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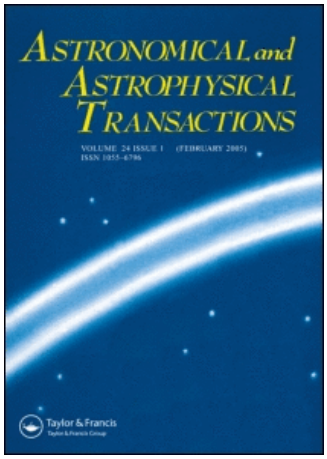

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UNIVERSALITY OF SPACE CIVILIZATIONS AND INDISPENSIBLE UNIVERSALITY OF THE ANTHROPIC PRINCIPLE IN COSMOLOGY

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The unity of natural science after Bohr and the uniform interconnected periodical systems in physics, chemistry, biology and psychology are discussed as the basis for the indispensible universality of the anthropic principle in cosmology.

KEY WORDS The anthropic principle, the periodic systems of the fundamental structural elements of matter

However different the living beings known to us may be, all of them have a common nature. This is by no means accidental. Universality is common to the fundamental structural elements of matter (and especially to standard elements) on all possible levels of natural self-organization: physical, chemical, biological and psychological (mental). Such universal elements, first of all, are: the standard fundamental elementary and sub-elementary particles and antiparticles of initial physical matter (leptons, quarks and antiquarks of the initial – electron – standard generation); standard atomic chemical elements of substance or antisubstance, which define the structure of the periodic system of chemical elements discovered by D.I. Mendeleev; standard fundamental submolecular – elementary and subelementary – amino acid and nucleotide bio-organic blocks which are vital for genetic structuring; the corresponding standard fundamental mental sets characteristic of typical thinking individuals (and even of the corresponding Higher Mind). The proper meanings of the demanded universal characteristics for these elements, being correspondingly (simply linearly or/and cyclically) evenly quanted, make quite determined periodic systems (Idlis, 1987a, 1987b, 1989a, 1989b. 1990, 1997a, Kuznetsov, Idlis, and Gutina, 1996; Buravichin, Egorov, and Idlis, 1997; Idlis, 1997b, 1997c, 1993d), which are unityped as far as their symmetry is concerned and deductively defined according to the necessary mathematical induction. This brings the indispensable universalhy to the so-called anthropic principle (Carter, 1978; Idlis, 1985a, 1985b;

Barrow and Tipler, 1986), which has already become firmly established in modern cosmology. This principle was first mentioned and analysed in detail by the author four decades ago (Idlis, 1959, 1958), and was predicted by the prophetic saying of Protagor: 'Man is the measure for all things – for the existence of existing thing and for the non-existence of non-existing things'.

The history of science knows four successive global revolutions. As a rule, they started with astronomy: there were attempts to solve the problem of the inconvenience of the existing measuring system for describing the motion of visible space objects. Then they touched on cosmology, making scientists revise completely their traditional conceptions of the whole world system. And, finally, they ended – if they ever ended – in physics, by establishing a new physical basis for the revised cosmological concepts of the Universe (Idlis, 1982, 1985a. 1985b, 1993).

The first revolution of this type was, in fact, the most difficult one. It became a kind of a prototype for all the following revolutions, but is very often ignored by lots of modern historians of science. The revolution dealt with the transition from natural initial (and, perhaps, even inborn) subjective egocentrism (i.e., anthropocentrism or ethnic topocentrism) to geocentrism, which is more justified, as it has a more or less objective centre of the world – an absolutely immobile Earth. This revolution, begun by Anaximandres, came to its end with the discovery of Aristotle's mechanics, which was, naturally, totally different for earth and space objects, but logically quite regular.

The next global scientific revolutionis generally known as 'copernican' and is often thought of as the first one, but in fact, it is the second. The core of it was the most natural transition from geocentrism to heliocentrism (and, later on, to polycentrism). And after the laws of Aristotle's mechanics had been successfully transferred from space objects to earth objects (or vice versa) by Galileo and Kepler, Newton's general world mechanics was discovered.

