Vernadsky: On the Way to Global Worldview

Some scholars think that Mikhail Lomonosov was the first to develop the idea of global worldview (Abylgaziev *et al.* 2011). So one can be almost sure that Lomonosov's ideas about the existing interconnections between various processes on the Earth predetermined Vernadsky's works and, in particular, his perceptions of biosphere as a global system with living matter playing the key role.

Vladimir Vernadsky considered Lomonosov to be a man of outstanding personality. In his article 'In the memory of Mikhail Lomonosov' (1911) Vernadsky wrote, 'Some of Lomonosov's ideas are closer and clearer on the verge of the 20th century than in the middle of the previous one' (Vernadsky 1989: 52). The same is true for Vernadsky's scientific legacy – his ideas are closer and more comprehensible at the beginning of the twenty-first century than in the middle of the previous one.

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Vernadsky began to study Lomonosov's academic pursuits in 1900 and dedicated to him a series of works. In 1900, when he was a professor at Lomonosov Moscow State University (MSU) Vernadsky published a brochure 'On the contribution of Lomonosov's research to mineralogy and geology' (Vernadsky 1900). According to Vernadsky, Lomonosov's views on various phenomena, which his generation had no access to, were far ahead of his time. Vernadsky considered Lomonosov's work 'On the layers of the Earth' (Lomonosov 1949) as a brilliant geological essay containing primary geological ideas. Here one should note that in Lomonosov's times geology did not evolve as a science. Thus, Lomonosov was one of the first scholars to view Earth as an entity that had evolved under the joint effect of various internal and external factors.

Vernadsky also highly evaluated Lomonosov's ideas about the causes of earthquakes, origin of mineral veins and their movement along crust faults, about the evolution of soils and fossil fuels, the formation of amber and other minerals and ores (Yanshina 1998). He even started writing an essay on Lomonosov's research in physics and chemistry entitled 'In memory of Mikhail Lomonosov' but only two pages of that essay have survived (Vernadsky 1988: 332–333). In 1927 Vernadsky established the so-called Lomonosov Commission affiliated with the Presidium of the Academy of Sciences. Later, in 1950–1967, thanks to the Commission's activity the Academy of Sciences succeeded in publishing ten volumes of Lomonosov's works and essays including the ones collected by the Commission (Yanshina 1998: 447).

Soon after his first works about Lomonosov had appeared, Vernadsky delivered several lectures at Moscow State University. In particular, he covered the issues of geographical discoveries, Earth's sphericity and a number of other phenomena related to the start of globalization. In 1981 those lectures were published in the volume comprising selected works in history (Vernadsky 1981: 301–303). Vernadsky devoted his efforts mainly to the scientific investigation of natural processes; however, he would also concern with the socio-humanitarian sphere and paid much attention to interdisciplinary research.

We think that further globalization along with globalization of science will reveal Vernadsky's global scientific ideas which used to be unrecognized. That is one of the reasons why Vernadsky was considered 'the twentieth-century Lomonosov'. However, such appraisal should not be reduced only to that century. At present, Vernadsky is widely recognized as an outstanding scholar of the global era that in the future is supposed to evolve into the noosphere era (Ilyin and Ursul 2013b; Ursul 2013).

While analyzing Vernadsky's academic legacy one constantly reveals some new ideas and concepts that used to be either incomprehensible or considered irrelevant. In this respect Vernadsky's legacy is inexhaustible since constantly changing thinking patterns and emergence of new issues make Vernadsky's works relevant today.

Many scholars stood at the origins of global worldview (for their explicit survey see Alexander Chumakov's monograph [Chumakov 2017]). Nevertheless, it was Vernadsky who gave impetus to the development of global consciousness and the way of thinking that would help explore the outer world. In his essay 'On the scientific worldview' he emphasized that along with the eighteenth-century circumnavigation of the globe the 'discovery of America and Australia and travelling across Africa were of considerable significance for the scientific worldview' (Vernadsky 1991: 195). Vernadsky also studied other global processes, including global population distribution, the control of fire and agro-neolithic revolution, *etc.* Vernadsky's planetary worldview was formed as a result of perception of

the revealed patterns of comprehensive study of the world as well as of his own investigations of global natural processes in natural sciences, especially in Earth sciences.

