INTERACTION AS FUNDAMENTAL NATURAL-SCIENCE CONCEPT

Shepel O.M., Elagina V.S.
Tomsk, Chelyabinsk, Russia

The problem of energy's definition in the educational process is discussed. Energy perception is suggested for one as the quantitative scalar characteristic of observable object interaction. Variants of physical interactions classification, taking into account the electroweak and substance–spatial interactions, are considered. Gravitational, kinetic, mass and entropy energies are interpreted as the special cases of substance–spatial interaction.

Educational standards of the some specialities got by students at universities of the Russian Federation provide discipline "the Concept of modern natural sciences» [1] and assume education of students in the spirit of high natural-science culture. The theme "Interaction" is one of obligatory themes in the course of its teaching. Thus, according to overwhelming amount of the educational literature, there are four fundamental physical interactions to which all are reduced the others: strong, electromagnetic, weak, gravitational (in decreasing order of force). Though the uniform theory of weak and electromagnetic interactions developed in the late sixties of the last century, and allowing quite authentically to speak only about three interactions: strong, electroweak and gravitational [2], by this time has become conventional theory, searches of new interactions traditionally are called as searches of the fifth interaction.

In particular, many of scientists consider the fifth interaction by universal one, including four interactions, named above. Still A. Einstein has begun to search it within the limits of creation of the uniform field theory. Some of researchers consider such theory is already created by G.I. Shipov under the name «Theory of physical vacuum», and the fifth interaction represents a torsional field [3]. Others try to search for a certain new constant of uniform interaction from which all known nowadays fundamental physical constants [4] would follow. However nowadays theorists are disposed more favorable to the modern theory of superstrings, because they consider it's the most perspective approach to long-awaited great unification — uniform description of a matter and all known interactions [5]. It is supposed that elementary particles represent vibrations of certain multidimensional formations — superstrings. According to its various variants there should be besides four accessible to us spatial dimensions, at least five-seven additional ones, curtailed into small areas in each point of space-time continuum. These areas render the influences comparable on force with usual gravitation and, according to some variants of the theory, can be found experimentally out on distances of an order of thousand shares of millimeter.

Besides, many of researchers are convinced of the existence of the fifth interaction which is not reduced to four classical ones. There is a point of view, for example, that the fifth interaction is observed in astronomical scales. Some astrophysical researches say that the Universe not simply extends, but extends with the acceleration, so astrophysicists suggest to return again to rejected some time ago A. Einstein's hypothesis about existence between masses not only forces of an attraction, but also forces of pushing away (dark energy). In 1986 the American physicists led by E. Fishbah even have declared experimental acknowledgement of this hypothesis [6]. Though by this time the touch of sensational nature of this message has already disappeared owing to ambiguity of the skilled data and was replaced by professional tone of discussion, however, activity of acknowledgement searches of dark energy existence does not fall down.

Behavior synchronism of the born together particles, having identical wave characteristics, also sometimes is classified as the

fifth interaction. Influence on one of them leads to simultaneous reaction of both, irrespective of distance between these particles. That is, interaction between such particles is carried out somehow with the speed exceeding a velocity of light.

There are messages devoted to discussion of possibility of the fifth interaction existence inside hadrons, between hypothetical partons which, according to tentative estimations, exceeds strong interaction approximately in 11 times [7].

The information also sometimes is considered as the fifth type of interaction. Some of the researchers believe that information is capable to be converted into the energy, generating mass in turn [8].

An attempt:

- to substantiate the expediency of substance–spatial interaction (between substance and space) recognition in the educational literature;

- to make more accurate the classification of fundamental physical interactions

is undertaken in the present work.

First of all, it is offered to correct the definition of interaction that is to perceive interaction as the influence physical *objects* against each other, instead of traditional representation that it is influence of *bodies* against each other, leading to a change of their movement state. The offered definition expands a circle of subjects are perceived by the researcher as interacting ones, including in it not only bodies, but also physical fields, vacuum, space-time continuum. Nowadays anybody knows that the mass of any substance bends space surrounding it. However, talking about interaction between substance and space is considered incorrect because of the fact “the space not is a body”.

