OTF - Total Theory of all Physics .

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I proceeded from the method of V.S. Sorokin (Advances in Physical Sciences, Vol. LIX , Issue 2, 1956, pp. 325-362) as presented by M.A. Aizerman, MIPT (Classical Mechanics, Moscow, Nauka, 1974, pp. 44 et seq.).

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Explanation

OTF is very simple. There is matter in space. She behaves as she wants. People want to turn its description into a scientific form. To do this, they try to describe the behavior of matter using mathematical formulas. But not everything is so simple, and we don’t know everything. Intermediate Principles and Laws are introduced. The fewer principles and laws in science, the better nature is described. This is the goal of the OTF to reduce their number to a minimum. I don’t completely abandon the Principles: we don’t know everything yet. I take as a basis Galileo’s principle of relativity, which is half physical, half mathematical, and asserts that the mathematical description of nature must be qualitatively preserved when quantitative physical parameters change.

Physics begins with the relativity of motion. If two trains are moving, it is not known which of them is moving and which is standing. There is also a principle that the equations describing motion should not change when moving from one frame of reference to another. This is Galileo's principle of relativity. In this work, such equations are sought. The simplest case of two colliding bodies at different speeds is taken. The speeds change and you will not get the same type of equations from them. But by taking some function, you can consider it in another frame of reference. It turns out that if the function is preserved, then its change is also preserved, and the change in changes, etc. There are 6 variable speeds for 2 particles. And there should be 6 independent changes, but there are many more such changes in changes, and they should not affect the solution. From these unnecessary patterns, the laws of physics are obtained. The laws of conservation of energy and momentum are obtained. For microbodies, the relativity of motion is also preserved and the equations of quantum mechanics are obtained. In thermodynamics, the relativity of motion is preserved and its laws are obtained. In Einstein's theory of relativity. the same And so on. In any section of physics, there is relativity of motion, and by applying it to the laws of this section, one can obtain formulas and laws.

It has been verified that these patterns are also preserved for a number of particles greater than 2. This is not given in the work, but you can do it yourself.

This is how the unity of command of all sections of physics is achieved.

1 Measure of movement (Sorokin V.S.)

(as presented by M.A. Aizerman, “Classical Mechanics”, Moscow, Nauka, 1974, p. 44 and further, the method of V.S. Sorokin, “Advances in Physical Sciences”, vol. LIX , issue 2, 1956, pp. 325-362).

Observing the movements of bodies, people have long paid attention to the fact that the greater the mass and speed of a moving body, the stronger the effect that occurs when it collides with other bodies. For example, when a cannonball moves, its destructive force is greater, the greater its mass and speed; when a moving ball hits a stationary one, the latter acquires a greater speed, the greater the speed of the first ball; a meteorite reaching the Earth penetrates the ground the deeper, the greater the mass and speed of the meteorite. These and many other examples of this kind suggest the existence of a measure of mechanical motion (in short, *a measure of motion*) and the dependence of this measure on the speed and mass of a moving material object.

Observing the motion of the balls before and after the collision, one can notice that if as a result of the collision the motion of one of the balls "decreased", then the motion of the second ball "increased" and even more so, the more significantly the motion of the first ball "decreased". It seems therefore that although the measure of motion of each of the balls changes during the collision, the sum of such measures for both balls remains unchanged, i.e. that under certain conditions an "exchange of motion" occurs while the measure of motion as a whole is preserved.

The history of mechanics is associated with long-standing disputes among scientists about what quantity is the measure of motion, in particular, whether the measure of motion is a scalar quantity or a vector. This dispute is of historical interest only, but it was during this discussion that two basic characteristics of motion were introduced - kinetic energy and momentum, which play a central role in the entire construction of mechanics. Let us therefore try to more accurately define the intuitively introduced concept of the measure of motion and, from general considerations, clarify some of the properties that it should have.

We will proceed from the assumption that the measure of the motion of a material point is a scalar function of the mass and velocity of the point $f(m_i, v_i)$, satisfying the following conditions:

1 ° The measure of motion is additive. This requirement means that the measure of motion of the system f $_c$ is obtained as the sum of the measures of motion of all N points included in the system

$$f_c = \sum_{i=1}^{N} f_c(m_i, v_i).$$

2 ° The measure of motion is invariant with respect to the rotation of the reference system. From this intuitively obvious requirement (which naturally follows from the basic assumptions about space and time) it immediately follows that the measure of motion should not depend on the position of the point, on the direction of its velocity and on time and can depend only on the modulus of the velocity $|v_i| = v_i$: $f = f(m_i, v_i)$.

3 ° The measure of motion of a closed system of material points should not change during temporary interactions. Interactions that last only a finite time τ and are not necessarily caused by direct contact of bodies are called temporary. It is assumed that during the time τ only the mechanical characteristics of the material points change - their positions and velocities, but other parameters characterizing their physical states - temperature, electric charge, etc. - remain unchanged. The concept of "temporal interaction" is a natural generalization of the concept of "collision". This requirement then means that the measure of motion of the entire closed system of material points f $_c$, calculated before the interaction begins and after its end, must be the same.

Of course, the condition of preservation of the measure 3 ° must be invariant with respect to Galilean transformations. This requirement is a direct consequence of Galilean relativity principle.

Let us now determine what form a scalar function has that satisfies all these conditions.

