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Determinism in Physics and Cognoscibility of a Picture of the World

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Abstract

The purpose of the article is to show the key role of the deterministic mechanism of irreversibility (DMI) in the understanding of the picture of the world and in its construction. For this, a brief analysis of the historical development of the picture of the world and the tasks of its further development, connected with the problems of describing the processes of evolution in the framework of the laws of fundamental physics, has been carried out. It is shown how DMI removes these problems. The role of DMI in the statement of the principle of causality in physics is studied. It is shown how DMI contributes to the realization of the ideas of universal evolutionism. It also shows how the conclusion that the open non-equilibrium dynamic system should be an element of matter and why matter should be a hierarchy of such systems follows from the condition of DMI existence. Using the example of the relationship between the laws of the evolution of systems and the laws of the dynamics of their elements, it is demonstrated how the law of transition of quantity to quality is implemented in physics and how one can build a picture of the world from simplicity to complexity. It is shown how with the help of numerical methods possible to substantiate that the laws of thermodynamics, statistical physics follow from the fundamental laws of nature.

Keywords

Determinism, Evolution, The Word's Picture, Causality

1. Introduction

Determination of ways and the principles of creation of a physical picture of the world is one of the main tasks of philosophical and methodological researches

(Stepin, 2000; Mostepanenko, 1972). Serious question which science is to face at a solution of this task is the causality problem in physics. The matter is that the principle of causality which is the cornerstone of an evolutionary picture of the world is not among the principles of the physics representing laws of the nature. It is connected with that that fundamental laws in physics are reversible in time while the natural processes possess "time arrow" (Callaway, 2019). It, in particular, led to the fact that not only the physical picture of the world does not accord with the principle of its unity, but also the physics represents set of the separate knowledge domains which are poorly connected among themselves such, for example, as mechanics, thermodynamics, and quantum mechanics. Therefore today the physics explains how the world is arranged, but does not answer questions as it evolves in what direction there are processes of evolution and what these directions are defined by (Callaway, 2019; Prigogine, 1985). Thus, the lack of "time arrow" within laws of fundamental physics substantially slows down creation and development of an evolutionary picture of the world (Nicolis & Prigogine, 1990; Zaslavsky, 1984; Ginzburg, 1999).

In the process of solution of irreversibility's problem, begun still by Boltzmann, its probabilistic mechanism was found (Zaslavsky, 1984; Aristov, 2016). The hypothesis about existence of the random external impacts on the systems was used into its basis. In connection with this mechanism, both irreversibility, and, therefore, evolution, has the random nature. It means that the nature of evolution cannot be studied within laws of physics. From here it is not clear how to construct a physical picture of the world, relying on laws of physics how to understand emergence of organized structures of matter from chaos. Therefore, the problem of the principle of causality at such mechanism of irreversibility remains open.

Existence of a probabilistic explanation of the mechanism of irreversibility is not the proof absents deterministic irreversibility within laws of fundamental physics. Really, such mechanism was rather recently offered. It was called deterministic mechanism of irreversibility (DMI) (Somsikov, 2016a, 2016b).

This work is devoted to studying of a role of DMI in development of a physical picture of the world. Here is discussed the principle of dualism of symmetry and how it leads to DMI. The connection DMI with fundamental concepts of the world's picture is studied. The role DMI in understanding of laws of philosophy, such as "transition of quantity to quality", "determinism", "reductionism", unity of a picture of the world is considered. How DMI strengthens positions of determinism and a reductionism, and how it helps to understand of the interrelation of evolution's laws with laws of physics are shown. It was shown that if to stand on position unity of the world, and also to rely on ideas of determinism, consistency of physical laws, then the basic element of matter should be *open nonequilibrium dynamic system* (ONDS). The principles of creation of laws of systems based on the laws of dynamics of their elements, and how these principles open a possibility of creation of a picture of the world were considered. In

general, it is shown how DMI strengthens the position of the cognoscibility of evolution's picture of the world.

2. About Development of a Key Concepts of the World's Picture

To explain DMI role in development of a physical picture of the world, we will briefly consider emergence of its basic concepts and also how they were modified in the processes of development of physical knowledge (Asmus, 1976; Aristov, 2016; Krylov, 1921).

Key concepts of a picture of the world arose in an extreme antiquity. One of the first fundamental concepts was connected with a question what *all consists* of? One of answers to this question was that the matter consists from elementary particles. Democritus was the most famous ideologist of this idea of matter (Anry, 1929; Asmus, 1976). He claimed that matter is constructed from atoms. Afterwards there were modern ideas of discretization of structure of matter, its fractality and self-similarity (Loskutov & Michailov, 1990). Today we observe opening of more and more small components of matter. Thus, the questions about of the limit of the matter divisibility and about form of its primary element are actual.

