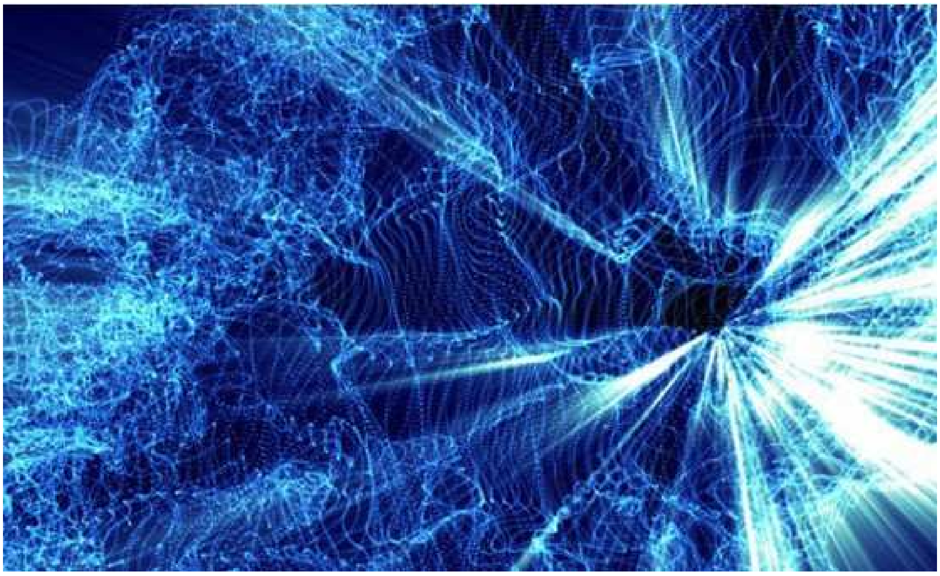
Published on *Metanexus* (http://www.metanexus.net)

Influence of the Theory of Natural Dynamism on Philosophical Cognition of Matter and Its Consequences for Modern Sciences Paradigmatism



May 24, 2007
By Boguslawa Lewandowska [1]

Introduction

There exist two basic aspects of the meaning of science regarded as knowledge: activity of the knowing subject and a source of information on the object. Now we are going to consider science perceived as a source of information on the object. The wider and deeper becomes our understanding natural things and events due to information contained by such a source, the more useful and valuable is the source for us. To discover the natural orderliness is an essential contribution of sciences. The orderliness of nature as brought to light by scientific investigation is regarded as one of the basic aspects of nature characteristics. Science could arise only when man started to be interested enough in regularities of nature of natural phenomena as well.

Most often the solution of every problem reveals a new problem or problem being interested for numerous investigators. In this way the sphere of interesting problems, questions and research tasks expands with extending range of our investigations and studies. The formulation of such new searching problem may be non seldom a proposal of transcending the boundary of the possibility both of the respective scientific theory (or theories) being known contemporarily and of the scientific method at all. Do such boundaries exist at all? Are we able to answer conclusively this question? Is the whole world accessible to our scientific experiments? Is it possible to describe scientifically a part of whole world which is accessible for our experiments? Does the scientific world's picture comprise all cognitive ranges of the world? At the end the most fundamental question which we formulate continuing this thinking, namely the question: How can we justify the existence of world? Some physicists express the view that in the future will be accessible only one theory enabling us to explain all what happens in the universe. However, before such and only one posssible theory will be proposed, it seems to be reasonable to reflect on the cognitive tools which are being proposed to us today by the contemporary physics

1. Orderliness and changeableness in the universe

1.1. Conception of the static orderliness and spatial regularities in nature

Thinking of order, in fact, we tend at first to imagine a fixed or unchangeable pattern (paradigm) and next to think of that. Former it was done the fundamental discovery of science that in nature there are fixed and unchangeable patterns and the form of order accessible to the human mind was supposed to be the static or repetetive one. It has been pointed out by scientists (e.g., biologists) that the scientific discovery of static order as something fixed and unchangeable in nature is an scientific achievement of great valuableness, for example, the conception of fixity is fudamental to an understanding of life [Rostand, J, *The Formation of Species*, in R. Taton, ed., *A General History of Science*, trans. A.J. Pomerans (London: Thames and Hudson, 1964), vol. II, p. 514].