The third revolution dealt with the natural transition from vain attempts to find a hypothetical immobile centre of the world (i.e., from the concept of indefinite polycentrism) to rejection of any centrism. This brought about the discovery of Einstein's Theory of Relativity, the special theory and the general theory. Einstein's relative mechanics and cosmology, based on it, were also worked out. At first Einstein suggested the unique static isotropic cosmological model of Universe, which was homogeneous and spherical and had an observable average non-zero density of mass with the required cosmology constant for the necessary compensation of world gravity (which is inversely proportioned to the square of distance) by means of hypothetical cosmological repulsion (which is directly proportioned to distance). But this model is unstable at the very outset. As found in Freedman's famous works, the General Theory of Relativity (or relative cosmology) allowed a world of different non-stationary homogeneous and isotropic cosmological models, with the special additional member which had been artificially introduced in the original Einstein's equations for gravitation field as well as without it, and these non-stationary models systematically widened and narrowed, and also periodically pulsated. Judging by the systematic repulsion of galaxies from each other discovered by Hubble, our observed Metagalaxy, which has been systematically widening for at least ten

milliard years, is adequately described by one of the many possible (but *a priori* quite equal) relativist cosmological models of Freedman. And these models can, and, frankly speaking, must, be realized as corresponding autonomous, or, perhaps, close to autonomous, macro-worlds. As a result modern cosmology is bound to admit an infinite plurality of macro-worlds as well as structural inexhaustibility of the Universe, which, in turn, enables scientists to solve Zeliger's famous gravitational paradox for the infinity of the Universe without any limitations of parameters of various space systems (of course, taking into consideration relativist defects of their masses) (Idlis, 1956, 1957).

The author worked out the idea of absolute plurality of various macro-worlds (Idlis, 1956) as far back as 1956. In 1957 he also introduced in modern cosmology the so-called anthropic principle, so as to answer the sacramental question: why the observable part of Universe, i.e. our independent, as it were. Metagalaxy, is what it actually is, with the scale, systematic widening, division into galaxies, stars and planets typical only of it? (Idlis, 1959, 1958). In 1957, too, Hew Everett in in his doctoral dissertation at Princeton suggested a possible multi-world interpretation of quantum mechanics (Everett, 1957; De Witt and Graham, 1972). All these discoveries have given rise to the fourth (the current) global scientific revolution, which has not yet been physically completed by anyone.

There are two bases in modern theoretical physics. The first is the General Theory of Relativity, which describes adequately the continual gravitation field i.e. the Universal fundamental physical interaction, which on macro-scales (for electrically neutral macro-systems) *priori* dominates the remaining three specific fundamental physical interactions: the electromagnetic, weak and strong. The other basis is quantum ideas of the discrete construction of matter, which are also necessary for describing elementary objects of the macro-world adequately, with their specific fundamental physical interactions, taking into consideration that they, on the contrary, dominate gravitation in the corresponding micro-scales. It may seem that these bases are quite independent of each other, as parts of diametrically opposed objects, but, as noticed long ago, extremes match – and turn into each other. This is true in the limit and also for centaurs-like quasi-closed macro-worlds, which are adequately described from the inside by the corresponding relativist cosmological models of Freedman. Because of the utmost decrease of their detachment zone size (the zone of detachment of the rest of Universe) and the utmost increase of their mass defect, from the outside they are looked upon as the proper elementary objects of the micro-world (with the smallest possible effective size and mass characteristic of them). As a result modern cosmology was bound to accept the theory of macro-micro-symmetry of the Universe, which was elaborated by the author as far back as 1964 and then developed by M.A. Markov independently (Idlis, 1965a, 1965b, 1970a, 1985a, 1985b).