Besides, it was noticed that the matter cannot exist without the movement (Asmus, 1976). As Heraclitus claimed, "everything flows, everything changes". *The movement is matter existence method*. As a result of works Galilee, Newton, Leibniz, fundamental laws of the movement were found. They allowed to connect the physical concepts of energy, acceleration, weight and force characterizing matter in its dynamics (Anry, 1929; Newton, 1999; Lancos, 1962).

It is impossible to describe the matter without use of space and time concepts. The interrelation of matter, dynamics, space and time is established by means of concept *of symmetry* (Wigner, 1964). The concept of symmetry was appeared at Plato. He considered as a root of the phenomena even not matter, but its mathematical form, symmetry. Elementary particles, the matter from which consists, have according to Plato "mathematically the finely" form. That is, according to Plato, not the matter as Democritus claimed, but the mathematical law, symmetry is the cornerstone of the world. The compliance of a matter's form and structure still is a problem. Complexity of this problem especially became clear in connection with discovery of the thermal radiation of matter by Planck (Geizenberg, 1968). Sharply there was a question: as there are qualitatively new properties whole which is not the amount of components. "More is different" (Anderson, 1972). In development of the world's physical picture there are three milestones selected today (Asmus, 1976; Krylov, 1921):

- it is Aristotle's doctrine;
- works Galilee, Descartes and Newton;
- Einstein's ideas and scientific developments up to the now time.

The first fundamental laws of logical thinking, fundamental concepts on the world, surrounding us, such as substance, force, the movement, space and time,

we find at Aristotle. He considered that the world is uniform, and laws of its development are universal. In particular, Aristotle claimed that *the speed of a body is proportional to force and is inversely proportional to friction.* From here Aristotle drew a conclusion that when the friction is equal to zero, body speed in the presence of any force will be infinite. It ideas of laws of dynamics was existed long enough. Only the millennium later, such concepts as acceleration and energy were entered, and were open the laws of classical mechanics defining the motion of material objects (Anry, 1929; Newton, 1999). Thanks to works Galilee, Descartes, Newton, it was found that *not the speed of a body is proportional to force,* as *Aristotle claimed, but its acceleration* (Krylov, 1921). As this contradiction has great cognitive value for understanding of development of knowledge, we will consider it in more detail especially as the answer to it is connected with DMI.

According to experiences, acceleration of a body is equal to zero when as a result of increase in speed, force acting on it is equal to friction force. In this case, all work of external forces goes on increase in internal energy of the chaotic movement of elements of a body (Asmus, 1976; Rumer & Ryvkin, 1977). Aristotle did not own concept of acceleration. Therefore he did not consider the period of establishment of the maximum speed of the movement. Newton, on the contrary, aimed to exclude friction to reveal an essence of the law of the movement regardless of diverse properties of bodies. He could make it, thanks to body model in the form of an unstructured particle. He established that the acceleration, but not of the speed, is proportional to the force. There is a natural question which of them is right? It turned out that if we take into account the body's structure, laws of Newton for its elements, a role of symmetries of a body and space in its dynamics, then we will obtain the motion equation of the structured body, which contains these two limits, at first sight, excluding each other (Somsikov, 2016a). From this equation follows, that if the role of structure of a body can be neglected, then it is fair the mechanic Newton. But if the work of external forces goes only for increase of internal energy, then Aristotle's statement is fair (Kolesnikov, 2011; Somsikov, 2016b; Somsikov, 2019).

The third milestone is creation of the theory of relativity. It promoted development of ideas of matter, space, time, energy on the basis of idea about a limiting of velocity of light. The deep understanding of interrelation of matter and energy appeared. At the same time the problems of the matter structure, its origin moved in forward.

In general, each subsequent step in knowledge of the world deepened and expanded the knowledge existing about it, established connection of these concepts among themselves. So, there was a representation that dynamics is connected with geometry of space and matter, and they, in turn, are connected with symmetry. Symmetry can describe in mathematical language. Thanks to dynamics, matter accepts such variety of forms which is defined by interaction of its structures according to symmetry of space and time.

Today on the way to creation of the world's physical picture, the next questions belongs to the important: how the principle of causality is connected with the physical laws; what nature of violation of symmetry; what parameters of systems are put in compliance to symmetry of bodies and space; how processes of violation of symmetry lead to evolution of matter and its properties; how from the chaos those are another structures are appearing; what is a basic elements of matter; how from simple elements the systems are appearing with the laws qualitatively differ from the laws of their elements. Let's consider how DMI defines answers to these questions.