Vernadsky paid major attention to the evolution of scientific worldview which, according to Mikulinsky, the editor of the book *Works on the History of Science*, he considered as an amalgamation of scientifically discovered fundamental laws and facts (Vernadsky 1981: 304). These ideas found their expression in one of his works – ‘Essays on the history of contemporary scientific worldview’ (Vernadsky 1981: 32–185). His essays and notes show that Vernadsky studied the scientific worldview not only within the evolutionary framework but also revealed that major scientific discoveries tend to transform the worldview.

At present, the continuing evolution of global worldview helps to explore the world. The global worldview or globalism is based on the following presuppositions: the world is a single entity, the humankind is a united world community, and this unity is perceived through global processes and problems.

Vladimir Vernadsky as a Founder of Global Studies

It is reasonable to consider the first half of the twentieth century as an onset of global science. It is back then when Vernadsky started to investigate global processes.

He argued that ‘in the twentieth century humans studied and perceived the whole biosphere, completed the world geographical map and inhabited the Earth's surface. The humankind actually became a single entity’ (Vernadsky 1991: 240). In his book *Scientific Thought as a Planetary Phenomenon* Vernadsky provided arguments for human endeavors to unity which remain relevant for contemporary scholars. In fact, Vernadsky studied globalization and in a sense made predictions concerning it.

One of the basic foundations of anthropogenic activity and further formation of the global worldview was the Earth's sphericity. Vernadsky pointed, ‘The first and foremost basis of scientific view is the form and size of the Earth’ (*Ibid.*: 104). ‘The idea of Earth's form was connected with the first circumnavigation. Meanwhile, the discovery of America has broadened the horizons for educated people’ (*Ibid.*: 115).

According to Vernadsky, the geographical discoveries began neither with Columbus nor with Magellan but with the Norsemen navigation (Vernadsky 1981: 122–129). However, ‘Earth's sphericity could be proved only when people could go round the Earth and complete the world's map. This process was long and gradual... Only the first circumnavigation solved the problem of the Earth's form’ (Vernadsky 1991: 115).

Vernadsky did not limit himself to the geographical aspect of global characteristics. He singled out at least two meanings of the notion that is currently interpreted as globality in science. The first meaning is associated with objects and laws characteristic both of our planet with its biosphere and of cosmos, i.e. sciences with subjects mostly dealing with real phenomena. The second meaning is connected with the phenomena that are characteristic of the Earth. In the latter case the two types of scientific objects might be distinguished: planetary phenomena and peculiar earth phenomena.

At present, however, it is not always feasible to distinguish between these two cases. ‘This is the plan for the future’ (Vernadsky 1991: 145). Thus, the scholar was the first to distinguish between *global* and *local* without apparently naming the terms.

Today global knowledge is generated in various scientific disciplines (even in mathematics) which apply the term *global* in different meanings. In global studies this term is

used in three main meanings: *global* meaning something referring to the whole planet as a cosmic object; *global* as spreading across the Universe and the whole creation; and *global* as a common characteristic or law typical for a certain set of phenomena under study. Due to this variety of meanings there is a necessity to study and bring to order this 'terminological chaos'.

Vernadsky started investigating global processes in 1902–1903, which one can deduce, in particular, from his *Essays on the history of science*. Back then he delivered lectures on that topic at MSU. However, he had no chance to publish all those lectures but only three of them (yet, he planned to write about 20 lectures). Nevertheless, the book was published later (Vernadsky 1981: 301–303). Vernadsky expressed his comprehensive views on a number of natural processes in essays in geology and other fields not related to geoscience. Therefore, he started investigating global issues in the early twentieth century, yet, his studies in this field were not taken into account by the academic community.