It should perhaps be sensible to remind here the existence of some fundamental concepts on which is based the theory and practics of the investigations of mathematical natural science. It may be said that performing investigations in this domain of science we most often have to be satisfied by obtaining only approximated results of measuring, calculating and computing, the error of the approximation being known and sufficiently small with respect to utilizing the results both in practics and in further investigations.

At the beginning of exploration, the demand for reaching the required exactness in measurements, calculation and computation induces us to employing the first and most important of the fundamental concepts, i. e. the concept of using the appropriate scales for measuring time and length. In our mind a scale is appropriate or reasonable if it, being applied to the description of nature, enable us to perceive and recognize the regularities and orderliness occurring in the sector of nature under study. It is obvious that quite different time scales are reasonable in description of the phenomena of the propagation of the acoustic and electromagnetic waves, and extremely different time scale should be used in describing the phenomenon of rheological creeping of mountains.

Similarly, extremely different length scale should be used in describing the structure of universe, of a solid bulk sample and an atom. For example, let us keep ourselves for a moment at the example of solid state. It seems to be fully justified in some approximated evaluations to consider a sufficiently extented space domain filled with a solid medium retaining in equilibrium (or in a state sufficiently close to equilibrium) as free of non-balanced forces, gradients of physical quantities and, consequently, free of flows of physical quantities and mass. Therefore, such a sufficiently extended medium (domain) may be regarded in the accepted approximation as an example of something fixed and unchangeable in nature, of course, if an appropriate time scale is used.

Then, generally, the more away from the domain boundary is the subdomain in which we perform the current observations, the better is the approximation of treating the subdomain as something fixed and unchangeable in nature. Concluding, it can easily be seen that studying static orderliness is a valuable step in the scientific exploration of nature. However, the valuableness of the conception of static order as a step in scientific understanding of the world does not change the fact that it may be very often only an introductory step in the discovery and explanatory of nature.

To make that comprehensible, it should perhaps be stressed here that, strictly speaking, the conception of static order consist in regarding the current momentary situation as a permanent one. It is obvious that the slower are the changes in the objects of our observation, the better is the approximation of regarding the observed current orderliness as a static one.

Briefly speaking, the scale of time is always involved in the problem of understanding and using the conception of static orderliness in nature. The conception of static order, in general, is playing an essential role as the first step in the scientific understanding the world, since it is revealing orderliness and spatial regularities in nature which are the first type of order significant to science. it should perhaps be stressed that physical phenomena also present orderliness and spatial regularities whose accuracy is beyond compare and significance is huge.

1.2. Conception of dynamic orderliness and spatial regularities in nature

1.2.1. Importance of the moton exploration

After pointing out briefly the valuableness and usefulness of the conception of static orderliness in studying nature, it should perhaps be stressed that natural phenomena also are revealing orderliness and spatial regularities whose accuracy is beyond compare and significance is huge. Observing and studying natural phenomena, we perceive factual occurrence of dynamical orderliness and regularities in nature whis are being revealed by the phenomena.

The basic stage of the science development was the discovery of precision and regularity in the observable world and the original field of the study and exploration was motion, from the movements of stars and planets to the most banal happening observed in everyday life. The importance of the motion study follows from the fact that motion is the most easily manifestation of what happens in nature.

There are two different ways complementing one another we can confirmed the orderliness and regularities of the phenomenon of motion being interested for us: observations and the discussion about the mathematical description of the observed phenomenon, the orderliness being regarded as universal dynamical feature of nature and called the natural dynamism. Such investigations are concerning the step of the understanding which, in turn, is perceptible "as a feature that affects the entire observable reality" [Cantore, E, *Scientific Man. The Humanistic Signifcance of Science*, p.85, ISH Publications, New York, 1977].

The path followed by scientist in the discovery of natural dynamism succeeds in transforming his science from description to intrinsic explanation. For example, physics had been able to describe accurately a large number of mechanical motions already before Newton. The universality of orderly dynamism is revealed by numerous scientists of different scientific disciplines by passing from description to intrinsic explanation: "nature as a whole is a huge dynamical process, orderly and expansive" [Cantore, E., see above]. Expansiveness is a feature of nature as such. It shows that matter (inanimate, too) "tends to grow in complexity and richness by taking advantage of all possibilities allowed by the environment" [Cantore, E. , see above]. The philosophical aspects of dynamical laws underlying mechanical motion have been explained quite recently in the book [Mittesstedt, P. & Weingartner, P., *Laws of Nature*, Springer, 2005].