Let us consider a closed system consisting of two material points with masses m $_1$ and m $_2$. Let the velocities of these points relative to the inertial frame of reference be equal v_1, v_2 at the moment t (before the interaction) and v'_1, v'_2 - at the moment $t' = t + \tau$ (after the interaction). If the function $f(m_i, v_i)$ serves as a measure of motion, then by virtue of condition 3 ° the equality must be satisfied

$$f(m_1, v_1) + f(m_2, v_2) = f(m_1, v'_1) + f(m_2, v'_2) \quad (1)$$

Let us choose a reference frame moving relative to the initial one translationally and uniformly with the velocity **-** ***u*** . This system is also inertial. The points under consideration have velocities in it v_1+u, v_2+u at the moment t and v'_1+u, v'_2+u at the moment t' . Due to Galileo's principle of relativity, the function f must be a measure of motion in this system as well, i.e. the equality must be satisfied

$$f(m_1, v_1+u)+f(m_2, v_2+u)=f(m_1, v'_1+u)+f(m_2, v'_2+u) \quad (2)$$

Let us choose in the “old” inertial reference system a Cartesian coordinate system **x , y , z** so that the coordinates of the vector ***u*** are equal to (u , 0, 0), i.e. let us assume that the “new” inertial system moves relative to the “old” one with a speed of ***-u along*** the **x axis** . Then

$$f(m, v+u)=f(m, v_x+u, v_y, v_z),$$

where v x , v y , v z are the coordinates of the vector ***v*** , and equality (2) takes the form

$$f(m_1, v_{1x}+u, v_{1y}, v_{1z})+f(m_2, v_{2x}+u, v_{2y}, v_{2z})=f(m_1, v'_{1x}+u, v'_{1y}, v'_{1z})+f(m_2, v'_{2x}+u, v'_{2y}, v'_{2z}) \quad (3)$$

Let us now expand the functions included in this equality into Taylor series in powers of ***u*** . Writing out only the linear terms and replacing the higher-order terms with dots, we obtain

$$f(m_1, v_1)+u\cdot\left(\frac{\partial f}{\partial v_x}\right)_1+\ldots+f(m_2, v_2)+u\cdot\left(\frac{\partial f}{\partial v_x}\right)_2+\ldots=f(m_1, v'_1)+u\cdot\left(\frac{\partial f}{\partial v_x}\right)'_1+\ldots+f(m_2, v'_2)+u\cdot\left(\frac{\partial f}{\partial v_x}\right)'_2+\ldots \quad (4)$$

where $\left(\frac{\partial f}{\partial v_x}\right)_k$ and $\left(\frac{\partial f}{\partial v_x}\right)'_k$ (k =1, 2) conventionally denote the derivative $\frac{\partial f(m, v_x, v_y, v_z)}{\partial v_x}$ after substituting into it the coordinates of the vectors instead of v x , v y , v z **v** 1 , **v** 2 And **v '** 1 , **v '** 2 respectively. Having discarded equal (due to (1)) the free terms on the right and left sides of equality (4) , dividing the result by ***u*** , tending u to zero and discarding the terms replaced by ellipses, in the limit we obtain

$$\left(\frac{\partial f}{\partial v_x}\right)_1+\left(\frac{\partial f}{\partial v_x}\right)_2=\left(\frac{\partial f}{\partial v_x}\right)'_1+\left(\frac{\partial f}{\partial v_x}\right)'_2 \quad (5)$$

Equality (5) has exactly the same structure as equality (1), only instead of the sought measure of motion *f* in equality (5) there is a partial derivative $\frac{\partial f}{\partial v_x}$. But this means that if the function *f* satisfies equality (1) , then its partial derivative $\frac{\partial f}{\partial v_x}$ also satisfies equality (1).

We arrived at this conclusion by assuming that the new inertial frame of reference moves along the x axis , i.e. that the vector ***u*** has coordinates (u , 0, 0). Let us now assume that it moves relative to the old frame of reference along the y axis or along the z axis , i.e. that the vector ***u*** has coordinates (0, u , 0) or (0, 0, u). Repeating verbatim the above reasoning, we establish that an equality of the type (1) also satisfy the partial derivatives $\frac{\partial f}{\partial v_y}$ and $\frac{\partial f}{\partial v_z}$.

We now introduce a vector $\boldsymbol{q}$ with coordinates $\frac{\partial f}{\partial v_x}$, $\frac{\partial f}{\partial v_y}$ and $\frac{\partial f}{\partial v_z}$. Each of these partial derivatives is a function of the variables v_x, v_y, v_z and m . Therefore, the vector $\boldsymbol{q}$ is a function of the variables v_x, v_y, v_z and m , i.e. $\boldsymbol{q}$ is a vector function of m and of the vector argument $\boldsymbol{v}$, satisfying equality (1). The function $q(m,v)$ is additive and, being a vector, is invariant with respect to rotation of the reference frame. Thus, relying only on the Galilean principle of relativity, we have established an important fact: if there exists a scalar function $f(m,v)$ satisfying conditions 1 °, 2 ° and 3 °, then there also exists a vector function $\boldsymbol{q}$ satisfying these three conditions, and $\boldsymbol{f}$ and $\boldsymbol{q}$ are related by the relations

$$q_x=\frac{\partial f}{\partial v_x}, q_y=\frac{\partial f}{\partial v_y}, q_z=\frac{\partial f}{\partial v_z} \qquad (6)$$

