



# In Search of the Foundations of a New Worldview

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## Abstract

The subject of the article is connected with the study of the attempts of scientists and philosophers to find the foundations and tools of a new worldview, which in the conditions of modern culture would reflect the systemic foundations of the world, the fundamental nomology of the world order, which underlies its permanent laws. The author pays special attention to the results of the study by scientists of the nonlinear processes of self-organization of complex systems and focuses on the nature of statistical laws and also sought to show that these patterns represent a more fundamental aspect of reality than dynamic laws. On the basis of factual material, the author shows that the results of the study of nonequilibrium systems are fully used in modern cosmological concepts. Without a doubt, these and similar discoveries will allow humanity to open the veil of secrecy over the eternal, fateful questions about how the Universe appeared, what are the global prospects for its existence, what is the place of man in it? This kind of epochal discoveries will be the crown of the most daring epistemological intentions of mankind in its eternal and tireless search, in its desire to look beyond the horizon of the known, to be involved in truly Divine knowledge, having received the key to the secrets of nature.

**Keywords:** Science; Cosmology; Philosophy; Fundamental Nomology; Regularity; Fluctuation

## Introduction

### Formulation of the Problem

If we take a retrospective look at human history, we cannot fail to notice that this whole history is permeated with a human desire to know the secrets of nature, to look beyond the limits known to man. A person's knowledge of the world around him and himself never reaches saturation point, and modern science is less and less like an archive of unshakable truths - its dynamics, the change of scientific paradigms is accelerating. The transition of science to a new phase of its own development, the "post-non-classical" stage, can be considered truly epoch-making. This transition occurs as the traditional linear (deterministic) assessments of the

interconnectedness and interdependence of phenomena and processes of reality, which have inextricably dominated European culture since its inception, are replaced by a new, deeper understanding of the nature of reality. Such an understanding, both in the natural sciences and equally in the humanitarian tradition, is closely connected with a significant rethinking of the phenomenon of determinism. The content of the worldview orientation of the new paradigm was the changing being in its constancy and change.

These views are especially pronounced in the field of cosmology. According to eminent philosopher Professor Anthony Flew, cosmology is "the branch of philosophy, often considered a subdivision of "metaphysics, that deals with the Universe as a totality of phenomena, attempting to combine

metaphysical speculation and scientific evidence within a coherent framework [1]". The well-known Ukrainian scientist Oleg Bazaluk develops the idea of Anthony Flue further, especially noting the dynamics of the process of such knowledge: "Philosophy of the cosmos actualizes new meanings in the understanding of the evolution of the Universe [2]". From here, through such a philosophy, it is necessary to explore new meanings in understanding the phenomena of reality around us at its macro and micro levels.

In postclassical science, a fundamental revision of the methodological principles of natural science begins. The changes are aimed at shifting the emphasis in ontological principles from essence to existence. The formation of a new style of thinking and a new scientific picture of the world made it possible to better understand the nature of reality and come closer to understanding previously unknown levels of the structural organization of matter. Hence, the choice of this topic is due to the need to give a correct philosophical assessment of the new state of development of science, in particular - cosmology, and their theoretical justification. The author of the article also draws attention to the interpretation in science of a number of phenomena, processes, parameters of matter variability. Therefore, the purpose of the author of this article is to summarize the content of those studies that are grouped around this range of issues. A separate task is also to compare the current state of development of science with its previous stage and to assess the issue from a new methodological point of view.