1.2.2. Chaotic motion

In the modern time in the situation when each non-linear differential and integral equation has become solveable (i.e., may be solved at least numerically by computing), we must take into acount another aspect of the orderliness of nature on which science sheds further and quite significant light. The new aspect is also the dynamism of natural order, which, in the mentioned cases and from the mathematical point of view, is a consequence of the above mentioned nonlinearity of the differential and integral equations governing natural phenomena. Then the dynamism of natural order reveals itself as the so-called dynamical chaos or chaotic motion which has been studied intensively by numerous bright scientists, for example by H. Poincare (e.g., [Poincare, P., *Les Methodes Nouvelles de la Mechanique Celeste*, 1892, Paris; *Science and Hypothesis*, 1952, Dover, New York; *Values of Science*, 1958, Dover, New York]).

The essential feature of the stochastic chaos is, firstly, that this chaotic behaviour is non-periodic motion, even in the case when no external disturbance is present. Secondly, if the motion is chaotic and the phase space sufficiently small, there will occur recurrence of the trajectory after some finite period of time. New discoveries about dynamical chaos show that even within an area when Newton's laws of motion are applicable, the behaviour of a natural system can change radically such that its motion may become chaotic, after changing slightly the initial conditions. For example, in this way, even simple mechanical systems can change from paradigms for strictly obeying dynamical laws to completely unpredictable systems moving chaotically.

1.3. Principles of causality as the underlying determinants of the character, direction and rate of the changes in nature

1.3.1. Maxwell's principles of causality

In explaining the process of forming orderliness in nature, essential role play the principles of causality, which are the underlying determinants of the character, direction and rate of the changes in universe. To my mind the mentioned problem of the determinants is so wide and complex, that it may be presented here only fragmentarily and selectively.

In his book entitled *Matter and Motion* [Maxwell, J.C., *Matter and Motion*, Dover, New York, 1991], Maxwell discussed two principles of causality formulated by himself. Trying to make more comprehensible the meaning of the principles let me use the concept of the so-called state of the physical system under consideration at a certain time *t*. Then the contents of the Maxwell's principles of causality may be presented as follows:

1. The same initial state of a physical system retaining under the same conditions and circumstances always leads the system to the same series of successor states.
2. In a great many physical phenomena only small variations in the initial conditions and circumstances induce small changes in the final state of the system. However, there are also other cases of very great changes in the final system produced by small variations in the initial conditions and circumstances.

We may say that the first Maxwell's principle shows that science is more than the observation and more the description of events as they occur. It is an attempt to perceive orderliness in nature, to show that certain events under considerations stand in lawful relation to other events. However, order is here not only a possible end product, but it is also a working assumption which must be adopted at the very start of studying.The first Maxwell principle sets us in the situation where we have an unique state as the effect if another unique state is a cause. Therefore, we may say that the first Maxwell principle represents a conception of deterministic causality.

The second Maxwell principle permits the existence of the necessary conditions for dynamical chaos, the conditions being consequences of the sensitive dependence of the initial state of the physical system on initial conditions.

It shoud perhaps be stressed here that causality is not one of the laws, principles, or axioms of physics. Causality appears in physics mainly as a regulative principle and as a requirement that is based on philosophical arguments. There is not only one set of principles of causality which is applicable in suitable way both to of different types of laws (dynamical and statistical) from different areas of physics, and to dynamical ones under sufficiently liberal conditions.

On the contrary, we have to distinguish different principles of causality and so accept numerous concepts of causality in physics. In the area of statistical mechanics both classical and quantum, the Jaynes' [Jaynes, E.T., *Information theory and statistical mechanics*, Phys. Rev., 106, 620-630, 1957]. principle of maximum Shannon's entropy [Shannon, C.E., *Bell System*, Tech. J.27,379, 623 (1948); reprinted in Shannon,C.E and Weaver, W., *The Mathematical Theory of Communication*, Univ. Of Illionis Press, Urbaban, Ill (1949)] seems to be the most general and of the greatest theoretical and practical meaning among the numerous other principles of causality.