3. DMI and Hierarchical Structure of Matter

3.1. How DMI Following from the Fundamental Physics Laws

In the 20th century, it became obvious that dynamics is defined by existential symmetry (Wigner, 1964). To them there correspond dynamics invariants, in particular, energy, an impulse. So, dynamics of a material point is defined by time and space symmetries. However, in reality we never have material points but only structural bodies. The dynamics and evolution of the structured bodies besides symmetry of space are defined also by their internal symmetry. It was called as *the principle of dualism of symmetry*. The essence of this principle in that that a body's state is defined by both the outside world, and structure of the body. That is, to find the DMI, it was necessary to accept as a basis that all bodies possess structure, and their evolution is defined by interrelation of symmetries of a body and of the surrounding space.

According to the principle of dualism of symmetry, only the sum of the motion energy and internal energy is invariant of the motion of the bodies. Importance of this principle for evolution of matter is considerable. In particular, DMI nature is caused by transition of the motion energy of bodies to internal energy of the chaotic motion of their elements. Matter evolution, formation of its structures, is caused by dualism of the "chaos" and the "order" which is transforming into each other. It is connected with the principle of "unity and struggle of opposites"! It turned out that the structured body plays a role of the "black hole" absorbing its motion energy. It is cause of the "time arrow".

To test the role of the principle of symmetry dualism in physics, numerical calculations of the oscillator motion in an inhomogeneous space were carried out based on the dual energy expression (Somsikov, Andreyev, & Mokhnatkin, 2015). As a result, the effect of oscillator passing through a potential barrier, when its motion energy is lower than the energy of the barrier, was discovered. Previously this effect was known only in quantum mechanics but unknown in classical mechanics.

DMI follows from the fact that the change of the body's motion energy at the movement in non-uniform space is defined not just by the sum of changes of movements of its elements, but also what part of the motion energy transformed into the internal energy. Indeed, the motion of each element of the body contri-

butes both into the energy of its motion and to the internal energy. Based on the principle dualism of symmetry, and used of the classical mechanics laws by analytically way was shown that if the motion of each element is reversible, the motion of the body is irreversible (Somsikov, 2016a, 2018). This fact demonstrates that the law of the transition of quantity into quality followed from the fundamental nature laws.

DMI was obtained through the use of the concept of energy and the fact that force is a derivative concept of energy, but not vice versa (Loskutov & Michailov, 1990; Somsikov, 2018). For an unstructured body, external forces are determined through the motion energy by the efficiency of the transition of kinetic energy into potential energy. However, for a structured body, the external forces fall into two classes: the forces that change the body's motion, and the forces that cause a change in the internal energy. The first type of forces, as in the case of a structureless particle, determines the transition of external energy into the motion energy of the system. The second type of forces determines the transition of the motion energy into the internal energy. These are dissipative forces.

The consideration of irreversibility in body mechanics became possible during the transition from classical mechanics of a structureless particle to the mechanics of a structured body. We denote this transition as follows: a structureless particle $\Rightarrow$ structured particle (a). To study the nature of DMI as a structured particle, a homogeneous, chaotic system of potentially interacting material points was used. We will proceed from the already well-established notion that in nature all systems are non-equilibrium (Klimontovich, 1995). The non-equilibrium system is the third step in approaching the body model to reality: structureless particle $\Rightarrow$ structured particle $\Rightarrow$ non-equilibrium system (b).

A non-equilibrium system can be represented by a set of structured particles, and structured particles, in turn, by a set of material points. Just as the mechanics of structured particles arise from the mechanics of a structureless particle, so does the mechanics of non-equilibrium systems arise from the mechanics of structured particles. If taking into account the structured particle in its dynamics leads to DMI, then taking into account the nonequilibrium of systems makes it possible to substantiate the laws of thermodynamics, statistical physics within the laws of mechanics (Somsikov, 2016b). Thus, the approaching the model of bodies to reality not only allows to find the mechanism of irreversibility, but also to establish connections between the branches of physics!

The formation of new structures of matter is possible only in the interaction of non-equilibrium systems. Their appearance and existence is due to the exchange of energy, impulses, matter and dissipative forces. From this it follows that when describing evolutionary processes, it is necessary to take into account the openness of systems (Klimontovich, 1995; Somsikov, 2019). In order for the physical model of the picture of the world to include evolution, it must take into account all the properties of matter listed above: structure, nonequilibrium, openness, dynamics, infinite divisibility and dissipation. But this means that as

a base element of matter should be taken of the ONDS and all natural systems are a hierarchy of ONDS. The structureless elements in nature cannot exist (Klimontovich, 1995; Somsikov, 2019).

The idea that matter is a hierarchy of ONDS has already been used to explain the processes of self-organization, the emergence of order from chaos, etc. (Zaslavsky, 1984; Landau & Lifshits, 1976). Thus, to include in the description of matter the processes of its evolution, the chain (b) should be extended one more step: the structureless particle $\Rightarrow$ structured particle $\Rightarrow$ non-equilibrium system $\Rightarrow$ ONDS (c).