Really, the space not is a body. But it is bent under the influence of mass, that is, mass influence on space takes place. And, according to some theorists, the mass grows out of a curvature of the same space-time continuum. Influence of objects against each other – substance and space interaction is available. Thus, gravitational interaction can be considered as a consequence of the substance-spatial interaction, leading to a mutual attraction of masses. However, it would have unlikely expedient to replace one interaction name (gravitational) on another (substance-spatial) if substance-spatial interaction had not been found out itself in other phenomena.

But if one agree that energy is not only a measure of work [9] or of the general quantitative measure of various matter movement forms [10] but, first of all, energy is the scalar quantitative characteristic of interaction of physical objects [11] he inevitably asks a question: about what object interactions there is a speech when we consider kinetic energy, mass-energy relation, entropy energy?

It is well known that kinetic energy is defined by mass and by speed of mass moving in space. So we have a right to maintain that kinetic energy, as well as gravitational energy, represents one of manifestation forms of substance-spatial interaction. Thus, temperature of macrobody, being a measure of molecule kinetic energy, also is the aspect of interaction between substance and space.

The space means four-dimensional continuum, including the fourth similar to time dimension. So energy of a rest mass can be perceived as the result of interaction of this mass with the specified fourth dimension of such space. That is, energy of a rest mass is one more special case of substance-spatial interaction.

And, at last, it is well known that entropy change (dS) is defined by:

- quantity of substance (n);
- temperature change (dT);
- volume change (dV):

$$dS = n(C\frac{dT}{T} + R\frac{dV}{V})$$

where:

- C – is the mole thermal capacity of a gas at constant volume,
- R – is the universal gas constant [10].

So entropy energy (TS) can be perceived as the result of interaction between

space and quantity of substance. Thus, all interactions are reduced to three the most fundamental ones: strong, electroweak and substance-spatial interaction. Thus:

- Strong interaction is manifested as energy of interaction between nucleons of an atom kernel;

- Electroweak interaction is perceived as electromagnetic energy and energy of weak interaction;

- Substance-spatial interaction is manifested as gravitational energy, kinetic energy, energy of mass and entropy energy.

References

1. The state educational standard of the higher vocational training. The state requirements to a minimum of the maintenance and to a level of preparation of the graduate on a speciality 011000 – Chemistry. Qualification – the teacher of chemistry. Moscow, 1995.

2. Bogush, A.A. Introduction in calibrating the field theory of electroweak interactions [Text] / A.A. Bogush – M., 2003. – 360 p.

3. Thorns, G.I. Theory of physical vacuum: the Theory, experiments and technologies [Text] / G.I. Shipov. – M: the Science, 1996. – 450 p.

4. Kosinov, N. Five Fundamental Constants of Vacuum, Lying in the Base of all Physical Laws, Constants and Formulas [Text] / N. Kosinov//Physical Vacuum and Nature, №4, 2000.

5. Каку, М. Introduction in the theory of superstrings / – М., 1999. – 624 p.

6. Fischbach, E. Six years of the fifth force [Text] / E. Fischbach,

C. Talmadge//Nature. – 1992. V. 356, p. 207-214.

7. Astafurov, V.I. Mathematical modelling of the physical vacuum and interconnection of fundamental interactions: Lecture [Text] / V.I. Astafurov,

A.M. Marennyy, M.I. Georgieva // The third international scientific school for mathematical modelling, 02-13 July, Saransk, Russia.

8. Pak, V.V. Engineer, mathematics and others. Simple methods of mathematic modelling of natural and technological processes [Text]/. – Donetsk, 1995. – 224 p.

9. Chernoutsan, A. Phisics. The handbook for senior pupils and entrants [Text] / A. Chernoutsan. – M., 2000. – P. 26.

10. Yavorsky. M. Handbook on the physicist [Text] / B.M. Yavorsky, A.A. Detlaf. – M., 1980. – 507 p.

11. Shepel, O.M. Matematiks: the manual [Text] / O.M. Shepel, N.I. Chabovskaya. – Tomsk, 2006. – 124 p.