1.3.2 Jaynes' principle of maximum Shannon's entropy

Information theory provides a criterion for setting up the probabilistic description of the system under study, the description being represented by a discrete probabilility distribution and set up on the basis of available partial knowledge of the system. In general, in most problems of statistical physics is involved missing information about the considered system, the missing information being measured in term of the so-called Shannon's entropy.

In turn, from the conception of the Shannon's entropy as a measure of missing information it follows that the Shannon's entropy may be defined only with an exactness to one additive and one multiplicative constants and is regarded as the synonymous with ”uncertainty”. The criterion mentioned above is called the principle of the maximum Shannon's entropy and leads to a type of statistical inference which is the least biased estimate possible on the available information. It means that such an approach provides a probability distribution which is maximally noncommittal with regard to missing information (amount of uncertainty) and represents the best estimates that could have been made on the basis of the information available. In this approach, it is possible to maintain a sharp distinction between physical and statistical aspects of the statistical mechanics both classical and quantum; the physical aspects consists only of the correct enumeration of the states of the considered system and their properties, while the statistical aspect is a straightforward example of statistical inference about the system drawn from partial knowledge.

Concluding, the information theory approach to statistical mechanics both classical and quantum has not led yet to any concrete new results. However, on one hand, the information theory approach is an effective method of finding the statistical description and statistical features of the considered system. More exactly, the principle of the maximum Shannon's entropy provides an algorithm enabling us to compute the numerical values of statistical moments and another quantities which are essential for determining the probability distribution and another statistical characteristics of the system being of interest to us. On the other hand, from the principle of the maximum Shannon's entropy it may be drawn every essential law of statistical physics.

2. Universe and time

2.1. Aristotle 's and Thomas Aquinas' conceptions of time

In the Aristotle's [Aristotle, *Physics*. In: *The Complete Works of Aristotle. The revised Oxford Translation*, Barnes, J. (ed.) Princeton, 1985] conception of time, the following features are essential:

(a) Time is strictly and twofold related to change (e.g., to motion): First, time is connected with time in such a way that if there is no change there is no time. Second, time, which cannot be disconnected from change, is independent of change's rate in the sense that all change may be faster or slower, but not so time. According to Aristotle, fast and slow changes ”are defined by time, ”faster” being more change in less time, and ”slower” less in more.”[Aristotle, see above].
(b) Time is defined as follows: ”When we perceive a distinct before and after, then we speak of time; for this is just what time is, the calculate measure or dimension of motion with respect to before-and-afterness”. [Aristotle, see above].
(c) In searching the standard unit for time measurement, Aristotle proposes a heavenly unit connected with the daily motion-in his understanding-the daily revolving of the firmament.

Thomas Aquinas' conception of time is mainly that of Aristotle. Time is the measure expressed in numbers for the successiveness of change or movement, in which one part is coming before another. From numbering antecedent and consequent parts of change, there arises the numberedness of before and after, or past and future, in change, which is simply the notion of time. Hence, without change or movement, there is no past and future, and consequently, no time. Therefore, the antecedent and consequent parts of change are the necessary conditions for time, which is bound to changing world and, consequently, was created by God together with the changing world. In other words, world was created in the beginning of time and hence is finite in time. Because time is a measure of change of the finite in time world, time is finite, too. However it is impossible to prove that experimentally, since every such experiment is a proof using universal laws of nature. In turn, the universal laws abstract from the place and point of time so that no point of time, neither of beginning nor of end of the world, could be implied by the universal laws.

Contrary to time, which is limited and bound to the successiveness of world changes, ”eternity itself exists as a simultaneous whole, lacking successiveness”. [Thomas Aquinas, *Summa Theologica*, I, 10, 1, *Christian Classics*, Westminster, Maryland, 1981]. Moreover, every thing existing in eternity is endless since it has neither a beginning nor an end.