Now, based on Galileo's principle of relativity, we require that equality (5) (and similar equalities for $\frac{\partial f}{\partial v_y}$ and $\frac{\partial f}{\partial v_z}$) be preserved under Galilean transformations. It is easy to see that repeating similar reasoning, but only based not on equality (1) but on equality (5) (and similar equalities for $\frac{\partial f}{\partial v_y}$ and $\frac{\partial f}{\partial v_z}$), we will establish that an equality of type (1) must satisfy all second derivatives, i.e. six functions

$$\frac{\partial^2 f}{\partial v_x^2}, \frac{\partial^2 f}{\partial v_y^2}, \frac{\partial^2 f}{\partial v_z^2}, \frac{\partial^2 f}{\partial v_x \partial v_y}=\frac{\partial^2 f}{\partial v_y \partial v_x}, \frac{\partial^2 f}{\partial v_x \partial v_z}=\frac{\partial^2 f}{\partial v_z \partial v_x}, \frac{\partial^2 f}{\partial v_y \partial v_z}=\frac{\partial^2 f}{\partial v_z \partial v_y}$$

It was established above that equalities of type (1) can be written for ten functions, namely for

$$f, \frac{\partial f}{\partial v_x}, \frac{\partial f}{\partial v_y}, \frac{\partial f}{\partial v_z}, \frac{\partial^2 f}{\partial v_x^2}, \frac{\partial^2 f}{\partial v_y^2}, \frac{\partial^2 f}{\partial v_z^2}, \frac{\partial^2 f}{\partial v_x \partial v_y}, \frac{\partial^2 f}{\partial v_x \partial v_z}, \frac{\partial^2 f}{\partial v_y \partial v_z} \qquad (7)$$

According to the problem statement, it is assumed that the masses m_1 and m_2 of two interacting points and their velocities before interaction are given $\mathbf{v}_1$ And $\mathbf{v}_2$ and that the assignment of these quantities completely determines six unknown quantities - the projections of the velocities of these same points after interaction $v'_{1x}, v'_{1y}, v'_{1z}, v'_{2x}, v'_{2y}, v'_{2z}$. Thus, the ten equalities of type (1), discussed above, constitute **a system of ten equations containing only six unknowns.** This system of equations must have a solution (and a unique one at that). It is therefore clear that of the ten equations only six are independent, i.e. of the functions (7) only six are functionally independent.

The function $\boldsymbol{f}$ is one of the six independent functions, and whatever the other five functions in this six are, at least one second derivative will not be included in it - after all, among the ten functions (7) there are six second derivatives. Our further reasoning does not depend on which specific second derivative is the dependent function - let it be, for example, $\frac{\partial^2 f}{\partial v_x \partial v_y}$ - and on which specific five derivatives are among the six independent ones - let it be, for example $f, \frac{\partial f}{\partial v_x}, \frac{\partial f}{\partial v_y}, \frac{\partial f}{\partial v_z}, \frac{\partial^2 f}{\partial v_x \partial v_z}, \frac{\partial^2 f}{\partial v_y \partial v_z},$. This means that there is a function

$$\frac{\partial^2 f}{\partial v_x \partial v_y}=F\left(f,\frac{\partial f}{\partial v_x},\frac{\partial f}{\partial v_y},\frac{\partial f}{\partial v_z},\frac{\partial^2 f}{\partial v_x \partial v_z},\frac{\partial^2 f}{\partial v_y \partial v_z}\right).$$

Due to the additivity of all functions under consideration, F can only be a linear function with coefficients that do not depend on the sought velocities [11)], i.e.

$$\frac{\partial^2 f}{\partial v_x \partial v_y}=\alpha_1 f+\alpha_2\frac{\partial f}{\partial v_x}+\alpha_3\frac{\partial f}{\partial v_y}+\alpha_4\frac{\partial f}{\partial v_z}+\alpha_5\frac{\partial^2 f}{\partial v_x \partial v_z}+\alpha_6\frac{\partial^2 f}{\partial v_y \partial v_z} \quad (8)$$

Recalling now that, due to considerations related to the isotropy of space, the function f can depend only on the modulus **v** , i.e. has the form $f(m,|\vec{v}|)$, we calculate the derivatives, where i , k = x , y , z ,

$$\begin{cases} \dfrac{\partial f(m,|\vec{v}|)}{\partial v_i}=\dfrac{\partial f(m,|\vec{v}|)}{\partial|\vec{v}|}\cdot\dfrac{\partial|\vec{v}|}{\partial v_i}=\dfrac{\partial f}{\partial|\vec{v}|}\cdot\dfrac{v_i}{|\vec{v}|} \\ \dfrac{\partial^2 f(m,|\vec{v}|)}{\partial v_i \partial v_k}=\dfrac{v_i v_k}{|\vec{v}|^2}\cdot\left(\dfrac{\partial^2 f}{\partial|\vec{v}|^2}-\dfrac{\partial f}{\partial|\vec{v}|}\cdot\dfrac{1}{|\vec{v}|}\right);(i\neq k) \\ \dfrac{\partial^2 f(m,|\vec{v}|)}{\partial v_i^2}=\dfrac{1}{|\vec{v}|}\cdot\dfrac{\partial f}{\partial|\vec{v}|}+\dfrac{v_i^2}{|\vec{v}|^2}\cdot\left(\dfrac{\partial^2 f}{\partial|\vec{v}|^2}-\dfrac{\partial f}{\partial|\vec{v}|}\cdot\dfrac{1}{|\vec{v}|}\right)\end{cases} \quad (9)$$

Here it is taken into account that $\frac{\partial|\vec{v}|}{\partial v_i}=\frac{\partial\sqrt{v_x^2+v_y^2+v_z^2}}{\partial v_i}=\frac{v_i}{\sqrt{v_x^2+v_y^2+v_z^2}}=\frac{v_i}{|\vec{v}|}$. From equality (9) it follows that the left-hand side of equality (8) contains the factor $v_x v_y$; at the same time, none of the terms on the right-hand side of equality (8) contains such a factor. Therefore, equating the coefficients of the terms containing $v_x v_y$ on the left and right in equality (8) , we obtain

$$\frac{\partial^2 f}{\partial|\vec{v}|^2}-\frac{1}{|\vec{v}|}\cdot\frac{\partial f}{\partial|\vec{v}|}=0 \quad (10)$$

