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TO OUR READERS



This Journal, Scientific Letters of Academic Society of Michal Baludansky has been conceived by the founders of Academic Society of Michal Baludansky as a printed platform for exchanging knowledge between university scholars and experts from different countries who take a keen interest and activities of the outstanding scientist, educator and statesman Michal Baludansky. The journal is published six times a year. The fifth A issue of year 2017 is devoted to the **Volodymyr Hnatiuk Ternopil National Pedagogical University** and the members of the **International Pedagogical Club "Professional Portfolio"**.

**Volodymyr Hnatiuk Ternopil National Pedagogical University** is one of the oldest higher education institutions in western Ukraine, which is now established as a recognized education and culture, science and methodology centre of pedagogical education in Halychyna. Its history dates back to 1620 when a brethren school was opened and provided the training of primary school teachers. Volodymyr Hnatiuk Ternopil National Pedagogical University is modern state-owned educational institution which is one of the leading pedagogical institutions of Ukraine and the regional center of pedagogical education in Western Ukraine. According to the ranking of higher educational institutions of Ukraine the university belongs to the top three humanitarian and pedagogical universities, and has been awarded a Laureate Diploma of International Academic Rating of popularity and quality "Gold Fortuna". The university comprises 9 departments, 1 institute and centers of pre-university training and postgraduate educational. 39 subdepartments currently employ 533 teachers, including 1 academician of Academy of Pedagogical Studies of Ukraine, 1 corresponding member of Academy of Pedagogical Studies of Ukraine, 7 academicians of specialized academies, 53 Doctors of Sciences, professors, and 352 Candidates of Sciences, associate professors. There are close to 4500 full-time and part-time students studying at the university, 5 dormitories, 6 gyms, an indoor training area, a stadium, biological station, medical care center, sanatorium-preventorium, computer labs providing access to the Internet, library, reading halls, dining hall and cyber-café are designed to serve the students' needs. The University provides opportunities for professional mastering specialities and specializations, allowing graduates to feel confident in the labour market, creating conditions for mastering innovative teaching and information technologies. In general, today the university concentrate efforts on training highly qualified specialists, young, educated people whom our society needs in times of rapid development of science.

**The International Pedagogical Club "Professional Portfolio"** is the association of teachers of higher and secondary educational establishments whose aim is to share their professional experience, accumulate and preserve the best teaching methods approved in real life classrooms. The Club was initiated by Olena Dobrotvor, the assistant professor of Pedagogy and Psychology of Professional Education Humanities Institute of National Aviation University and Alexander Skakunov, the author of IT-education project "Zero to Hero" who decided to change the format of traditional training courses completely and create the new informal space for communication and constructive work. To explain more clearly, the feedback from colleagues makes it possible to objectively reflect on teaching practices and prove their own professional achievements, be open to the criticism and recommendations, plan more effective approaches to new classroom situations. Since May 14, 2016 the project has registered 48 participants from different regions of Ukraine as well as Slovakia, Poland, Germany, Bulgaria, Georgia (<https://www.facebook.com/groups/234752410224796/?fref=ts>). Among them are the heads of teaching departments of the universities, the authors of educational projects (including those based on online platforms), scientists and school teachers.

The organizers of the Club launched a series of training workshops and alternative so called anti-conferences named «Self-Teacher». In the given format of pedagogical discussions club members inform colleagues on the ways of improving teaching-learning practices and demonstrate working techniques and ways of evaluating training results. **The following issues have already been discussed:** Critical thinking of the young people, their ideas on training and lectures, Learning a foreign language by "ear-mouth-eyes-hand method", Visualization cognitive activity of students in the classroom, Academic integrity, A workshop on poetry for everybody, Establishing criteria for assessment of student's achievements, Probability theory in the interaction between children and students. In the near future they plan to create a permanent International Open Methodical Center the aim of which will be to organize systematic communication between the teachers of different countries, to issue electronic Portfolio to support current teachers, to expand best practices and support international and democratic education.