### **Presenting Main Material: New World Outlook - Essence and Phenomena**

Re-awareness of traditional ideas, concepts, concepts entails a transition to a new non-linear paradigm of thinking. The content of the worldview orientation of the new paradigm was a changeable existence in its constancy and change, directly related to man's long-standing attempts to give a unified explanation for all the facts of reality, to understand the latter from the point of view of a single constant. It is not only and not so much about the truths of fact, but about the fundamental relationship of the world to its first cause, the first principle; it is gradually practically cast into the question of the initial mystery of the world, of reality in general and the nature of this reality. Academically minded scientists are at the forefront of these searches, searches that are focused on the intention to create a unified theory of everything or to find the "God's equation" that would act as a universal explaining idea for all processes of the universe: "It would be the holy grail of physics, a single formula from which, in principle, one could derive all other equations, starting from the Big Bang and moving to the end of the universe [3]", that is, the only formula from which, according to Albert Einstein and Michio Kaku, equations can be derived for all states of

the Universe, from the beginning of the world to its end - that capacious and short equation that would allow ... "to read the thoughts of God [3]".

And if someday it will be possible, either through carefully conducted observations and experiments, or through a happy guess, to finally establish and subsequently show even the most ardent skeptic the essence of the fundamental reality of the world, and, along with this and inextricably linked with this, the original meaning of the world and the openness of his being, and really treat all this as an eternal question of man, as a mystery ("where does everything that exists from?"), not obscured by quasi-mysteries invented in different cultural and historical eras by mankind, this will finally allow us to give an answer to the greatest worldview question of a person, to the most ancient secret of the world, which at all times thinkers and scientists have tried to comprehend.

The revival of such ideological searches occurred at first in the first quarter of the last century; the discoveries of physicists of that time and the further progress of science forced researchers, in particular, to make significant adjustments to the scientific understanding of causality. "The advances in the physical sciences at the turn of the twentieth century revealed an infinitely more dynamic and complex world than previously known to classical scientists [4]". It turned out that many dynamic systems - physical, chemical, biological, which fall under nonlinear dynamic equations, become unpredictable, in the case of manifestation at the macro level. After all, some systems are considered "normal" and function in accordance with deterministic laws only up to a certain time - between bifurcation situations. Here their "behavior" can be completely predicted. However, during the tendency in its development to certain extreme changes, two variants of the quality state appear. They appear to overcome these extreme conditions. Each of these options can happen first, when the object passes through the so-called critical points. However, it is impossible to predict which variant will acquire ontological legitimacy. For some time, the object undergoes micro fluctuations between these two physical alternatives. But with increasing value of the key parameter of one of the alternatives there is a further complication of the condition - sequential bifurcation. Bifurcation is an alternation of two existing states, periods of instability, when it is impossible to predict the state of development of the object at all.

The study of the phenomenon of neodeterminism turned out to be even more effective in relation to space-time models of system behavior. By means of scientific research it has been reliably established that at the bifurcation points of such a medium successive micro change reach the limit values. The scale of micro-changes here is compared with the

system itself. The system changes during fluctuations, until a new quality appears. Studies in the field of thermodynamics by scientists at the Brussels School, Ilya Prigogine and Isabel Stengers [5], cover a wide range of such issues. Namely, the parameters of variability of open dissipative systems, with their internal characteristics of imbalance and nonlinearity. Such studies have opened up new horizons for understanding the emergence of new “ordered” systems. First of all, the concept of I. Prigogine made it possible to more clearly understand the Universe as an open non-equilibrium system that arose at an extremely remote time, due to a grandiose vacuum fluctuation.

The reason for this was the thermodynamics of the systems themselves. The consequences of the study of non-equilibrium systems are fully used in modern cosmological concepts. The special value of such studies is in the field of verification of a new hypothesis of Cosmo genesis. The assumption of scientists is as follows - the universe in the first moments of Planck's time was in extremely unbalanced states; for if it were otherwise, that is, when the Universe at the dawn of its own formation was in a state of equilibrium, then according to the law of action of the masses there would be a quantitative equality of matter and antimatter; therefore, in the drama of the opposition of matter and antimatter, equal numbers would annihilate each other.