(here comes the mass)

The solution to which is:

$$f=a(m)\left(v_x^2+v_y^2+v_z^2\right)+b(m) \quad (11)$$

Thus, from requirements 1 °-3 ° it follows that if there exists a scalar measure of motion, $f(m,|\vec{v}|)$ then it has the form (11) and that then there is a vector measure of motion ***q*** : $q_i=2a(m)v_i$, where i = x , y , z or in vector notation

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11) Indeed, from the previous reasoning it follows that $\left(\frac{\partial^2 f}{\partial v_x \partial v_y}\right)_c=F\left[f,\left(\frac{\partial f}{\partial v_x}\right)_c,\left(\frac{\partial f}{\partial v_y}\right)_c,\left(\frac{\partial f}{\partial v_z}\right)_c,\left(\frac{\partial^2 f}{\partial v_x \partial v_z}\right)_c,\left(\frac{\partial^2 f}{\partial v_y \partial v_z}\right)_c\right]$; the index c indicates that the functions are calculated for the system as a whole, for example: $f_c=f(m_1,v_1)+f(m_2,v_2)$, $\left(\frac{\partial f}{\partial v_x}\right)_c=\frac{\partial f(m_1,v_1)}{\partial v_{1x}}+\frac{\partial f(m_2,v_2)}{\partial v_{2x}}$. Since is also represented by a similar sum, the function $\left(\frac{\partial^2 f}{\partial v_x \partial v_y}\right)_c$ F must also have this property , and this is possible only under the condition that F is linear in all arguments and the coefficients α do not depend on the velocities.

$$\vec{q}=2a(m)\vec{v} \quad (12)$$

In classical mechanics, ***f is normalized*** so that *b (m) = 0* and *a (m) = m /2* .

2.(Continued by Sha S.V.)

The number of possible functions **is ten** :

$$f,\frac{\partial f}{\partial v_x},\frac{\partial f}{\partial v_y},\frac{\partial f}{\partial v_z},\frac{\partial^2 f}{\partial v_x^2},\frac{\partial^2 f}{\partial v_y^2},\frac{\partial^2 f}{\partial v_z^2},\frac{\partial^2 f}{\partial v_x \partial v_y},\frac{\partial^2 f}{\partial v_x \partial v_z},\frac{\partial^2 f}{\partial v_y \partial v_z} \quad (7).$$

Number of variables $v'_{1x},v'_{1y},v'_{1z},v'_{2x},v'_{2y},v'_{2z}$ **six** ,
and for equations of type (8)

$$\frac{\partial^2 f}{\partial v_x \partial v_y}=\alpha_1 f+\alpha_2\frac{\partial f}{\partial v_x}+\alpha_3\frac{\partial f}{\partial v_y}+\alpha_4\frac{\partial f}{\partial v_z}+\alpha_5\frac{\partial^2 f}{\partial v_x \partial v_z}+\alpha_6\frac{\partial^2 f}{\partial v_y \partial v_z}$$ **three** .

So, 10-6-3=1.
Therefore, we will try to find one more equation.

In searching for equations satisfying (8) , we equated terms with the same velocity components, for example, $v_x v_y$.
Now we note that in the third equation of system (9) there is a term with v_i^2, summing over all i={x,y,z}, we reduce it to v^2.
Thus we obtain the equation:

$$\sum_{i=x,y,z}\frac{\partial^2 f}{\partial v_i^2}+\alpha f=\beta \quad (13)$$

(where α,β are constants). The constant β is unimportant, you can always replace it f with $f+const$, zeroing out β. Therefore, we will write 0 instead of β.
Substituting the values of the derivatives (9) in (13):

$$\frac{\partial^2 f}{\partial|\vec{v}|^2}+\frac{2}{|\vec{v}|}\cdot\frac{\partial f}{\partial|\vec{v}|}+\alpha f=\beta \quad (14)$$

$$\frac{\partial^2 f}{\partial|\vec{v}|^2}+\frac{2}{|\vec{v}|}\cdot\frac{\partial f}{\partial|\vec{v}|}+\alpha f=0 \quad (15)$$

His solution:

$$f=C_1\cdot\frac{\exp\left(-\sqrt{-\alpha}|\vec{v}|\right)}{|\vec{v}|}+C_2\cdot\frac{\exp\left(\sqrt{-\alpha}|\vec{v}|\right)}{|\vec{v}|} \quad (16)$$

Where C_1 and C_2 are constants.
This is **a new measure of motion** that generates a new conservation law. Let's study it. To do this, let's look closely at equations (10) and (15) . In one case, you can remove the 2nd derivative, in the other, the 1st, and you can also play with the coefficient α.

Both Newton's laws and the new measure of motion follow from Galileo's principle of relativity. Newton's laws alone (and similar Theories of Relativity by

Einstein) are an incomplete system of equations for Galileo's principle of relativity, they lead to the disintegration of matter particles upon collision and do not preserve their material pointness. Only with Newton would matter be scattered throughout space. But Newton and the new measure of motion are already a complete system for Galileo's principle of relativity, and should ensure the existence of particles.

2.1 Langrangian

System of equations (10) and (15) of course, do not have common solutions. But if a particle tries to satisfy both of them, then it strives to choose the place where the values of the functions and their derivatives in these equations will differ the least. Ideally, it will choose the point in phase space where they coincide.