*Lenka Dubovická, editor*

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THE ROLE OF MODERN PHYSICAL THEORIES IN FORMATION OF THE WORLDVIEW

## THE ROLE OF MODERN PHYSICAL THEORIES IN FORMATION OF THE WORLDVIEW

Matsyuk Viktor

### Annotation

The article is devoted to the actual problem of the formation of the world outlook. The main stages of development of physics and fundamental physical theories have been considered. The basic modern ideas about the structure of matter and fundamental interactions have been characterized. The ways of becoming a modern scientific picture of the world have been revealed.

**Keywords:** scientific worldview, physical picture of the world, synergetics, elementary particles, quarks, fundamental interactions.

## РОЛЬ СОВРЕМЕННЫХ ФИЗИЧЕСКИХ ТЕОРИЙ В ФОРМИРОВАНИИ МИРОВОЗРЕНИЯ

Мацюк Виктор

### Аннотация

Статья посвящена актуальной проблеме формирования мировоззрения. Рассмотрены основные этапы развития физики и фундаментальных физических теорий. Охарактеризованы базовые современные представления о структуре материи и фундаментальных взаимодействиях. Раскрыты пути становления современной научной картины мира.

**Ключевые слова:** научное мировоззрение, физическая картина мира, синергетика, элементарные частицы, кварки, фундаментальные взаимодействия.

### Relevance of the problem

Physics is known to investigate the most common properties and forms of motion of matter. It answers the following questions: How is the world around set? What laws are the phenomena and processes that occur in it subject to?

Formation of the scientific worldview is a complex and multifaceted process, which consists of a number of components. The scientific worldview is a theoretical system of generalized knowledge about the surrounding world and the place of a human being in it [2]. Scientific knowledge is the necessary component and the basis for the formation of scientific worldview.

The evolution of physical ideas, which are based on fundamental physical theories, led to the formation of a physical picture of the world (classical, electrodynamic, quantum field) [3].

Worldview includes three forms of intellectual and emotional experience of people: world outlook, world perception and worldview. World understanding is decisive. On its basis, the scientific picture of the world, including the physical one, is formed and developed, the basis of which are the laws and categories of philosophy and natural science (physics) [4].

### The contribution of basic physical theories to the formation of a scientific picture of the world

In the natural sciences picture of the world, the physical picture of the world dominates (PhPW) and plays an important role in the formation of fundamental physical concepts that have the status of philosophical categories (matter, its types, forms of movement, ways of existence) and significantly affect the outlook of pupils.

Since the 60's to 70's of the twentieth century a new scientific trend - synergetics – has been developed and revealed the processes of self-organization in both wildlife and inanimate nature. The founders of this scientific direction (G.Khaken, I.Prygozhyn) essentially laid the foundations for a new contemporary picture of the world – synergistic (SPW). The basis of this picture of the world consists of the philosophical ideas (unity of the surrounding world – inanimate nature and wildlife, global evolutionism, universality of the algorithm of development on the basis of self-organization); synergistic ideas (dissipativeness of structures, nonequilibrium of thermodynamic processes, phase transitions of systems, deterministic chaos, fractals, attractors, complexity, self-organized causality, generation) [8].

The physical picture of the world is a high level of systematization of knowledge; here the relationship between science and philosophy is most closely realized. The physical picture of the world is a model of nature, which includes in the

most general form all the basic theoretical ideas of a certain period of the development of physics.

In recent years, a new theory – quantum chromodynamics (QCD) – has been created. In this regard, one can hope that a new world picture will be created in the near future, which will respond to the physical ideas of the QCD. This model of nature will be more adequate to the world around us.

As the researchers in the process of learning moved from molecule to atom, and then to the atomic nucleus with its elemental particles (protons and neutrons), they managed to unravel the riddle of the interaction of matter and energy. With the development of new knowledge, lasers, computers, atomic energy, space flights, and other things came into existence.

In the middle of the twentieth century a new concept of the physical picture of the world arose. Scientists experienced a new revolution similar to the one associated with the works of Copernicus about the rotation of the Earth around the Sun. In 1963, Murray Gell-Mann of the California Institute of Technology and George Zweig of the European Center for Nuclear Research (Cern, Switzerland) independently came to the idea of the existence of even smaller particles of the universe – quarks (the term was offered by M. Gell-Mann). In 1969 M. Gell-Mann was awarded the Nobel Prize for these works. Quarks have a fractional charge (in units of electron charge: plus or minus one third, plus or minus two thirds). Currently, 36 types of quarks are distinguished. The elemental particles (hadrons) are considered as consisting of quarks in accordance with their 'colors' (a special characteristic of quarks). For example, a proton consists of two u-quarks, which have a positive charge equal to two thirds of the charge of the proton, and one d-quark with a charge of one third. Together they form a particle of a proton with a charge of +1. The neutron is formed by one u-quark and two d-quarks, which collectively form a neutral particle and so forth.