2.2. Newton's and Leibniz's conceptions of space and time.

2.2.1. Newton's conception of space and time.

As far as space and time are concerned, it may be stated in the most general way that throughout the history of science there appeared two different conceptions of space and time, two different models have been used for space description, the models colliding with one another. Briefly, the space has been regarded alternatively to be absolute or relative. In the first conception associated with Newton, space is regarded to be a component of the world, the space being independent of matter. All places in absolute space are having equal rights and the units in the frame of absolute time do not differ from each other. Localizing an event in space and time, one justifies sufficiently that the event takes place here and now. In accordance with this conception, matter does not exists beyond space. Moreover, in accordance with the Newton's classical mechanics, absolute space and time are the basic components of the world enabling us to order events and to describe motion. ”Absolute time, in astronomy, is distinguished from relative by the equation or correction of the apparent time. ... It may be that there is no such thing as an equable motion, whereby time may be accurately measured. All motions may be accelerated and retarded, but the flowing of absolute time is not liable to any change” [Newton, I., *Mathematical Principles of Natural Philosophy*, Ed. F. Cajori, Univ. of California Press, Berkeley, 1934]. Therefore, it seems that everyone is justified to say against Newton's idealisation of absolute time, following Mach [Mach, E., *Die Mechanik in ihrer Entwicklung*, Leipzig (9th edition), 1933], that Newton's time is not measurable with the help of any movement, nobody knows what is the sense of it and, concluding, it is only an useless concept.

2.2.2. Metaphysics as justification of physics in Leibniz's conception of space and time
Contrary to Newton, Leibniz supposed that time and space are not absolute. Leibniz replaced the Newton's absolute time and absolute space by relative those. Leibniz's physical world is a set of events which are put in order (got into sequence) by employing the two following order relations: 1) order resulting from the relation of "events' coexistence" called the space; 2) order resulting from the sequence of events called the time. For these reasons the Leibniz's doctrine is called relation conception of space and time. When the events do not occur the phrase "the concept of the relations puting in order the set of events" makes no sense. Therefore, each of the terms "empty space" and "empty time" defines something what is logically intrinsically contradictory and for this reason they can not exist. In Leibniz thinking, space and time are the property of thing. According to Newton conception, God had created the world in time and space. Contrary to that, Leibniz held a view that God had created the world, time and space together.

Leibniz supplemented his doctrine of time and space by elaborating the so-called causal conception of time. In accordance with the Leibniz's outlook upon time and space expressed in the supplemented doctrine, if we put in order events geting those into chain (sequence) in this way that each link of the chain contains new sufficient reasons for the events being the links subsequent to the previous one, then we obtain a causal order of events identical with the time order of those. Therefore, causal relations define the direction of time. In the Leibniz's world there exists only one time defined by causal relations; strictly speaking, by relations of the type: "sufficient reasons => their consequences". Leibniz was not able to prove his philosophical theses by employing his own conception of mechanics, despite his conviction that the theses should work in the mechanics proposed by himself. For this reason the Newton's doctrine of absolute time and space was dominating throughout two centuries till the appearing of the Einstein's theory of relativity what caused returning to the Leibniz's conception of time and space.

Substance was comprehended by Leibniz dynamically. He was convinced that the idea of continuity in nature is right and he attributed metaphysical meaning to that. Leibniz supposed that substances do not interact with one another. According to Leibniz's conceiving, interaction of substances issues from God on the strength of "harmonia praestabilita". However, due to this harmony, we obtain in physical order a picture suggesting that substances interact with one another. In this way metaphysics becomes a justification of physics: discovering the laws of physical interaction of substances leads us to discovering the scheme "harmonia praestabilita". Leibniz showed metaphysical conditioning of physics. Newton created mechanics, which strongly influenced on his philosophical views, while Leibniz in metaphysics sought the fundamentals of mechanics. Therefore the conception of space and time is the place where philosophy of nature meets metaphysics.

2.2.3. Logic as ontology in the Leibnitz's conception of space and time
According to Leibniz's conceiving,the God's intellect is the source of the existence of the things. God foresees the existence of each thing in the safe way and it is God's intention to spring into existence the most perfect things. In this approach all logical substances springs from God. Being logical of world is a consequence of the relations between the existing things and God. Here logic is simultaneously ontology. According to Leibniz logical understanding a substance consists in the fact that the constitutive feature of the substance is the possibility of deducing all substance properties from the substance itself. Only God is able to do that since his logic is not restricted by human constraints. Leibniz maintained that substances do not exhibit expansion but their nature is dynamical. Contact between them is only due to the chain of logical and ontological consequences originating in God.