Let us consider what properties should matter, if it is a hierarchy of ONDS. To do this, we will proceed from the fact that the laws of the mechanics of a material point, a structured particle, a nonequilibrium system are connected in a reduction way.

3.2. Why the Matter Is a Hierarchy of ONDS?

The mechanics of ONDS, which takes into account the openness of bodies, follows from the mechanics of the structured particles in inhomogeneity space. In accordance with the reductionism of the laws of the structured body's which are followed from the laws of their elements, the following conditions exist for the relationship between the laws of the ONDS and the laws of their elements (Somsikov, 2016a, 2016b, 2019):

1) The laws of the upper hierarchical level of the ONDS follow from the laws of its lower hierarchical level;

2) The model of the body representing ONDS should include the parameters included in the adjacent description levels (macro description and micro description);

3) A macro description that determines the behavior of the upper hierarchical level of the ONDS is determined from the micro description of the lower hierarchical level of the ONDS, with the exception of singular points. That is, the macro description is "embedded" in the micro description;

4) In the transition to the upper hierarchical level of the ONDS, the system of fundamental concepts and defining parameters of the lower hierarchical level is supplemented with fundamental concepts and parameters that reflect the properties of the upper hierarchical level of the ONDS;

5) The main physical concepts that determine the evolution of the ONDS are energy, entropy, force. Forces determine the efficiency of transformation of the corresponding types of energies and entropies. Potential forces determine the change in the energy of motion of systems. The dissipative forces determine the change of entropy;

6) The evolution of ONDS at each hierarchical level is determined by the symmetries of bodies and the symmetries of space-time, that is, by the principle of the dualism of symmetry;

7) The description of the processes of emergence and development of the up-

per hierarchical level of the ONDS requires consideration of the structure of all its lower hierarchical levels.

These conditions follow from the construction of the mechanics of a structured body. They testify to the reduction nature of the formation of system properties based on the properties of their elements and are consistent with the DMI, the principles of causality, determinism and the requirement of uniqueness of the picture of the world (Hooft, 2017).

The fact that matter consists of ONDS corresponds to the existence of a stable hierarchy of structures of matter: molecules, atoms, nuclei, nucleons, etc. Moreover, the hierarchy of forces is built in accordance with the hierarchy of matter. The greater the external forces, the deeper along the hierarchy is the restructuring of the system. When external forces are much less than internal forces, the role of body structure in interactions can be neglected. Then the motion of the body is described by the Newton equation and is determined by the symmetries of space. But here in some cases, for example, with bifurcation, such a simplification is impossible [14]. The essence of the bifurcation is that at special points in the phase space, a change in the topology of the system occurs, and symmetry breaking is observed. To solve bifurcation problems, the concept of probability is used. However, if we take into account the condition of infinite divisibility of matter, then we can see an analytical way to solve it. It relies on the fact that when taking into account the infinite divisibility of matter, the bifurcation point has a structure. That is, the description of the system at the micro level removes the feature of the macro-description of the body dynamics at the bifurcation point! In micro-variable, the bifurcation point becomes a certain region of space. Indeed, consider a disk on the top of an isosceles triangle (see **Figure 1**). If we consider that the disk and the triangle have a structure, then the task of describing the dynamics of the disk is reduced to solving the equations of motion of the microparticles of the disk and the triangle. Thus, taking into account the structure of matter leads to the possibility of a deterministic description of the processes of evolution at singularities points of the macro-description.

A similar situation arises in the case of the butterfly effect (Loskutov & Mihajlov, 1990). These examples indicate that the probabilistic description of the processes of evolution is not connected with its fundamental nature, but with the

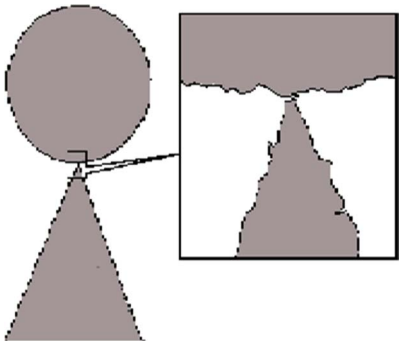

Figure 1. Explanation of the mechanism of bifurcation.

coarsening of micro-descriptions. Such a conclusion has important methodological significance. It shows that the possibility of using one or another mathematical apparatus to describe physical processes is determined by their physics. Thus, the region of the use of statistical laws to describe matter is determined by the deterministic laws of physics. The use of probabilistic patterns can be viewed as a possible coarsening of models of natural phenomena to solve specific problems, or as a permissible simplification in physical problems in the absence of sufficient information about the initial or boundary conditions.