A deep awareness of the importance of a new style of scientific thinking is closely linked to a radical rethinking of the problem of self-organization of matter in nature. The ability of matter to change has previously been studied only within macroscopic statistical equilibrium states. Programs for studying nonlinear processes of self-organization of complex systems are focused on the conditions of unstable states of initial systems and the inevitable study of the phenomenon of the emergence of stable factors. They allow us to see in a new way the root causes of the ability of the natural world to generate new forms of organization. This style of scientific thinking and the new picture of the world due to this style of scientific thinking are related to the study of nonlinear and unbalanced open systems. This style demonstrates a non-trivial understanding of matter itself, its ability to self-organize, until matter acquires new forms of existence. The emergence of new forms of existence of matter is due to its own internal forces and properties of matter itself. Elevated to worldview generalizations, these tremendous scientific insights and majestic academic discoveries provide a deeper understanding of the world. This world is self-organizing in general and at different levels of its existence.

Within the framework of synergetic conceptualizations of reality, the very concept of “chaos” acquires a new meaning. Previously, the concepts of “chaos” and “entropy” were logically identified and had a common sign of

increasing disorder. Currently, within synergetic research programs, chaos is considered a factor in the physical provision of imbalance and, at the same time, a factor in the self-organization of matter. Observations and experiments of scientists have established that at points far from equilibrium, matter is able to self-organize autonomously and eventually reach stable ordered states; in this way matter reduces entropy. The phenomenon of the transition of the system to an ordered state from chaos allows a new look at the world around us, to understand the immanent ability of the world to self-organization and to the emergence of new forms. According to Helena Knyazeva chaos at the macro level is not a factor of destruction, but a force that causes self-construction of a nonlinear environment. Helena Knyazeva was not mistaken and did not even exaggerate when she presented a new understanding of the essence of chaos: “Synergetic reveals the creative role of chaos (random fluctuations) in the evolutionary processes which occur in nonlinear complex systems. There must be a certain degree of chaos and destruction in the world. Chaos and fluctuations on a micro-level play an essential role in determining the actual trends, or “aims”, of processes at a macro-level. Chaos manifests itself as a “force”, as a mechanism underlying an exit to one of several evolutionary structure-attractors. The macro-organization evolves from chaos on micro-level. Dissipative processes, being the macroscopic revelation of micro-chaos, act in the same way as a sculptor who chisels and shapes a statue from a block of marble [6]”.

Shifting the focus of attention within the synergetic paradigm to the phenomenon of instability and randomness in the course of world processes has laid the foundations for a new nonlinear style of thinking. Such processes also caused the active articulation of the provisions of nonlinear determinism in the main disciplinary practices - science, philosophy and religion. There has been a change in ontological philosophical ideas about the nature of the original nomology - that is, the fundamental laws of the universe and later - a revision of traditional views on the uniqueness of connections and relationships in nature. All this was caused by the development of non-equilibrium thermodynamics and the introduction of statistical methods and research operations in scientific studies. The advent of quantum mechanics has played an important role in rethinking the place of chance in the processes of the objective world. The main topic of scientific interest here was the probabilistic (random) behavior of micro-objects.

Dynamic laws describe the behavior of isolated and idealized objects. The absolutization of such laws in the period of formation and development of classical science produced the provisions of mechanistic determinism. Here the universe was compared with a clockwork whose action can be fully understood by referring to Newton's laws of

dynamics. "But, in principle, nature was regarded as a huge conservative and deterministic system the causal events of which can be forecast and traced back for each point of time in future and past if the initial state is well-known [7]". Instead, the study of chance in quantum processes has shown that the predictions of the scientist are not reliable, but only probabilistic. This state of affairs is associated with the action of a number of random factors. It exists in statistical phenomena such as mass events.

Discovering the physical nature of the processes of self-organization in the world and its individual elements has forced researchers to pay close attention to bifurcation models of development. In them, as is known, the initial medium falls under linear equations and under conditions of change of value of a key parameter (temperature, pressure) such environment can lose a condition of stability. The nature of the interaction between the elements of the environment becomes so intense that the environment itself becomes nonlinear. The nonlinear characteristic of the interaction of the elements of the medium generates several variants of development in the bifurcation nodes. One of the equally probabilistic solutions is realized due to fluctuations. Such fluctuation determines random selection; this choice determines the existence of a new macrostructure. The nature of the world has shown scientific thinking a new, more complex level of its own organization. This level, according to I. Prigogine, can be deeply understood from the standpoint of "physics of formation".