It is absolutely out of question that the continual relativist theory of the universal gravitational field could and should be united with the discrete quantum ideas of matter construction, which are also fundamental and natural. But no one has yet created the required unified theory of the various elementary and subelementary particles and anti-particles of physical matter and all their fundamental physical

interactions, or, at least, the corresponding unified theory of all fundamental physical fields. This means that the latest global scientific revolution in question still remains incomplete.

If the global scientific revolutions in question were given names (according to the names of the scientists who had physically completed them), the first three of them are likely to be called Aristotle's, Newton's and Einstein's revolutions (Idlis, 1985a, 1985b).

On the other hand, each of the aforementioned great creators and reformers of science (Aristotle, Newton and Einstein), being a leading light in astronomy, cosmology and physics, had not only physically completed his revolution, but also created the necessary preconditions for the next corresponding revolution. That is, we can be right to treat Newton's revolution as post-Aristotle's, Einstein's as post-Newton's, and the modern one (which is not yet completed by anyone) as post-Einstein's (1985a, 1985b). Anyway, in elaborating their new laws Galileo and Kepler (Newton's immediate forerunners as far as the creation of the classical mechanics is concerned) relied on Aristotle's paradigm (Idlis, 1993), and Newton's opinions used as epigraphs for the paragraphs of Vavilov's (1956) book '*Experimental Basis of the Theory of Relativity* give fair reason to suppose that Newton himself, in contradiction to his followers, didn't think of his classical mechanics as unshakable, and, in fact, foresaw the possibility to generalize it just as Einstein's theory did. And, finally, it is Einstein who has written fundamental works not only on the special and the General Theory of Relativity, but also on the quantum ideas of matter construction, i.e. on both of the bases of modern theoretical physics, which are to be united during its reorganization.

Beginning from ancient times philosophers strove to solve the problem of the correlation between space (or the Universe, Nature, Matter) and Man (or Conscience, Mind). It is at last clear to everybody that none of us, nor the Earth, populated by us, nor our Solar system with the Sun occupying the central position in it, nor our Galaxy, nor even our Super-galaxy, can form a universal centre of our world of the Universe as a whole: all people are equal in principle, the Earth is an insignificant planet, the Sun is a common star, Milky Way is common galaxy, and our Supergalaxy is one of many other supergalaxies (Idlis, 1957). And the whole Metagalaxy, which is independent, as it were, is only one of many quasi-closed worlds, but with some basic traits characteristic of typical populated space systems (Idlis, 1959, 1958).

The latest (the modern, the current) global scientific revolution means, on the one hand, space centrism is fully past (Idlis, 1978). On the other hand, in the end, as we should have expected (according to Ecclesiastes), 'everything returns to its beginning'. And anthropocentrism, though it has been rejected by science, was always recognized by real scientists and philosophers and has finally (and happily!) returned. It has been revived as the so-called anthropic principle (Idlis, 1959, 1958), which was predicted in Protagor's prophetic saying ('Man is the measure for all things – for the existence of existing thing and for the non-existence of non-existing thing') and in the same (but slightly altered) saying of Vernadskii (Idlis, 1994–1995,

1997c): 'Thinking man is the measure for all things' (1942) (Vemadskii, 1989, p. 233).

Man isn't really the centre of the Universe. But our Metagalaxy is systematically widening, with all its star systems like our Galaxy, containing stars Uke our Sun and planets turning round the corresponding stars like our Earth does – in other words, our macro-world is defined as first of all having every necessary characteristic for generating life of the type of biologic forms known to us and for its evolution till the emergence of Mind in the form of reasonable beings realizing themselves and the whole Universe, i.e. beings of our kind (Idlis, 1994a, 1994b).

Far later than the first works on the so-called anthropic principle (Idlis, 1959, 1958) but absolutely independently of them there appeared theories (based on different arguments) elaborated by Dicke, USA (Dicke, 1961) and Carter, UK (Carter, 1970 1978). Carter was the first to call the above principle the anthropic principle. Then there followed works by S.W. Hawking (Hawking, 1978, 1990), J.A. Wheeler (Wheeler, 1978) and plenty ofothers (Bartow and Tipler, 1986).