From a mathematical point of view (10) and (15) are not a system of independent equations. This is not a system at all. The problem is to find the final velocities, and their solution lies outside the solution domains (10) and (15). In equation (10) and (15) are obtained as functionally independent. Their solution domain is not **the intersection of** the solution domains of each individual one. To obtain the solution domain of the original problem, it is necessary **to combine** the solution domains (10) and (15). (See (7) and a paragraph of explanation further on.)

This can explain the subtraction and addition of equations. (10) and (15) in ch. **2** .

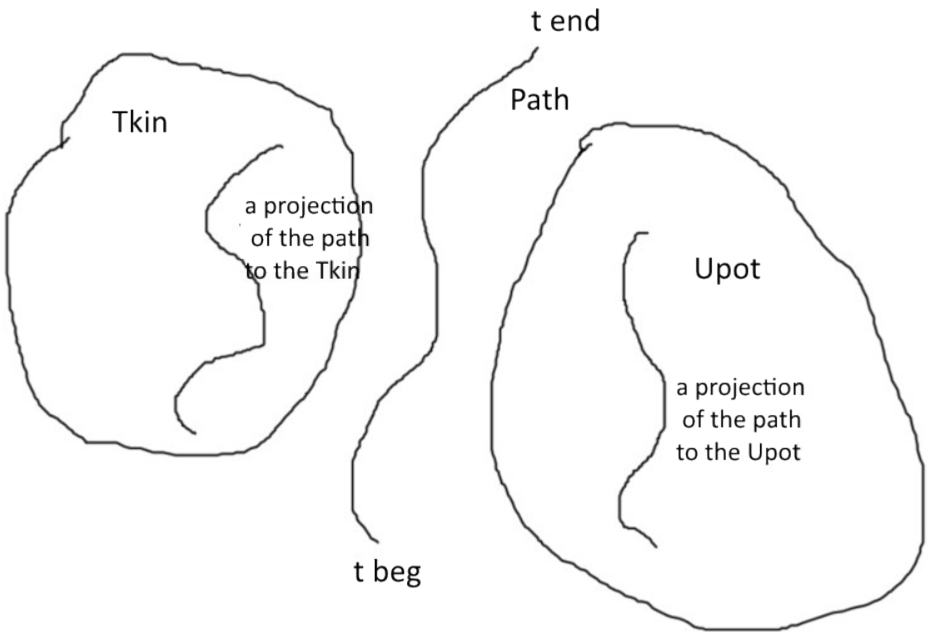
If areas (10) and (15) do not intersect. It is better to look for the points of their greatest convergence. (Or you can choose any you want.)

Finding the minimum difference between equations (10) and (15) substantiates the principle of the optimal path in variational analysis, from which follows the principle of least action of Lagrange with his Lagrangians. And that the Lagrangian is equal to the difference between the kinetic and potential energies.

Let us consider a set of material bodies. Their total measure of motion is represented by the sum of kinetic energies $T_{kin}=\sum_i f(|\vec{v}_i|)$from the equation (10). These bodies interact via particle fields (PF). In order to ignore PF, their action must be expressed via potential fields dependent on radius vectors. To do this, we introduce $\vec{r}=\vec{v}*$ (average lifetime of PF) , and average$\vec{r}$ to the radius vectors between material bodies. Thus, we introduce a potential field $U_{pot}=\sum_i f(|\vec{r}_i|)$, where f is taken from equation (15) .

Value domains (10) and (15) do not intersect. In order to be able to work with these equations simultaneously, it is necessary to find the minimum difference T_{kin} and U_{pot}on some trajectory of movement of material bodies.

That is, find the minimum $\int_{t_{beg}}^{t_{end}} (T_{kin} - U_{pot}) dt$, where t is time. This is the Maupertuis-Lagrange principle (least action).



Explanation of gauge invariance:

In case the potential energy Upot has two different minimum values, but they give the same contribution to the Lagrangian, then one potential can be represented plus the difference to the second, which will correspond to one second potential. This difference is expressed as another field, by which one can search for one's particles.

2.2 Canonical Gibbs distribution

Let's look for **other laws** using conserved functions.
Thermodynamic potentials do not take into account the kinetic energy of the entire object. That is, kinetic energy is removed from the total energy. Let's try to act similarly.
we subtract (10) from equation (15) , we get: $\frac{\partial f}{\partial |\vec{v}|} \cdot \frac{3}{|\vec{v}|} + \alpha f = 0$,
integrating it, we get:

$$f = C \cdot \exp\left(-\frac{\alpha}{6} \cdot |\vec{v}|^2\right) \quad (17)$$

, where C is a constant. Equation (17) closely resembles **the statistical distribution (canonical Gibbs distribution)** if α is inversely proportional to temperature.
Also formula (17) is a solution to equation (15) at $|\alpha| \ll 1$.

When adding equations with different coefficients α, the average value of the new α is obtained. That is, the minimum α cannot decrease, and the maximum cannot increase. Which justifies the 2nd Law of Thermodynamics.

To explain the transition from equation (17) in the form of a dynamic law to statistical distribution I quote from:
Landau L.D., Lifshitz E.M. - Theoretical Physics. Volume 05 of 10.
Statistical Physics. Part 1, 2002, 5th ed.
Page 23.

§ 3. Liouville's theorem
Let us return to further study of the properties of the statistical function distribution. Let us assume that we observe for a very long time a long period of time some subsystem. Let's divide this a very long period of time (in the limit, infinite) the number of identical small intervals separated by moments in time t1, t2,... At each of these moments the subsystem under consideration will be represented in its phase space by a point (let's call these points A1, A2, A3...). The set of obtained points will be distributed in the phase space with a density that is proportional in the limit in each given place the value of the distribution function p(p,q), by its very meaning the latter, as determining the probability of various states subsystems.