3.3. Stationarity of ONDS

Although in nature there is no matter without movement, in practice we are confronted with stationary objects. Therefore, the question of how stationary states are realized is very important, if the ONDS is the basic element of matter.

The concept of stationarity for evolving systems is relative. ONDS can be considered stationary if there exists such a characteristic time interval, which is much longer than the characteristic times of its internal processes. The stationarity means that in all physical points of ONDS the values of its parameters do not change during the characteristic times of the processes (Landau & Lifshits, 1976; Somsikov, Andreyev, & Mokhnatkin, 2015; Geizenberg, 1989). That is, during these times ONDS must retain its hierarchical form as a set of attractors. The stationary ONDS is possible only if there are external constraints that ensure the balance of incoming and outgoing flows of matter, energy, entropy at all hierarchical levels (Rumer & Ryvkin, 1977; Klimontovich, 1995).

The simplest stationary ONDS is a Bernard convective cell. It arises and exists in the presence of a heat flux created by a temperature difference at the boundaries of a gas or liquid (Landau & Lifshits, 1976; Prigogine, 1985). This flow, supported by a temperature gradient, compensates dissipative processes. The higher on the hierarchical ladder of matter is ONDS, the more difficult must be the flows ensuring its stationarity. Therefore, if the existence of a Bernard cell is ensured only by the constancy of the heat flux, then for the existence of a more complex ONDS, for example, a living cell, a balance of flows of various types of matter and energy is required. In this case, the incoming substance itself is a combination of ONDS of lower hierarchical steps. Thus, all elements of matter can exist only due to interactions between themselves and with the outside world. It is convenient to call the external constraints that keep the ONDS in a stationary state and allow them to evolve in accordance with their inherent processes as harmonious constraints. It follows from the principle of dualism of symmetry that harmonious constraints are determined by symmetries of both the body and space. Stationary ONDS requires harmony at all its hierarchical levels. Symmetry breaking and evolution are associated with qualitative changes in the structure of over-the-spinning vibrations because of breaking the conditions of their existence.

The unity of nature follows from the condition of openness. It is decisive in

constructing a physical picture of the world. The universe cannot be divided into independent parts, which of necessity is made in its mathematical description. This is a huge lack of mathematical models. Dirac suggested that it could be eliminated if we develop the theory of odds, studying the principles of their interaction and evolution (Dirac, 1938). This confirms the conclusion about the structure of matter, as about a self-consistent hierarchy of evolving in the space of ONDS (Nicolis & Prigogine, 1990). Such a conclusion is in agreement with evolutionism, with the idea of unity, interrelation and interdependence of all structures of the Universe (Callaway, 2019). It is clear that such an idea of matter follows from the principle of causality in physics and corresponds to the law of the transition of quantity into quality.

4. DMI and the Physics of Evolution

Without taking into account the processes of origin, development and destruction of natural systems, the picture of the world not only cannot be complete, it cannot be built in principle. In order for physics to be able to describe the processes of evolution, it is necessary to fulfill the principle of causality within its laws. Its implementation is confirmed by the existence of DMI and that that the DMI was found thanks to the possibility of determining qualitatively new laws of the behavior of systems from the laws of the dynamics of their elements within the framework of the fundamental laws of physics. That is, the existence of DMI is a proof of the possibility of describing the processes of evolution within the framework of the laws of physics.

This means that the establishment of DMI has opened the possibility of building a section of physics—the physics of evolution (Somsikov, 2016a). Let us clarify what we mean by "evolutionary physics". The need for this clarification is dictated by the fact that in various fields of science, and sometimes even in sections of one of its fields, the concept of evolution is often interpreted differently.

The emergence of the concept of evolution is associated with the name of C. Darwin (Aristov, 2016). He defined evolution as the development of biological species as a result of their adaptation to changing external conditions. The concept of evolution is used in physics. As a rule, in physics it is associated with the second law of thermodynamics, which determines the existence of the "arrow of time" (Prigogine, 1985). However, such a notion of evolution narrows the possibility of its use before describing the processes of increasing entropy, and does not allow it to be used when considering the processes of the emergence of organized structures. To eliminate this difficulty, one should take into account that the processes of birth of new systems, their development and disappearance are also due to dissipation. In accordance with this, the physics of evolution will be called the field of physics, which studies the processes of origin, development and destruction of natural objects. This definition allows it to be used not only to describe processes in bone matter, but also in living. If we accept that all physical objects are ONDS, then the task of the physics of evolution is to study the prin-

ciples and laws of the origin, development and destruction of the ONDS based on fundamental physical laws.