Currently, physicists believe that the four types of interactions are manifestations of some deep-seated power. Over the past two decades, scientists have proposed the theory of "Great association", according to which three types of interactions – weak, strong and electromagnetic – are an integral part of one fundamental interaction, and therefore cannot be considered a complete theory. However, due to quarks and quark models, a new theory – quantum chromodynamics – has been created and it can serve as the basis for creating a new picture of the world. This statement does not contradict the basic law of dialectics on the recognition of the world [8].

The sphere of manifestation of this or that type of interaction is due to the structural levels of matter, the forms of its movement, and spatial domains. All this together defines the diversity of the phenomena of the material world and the

most important properties of its objects [9]. Fundamental interactions and fundamental physical theories are mutually subordinated and interconnected.

In the classical mechanics and molecular-kinetic theory, carriers of interactions are the gravitational and electromagnetic fields. The energy of the interaction is determined by the inequality  $E \ll mc^2$ . The main material objects are classical objects, bodies on Earth, particles of matter (atoms, molecules), charged particles (nuclei of atoms, electrons, ions) [5].

In the classical electrodynamics, the interactions are carried out through an electromagnetic field. In the field of relativistic physics, the energy of bodies and particles is proportional to the energy of rest. This type of interactions is due to the interconnections between the electric particles and the electromagnetic field. Electromagnetic and gravitational interactions manifest themselves at distances of  $10^{20}$ - $10^{-8}$  meter. [6].

Quantum mechanics studies physical phenomena conditioned by the motion of electrons in atoms and molecules. The main type of particle interaction is electromagnetic. The energy of particles is commensurate with the energy of rest. The range of distances in which this type of interaction of microparticles is carried out is  $10^{-10}$ - $10^{-15}$  meter [7].

Quantum electrodynamics describes the interaction of electrons and photons. Electromagnetic interaction of particles is carried out in the spatial region, which is  $10^{-10}$ - $10^{-18}$  meter. The energy of the interaction of particles is greater than the energy of their rest [1].

In the quantum theory of elementary particles and the field, the space range of  $10^{-13}$ - $10^{-15}$  meter corresponds to the atomic nucleus. Electromagnetic, strong and weak interactions play an important role there. The binding energy of the nucleons in the nucleus is 1-10 MeV. This type of interaction determines the stability and decay of the nucleus [7].

The mutual transformation of elementary particles is described in the theory of elementary particles. The main types of interaction that characterize these processes (electromagnetic, strong and weak) manifest at distances of  $10^{-15}$ - $10^{-18}$  meter. The energy of these particles is much greater than the energy of their rest.

### Conclusion

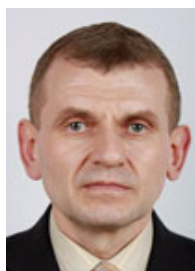
The modern physical picture of the world is the result of a synthesis of the most important achievements of all natural sciences. However, although this picture of the world is characterized by a large generalization and successfully explains many phenomena, there is still an inexhaustible

amount of phenomena in nature, which the modern physical picture of the world cannot yet explain. Therefore, one cannot consider the modern physical picture of the world as somehow completed. The complexity of the world surpasses and will always surpass the complexity of human perceptions about it.

The deep internal relations between classical and modern physics are reflected in the principle of conformity, according to which certain connections between the further development of physics and its previous meaning are established: in certain extreme cases, a new physical teaching passes into the old one. The patterns set at a certain stage of the development of physics and correctly explain the experimental data are not discarded with the development of a new phase of the doctrine, but are included as a limiting case, valid under certain conditions. This is confirmed by the materialist doctrine of the absolute and relative truths and of the continuous transition in the process of cognition from shallow entities to the deeper ones.

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