Instead of considering points representing the states of one subsystems at different moments of time t1,t2,..., can be formally thus introduce into consideration simultaneously a very large (in the limit - infinite) number of identically arranged subsystems 1) located at some point in time (say, t = 0) in states represented by points A1, A2,...

1) Such an imaginary set of identical systems is usually called statistical ensemble.

So it is not necessary to consider statistical laws as functions distributions - can also be dynamic.

The sum of the exponents of v [2 is preserved], and no matter how v changes, the sum will be preserved. And this leads to the Gibbs distribution.

2.3 Wave equations (quantum mechanics)

Just as when obtaining the Hamiltonian, the Lagrangian is subtracted from the doubled kinetic energy, let's try to play with doubling.
we add double (10) to equation (15) , we get :

$$3\frac{\partial^2 f}{\partial|\vec{v}|^2}+\alpha f=0 \qquad (18)$$

This is the equation of a simple oscillator. Integrating it, we get:

$$f=C_1\cdot\sin\left(\sqrt{\frac{\alpha}{3}}|\vec{v}|\right)+C_2\cdot\cos\left(\sqrt{\frac{\alpha}{3}}|\vec{v}|\right) \qquad (19)$$

Thus we obtained wave equations similar to those used in **quantum mechanics** . Applying the Fourier series expansion to the coordinate (for example, x), we obtain:

$$f=C_1\cdot\sin\left(C_3 v_0\left(x+C_4\right)\right)+C_2\cdot\cos\left(C_3 v_0\left(x+C_4\right)\right) \qquad (20)$$

where v_0 characteristic value of the velocity, for example the period if f is periodic. Which certainly shows the wave properties.
Note that $v_0 x$ is not a scalar product, but a multiplication of the modulus of v_0 and x as coordinates. C_4 gives rise to the trembling of elementary particles and relativism, which were predicted by Schrödinger .
Let's drive C_4 into x . We get:

$$f=C_1\cdot\sin\left(C_3 v_0 x\right)+C_2\cdot\cos\left(C_3 v_0 x\right) \qquad (21)$$

Remembering how we got it from (1) equation (5) , we can take into account (17) and consider that $\frac{\alpha}{6}\cdot|\vec{v}|^2$ it can express kinetic energy, and therefore the Hamiltonian. Then, expanding in a Fourier series over time, and multiplying with the Fourier series over the coordinate, we obtain the wave equation:

$$C_1 e^{C_2 v_0 r-C_3 H t+C_4} \qquad (22)$$

what is the wave function of particles in quantum mechanics. C_1, C_2, C_3, C_4 are constants.
expansion into a Fourier series in r and in t is made for reasons of coincidence of dimensions.

Taking partial derivatives in one case with respect to time, and in the other with respect to the coordinate, we obtain the Shroed Önger equation and an expression for the momentum operator as a partial derivative with respect to the coordinate. The expression for the momentum coincides with Quantum Mechanics only if the

Hamiltonian does not depend on the coordinate. Otherwise, there is also a derivative with respect to the coordinate of H t.
We get Shredder :

$$\Psi = C_1 e^{C_2 v_0 r - C_3 H t + C_4} \tag{23}$$

And

$$\frac{\partial \Psi}{\partial t} = -C_3 H \Psi \tag{24}$$

For impulse:

$$C_2 v_0 r = C'_2 P r \tag{25}$$

And

$$\frac{\partial \Psi}{\partial r} = C'_2 P \Psi - C_3 t \frac{\partial H}{\partial r} \Psi \tag{26}$$

Here we consider the general case. Specifically for quantum mechanics we should use not just Ψ, but a complex square $\Psi^* \cdot \Psi$. I explain this using the torsion theory. There, the field particles move along a closed trajectory in the form of a torus. A closed motion can be created using another field, the particles of which fly away radially from the center. But such a field would quickly dissipate all the energy of the torsion particle. A way out of this situation is possible if we introduce an additional field, which is also a torsion field, but with some shift or be slightly asymmetric to the main field. This new field should interact with the main one, and vice versa. Then the energy of the torus particle would not evaporate. The general behavior of these fields was described as $\Psi^* \cdot \Psi$, where $\Psi$is the main field, and $\Psi^*$is the new (asymmetric) one. This explanation is proposed in my work " 02. OTVS - General Theory of All Forces ":

In other words, each particle must have two torsion fields so that the particles of these fields do not fly away from the center to infinity and do not "evaporate" the particle. One field creates a centripetal force for the other. And vice versa. Since these fields do not coincide, it is necessary to introduce not a simple square of the field amplitudes, but a complex one. Complexity explains the phase shift of these fields in space and time. Which determines their distinguishability.

This explains why the wave function in quantum mechanics must be squared.

This suggests the need for 2 fields in the form of Electric and Magnetic.

Oh! Found where the second field is hidden!

These are the outer turns (one field) and the inner ones in the core (another field). Now both the complex conjugacy is explained, and the calculation of macro-parameters: why, for example, the impulse is the product of the core field by the impulse operator and by the external field of the particle. Simply, the external field must be adjusted to the internal one. This is what determines the impulse operator in the middle of the brackets.

It is also proposed to describe quantum gravity through $\Psi^{*2} + \Psi^2$:

- The mass of the body is determined by the interaction of the torus core and the outer turns.

- Gravitational mass is determined by the same thing, taking into account the asymmetry of attraction and repulsion.