Vernadsky's works, especially the ones on the history of science, cover some relevant issues that are presently discussed in global studies. However, instead of the terms *global* and *globalization* he used the term *planetary* or *universal* to which he assigned similar meaning. The majority of Vernadsky's 'global ideas' were expressed in his *Works on the history of science* (mostly written in the early twentieth century), and *Scientific Thought as a Planetary Phenomenon* (written in 1938) the latter being Vernadsky's scientific pinnacle, since according to the authors of the preface A. L. Yanshina and F. T. Yanshina it is 'related to the destiny of scientific cognition, interconnection of science and philosophy and future of the humankind' (Vernadsky 1991: 9). A decade later, the German philosopher Karl Jaspers independently came to the same conclusions about humankind's unity (Jaspers 1991: 141, 158, 205). Some ideas concerning the humankind's endeavor to unity presented in the above-mentioned works coincide with the ones developed by contemporary scientists.

Vernadsky argued that in the twentieth century the 'scientific thought became international' (Vernadsky 1991: 45), it spread across the planet and countries (*Ibid.*: 80) and played an important role of a transnational actor of global development. Vernadsky quite clearly defined the evolution of global scientific thought with regard to noosphere genesis as well. In his works the concept of noosphere was elaborated within the framework of noospheric globalism (nooglobalism), where globalism and evolution of noosphere intertwined and evolved into a kind of scientific worldview (Ilyin and Ursul 2012; Chumakov 2013; Ilyin, Ursul A. and Ursul T. 2014a; Ursul 2015).

Vernadsky pointed out that humans as 'residents of the planet ... must think and act in a peculiar manner and take into account not only individuals, families, kindreds, nations or units, but the planet as a whole. Just like all living beings humans can think and act in planetary terms only in the sphere of life – in biosphere, that is in a certain earth shell with which they are connected and are unable to leave. Their whole existence is its function. They carry it everywhere' (Vernadsky 1991: 28). Hence, Vernadsky perceived the role of humankind as a global developmental actor and did not divide his thinking into local and planetary dimensions which was proclaimed by the rule 'think globally – act locally'.

Henceforth, Vernadsky established a framework for investigation of global processes both in Russia and in world science. Thus, he was the pioneer of global trend in science although he did not use the terms introduced later – globalistics, global studies *etc.* (Ilyin and Ursul 2013b). In the respect we should emphasize that here we speak about the global trend in science that involves the whole range of already existing disciplinary, interdisciplinary and transdisciplinary studies of global processes and systems. Apparently, Vernadsky laid the foundation not just for globalistics; it is reasonable to speak about the priority

of his academic interests in a broader global format. It is only today that Vernadsky's 'global syncreticity' can be perceived and structured. Moreover, only now it is possible to define the content and trend of contemporary science, a specific 'global cluster' of scientific search, which is denoted as global studies.

On the Way to Global Cluster of Scientific Knowledge

Globalization of science proceeds in different dimensions. One can even say that global studies are gradually forming a separate scientific cluster (a global cluster of scientific knowledge) which includes globalistics as its core, and also global evolutionism, other global sciences like global economics, global ecology, global history, global geography, *etc.* At the same time, there evolve the so-called globalization studies that investigate both certain globalization trends (processes within globalization) and their combinations (Abylgaziev and Ilyin 2012). The global cluster of scientific knowledge also tends to integrate new global knowledge obtained in the fields that study their subject matter in terms of globalization (or other global processes) and this knowledge is already included in non-globalized scientific discipline.

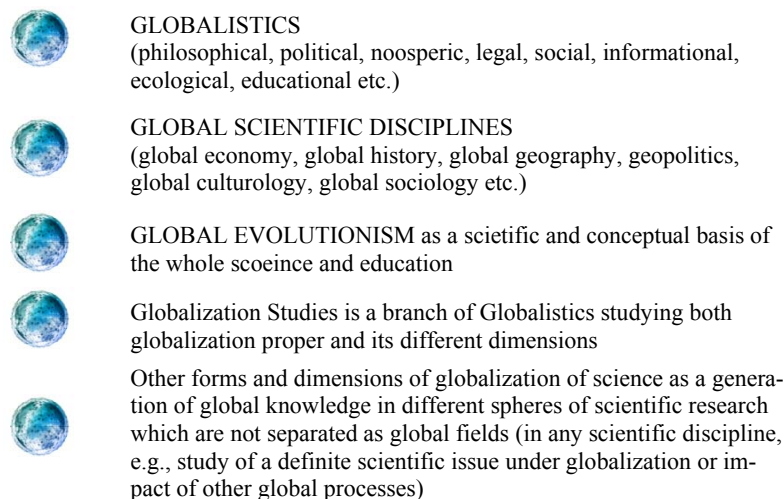


Fig. 1. Main constituents of the Global Studies cluster

One of the reasons why global trend in science as well as globalistics develop so rapidly is that they study global processes and systems that determine our future. The terms *globalistics* and *global studies* came into common use in association with global threats, especially after the first reports of the Club of Rome (Chumakov 2017).