The epoch of classical and non-classical science was characterized by the methodological principles of "physics of existence" and the ontologization of immutable substance. Such a substance was considered at that time the essence and the only basis of existence. But post-classical science focused on others - quantum or relativistic realities. This carried out a conceptual restructuring in science. There was a qualitatively new awareness of the essence: from the interpretation of the essence as immutable - to the understanding of dynamic stability in material interactions.

The phenomenon of instability creates a problem. This problem awaits explanation both in the field of academic science and in the field of humanitarian tradition. This is a problem of forecasting. In the initial states of some systems during the processes of self-organization there is a factor of random fluctuation. Knowledge of such systems does not imply a high probability of inferences of the prognostic type regarding the future states of the system as a whole. Because chance comes to the fore here. It cannot be neglected in non-equilibrium states of the system. Because in such states the relationship between randomness and necessity, between fluctuations and deterministic algorithms, is different than in a stationary environment. Micro fluctuations or

randomness reign supreme in the vicinity of the bifurcation nodes. At the same time, there is a deterministic state of affairs in positions distant from the bifurcation points. In the study of the synergetic of a number of objects, chance is no less important than necessity. Here the significance of the fluctuation and the situation of choice itself are objectively justified, and randomness is a complement to necessity.

Several profound and original studies have uncovered the relationship between cultural factors and ways of thinking. Several researchers have effectively used the comparative method, as a result of which it was possible to show that the thinking of the West and the East differ significantly in a number of sociocultural features [8]. And the reasons for this difference lie in the peculiarities of the historical formation of these types of thinking. The cultures of the Greco-Roman world, like the Western culture, which inherited their key principles and values, with their recognition of the position of an independent "I", developed into cultures of a linear type of thinking, while the cultures of the East developed a holistic understanding of the individual and nature, centered on interdependent "I", which formed a different way of thinking - dialectical thinking.

The concepts of nonequilibrium thermodynamics and the theory of self-organization of a nonlinear medium have caused paradigmatic shifts in modern science. The widespread use of statistical research techniques has opened up new and more complex levels of reality. It allowed us to see chance as an independent factor and a necessary component of self-organization of the material world. In the process of formation of a nonlinear environment, necessity makes its way through a series of coincidences. Here, the autonomous self-organization of matter and its achievement of greater order arises from chaotic states and ultimately reduces entropy.

In the light of such ideas, the hypothesis of spontaneous quantum birth of the Universe from "nothing" is interesting [9]. For science, it is valuable in the sense that it allows us to trace the process of formation and qualitative change of knowledge itself as such, in particular in the field of cosmology; for philosophy, this hypothesis is interesting because in its own way it answers the question - from what the Universe arose, it is also valuable in the sense that it argues the idea of integrity and plurality of being.

The conceptual restructuring in science looks especially impressive in the way of the search for the main physical theory mentioned at the beginning - the theory of everything. According to Michio Kaku, researchers are very close to its final formulation; the presentation of his thought is convincing and not devoid of a certain aesthetics: "The leading (and to my mind, only) candidate is called

string theory, which posits the universe was not made of point particles but of tiny vibrating strings, with each note corresponding to a subatomic particle... This means that all the laws of physics can be reduced to the harmonies of these strings... The universe is a symphony. And the mind of God, which Einstein eloquently wrote about, is cosmic music resonating throughout space-time [3]". The scientist puts forward a non-trivial assumption about the nature of this extremely capacious and generalizing equation, its explaining possibilities in the question of the origin of the Universe: "So where did the Big Bang come from? Most likely, it was a quantum fluctuation in Nothing. Even Nothing, or a pure vacuum, is frothing with matter and antimatter particles continually jumping out of the vacuum and then collapsing back into the vacuum. This is how something came from nothing [3]".

