

**INFORMATION METHODS OF RESEARCH OF LAWS
AND PROPERTIES OF THE NATURE**

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«ALL FROM BIT»

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Along with matter and energy the Universe contains, includes information. Information is an integral part of the Universe. Each physical system along with physical characteristics has information characteristics. Information is inseparably linked with matter and energy. Scientists study physical characteristics and physical laws when they study informational characteristics and informational laws. The report provides an overview of the fundamental results obtained by the outstanding scientists: Einstein A., Neumann M., Shannon C., Wheeler J., Janes E., Brillouin L., Everett. H., Zeilinger A., ... The findings of investigation gained by the author, including the results published in the works of the International conferences «Problems of Cybernetics and Informatics» are enumerated. The basic result of the author is formulation of nature's laws by means of more general, than physical - informatics laws [1-6]. The author conducts research of complex systems, including physical systems, in terms of informatics laws. The informatics laws define, limit physical phenomena and processes. The informatics laws precede the physical laws. The quantity of scientists using the information approach and information methods in physical researches, quickly increases. There are many works that appeared in the beginning of 2010. Among them there are following works [7-12].

The 1-st approach. (Gurevich)

The starting positions. Information is physical heterogeneity. The information characteristics of heterogeneity: Shannon's information entropy, information divergence, joint entropy, communication information [14]. The informatics laws of nature are [1-6]: the law of simplicity of complex systems; □ the law of uncertainty (information) conservation; the law of finiteness of complex systems characteristics; the law of necessary variety by W. Ashby; □ the theorem of K. Gödel. The main principle of quantum mechanics by A Zeilinger: elemental physical systems contain (carry) one bit of information [15].

The law of finiteness of complex systems characteristics and the principle of necessary variety by W. Ashby impose restrictions on topology and symmetry of the Universe: time is one-dimensional Euclidean space. Space is three-dimensional Euclidean space. Time is homogeneous. Space is homogeneous. Space is isotropic. Space is flat. The Universe is four-dimensional pseudo-Euclidean space. The law of simplicity of complex systems, the law of information conservation impose restrictions on physical transformations of the space-time and transformation of internal symmetry: jacobian transformations are equal to 1. Transformations are linear. Equality to 1 of the determinant of linear transformation defines, that among the space-time transformations only translations and own rotations are physically possible. Irreversibility of time, not the own rotations, reflexions are forbidden and physically can not be possible (1989) [1]. Equality to 1 of the determinant of linear transformation defines, that among transformations of the internal symmetry, physically possible are only unimodular transformations.

Restrictions on symmetry of the space-time define physical laws of conservation. The homogeneity of time defines the law of energy conservation. The homogeneity of space defines the law of impulse conservation. Isotropic spaces define the law of conservation of impulse momentum. The principle of field interaction imposes restrictions on interaction process: the interaction of particles is carried out through corresponding fields. A particle «does not need to know interaction laws it must feel a field».

The law of simplicity of complex systems and the law of information conservation allow to select the most simple models, adequately describing the Universe: the Universe is identical to Metagalaxy; the Universe is a homogeneous object; the Universe is an isotropic object; the Universe is a flat object. Increase in the scale factor of inflationary expansion of the Universe makes approximately $\approx 10^{45}$ times.

□ It is shown, that the estimates of the joint entropy of matrixes mixture of electroweak interaction according to different independent experimental data, are close to the estimates of the joint entropy of matrixes mixture of quarks. It testifies to the uniform informational and physical nature of strong and electroweak interaction.

Taking into account Zeilinger's principle the basic information principles of quantum mechanics construction are defined. In particular, necessity of sharing the law of energy conservation and the law of uncertainty (information) conservation is defined.

Hawking's formula for the black holes (informational spectrum of radiation) is deduced (2007) [4]. The formula for the informational spectrum of radiation of neutron stars and white dwarfs is deduced (2009) [6].

Existence of several types of substance with different dependence of information content I on mass M (including, linear for usual substance and for dark substance $I \propto M$, square for black holes $I \propto M^2$, linearly-logarithmic for neutron stars and white dwarfs $I \propto M \log_2 M$, zero for dark energy $I \equiv 0$) is disclosed (2007-2009) [4-6].

Consumption of energy (mass) for creation of microinformation and classical information (remembered, played back) for different types of matter are determined.

At standard model of the Universe expansion the mass of usual substance decreases. At expansion of the Universe with acceleration the mass of usual substance in the beginning decreases, reaches a minimum, and then increases (2007) [4].

Existence of optimal black holes is disclosed and characteristics of optimal black holes (minimising the volume of information in a part of the Universe, and the Universe as a whole) are researched (2007) [4].

□ The structure of the Universe with the information minimum is determined. Limitations on the volume of information in the Universe are defined.