The development of globalistics is accompanied by intensive debates concerning its subject. In the Russian academic community there are two main points of view on that issue. Alexander N. Chumakov supposes that 'globalistics is an interdisciplinary sphere of scientific research aimed at examining the origins of globalizations, its causes and trends along with the analysis of its negative and positive effects' (Chumakov 2012: 4). One of the authors of the present article together with Tatyana L. Shestova sticks to a different point of view, supposing that 'the systemic role of globalization can hardly be underestimated. Thus, it is difficult to single out a separate discipline for the study of globalization

(like there is no single science for evolution) ... Hence, it is wrong to define globalistics as a science of globalization' (Ilyin and Shestova 2015: 68). These authors point out that the notion and the issues of globalization are of inter-scientific importance and are investigated within the frameworks of different social and other sciences.

In this paper we define globalistics as a system of scientific knowledge, a forming scientific discipline (especially with respect to its theoretical foundations) and as an integrative universal scientific field which investigates various aspects of global processes and systems (globalization and global problems in the first place) and identifies their laws and trends. In this regard global processes can be divided into natural, social and socio-natural processes of the planetary scale, for example, globalization, global problems, sustainable development, noosphere genesis *etc.* (as for the natural processes, they are considered only in terms of their impact on humans and society). The above-mentioned global processes can be divided into already unfolding and potentially global, like, for example, sustainable development.

Some Russian scholars used to think that globalistics and global studies have the same meaning and differ from each other only in the origin of the term. Later, however, it became obvious that it is not reasonable to equal them. Globalistics as a sphere of scientific inquiry forms a conceptual core of global studies and develops a system of scientific knowledge investigating global processes and systems and identifying their laws and trends (Ilyin and Ursul 2013a; Ilyin, Ursul A. and Ursul T. 2016).

In this context, it is important to note that globalistics is interdisciplinary while global studies are multidisciplinary in their nature and form a cluster of global knowledge. One can observe numerous publications covering new interdisciplinary spheres within globalistics proper: philosophical globalistics, political globalistics, historical globalistics, legal globalistics, cosmoglobalistics, economic globalistics, informational globalistics, security globalistics, social globalistics, civilizational globalistics, educational globalistics, evolutionary globalistics, ecological globalistics and others with the total number of more than 20 (Ilyin and Ursul 2013a; Ilyin, Ursul A. and Ursul D. 2016) (for details see Table below).

Table

№	Section of globalistics	Main characteristics
1	Philosophical globalistics	Development of philosophical aspects of globalistics and its methodology; one of the most developed sections of globalistics
2	Political globalistics	Research on regular trends in global politics, formation of global political system and global governance
3	Historical globalistics	Investigation of the history of global processes and systems by means of historic approach and methods to examine mainly social and socio-natural global processes and systems
4	Social globalistics	Investigation of the global dimension of social activity and impact of various global processes on the society
5	Civilizational globalistics	Research on how global processes influence civilizational development and evolution of the global civilization
6	Legal globalistics	Identifying of the global-scale patterns in legal sphere, their evolution towards global law and formation of legal basis for global governance
7	Informational globalistics	Investigation of information dimension as a global one, informational globalization and other forms which use informational approach to examine socio-natural and natural global processes and systems

