MOMENTUM AS A FUNDAMENTAL CATEGORY OF PHYSICS

Abduhakim Khadjivaev

Abstract

It is known that the most complete description of the concept of «momentum» as «quantity of motion» *(Latin: quantitas motus)* was given by Rene Descartes in the first half of the 17th century. Later this definition was refined by Newton (1687), who first introduced the concept of «mass of an object» into science. According to Newton «the quantity of motion is a measure of motion, established in proportion to velocity and mass of an object».

At present, it is generally accepted that «momentum» is a vector physical quantity, which is a measure of mechanical motion of an object.

****

In relativistic mechanics, the most generalized definition of momentum is «the additive integral of motion of a mechanical system associated according to the Noether's theorem with the fundamental symmetry - homogeneity of space». There is also another definition of momentum as «the property of an object to act», i.e. its ability to exert an effect on another material object (MO). In our opinion, it is this definition that most adequately reveals the essence of momentum as a physical category. For it «hints» and is based on the fact of the existence of physical substrate, or «operator» of momentum!

lt should be noted that none of the previously proposed definitions of the momentum answers the question about the presence or absence of a physical substrate or an «operator» of the momentum.

Based on our proposed concept of «single mechanical theory» [1, 2], we emphasize that the momentum has a specific physical substrate in the form of a «squish zone» of the space-time continuum (STC) formed behind (i.e. opposite the direction of motion) material body (MO), consisting of the Primary Direction Graviton Pulse Stream (PDS). It is the total graviton-momentum from the total PDS of this zone that is the physical substrate of the momentum, as well as the inertia

(inertial force) and kinetic energy of the moving MO. As for its magnitude, it is determined by mass, which, in tum, is determined by the number of atoms and nucleons that make up the given MO, and by the velocity of the MO.

Unfortunately, modem physics, like Newton, has moved «momentum» to second place after «force» in importance. In his work «Mathematical Beginnings of Natural Philosophy» I. Newton wrote: "The change in the amount of motion is proportional to the FORCE and occurs in the direction of the straight line along which the force acts». This formulation is Newton's famous «Second law».

In modem physics the following formulations of this law are used: "In inertial reference systems the acceleration acquired by a material point is directly proportional to the FORCE that causes it, coincides with it in direction and is inversely proportional to the mass of the material point. Or: «The product of the mass of a body by its acceleration is equal to the force acting on it». There is also such a formulation: «In inertial reference systems, the time derivative of the momentum of a material point is equal to the FORCE acting on it».

As you can see, in all variants of the wording the emphasis is on the concept of FORCE rather than momentum, even in physics textbooks the following definition of force is given: «Force is a vector physical quantity, which is a measure of mechanical impact on an object by other objects, as a result of which the object gets acceleration, or changes shape and size» [3].

However, in essence, «force» is a measure of intensity, or «velocity» of momentum transfer *(F=t.PIt.*T). Just as «velocity» being a measure of intensity of «motion» cannot occur without «motion», neither can «force» without «momentum»! As a measure of the intensity of momentum transmission (change), force is inherently secondary to it.

Logically, it is not correct to consider or identify «force» with motion (or interaction). Force is merely a measure of the intensity of motion (interaction)! It makes no sense to talk about «force transfer» - we can only talk about «momentum transfer»!

The protrusion of the concept of «force» and leveling of «momentum » is reflected in the fact that force has its name as a unit of measurement (newton, dyne), while momentum does not (it is measured in kg-m/s)

The most logically correct, according to our statements, is the following definition; «Force is a measure of intensity of momentum transfer of one physical system (PhS) to another». Such formulation of the concept «force» completely changes its essence! It ceases to be the main or fundamental physical quantity. It is only a measure of intensity of momentum transfer (change) of a physical system! Force shows with what intensity a given physical system can transfer its momentum to another one.

It seems not quite logical to talk about «momentum of force», as it is accepted in modem physics. For in this case «momentum» is put as a parameter of «force», i.e. secondary to «force». It would be correct and logical to speak of «momentum force» (analogy, you cannot speak of'« motion of velocity», you can say «velocity motion»),

We believe that it is the momentum - as the simplest integral quantity that includes all three basic physical parameters (meter, kilogram and second) that is the true fundamental category.

According to the author of this article, it would be expedient and historically fair to introduce the unit of momentum measurement - «Descartes» (d), which is equal to 1 kg *mis*. Hence: 1 N dis; 1 J=l dxm/s; lPa (pascalj=d/sxrrr'.

As applied to mechanical motion, momentum transfer manifests itself as «acceleration». It is «acceleration» as a change in velocity of MO that is the manifestation and description of the process of momentum transfer during a certain time interval (n=P/M~ T). In this regard, it is difficult to agree with the statement that «force is the cause of acceleration. The acceleration is based on the transfer of momentum»!

The recognition of this position will lead to a radical revision of many of the basic propositions of physics.

First of all, force ceases to be a diverse (mechanical, electrical, nuclear, gravitational, etc.) and fundamental physical quantity. As a measure of the intensity of momentum transfer (change), it can be essentially only in one form: F=P/ ~T! It follows that all four fundamental forces (interactions) of Nature have the same meaning - momentum transfer!? The author believes that under the concept of «motion» (interaction) should be understood as momentum and only momentum, Force itself cannot be «motion», force is a measure of intensity of motion.