Dissipation, before explaining DMI, was included in physics in an empirical way. Only because of the establishment of the DMI, was it possible to connect it with the fundamental laws of physics. That is, due to taking into account the structure of bodies in their dynamics, the possibility of a deterministic description of dissipation and evolution processes (Loskutov & Mihajlov, 1990). However, if the world evolves in accordance with the deterministic laws of nature, then it is true that there is nothing in nature exist that does not arise from the simpler (Dirac, 1938).

DMI follows from the principle of dualism of symmetry and the structure of matter. The principle of causality follows from DMI (Somsikov, 2018). Therefore, evolution is a deterministic process, and the laws of evolution follow from the fundamental laws of physics, subject to the implementation of the law of transition of quantity into quality.

One of the key parameters characterizing evolution is entropy. Entropy can be associated with the process of transformation of the part of the body's motion energy into internal energy of chaotic motion of its elements. This part of the motion energy is characterized by D-entropy. Thus, D-entropy is defined as the ratio of the magnitude of the change in internal energy to its total value (Somsikov, 2018). D-entropy plays the role of a measure determining the transition of the "order" energy of bodies into energy of "chaos". A violation of time symmetry is also associated with transformation motion energy into internal energy. Therefore we can offer the evolutionary concept of time as a measure of the efficiency of the conversion of order energy into chaos energy, determined by D-entropy. The process of evolution is in accordance with the law of the unity and struggle of opposites—"order" and "chaos". The "order" should be associated with the ordered movement of matter. The "chaos" should be associated with the internal motion energy of its elements. In real nature, the "Chaos" and "order" in nature are not perfect. This conclusion following from the statement that OND is a basic element of matter (Somsikov, 2019). This means that the entropy does not reach of the maximum and the internal energy of any elementary natural object cannot be equal to zero. It is means also that the matter cannot be in the state of absolute rest! It is very important that this conclusion followed from classical mechanics. As it was known before this conclusion was followed only from the laws of quantum mechanics (Greenstein & Zaionz, 2012).

Analysis of D-entropy for systems with different numbers of elements moving in an inhomogeneous space showed that key statistical laws, for example, the law of fluctuations of quadratic functions (Landay & Lifshits, 1976), follow from the fundamental laws of physics. It was shown by numerical computation methods that with the number of elements of the system $N > 100$ D-entropy can only be positive. This number characterizes the transition of the system to a new quality, in which the laws of statistics are applicable. When $N > 1000$, the increase in

D-entropy ceases to depend on the increase in the number of elements. This number defines the region of applicability of thermodynamics. That is, the fundamental laws of physics determine the field of using empirical laws (Somsikov, Andreyev, & Mokhnatkin, 2015). As a result, DMI led to a possibility of consolidation of the different branches of science according to the principles of unity of a picture of the world and universality of laws of the nature. All this, eventually, was help open the way of creation *of the physics of evolution* (Mostepanenko, 1972; Somsikov, 2019; Anry, 1929).

Let us assume that matter is a hierarchy of ONDS and the processes of emergence and evolution possess universality. We will proceed from the possibility of constructing the laws of evolution of hierarchical structures of matter based on the laws of their elements. That is, the laws of behavior of the upper steps of matter follow from the laws of the lower steps. Thus, we can talk about the possibility of building an evolutionary picture of the world within the framework of the fundamental laws of nature, going up the steps of the hierarchical ladder of matter from the base ONDS to the Universe itself. And there is no reason to exclude living matter from its physical picture with its most complex inverse relationships with the outside world. If we stand on the position of Marx, according to which consciousness is understood as the property of matter to reflect itself, and not as a separate, independent entity, then, in principle, we can develop the physics of consciousness.

It has already been noted that without dissipative forces, the emergence of attractors, which in their essence are all natural systems, is impossible. This means that structureless elements do not exist in nature. After all, dissipation is impossible for them, without which the appearance of elements of matter is impossible (Loskutov & Michailov, 1990). Consequently, the structural structure of matter, which determines dissipation, is a necessary attribute of evolution, causing the emergence and evolution of natural systems. A similar conclusion also follows from the statistical analysis of ONDS, according to which, when studying evolutionary processes, it is necessary to take into account the structure of bodies already in the first steps of describing processes (Klimontovich, 1995).