This conclusion seems to be quite unexpected, but it has been made a principle, being actually rather natural. In modern cosmology it factually means that it is absolutely necessary for the generation and existence of man or living beings of the type to have at least a whole infinite systematically widening Freedman macro-world similar to our real Metagalaxy, which is far from its starting conditions and is at a definite stage of development. This principle was included in Misner, Thorne and Wheeler's fundamental monograph *Gravitation* (1973). In its three-volume Russian edition (edited in 1977 by V.B. Braginskii and I.D. Novikov), in its third volume translated by A.G. Polnaryov to be exact, the corresponding paragraph (*The Connection between Physical Constants and Life Possibility Conditions*) (Misner, Thorne and Wheeler, 1977, p. 487–488) is provided with a special editor's reference to the monograph by Zeldovitch and Novikov *Construction and Evolution of the Universe* (1975) (I mean that part of it on *Mach's Principle and Coincidence of Large Numbers in Physics and Cosmology*) (Zeldovitch and Novikov, 1975, p. 667–675). See also the articles (Zeldovitch, 1981, Novikov, Polnarev and Rosental, 1986) with reference to (Idlis, 1958).

Besides, the cosmological conclusion of the author (Idlis, 1959, 1958) was used for the fundamental review of USSR cosmology for 50 years, which was made up by Zelmanov in 1967 (Zelmanov, 1967). Later on, Zelmanov himself arrived at the same conclusion: 'We are witnesses of processes of definite type, because the processes of other type pass without ones' (Zelmanov, 1970).

As has already been mentioned, this anthropic cosmological principle, which seems to be exclusively metaphysical, was analysed in detail in the first corresponding work of the author (Idlis, 1958), and in this country it attracted the attention of such physicists as academicians Ja.B. Zeldovitch (Zeldovitch, 1981), A.D. Saharov (Saharov, 1984) and L.B. Orunj (Orunj, 1991).

By the way, it is this work of the author (Idlis, 1958) which was particularly noted by J.D. Barrow and F.J. Tipler in their introduction to their major monograph *The Anthropic Cosmological Principle* (Barrow and Tipler, 1986), with J.A. Wheeler's preface.

But so far in most works on the anthropic cosmological principle authors have confined themselves to consideration of the 'mystic' coincidence of corresponding non-dimensional characteristics of the physical micro-world explored by us and the cosmological macro-world available for us. These authors usually linked the objective characteristics of Nature (or matter and the Universe) with the subjective demands of Life and Mind (i.e. space civilizations), ignoring the absolute necessity of the principal macro-symmetry of the Universe (Idlis, 1965a, 1965b, 1970a) and the universal character of various fundamental structural elements of matter (and first of all the standard elements) at the four possible basic levels of its natural self-organization: physical, chemical, biological and psychological (i.e. conscientious, mental) (Idlis, 1987a, 1989a, 1990, 1997a; Kuznetsov, Idlis and Gutina, 1986; Buravihin, Egorov and Idlis, 1997; Idlis, 1997b, 1993, 1994–1995, 1994a, 1994b, 1970b, 1987b, 1989b, 1994b, 1996, 1997c, 1997d).

Analysing the fundamental problems of science (i.e. the science of Nature) one can not but face and try to answer three consistent questions. The first is: *what* is the nature we explore? The second, *how* does it functions? The third, *why* is it the way it is?

It's rather easy to answer the first question. All that one has to do here is to give the definition of science and its subject. Let's say. Nature is everything that exists or is potentially possible. And science is the knowledge of Nature as a unity. There could be another definition: science is a system of natural sciences taken in its entirety with a definite hierarchy of interrelated systems of various fundamental structural elements of matter at all possible consistent levels of self-organization, with correspondingly guanted proper meanings of the universal characteristics of the elements at issue. But in that case it is still doubtful whether one should include the Humanities into the field of science, because the Humanities deal with thinking individuals, and this means that sciences such as psychology and sociology are to be included into science alongside with natural sciences in the proper sense of the word (i.e. physics, chemistry and biology). Thus there would be no longer any difference between matter (in its proper understanding) and mind, or conscious individuals.