3. Scientific picture of the world

3.1 Dynamism cognition development and its influence on the scientific picture of the world
According to M. Heller (see, [Heller, M. ”Is Physics a humanistic art?”, Chap. 13, Biblos, Tarnow 1998 (in Polish)]), to the picture of world contribute (1) metaphysical preassumptions, (2) scientific problems and

another open problems, (3) various rules of thinking and acting. From the time of Galileo and Newton up before the appering of the relativistic cosmology, there did not exist any scientific theory of the universe. Then was obligatory the description presenting the world in terms of infinite Euclidean space and absolute Newtonian time. In the framework of the classical typology of the world's pictures, we may point out the following models of the world's pictures created in this time:

- the Cartesian model where the mutual interaction of matter was understood as immediate contact of the interacting bodies;
- the Newtonian model where, due to the introduction the gravitationa law, the interaction of matter is also possible when the interacting bodies are separated from each other (interaction at a distance).

The relativistic cosmology was regarded initially rather as scientific curiosity. Then forming the world's picture was essentially influenced on by positivism and neopositivism. The influences were impressing some limitations resulting from methodological rules and, in this way, they were discouraging from formulating cosmological hipotheses.

In the seventies of XX century, the significance of positivism was diminishing and simultaneously was increasing the number of researchers accepting cosmology as a science and utilizing attainments of cosmology. It is generally agreed, that the new approach to forming the scientific world's picture resulted from the increasing quantity and quality of the data obtained from astronomical observations, the data both confirming the reasonableness of the so called standard universe's model and revealing the improvement of the model towards its integration with physics of elementary particles. It should perhaps be said here that, firstly, numerous and still open problems have been revealed by the standard universe's model and, secondly, from the all open problems just the ones concerning the universe's ”origin” are of the greatest importance. The standard universe's model creates the vision of the world expanding from its initial state of high density. The vision, which does not result from an action of imagination but is a conclusion drawn from the scientific theory, becomes more and more obligatory as an element of the world's picture.

We can say after Dennis W. Sciama, that in the contemporary cosmology the existence of the universe was proved in such a sense that, despite the pre-Einstein hypotheses concerning the cosmological models, the universe may be regarded as one existing physical system accessible to exploration with using physical methods. That is the formulation of the hypothesis about the physical universe. In this way cosmology is recognized today as an empirical science. In this context, there arises the question whether science will be able metologically to deal just as well with the problems of life in the cosmological scale.

Philosophical problems of cosmology arises around the question what is the universe. However, the discussions about the meaning of the word ”universe” are of interest for philosophers but not necessarily for cosmologists. The term ”universe” appears in the works of cosmologists during solving the problems under consideration, also is present in the layer of commentaries, remarks and interpretations. In turn, a philosopher of science is analysing the cosmological works in order to formulate the conclusions concerning functioning of the concept of universe in the contemporary cosmology.

In philosophical elaborations concerning the concept of the universe the readers' attention is turned to some questions of the properties of the universe concept. [Michał Heller]. As the first example of such a question let us to mention that the universe is a theoretical concept. Otherwise in physics, there do not exist statements without any theoretical element. The theoretical character of a concept is not any surprise to more so with reference to the concpt of the universe which is apart from any experiment. In cosmology the concept of the universe does appear as a technological term. In turn, the universe is also a boundary concept. Now let us point out two aspects of that.

The first aspect is involved in the fact that the concept of the universe appears in the philosophical problems of cosmology and always contains intuition that something is the greatest one what now and then transcends the boundaries of the current cosmological knowledge, e. g., as in the case of conceptions of Lind and Smolin (the universe is a set of universes). The above mentioned technological meaning of the universe's concept also.formalized intuition that something is the greatest one what, in this case, does not transcend the current boundaries of science. Let us remind that science is continually broadening its horizons and that in the boundary zone between ”already-science” and ”yet-non-science” occurs ”problems boilling” resulting among other in appearing of such hypotheses and conjectures, that only non numerous from that have a chance of recovering from the boilling; then it becomes evident to us , that the boundary between cosmology and its philosophical coat is non sharp and non unique. The concept of the universe inherits the lack of sharpness and uniqueness.