We have shown that DMI solves the problem of the principle of causality in classical mechanics. Consequently, according to its laws, a deterministic construction of the physics of evolution is possible. However, this still does not prove the possibility of its construction in the microcosm, where the laws of quantum mechanics are valid. Here, the creation of evolutionary physics rests on the problem associated with the Heisenberg uncertainty principle. According to this principle, it is impossible to determine the position and momentum of microparticles simultaneously (Werner & Farrely, 2019). This violates the principle of causality in the micro world and practically eliminates the possibility of constructing the physics of evolution. But, as it turned out, even here the principle of dualism of symmetry opens up the possibility in principle to overcome this difficulty. Indeed, according to this principle there is a DMI. According to the

DMI, matter is divisible to infinity, and any microparticles have a structure, and therefore an internal energy. It turns out that if one builds quantum mechanics taking into account the principle of dualism of symmetry, then the uncertainty principle can be related to the fact that it is determined by the structure of "elementary" particles. Indeed, the uncertainty principle appeared in quantum mechanics because its construction based on the Schrödinger equation, which takes into account quantum-wave dualism. But this equation, like the equations of motion of a material point, does not take into account the role of the structure of particles in their interactions. This inevitably leads to errors in calculations. They are because in the interaction of microparticles there is always a change in their internal energies (Somsikov, 2017). It is possible that these errors are because the internal energy of a particle cannot be less than Planck's constant. That is, the uncertainty principle can be associated with methods for describing quantum systems, but not because it is dictated by the nature of the micro-world. Then the problem of justifying the possibility of constructing the physics of evolution, associated with quantum mechanics, is removed.

Thus, DMI, the conclusions about: the infinitely divisibility of the matter; the possibility of building an evolutionary picture of the world; determining the laws of systems based on knowledge of the laws of its elements; substantiating the cognoscibility of a picture of the world etc.; were appeared from taking into account the role of body's structure directly in the dynamic equations of the classical mechanics. It is demonstrates perspectives of knowledge development by approaching models of the matter in physical theory to reality. The most striking example in physics, which confirm this conclusion, is Boltzmann (Prigogine, 1985; Rumer & Ryvkin, 1977; Zaslavsky, 1984) has created the molecular-kinetic theory. And in the molecular-kinetic theory Boltzmann firstly faced with a problem of the irreversibility which brought to the ideas of need of creation of physics of evolution.

5. Conclusion

It is impossible to create of the physical picture of the world without taking into account of evolution. This requires the construction of a theory of the physics of evolution. The tasks of the physics of evolution should include the identification of laws determining the evolution of matter. Until recently, the solution of these problems was faced with the fact that physics could not explain evolution, since its fundamental laws did not explain "arrow of time". They did not include the principle of causality. DMI, in contrast to the previously known probabilistic mechanism of irreversibility, eliminates this problem. The existence of DMI in the framework of the fundamental laws of physics leads to the following main conclusions:

- Dynamics of bodies is determined by the principle of dualism of symmetry;
- "The arrow of time" is due to the possibility of the transition of the orderly movement of interacting systems into the chaotic movement of their elements;

- The matter is divisible to infinity and is a hierarchy of odds;
- For describing the evolutionary processes, its model should be specified in the form of the ONDS;
- There are universal principles of transition between adjacent hierarchical steps of the ONDS structure;
- The transition between the hierarchical links of matter is determined by the fundamental laws of physics and obeys the principle of causality, which allows us to build a picture of the world according to the principle "from simple to complex".

Thus, the fact of the existence of DMI indicates the existence of the principle of causality in fundamental physics, the determinism of the law of transfer of quantity into quality and the possibility of detailing this law for various natural processes.

According to DMI, the future follows from the present in a deterministic way. As Einstein argued; "God does not play dice." Therefore the existing boundaries of knowledge of the world are associated both with the limitations of our knowledge about it and with the limitations of the models used, but not with the fact that these limitations lie in the very nature of the evolution of matter.

According to the principle of dualism of symmetry, evolution is determined by the interconnection of the internal and external world for the object in question.

DMI was discovered as a result of replacing the body model in the form of a structureless particle on the model that takes into account its structure. This showed that physical knowledge can be developed if existing theories are developed by using the models which more realistic.

It is obvious that in the process of developing knowledge about the diversity of structures of matter, new laws of behavior of higher hierarchical levels of matter should be appeared. At the same time, any of these new laws of physics cannot contradict the known laws, although it does not exclude the possibility of determining of the region of their use. DMI is argues in favor of the universality of the fundamental laws of matter's physics.

Thus, the existence of DMI testifies in favor of the existence of the principle of causality within the framework of the fundamental laws of physics, confirms the principle of common foundations, according to which all material objects have common roots. DMI opens up new possibilities for constructing a physical picture of the world in the frame of universal evolutionism within the laws of physics, ascending the hierarchy of matter from simple to complex.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

Anderson, P. W. (1972). More Is Different Science. *New Series, 177,* 393-396.

https://doi.org/10.1126/science.177.4047.393

Anry, V. (1929). Modern Scientific Worldview. *UFN, 1,* 3-13.

Aristov, V. V. (2016). Ernest Mah and Ludwig Boltzmann. A Drama of Ideas, a Drama of People. *Metaphysics, 3,* 100-115.