No	Section of globalisites	Main characteristics
8	Cosmoglobalistics	A field that cooperates with cosmic investigations and cosmo-practice and investigates the influence of extraterrestrial factors on global processes, development of cosmonautics and transformation of global processes into cosmic along with the opportunities of colonization of other planets including exoplanets
9	Educational globalistics	The sphere of global studies which links globalistics with education sciences, investigation of educational globalization, formation of global education and united educational and scientific space
10	Ecological globalistics	Investigation of interaction between humanity and biosphere, global action of the civilization oriented at overcoming global socio-ecological crisis
11	Global economics	Investigation of global processes and systems, formation of global cooperation in terms of economy
12	Evolutionary globalistics	A section that uses interdisciplinary approach to investigate global processes and systems in terms of evolution from the point of global evolutionism in the first place
13	Nooglobalistics	Forecasting of evolution of the sphere of human thought on the way to global informational society with sustainable development
14	Paleoglobalistics	Investigation of former mainly post-astronomic natural and socio-natural global processes and systems
15	Futuroglobalistics	Investigation and forecasting of the future global systems, processes and problems
16	Security globalistics	Investigation of social and socio-natural global processes and systems within the framework of security and development and transition towards sustainable development
17	Geographical globalistics	Investigation of geographical aspect of global processes, trends and ways of forming a geological shell (geosphere) of global development
18	'Sustainable' Globalistics (Globalistics of sustainable development)	Investigation of interconnection of sustainable development and global processes, formation of global development as sustainable development
19	Demographic globalistics	A section that investigates global processes in terms of demography; global development is seen through achieving sustainable future

Here a question arises: why along with interdisciplinary sections of globalistics do there emerge separate global disciplines and how should we differentiate between them? When these disciplinary and interdisciplinary scientific spheres were formed scholars would see no reason to give a name to a new sphere of global knowledge. That processes depended solely on individual scholars who would denote a new discipline as they wish. Eventually, that led to inadequate names, for example, economic globalistics, legal globalistics and others, which fact was revealed only much later.

Meanwhile, there exist criteria to differentiate a global discipline from a respective interdisciplinary branch of globalistics. It is of major importance to distinguish between the subject of scientific studies and its aspects. Globalistics focuses on global phenomena (subjects) while the disciplines evolving into global ones continue to investigate their traditional subject but on a global scale. In other words, they expand the traditional subject of a scientific field.

Global Studies in the Context of Evolutionary Approach

Vernadsky's idea about the 'planetary' nature of scientific thought is perceived within the framework of current global processes and future investigations of social and socio-natural processes. He considered the idea of evolution to be of major importance and thought that 'there will be a turning point in biological sciences due to the evolutionary theory' (Vernadsky 1981: 34). He supposed that the idea might penetrate scientific worldview and other sciences via philosophy as it happened with 'the notion of evolution which manifested in progress' (*Ibid.*: 54–55).

The significance of evolutionary approach was obvious to Vernadsky already in the early twentieth century, when he pointed out that Buffon 'was searching for a universal principle which would allow him to explain the natural order and similarities between objects. He found that principle in the idea of evolution and in the genetic correlation existing between various species of animals and plants and between different natural objects' (*Ibid.*: 205). However, as Vernadsky pointed out, those ideas stood aside from the metaphysical systems that were elaborated in the seventeenth and eighteenth centuries (*Ibid.*: 206).

The global issues make us pay more attention to the evolutionary approach and its application to the study of our future which is now at stake. The idea of evolution has penetrated global studies and brings us to a new view on global science which evolves both in gnosiological and ontological terms. The evolutionary view on the study of global processes is a natural step towards their comprehension and it may also contribute to the formation of global governance.

Evolutionary globalistics is most likely to develop as one of the branches of globalistics along with others. But as soon as scholars perceive the necessity to use evolutionary approach in global studies the latter will be filled with evolutionary ideas. So there might start a new 'evolutionary' stage of development of global knowledge as it happened in biology (Ilyin and Ursul 2013a).

We consider evolutionary globalistics to be a field which investigates evolution and coevolution of global processes and their synergetic development. Therefore, we expect the formation of new branches of globalistics, in particular, paleoglobalistics and futuroglobalistics along with already existing neoglobalistics (global studies of the ongoing processes).

Global Character of the Noosphere Genesis

Vernadsky's interpretation of scientific thought as a planetary phenomenon, his ideas of humanity as a strong geological force and noospheric evolution allow making some predictions and directing a number of upcoming investigations. In the first half of the 20th century Vernadsky and two French scholars Pierre Teilhard de Chardin and Edouard le Roy put forward the idea of evolution of the sphere of human thought – noosphere – as the main trend of human development that can somehow rationalize civilizational process and guarantee the civilization's survival. The idea of a society with prevailing human intelligence was rather utopian and differed from the real situation when human thought was far from being prioritized. Nevertheless, one should point that the role of human intelligence was growing.