- For the closure of torsion fields, another such field is required, only with a shift. Therefore, in ordinary quantum mechanics, they take into account $\int \Psi_1^* \cdot \hat{f}\, \Psi_2$

And in quantum gravity, fields Ψ^* *interact* Ψ *to bend each other's trajectories, but these fields affect the interactions of torsion particles separately. That is, it would be necessary to apply*

$$\int \left(\widehat{f_1^*} \Psi_1^* \cdot \widehat{f_2^*} \Psi_2^* + \widehat{f_1} \Psi_1 \cdot \widehat{f_2} \Psi_2 \right) \qquad (27)$$

. This can be confirmed by the Taylor series, in which an asymmetric term is followed by a symmetric one (and then an asymmetric one again, etc.).

One more remark. At the very beginning, when we calculated the Hamiltonian as the sum of twice the kinetic energy (10) and Lagrangian (15) , then in fact potential energy was added to the doubled classical kinetic energy. That only potential energy was added can be explained through Einstein's Lagrangian (described in the next paragraph), but Einstein does not have kinetic energy. Adding, or more precisely, multiplying by a term $C_1 e^{-C_3 H t}$ is analogous to gauge invariance. In particular, therefore the Hamiltonian is more or less constant over time.

By the way, the Heisenberg uncertainty and the Fourier series are proved by the same algorithm. This confirms the approach to Quantum Mechanics through Fourier.

It is immediately clear that Schrödinger cannot live without Newton, and this demonstrates the incompatibility of quantum mechanics with the theories of relativity.

2.3.2 , The connection of the Fourier series in Schrödinger with the generation of the constancy of the speed of light.

In fact, when C $_{4 \text{ was dropped}}$ in equation (20)
$f = C_1 \cdot \sin\left(C_3 v_0 \left(x + C_4\right)\right) + C_2 \cdot \cos\left(C_3 v_0 \left(x + C_4\right)\right)$
and similarly for H(t+C $_5$) C $_5$ was discarded this should have led to a shift in space and time, which in standard calculations for magnetic and electric fields leads to the constancy of the speed of light and to the concept of spin. This is how quantum mechanics needs to be improved. This also describes the trembling of elementary particles, predicted by Schrödinger .

2.4 Einstein's STR

From Galileo's principle of relativity, the limitation of the speed of light cannot be obtained. But nonlinearity can be added.

For example, let us consider the case when the factor $\frac{1}{|\vec{v}|}$in the term $\frac{\partial f}{\partial|\vec{v}|}\cdot\frac{2}{|\vec{v}|}$is conditionally constant, $\approx\frac{1}{|\vec{v}_0|}$, where $\vec{v}_0$is conditionally constant **.**

This case can be justified by the fact that the particle consists of subparticles. We divide the time motion of these subparticles into intervals, and assuming that at the end of each interval the interaction is switched off, and at the beginning of the next one it is switched on, we obtain the case when f corresponds to the conditions of this article. We simplify the model to 2 particles moving with velocities $\vec{v}_0+\vec{u}$and $\vec{v}_0-\vec{u}$, where $\vec{v}_0$is the velocity of the center of mass, and $\vec{u}$is the relative velocity.
(for brevity, we will not write the vector sign and the absolute value function, but $v\approx v_0$, where $v$is the variable)
Let's expand u(const) into a Taylor series up to the 2nd order :

$$f(v_0)=f(v\pm u)=f(v)\pm\frac{\partial f(v)}{\partial v}\cdot u+\frac{\partial^2 f(v)}{\partial v^2}\cdot\frac{u^2}{2};$$

$$\frac{\partial f(v_0)}{\partial(v_0)}=\frac{\partial f(v\pm u)}{\partial(v\pm u)}=\frac{\partial f(v)}{\partial v}\pm\frac{\partial^2 f(v)}{\partial v^2}\cdot u;$$

$$\frac{\partial^2 f(v_0)}{\partial(v_0)^2}=\frac{\partial^2 f(v\pm u)}{\partial(v\pm u)^2}=\frac{\partial^2 f(v)}{\partial v^2}.$$

Substituting these Taylor series into equation (15) and summing them up, we obtain:

$$\frac{\partial^2 f(v_0)}{\partial v_0{}^2}+\frac{2}{v_0}\cdot\frac{\partial f(v_0)}{\partial v_0}+\alpha\cdot f(v_0)=0$$

$$\frac{\partial^2 f(v)}{\partial v^2}\cdot\left(1+\frac{\alpha}{2}\cdot u^2\right)+\frac{2}{v_0}\cdot\frac{\partial f(v)}{\partial v}+\alpha\cdot f(v)=0.$$

Discarding the terms comparable and less than u^2, we obtain:

$$\frac{\partial^2 f(v)}{\partial v^2}+\frac{2}{v_0}\cdot\frac{\partial f(v)}{\partial v}+\alpha\cdot f(v)=0 \tag{28}$$

.

The solution to which is:

$$f=const_1\cdot\exp\left(\frac{+\sqrt{1-\alpha\cdot v_0^2}}{v_0}\cdot v\right)+const_2\cdot\exp\left(-\frac{\sqrt{1-\alpha\cdot v_0^2}}{v_0}\cdot v\right) \tag{29}$$

. Taking into account $v\approx v_0$, and substituting $\alpha=\frac{1}{c^2}$, we get

$$f = const_1 \cdot \exp\left(+\sqrt{1-\frac{v^2}{c^2}}\right) + const_2 \cdot \exp\left(-\sqrt{1-\frac{v^2}{c^2}}\right) \qquad (30)$$

,
which is very close to Einstein's formulas of special relativity.