Asmus, V. F. (1976). *Ancient Philosophy*. Moscow: VSH Press.

Callaway, H. G. (2019). Fundamental Physics, Partial Models and Time's Arrow. In L. Magnani, & C. Casadio (Eds.), *Model-Based Reasoning in Science and Technology: Logical, Epistemological, and Cognitive Issues* (pp. 1-19). Berlin: Springer. https://www.researchgate.net/publication/296327588

Dirac, P. F. V. (1938). The Relation between Metaphysics and Physics. *Proceedings of the Royal Society of Edinburgh, 59,* 122-129. https://doi.org/10.1017/S0370164600012207

Geizenberg, V. (1989). *Physics and Philosophy. A Part and Whole*. Moscow: Sci. Press.

Geizenberg, V. (1968). Planck's Opening and the Basic Philosophical Problems of the Nuclear Theory. *UFN, 2,* 163-175.

Ginzburg, V. L. (1999). What Problems of Physics and Astrophysics Are Represented Now Especially Important and Interesting (Thirty Years Later, and Already on a XXI Century Threshold). *UFN, 169,* 419-441. https://doi.org/10.1070/PU1999v042n04ABEH000562

Greenstein, J., & Zaionz, A. (2012). *Quantum Challenge. Modern Research of the Foundations of Quantum Mechanics.* Dolgoprudny: Intellect Press.

Hooft, G. (2017). *Free Will in the Theory of Everything*.

Klimontovich, Yu. L. (1995). *Statistical the Theory of Open Systems*. Moscow: Janus Press. https://doi.org/10.1007/978-94-011-0175-2

Kolesnikov, A. A. (2011). From System Synthesis to the Principles of System Physics, Izv. SFD. *Technical Science, 119,* 6-19.

Krylov, A. N. (1921). Sketch of History of an Establishment of the Basic Beginnings of Mechanics. *UFN, 2,* 143-161. https://doi.org/10.3367/UFNr.0002.192102a.0143

Lancos (1962). *Variation Principles of Mechanics*. Moscow: Mir Press.

Landau, L. D., & Lifshits, E. M. (1976). *Statistical of the Physics*. Moscow: Sci. Press.

Loskutov, A. J., & Mihajlov, A. S. (1990). *Introduction in Synergetrics*. Moscow: Sci. Press.

Mostepanenko, M. V. (1972). *Philosophy and Methods of Scientific Knowledge*. Leningrad: Lenizdat Press.

Newton, I. (1999). *The Principia: Mathematical Principles of Natural Philosophy*. Cambridge, CA: University of California Press.

Nicolis, G., & Prigogine, I. (1990). *Exploring Complexity*. Moscow: Mir Press.

Prigogine, I. (1985). *From Existing to the Arising. Time and Complexity in Physical Sciences*. Moscow: Sci. Press.

Rumer, J. B., & Ryvkin, M. Sh. (1977). *Thermodynamics, the Statistical Physics and Kinematics*. Moscow: Sci. Press.

Somsikov, V. M. (2016a). *To Bases of Physics of Evolution*. Almaty: Sci. Press.

Somsikov, V. M. (2016b). Transition from the Mechanics of Material Points to the Mechanics of Structured Particles. *Modern Physics Letter B, 30,* Article ID: 1650018.

Somsikov, V. M. (2017). Extension of the Schrodinger Equation. *EPJ Web of Conferences, 138,* Article ID: 07003. https://doi.org/10.1051/epjconf/201713807003

Somsikov, V. M. (2018). Deterministic Mechanism of Irreversibility. *Journal of Advances in Physics, 14,* 5708-5733. https://doi.org/10.24297/jap.v14i3.7759

Somsikov, V. M. (2019). Deterministic Irreversibility and the Matter Structure. *Journal of Advances in Physics, 16,* 21-33. https://doi.org/10.24297/jap.v16i1.8109

Somsikov, V. M., Andreyev, A. B., & Mokhnatkin, A. I. (2015). Relation between Classical Mechanics and Physics of Condensed Medium. *International Journal of Physical Sciences, 10,* 112-122.

Stepin, V. S. (2000). *Theoretical Knowledge: Structure, Historical Evolution* (pp. 185-192). Moscow: Progress-Tradition Press.

Werner, R. F., & Farrelly, T. (2019). Uncertainty from Heisenberg to Today. *Foundations of Physics,* 1-32. https://doi.org/10.1007/s10701-019-00265-z

Wigner, E. (1964). Symmetry and Preservation Laws. *UFN, 4,* 729-740.

Zaslavsky, G. M. (1984). *Stochasticity of Dynamic Systems*. Moscow: Sci. Press.