It is general practice to pay more attention to the second question, i.e. to the description of Nature itself, to the empirical (or theoretical) research of scientific laws typical of it.

But even if such laws had already been discovered, there still remains the last (but by no means least) question: *why* they are what they are.

The most radical answer to this question is likely to appear very suggestive: as distinct from various artificial rules all natural laws (being quite determined and not accidental) have to be what they are, not something else.

Of course, there are laws and laws. And the laws which define various (and first of all standard) fundamental structural elements of matter on the four levels of its natural self-organization – physical, chemical, biological and mental – are (or, at least, must be) the most important ones, the ones which predetermine everything. Such laws deal with the systems of equally quanted (to the possible natural limit) proper meanings of universal characteristics of the elements at issue, with the sys-

tems which are symmetrically of the same type and are deductively defined by the necessary mathematical induction.

It is therefore reasonable to begin establishing the required scientific laws (and first of all the fundamental laws) with general metaphysical and philosophical ideas of Nature, and to postulate that the proper universal characteristics of fundamental structural elements of matter exist.

The above-mentioned universal characteristics of various fundamental structural elements of matter, as they are the simplest possible ones, have to be equally quanted with their consistent proper meanings being equidistant, at, least, to the possible natural limit.

The necessary universal characteristics can and must be constituted by characteristics complementary to one another such as *integral* and *differential basic characteristics*, i.e. *exterior* and *interior*, or *quantitative* and *qualitative characteristics*, being, as it were, transverse to one another, indirectional, charge – that is, connected with the corresponding transverse charge quantities, for instance, zero. But together with these complementary *basic characteristics* there can be (and, generally speaking, should be) an *additional* and less important characteristic, which is *spinal, longitudinal, directional, orientational*, i.e. which is non-zero for any of the fundamental structural elements of matter.

Discussing it in an adequate scientific language, i.e. in the language of mathematical logic (or simply mathematics) one has to interpret the importance of the universal characteristics in question from a metrical point of view (as a number of their proper meanings) and treat their mutual complementarity as alternative relative positions of their proper meanings, which are equally quanted either linearly or cyclically or linearly-cyclically.

In the initial yet non-degenerate maximally symmetrical physical case (with elementary leptons and sub-elementary quarks and anti-quarks of all generations beginning with the initial standard electron generation) everything is simply defined immediately by its maximal possible symmetry.

And then consistently in the minimally degenerate chemical case (with atomic chemical elements), as in the situation of the same biological case (with elementary amino-acid and sub-elementary nucleotide fundamental submolecular bio-organic blocks which are vital for genetic structuring) and of the corresponding utmost mental case (with typical thinking individuals and a special Higher Mind), everything is also simply defined with the help of the necessary mathematical induction, when the initial maximal symmetry is broken each time in the minimal possible way.

As a result the principal unity of the whole science is really stationed, and not only declared, in spite of the seemingly absolute independence of such fundamental parts of it as physics, chemistry, biology and psychology (which turn out to be non-trivial in the case of the latter).

All the great creators and reformers of the natural sciences (beginning with Aristotle and Newton) tried to present it as though it were a unified discipline, adequate to the whole of Nature. Einstein also strove for this purpose, trying to find the required unified mathematical laws of theoretical physics and supposing

that 'they must form the basis for discovering the picture of all natural phenomena, and the phenomenon of life, too, by means of meditative deduction' (Vigner, 1986). But he is also the author of the following saying: 'It would be really a marvel if man could discover the general basis of all sciences – physics, biology, psychology, sociology and the rest. We strive for it, though we can adduce arguments against its attainability' (Vigner, 1986). But this the 'marvel' that is now being accomplished in the conceptions of modern science – the conceptions of interrelated periodical systems of fundamental structural elements of matter at the possible basic consistent levels of its natural self-organization (Idlis, 1987a, 1989a, 1990, 1997a; Kuznetsov, Idlis and Gutina, 1996; Buravihin, Egorov and Idlis, 1997; Idlis, 1997b, 1993, 1994–1995, 1997c, 1994a, 1970b, 1987b, 1989b, 1994b, 1996, 1997d).