At the approach 1 for the estimate of information volume in physical system the use of holographic principle is not required. The procedure of the estimate of information volume in physical objects consists in the following. At first the volume of information in the lower level objects – the fundamental particles (leptons and quarks) is estimated. According to Zeilinger's principle, we consider, that in the lower level objects - 1 bit of information contains. Further the volume of information in the objects of the second level is estimated. It is equal to the total of the information volume of objects of lower level plus the volume of information contained in the structure of object of the second level of hierarchy (mesons, baryons). The volume of information in the structure of object of the second level is estimated on a wave function of the object of the second level. The volume of information in objects of following levels is similarly estimated.

Direct estimates of information content in physical systems are given (2007-2009) [4-6].

It is shown, that the space uncertainty (information) on the particle layout in space spots the Newtonian gravitational potential (the first derivative of information on radius), strength of gravitational field (the second derivative of the information on radius): the type of gravitational potential is $\propto 1/r$ (2008, 2009) [4, 6], the type of strength of gravitational field is $\propto 1/r^2$ (2008, 2009) [4, 6]. The same is true for Coulomb interaction potential and field intensity strength of Coulomb interaction.

□ It is shown, that to four known types of interaction (gravitational, electromagnetic, strong and weak) one should add one more type of interaction - informational interaction (2007) [4].

□ The informational models of cosmological objects (black holes, neutron stars, white dwarfs, stars of solar type) are developed (2007-2009) [4-6]. The procedure is developed and the estimates of information volume in cosmological objects is given (2007-2009) [4-6].

. The informational limitations on forming and merging of black holes is received (2008-2009) [5-6].

Existence of initial discontinuities of the Universe (with the use of informational divergency) is proved. The estimates of initial discontinuities mass of the Universe are given.

Expansion of the Universe from initial heterogeneity generates new heterogeneity (information). The Universe expansion is the reason and source of information formation. Various physical processes in the extending Universe form information (1989 - 2009) [1-6].

□ Curvature of the Universe also generates heterogeneity (information).

It is shown, that the volume of information, shaped in a frame of reference, moving with acceleration, is equal to $I = -\log_2 J = -\log_2 \sqrt{1 - ax/c^2} \approx ax/c^2$. J -jacobian, a - acceleration, x -coordinate, c -speed of light [6, the second issue of the book]. We will pay attention to analogy to the effect Unru. Appearance of thermal radiation in an accelerated frame of reference in the absence of this radiation in a counting inertial system is the appearance of additional information in an accelerated frame of reference in the absence of this information in a counting inertial system.

The estimates as far as possible and as low as practicable, and also of flowing volume of information in the Universe are given. The estimates of the main informational characteristics of the Universe are given (1989 - 2009) [1-7].

Statement of the Universe management problem is given.

From the informational point of view the necessity of physical systems description (quantum mechanics) by means of nonclassical probabilistic logic is defined (2009) [6].

It is shown, that in all possible Universes the informatics laws and likewise physical conservation laws operate (2009) [6].

The logic structure of nature's laws governs the stages of the Universe emergence and development. From two events in the Universe life there is earlier that event, which logically precedes the other. During the initial moments of time information laws of nature operated. The information laws either have been set in initial "design" of the Universe, □ or were contained in initial heterogeneity of the Universe, □ or have been set from the outside of the Universe.

Expansion of the Universe from the initial heterogeneity has generated the heterogeneity (information): various types of interaction; various types of particles and fields corresponding to them; various types of atoms, molecules; various types of stars, planets; □ the Life, ...

The approach 2. (Lisi, Verlinde, ...[8-13]).

The starting positions: the first law of thermodynamics, the second law of thermodynamics, holographic principle, Hawking's formula, Unru effect.

Unru effect (radiation Unru): predicted by a quantum theory effect of observation of the thermal radiation in the accelerated frame of reference in the absence of this radiation in the inertial system of counting. The temperature of the observable Unru radiation expresses the same formula, as the temperature of Hawking's radiation, it depends not only on the superficial gravitation, but also on the acceleration of frame of reference $T = \hbar a / 2\pi k c$. a -acceleration, c - speed of light, \hbar -reduced Planck constant, k -Boltzmann constant. The volume of information in physical systems is evaluated on the basis of the holographic principle.

The main effects: proceeding from the principle of maximum entropy the necessity of probability description of physical systems (quantum mechanics) (2006 [8] is stated, from informational aspect are spotted: the law of gravitation (2009-2010 [9-11], the second Newton's law (2009-2010) [9-11], Fridman's equations (2010) [12], irreversibility of time (2009) [13] is shown.

Conclusion

The works of the author and foreign scientists (American, Canadian, European, Chinese ...) are confirming primacy of informational laws: the informational laws (informatics laws) define and restrict the physical laws; the informatics laws have general, universal character, operate in all possible universes, even in the universes with different physical laws. The given data show, that the priority use of informational methods of physical systems research belongs to the author, though the last results of foreign scientists are very interesting and important. The informatics laws together with the physical laws will allow to open all secrets of nature, in particular, to construct the theory of quantum gravitation.

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