As for «energy» and «work», according to the author, «energy» is a momentum accumulated in the three-dimensional dimension. If momentum exists and «works» (is transferred) in the two-dimensional dimension (plane), which the author calls the «time layer» [1], then energy exists only in the three-dimensional dimension. Transmission of momentum means transfer of energy, any form of energy transfer is «work», i.e. work is the process of energy or momentum transfer!

One cannot disagree with the statement that «it is possible to transfer (receive) only that which has a physical substrate», i.e. it makes no sense to speak about transfer of any properties or parameters of the system (for example: «color», «temperature» or «sizes»), it is possible to transfer only an operator of such properties. The property is not «transferred» but «imparted». Consequently, it makes no sense to speak of «transferring velocity>> (only motion can be transferred), or of «transferring force».

In this regard, the author considers it appropriate to distinguish such concepts as «momentum» («pure momentum») and «momentum of a material body»! Under the latter the author means the total amount of the «whirling zone» of momentum gravitons with PDS attached exactly to a given moving MO. Its value is determined by the mass (quantity) of this MO and determines its velocity.

It can be argued that any PhS or MB, as a distinctive physical reality being in a state of motion relative to the environment (STC), possesses momentum!

As for «pure momentum», the smallest portion of it in Nature is a quantum of light, or photon.

As it is known, photon (quantum) has no mass (rest mass), because it itself is the minimal portion of momentum.

As noted, «momentum transfer» is a process of two acts (components): a) giving away momentum; e) receiving momentum (i.e. «transfer» «giving away» + «receiving»). These two components are inseparable and seem to be equivalent. However, this is not entirely true. First, they each concern (relate to) two different MO or PhS, one of which «gives» and the other «receives» the momentum. The author believes that it is in the «two-component» process of momentum transfer that the deepest meaning lies - its dualism.

As for the amount of «given» and «received» momentum, it is always absolutely the same and, at first sight, depends on the difference of velocities of the colliding MO (PhS). However, its value is determined not only by the velocity of motion, but also by the ratio of the mass of MO. The fact is that the amount of «transmitted» momentum is determined not only by its value in the «giving» MT, but also by the possibility of the «recipient» - the second MB, which is determined by the velocity and mass of the latter.

It is known that atoms (nucleons) are the operators of the «momentum of a material body», Consequently, the momentum is transferred from atom to atom. If we take into account that momentum of a MO consists of the sum of momentum of atoms that make up this MO, then it should be recognized that the transfer of momentum of one MO to another MB does not happen instantaneously, but within a certain time (~T), which manifests itself as a force.

There are a few words about «pressure», It is known that according to the modem definition «pressure» is a physical quantity characterizing intensity of the mechanical influence of the environment on the surface of a body in the direction perpendicular to this surface and is numerically equal to the ratio of averages perpendicular components of force to the surface value. In the mathematics language, this is: p= Fn/S; where Fn is the averaged perpendicular component of the force. If the force is replaced by the momentum, the equation will be p P/~TS.

The realization of force, or the transfer of momentum from one system to another is always in the form of pressure, i.e., pressure is the same process of transferring momentum to a certain surface (S) with a certain force (F) for a certain time (T), which may be constant, or long. In this connection, we can consider that pressure reflects (characterizes) the density of momentum transfer through the contact surface units.

Thus, the analysis of generally known facts allows us to make the following, seemingly trivial, but revealing the physical essence of momentum:

- the momentum arises from the MB (PhS) being in a state of motion relative to the «environment» (STC), and has a specific physical substrate in the form of a «whirling zone» consisting of a flow momentum of graviton with PDS in the direction of motion;

- the momentum transfers from one MO (PhS), to another, means transfer of a flow of graviton-momentum with the PDS (within the «whirling zone» behind the moving MB);

- the momentum, as an interaction of two or more MO (PhS), can be transmitted only by contact way at their collision;

- the process of momentum transfer cannot be performed remotely, which excludes the possibility of any kind of «long-range action» in nature;

- the momentum, being a vector quantity, always has a direction of motion (from the momentum source) «from itself» and in no way «to itself»;

- the direction of momentum transfers of colliding MO (PhS) is determined not by the value of their momentum modulus, but by the value of velocity of motion. The momentum is transmitted not by the principle «from more to less», but «from fast to slow»;

- the momentum transfer means change of velocity of motion of MO (PhS) subjected to interaction, i.e. the process of momentum transfer is visualized or manifested as acceleration;

- the force cannot be a more fundamental physical quantity and measure of action than momentum, it is an indicator of intensity of momentum transfer from one MO (PhS) to another;

- the pressure is a manifestation or transmission (action) of momentum on a continuous basis or for a certain time.

REFERENCES

[1] Khadjibaev A.M. Reflection on the essence of things and phenomena (an outside view of physics). Tashkent: IPTD "Uzbekistan", 2015. - 312 p.

[2] Khadjibaev A.M. About space as a physical reality // Uzbek journal "Problems ofMechanics". Tashkent. 2016. No l. - P. 78 - 82.

[3] Kasyanov V.A. Physics, 10 cl. Textbook for general educational institutions. 6th edition, Moscow: Drofa, 2004. 416 p.