These conceptions predict the inborn character of the spin of electron neutrinos and antineutrinos (i.e. their constant motion with the maximum physically possible speed, or their masslessness). They make scientists begin the periodic system of atomic chemical elements with the neutron (and not with hydrogen) and predict its last theoretically possible element with the atomic number $z = 118$ (despite the hypothesis of the existence of stable islands in the area of far post-uraniom elements). They also bring us to the conclusion that elementary left-spiral amino acid and right-spiral nucleotide fundamental sub-molecular bio-organic blocks which are vital for genetic structuring, are principally determined, as well as the mental complexes characteristic of typical thinking individuals. All this, by the way, brings the necessary universality to the so-called anthropic principle which has already been established in modern cosmology.

Among the various fundamental structural elements of matter at each of the basic consistent levels of its natural self-organization, explorers found their 'stumbling-blocks' in the initial elements with zero proper meanings of both the basic universal characteristics, i.e. they found themselves in a real predicament when faced with the most perfect elements, vital as far as their meanings are concerned. They are neutrinos and antineutrinos, which have been escaping the notice of scientists for quite a time, in the case of physics. As far as chemistry is concerned it is the neutron element ignored by chemists in spite of the fact that whole neutron stars exist. In biology it is the simplest glycine amino acid residue with specific and non-specific side radicals identical to each other complicating determination of its spirality – the residue which usually discourages biologists. As for psychology it is the Higher Mind, or the Thinking Universum which turns out to be the necessary maximum element as well as the initial one (Idlis, 1987a, 1989a, 1990, 1997a; Kuznetsov, Gutina and Idlis, 1996; Buravihin, Egorov and Idlis, 1997; Idlis, 1997b, 1993, 1994–1995, 1997c, 1994a, 1970b,1987b, 1989b, 1994b. 1996, 1997d).

The latter is especially important. Until quite recently the social situation in this country, being connected with forcible indoctrination of authoritarian materialistic concepts, wasn't favorable for recognizing the cosmological role of the anthropic principle. It also made scientists disregard the natural (and, in fact, inevitable) idea of the existence of a Thinking Universum or a divine omnipotent Higher Mind as the Rational Origin of Nature. Russian scientists even ignore Einstein's words on the topic noted by the third generation Russian emigrant Petr Kalinovskii (in

his book *There Is No Death*): 'only a narrow-thinking person can oppose science To religion. They are not opposite to each other, but they are just two ways of world cognition, of knowledge of the Universe and the Creative Mind reigning over it, which is far more perfect than the human one and that's why only partly comprehensible for us' (Nesmelova, 1996).

The above-mentioned systems of the fundamental structural elements of matter at all four consistent levels of its natural self-organization can (and should) form the basis of the corresponding fundamental natural sciences, but, of course, they are not the whole of physics, chemistry, biology and psychology.

But these determined systems predefine, for instance, the universal character of *sapiens* civilizations and the laws of their development (Idlis, 1981).

Ultimately everything is connected to everything, and the basis of everything can be formed by some principle of causality, without which there are no natural laws. If it were not for this principle we would have to deal with a simple declaration of various facts not connected with each other.

Causality taken as the basis of cosmology enables us to formulate *the universal cosmological principle*: during the transition from the immediately given world to the Universe as a whole the corresponding characteristics in question either stay identical invariable universal world constants, or take one of two especially marked natural utmost meanings (the zero or the infinite can), or just lose their sense (Idlis, 1961).

That is why there are no reasons to assume any random variation of universal world constants.

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