The above-mentioned authors considered human intelligence as the core of the noosphere concept. Yet, the idea of growing role of intelligence in social development did not originate in the late 1930s when the above-mentioned scholars coined the term 'noosphere'. Vernadsky himself considered the French colleagues to be the pioneers in

introducing the term. Thus, in the work 'On the Noosphere' he pointed out, 'Having taken my biogeochemical basis of the biosphere as a source, the French mathematician and philosopher E. Le Roy, when delivering lectures at the College de France in 1927, used the term "noosphere" to describe the current stage of the biosphere. He emphasized that he had drawn such a conclusion together with his friend, an eminent geologist and paleontologist Teilhard de Chardin, currently working in China' (Vernadsky 1991: 241).

The concepts of noosphere introduced by its founders differed considerably, yet, having a common idea of powerful intelligence (not only human) as a driving force of further 'reasonable' evolution.

Tsiolkovsky did not use the term 'noosphere' but also suggested that intelligence was of major importance in the Universe and could become not only a geological, but a decisive factor in the evolution of cosmos. Moreover, intelligent creatures might be able to influence and change the whole Universe.

Vernadsky considered noosphere to be the main trend of human development. According to the scholar, 'both capitalism and socialism are alien to me along with the nation-state. My ideal is different; it is the matter of the future, which I will surely never reach. I live to serve the science. What is currently happening in the scientific thought is deeper and more powerful for the humankind than any social transformations whatever great they seem' (Vernadsky 1991: 146–147). Vernadsky came to the idea of noosphere being dissatisfied with the social system existing then.

One of Vernadsky's ideas concerning the noosphere was the role of intelligence not only in social life, but in the evolution of biosphere, especially in geological evolution. The idea of noosphere genesis differs from the idea of noogenesis (proposed by P. Teilhard de Chardin) since the former analyzes noogenesis together with its environment in terms of coevolution. This is similar to the idea of biosphere implying that biota interacts with the inanimate matter. Such idea proves to be more relevant in terms of evolution. It is reasonable to regard progressive development as coevolution of system and environment. Here we come to global noospherology or nooglobalistics, which are intertwined with sustainable development and were developed together.

In Vernadsky's works the noosphere theory was developed on a planetary scale in the form of nooglobalism in which globalism and the idea of evolution of noosphere merge into a single system. The evolution of noosphere was considered global. Vernadsky claimed that suggesting that biosphere would evolve into noosphere.

Vernadsky's followers in the USSR and Russia developed his ideas and proved that the evolution of noosphere may contribute to the survival of humanity. A civilizational development without crises as a coevolution of humans and biosphere presupposes the development of humans within noosphere, which would guarantee a rational governance and interaction between society and nature. Vernadsky believed that the evolution of noosphere is an inevitable natural historic process that emerges spontaneously.

At present, we hardly believe that biosphere can spontaneously evolve into noosphere. It will be modelled and formed theoretically and then implemented in social and socio-natural spheres, in construction and implementation of the principle of global governance in a noospheric terms.

Conclusion. On the Global Noospheric Revolution in Science

Vernadsky's contribution to the development of science on a global scale is not reduced to his global noospheric research. In his works he in a certain sense predicted the new global stage of scientific development unfolding in the new era when a human and nature will

integrate in the global sphere of thought. This impact on science is observed in the formation of a global cluster of scientific research and the onset of global scientific revolution (Ilyin, Ursul A. and Ursul T. 2014b). Here the term 'global' characterizes not internal extensive scientific processes but the existential feature of reflected phenomena which acquire a form of 'global being'.

While the previous scientific revolutions followed each other, 'the new global revolution in science' interacts with a number of other revolutionary scientific transformations in IT, ecology etc. 'Revolutionary transformations' have been an ongoing process since the mid-twentieth century in the framework of 'multirevolutionary explosion'. Global revolution is accompanied by cosmic revolution, IT revolution, ecological revolution, temporal revolution (futurization of science), which lay the basis for noosphere.

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