The second aspect is connected with the science language. It is commonly known, that in the science the boundaries of the language strictness are the boundaries of science. However, the strictness should be fitted with the language character. In the formal languages, i. e., in logics and mathematics, precise definitions are absolutely necessary; the lack of them is revealed by apparent contradictions appearing earlier or later. In correctly formulated physical theories, there are very important the definitions of the basic concepts. It is required that the definition of every concept should be of operational form, i. e., it should be a description of the way of measuring the quantity corresponding to the concept under consideration. A theory encumbered by the lack of such definitions is without any chance to be confronted with experiment and, consequently, its status as a physical theory is at least doubtful. However, in physics in itself strictness should be fitted wth needs (this is worth noting on occasion that fulfilling this requirement non seldom requires to be a genius). The language of physics is endowed with a mechanism guarding the language strictness. This role is played by mathematics. In physical theories the language layer (of a sufficiently strict colloquial language) is only a commentary on mathematical expressions. In the most cases it is possible to learn about the sense of language expressions from the respective mathematical expressions. The terms ”universe” and ”universes”, if they occur in the layer of a verbal commentary on mathematical expressions, belong not only to philosophical coat of cosmological investigations, but also to mathematical structure of cosmological theory.

The universe is a dynamic concept. The contribution of the concept of the universe to the evolution of scientific theories is important. The concept of the universe changes when it is being in touch with the problems which compose the warp of the evolution. Hence the definitions of the universe's concept changes with progressing science. In this situation tthe role of the philosopher of science is to set in order the creative processes connected with pacticing science and next to cram the processes into the framework of a transparent scheme.

3.2. Components of the scientific wold's picture

The scientific picture of the world is the resultant outlook of the views being formed under the influence of the scientific discoveries. Since last years of XX century the information contained in the so-called standard universe's model has been included to the set of scientific truths about the universe, the set being called the scientific picture of the world. The riddle of the existence of the universe always has appear as one of the scientic problems stimulating the development of science.
What, therefore, composes the scientific world's picture which is built in accordance with the current state of knowledge?

A. Evolution of the universe

The world is developing due to evolution. The standard cosmological model is extending the evolution over the universe. According to this model, the cosmic evolution is identified with the expanding of the universe. The evolution comprises global changes and coming into being more and more organized biological structures as well as the problem of life. The development of science, prticularly arising of non linear thermodynamic and the theory of dynamical systems are responsible for the better explanation of the fundamentals of the evolution processes.

B. Increase of the indeterminism significance

The mechanisms of arising more organized structures reduces to the results of actions of physical laws. In turn from that it follows that the future of the universe is not determined. However, the feature of the world's openness, if it is considered in the framework of the scientific world's picture, is in the highest degree a result of the indeterminism of quantum mechanics, which has been accepted in XX century.

C. Restore the man to the proper place in the scienti world place

In XX century the man was being treated as falling into philosophical categories. Philosophical antropologies, which since mid XX century has been developed particularly intensively, were rendering man as reference point, also in the domain of concept systems and scientific definitions. The philosophy of man was being transferred to the domain of methodological and epistemological speculations connected with creating the word's picture in the contemporary science. It may be reminded here, that dethronment of the man as the central point in the universe took place in the period of the development of empirical parts of science in the turn of XVI century. The man was removed from the domain of knowledge, which, in turn, could not be lacking in rigour of scientific method since the cognition of the world was being replaced measurements of the world. However, the later quantum revolution revealed that a measurement was something more subtle than it might be expected.

From the antropological argument of the contemporary science, i. e., from the fact that the man regained important place in the universe, we can infer, that we observe the universe in which life is possible. In accordance with the antropic principle, the world is such as it is since we are living in that. It may be expected that numerous problems, which currently are at the boundary of the secure domain of science, some time they become the subjects of normal scientific investigations. Certainly in the place of the former interrogative marks there will appear new ones.

Conclusions
We have outlined some main aspects that constitute orderliness in the structure of nature that is of interest to science. Among other, we have outlined some dynamical aspects of the structure of nature and some sources of the dynamism phenomenon. We have seen that science is a form of knowledge whose intrinsic purpose is the discovery of natural orderliness

To attain a deep and comprehensive view of the dynamical aspects of the nature structure it suffices that the line of thought sketched above and followed so far will be continued and extended by including the consequences for modern sciences paradigms.