Academic science, discovering a deeper dialectical connection between necessity and chance, has made it possible to rethink the established provisions of certain branches of knowledge. Within linear explications, for example in the concepts of evolution, the factor of chance was not taken into account as external, insignificant. However, a nonlinear understanding of reality, where random fluctuations are intrinsic to the environment, allows us to see chance as a crucial component of evolution. The linear vision of the world was based on the unquestioning recognition and absolutization of causal relations of a deterministic nature. Overcoming the stereotypes of the linear worldview paradigm, Stephen Hawking refuted the opinion of A. Einstein, who considered the probability of chance to be extremely small: "God does not cast lots". In this regard, he remarked: "Einstein was twice wrong when he claimed that God does not cast lots. In fact, God not only certainly draws lots, but sometimes confuses us, throwing lots where it is impossible to see [10]".

The new style of scientific nonlinear thinking has significantly enriched the scientific and philosophical and methodological culture. This style of thinking has allowed us to radically reconsider the ontological principles of existence, to give humanity a new, deeper vision of reality. "In linear systems, the whole is exactly equal to the sum of the parts, and causes are proportional to effects. Nonlinear systems perform at the chaotic zone to become self-organizing emerging systems with fractal dimensions in such a way that the behavioral patterns of the elements and the whole system are in synchronization. All members of nonlinear networks implement their assets in cooperation and partnership to achieve the long-term goals of the whole network, creating a whole that is greater than the sum of the parts. The nonlinear process creates a cognitive system with a higher level of functionality, information content, efficiency, and creativity. Nonlinear systems are emerging systems

with a high level of interdependency, inter-connectivity and unpredictability that operate at the chaotic zone where there is no proportionality between cause and effect [11]".

This style of scientific thinking is not yet finalized because some of its moments are currently presented only in fragments. However, despite what has been said, it is still possible to distinguish its common features. These features are a denial of the principles of classical science and, moreover, reveal the main conceptual features of the new scientific paradigm. The new understanding of the nature of reality is reflected in ideas about the ability of matter to self-organize, in the awareness of instability as a fundamental characteristic of systems in their development, in the reception of thought about the constructiveness of chance, in justifying and substantiating the thesis of order from chaos.

Rising to worldview generalizations, one should emphasize the importance for science of both linear and nonlinear styles of thinking, each of which has its own cognitive significance and scope for effective application. What researchers have repeatedly paid attention to: "Both linear and nonlinear-thinking styles are important. Linear thinking has utility for comprehending relatively simple, unchanging systems and performing highly structured tasks, but it is not sufficient for complex, turbulent systems and poorly structured tasks. Thus, the traditional analytical tools that are associated with linear thinking have limited applicability to the complexity of today's real-world problems. Nonlinear thinking, on the other hand, is more useful than linear thinking in dealing with complex, changing systems [12]".

## Conclusion

But what is the fate of such grandiose discoveries and deep insights, besides the fact that they, being the triumph of the human mind, will forever take the most honorable place in the golden fund of science, can they immediately significantly change the quality of human life, worldview in general? Michio Kaku is convinced that such an influence will manifest itself mainly in the ideological sphere - in quenching the eternal spiritual thirst of mankind, the realization of an existential function, the answer to universally significant, "cross-cutting" questions of human existence: "The real impact of the theory on our lives may be philosophical, because the theory may finally answer deep philosophical questions that have haunted great thinkers for generations, such as is time travel possible, what happened before creation, and where did the universe come from? [3]".

Without a doubt, these and similar discoveries will allow humanity to open the veil of secrecy over the eternal, fateful questions about how the Universe appeared, what are the global prospects for its existence, what is the place of man

in it? This kind of epochal discoveries will be the crown of the most daring epistemological intentions of mankind in its eternal and tireless search, in its desire to look beyond the horizon of the known, to be involved in truly Divine knowledge, having received the key to the secrets of nature.

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