Because of the current state of the development of science, nowadays it is impossible thinking about science with omitting the non linear mechanisms of arising structures which are the subjects of the investigation of thermodynamics and the theory of dynamical systems.

M. Heller proposed employing these physical theories to the problem of science evolution. According to M. Heller's view on the science evolution, the effect of non-linearity on the science development is marked by occurring phases in the science development, the phases being both stationary and non stationary (with bifurcations).

During the evolution, the science development is governed by laws of internal logic; however, this logic is non linear and statistic. Stochastics of events surrender themselves to the humanistic method of history. Experimental predicting is an important element of scientific method. In accordance with the model of non linear evolution of science, it is easy to predict in the course of stationary phase. It is possible to predict with large probability the general direction of the development of stationary science.

However, occurring the periods of bifurcations causes that the predictions concerning sufficiently long time intervals becomes doubtful. Scientist is able to predict faithfully only oncoming of bifurcation. It may be visualized in the form of increasing difficulties and paradoxes, i. e., in appearing new theorems transcending the contemporary boundaries of sphere comprising the problems, which be treated with using the contemporary scientific method.

However, the logic of the development of scientific theory, for example, the theory of time and space, reveals after a few bifurcations. Therefore, the mechanisms being the base of non linear evolution, play also the essential role in processes connected with science development. The model of the non linear evolution of the science is created on the base of the current state of the knowledge of the dynamics of evolution processes, i. e., the processes creating information and new structures; hence, it is dynamical model revealing the dynamics of the process.

Bibliography

1. Aristotle, *Physics*. In: *The Complete Works of Aristotle. The revised Oxford Translation*, Barnes, J. (ed.) Princeton, 1985.
2. Cantore, E, *Scientific Man. The Humanistic Signifcance of Science*, ISH Publications, New York, 1977.
3. Heller, M., *Czy fizyka jest nauka humanistyczna?*, Biblos, Tarnow 1998.

4. Heller, M., *Ewolucja kosmosu i kosmologii*, PWN, Warszawa 1983.
5. Heller, M., *Filozofia przyrody. Zarys historyczny*, ZNAK, Krakow 2004.
6. Heller, M., *Fizyka ruchu i czasoprzestrzeni*, PWN, Warszawa 1993.
7. Heller., M., *Granice kosmosu i kosmologii*, Scholar, Warszawa 2005.
8. Heller, M., Liana Z., Maczka, J., Skoczny, W., *Nauki przyrodnicze a teologia: konflikt i wsspółistnienie*, Tarnow 2001
9. Heller, M., *Poczatek jest wszedzie. Nowa hipoteza pochodzenia Wszechswiata*, Proszynski i S-ka, Warszawa 2002.
10. Heller, M., *Teoretyczne podstawy kosmologii*, PWN, Warszawa 1988.
11. Heller, M. Lubanski, M., Slaga, Sz. W., *Zagadnienia filozoficzne wspolczesnej nauk. Wstep do filozofii przyrody*, ATK, Warszawa 1992.
12. Jaynes, E.T., *Information theory and statistical mechanics*, Phys. Rev., 106, 620-630, 1957.
13. Mach, E., *Die Mechanik in ihrer Entwicklung*, Leipzig (9th edition), 1933.
14. Newton, I., *Mathematical Principles of Natural Philosophy*, Ed. F. Cajori, Univ. of California Press, Berkeley, 1934.
15. Maxwell, J.C., *Matter and Motion*, Dover, New York, 1991.
16. Mittesstedt, P. & Weingartner, P., *Laws of Nature*, Springer, 2005.
17. Poincare, P., *Les Methodes Nouvelles de la Mechanique Celeste*, 1892, Paris; *Science and Hypothesis*, 1952, Dover, New York; *Values of Science*, 1958, Dover, New York.
18. Rostand, J, *The Formation of Species*, in R. Taton, ed., *A General History of Science*, trans. A.J. Pomerans (London: Thames and Hudson, 1964), vol. II.
19. Shannon, C.E., *Bell System*, Tech. J.27,379, 623 (1948); reprinted in Shannon,C.E and Weaver, W., *The Mathematical Theory of Communication*, Univ. Of Illionis Press, Urbaban, Ill (1949).
20. Thomas Aquinas, *Summa Theologica*, I, 10, 1, *Christian Classics*, Westminster, Maryland, 1981.