The same formulas are obtained when the constituent particles rotate at speeds much greater (and not just less) than the center of mass $|\vec{u}| \gg |\vec{v}_0|$.

If (30) is used in constructing the Lagrangian, then, firstly, the exponent can be ignored, since it is a monotone and smooth function, and secondly, (30) is included as potential energy, recall: Lagrangian = kinetic energy minus potential. In this Lagrangian, kinetic energy is not taken into account, but only potential energy with a minus is taken into account. Because of this minus, it is necessary to look for not the minimum, but the maximum of the integral along the path of the particle. This is done in "Field Theory" (see Landau-Lifshitz, volume 2, "Field Theory").

In the section "Einstein's Special Relativity" the energy, possibly potential, is obtained, which differs from the famous $E=mc^2$exponent. The exponent is easily converted into sines/cosines. If we take into account the explanations of Lagrangian in section 2.1, then the sines from can fall into the least action mc^2. It is quite possible that at some angles the difference between kinetic and potential energy can be even smaller than without angles. Thus the famous Lagrangian correction for can appear $\sin(28^o)$. 28^overy close to 30^o, and hence the confirmation of the arrangement of quarks in the form of a regular triangle, as in the article "Fields and Particles". There the proton is represented by a regular triangle of quarks.

Conditional constancy $v_0$explains why STR is only applicable to coordinate transformations and is weak for dynamics.

Note that the calculations were performed with the interaction of subparticles disabled, and therefore the resulting formulas do not violate Galileo's principle of relativity.

The incompatibility of quantum mechanics (QM) and Einstein's special theory of relativity (STR) is justified as follows: the Lagrangian in QM contains only the kinetic term, and the entire STR is an expression of all matter through potential energy. So it turns out that since the Lagrangian = kinetic energy - potential energy, then since
the Lagrangian of QM = only kinetic energy, and for me it is exp(momentum *

coordinate), the Hamiltonian is constant and can be ignored.
And the Lagrangian of STR = - potential energy. That is, = -exp(mc ^{2}).

And pure kinetic energy is incompatible with pure potential energy.

That QM is incompatible with STO.

The speed is limited by the speed of light only for complex objects. Which consist of something. Like a nucleus of protons and neutrons, like protons and neutrons of quarks, etc.
But simple particles should easily overcome the speed of light. This can explain Hyperinflation, when the expansion of the Universe was going on at a huge speed. Much greater than the speed of light.

In quasars (black holes) time dilation is not observed in the brightness of flares at cosmological distances. This is explained by the fact that when a quasar absorbs another cosmic object, its particles disintegrate into single subparticles and STR does not work. But in supernovae, during flares, particles do not disintegrate into single subparticles, therefore time dilation is visible and STR works.

2.5 Justification of QED and QFT

(QED stands for Quantum Electrodynamics and QFT stands for Quantum Field Theory.)

To extend Quantum Mechanics to Einstein's STR, we must somehow substitute equation (30) into the Lagrangian. (Let's denote the right-hand side of this equation as E.) Note that at low velocities v, the exponent of E is close to $1 \pm \sqrt{1-\frac{v^2}{c^2}} = 1 + const\, T_{kin}$, where T_{kin} is the kinetic energy. But E is a description of potential energy, not kinetic energy, and we cannot obtain mass from it. Therefore, E is a Taylor series of T_{kin} at m=0. We obtain a series of interacting virtual particles. Let's represent the total potential energy as E + U_{pot}', and T_{kin} (at m # 0) = 0. In this case, in order for the particles to satisfy both E and U_{pot}, we must take the minimum of E - U_{pot}, since the solutions for E and U_{pot} are different.

Then we get the Lagrangian L = E - U_{pot}.

But E is a certain Taylor series of T_{kin} at m=0. We obtain series of creation and annihilation of virtual particles. (We immediately note that these series converge, since they are generated by the exponentials in the equation (30) and there is no need to suffer, as in QED and QFT.)

Because in (30) two exponents with arguments of different signs, then both particles and antiparticles are obtained ; and their birth and death both before and after the start of the interaction.

This is the basis for QED and QTP.

If you want to calculate the mass of your particle, then take the Lagrangian: $L = T_{kin}$ (at m#0) – ($E + U_{pot}$), but do not forget to change the sign of E.

2.6 Yukawa potential of the strong interaction

If we multiply the lifetime of a pion by its speed, we get the distance **r** interaction of nucleons. Its potential is obtained by replacing the velocity **v** on **r** in the first term of equation (16)

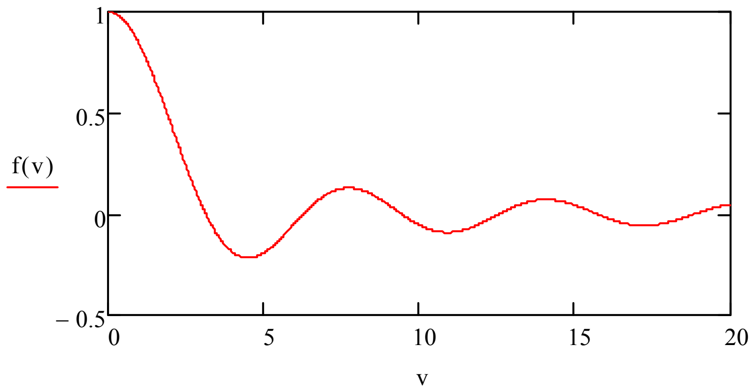
$$f = const \cdot \frac{\exp\left(-\sqrt{-\alpha}\, r\right)}{r} \qquad (31)$$

This is exactly in line with Yukawa's potential.

2.7 Graphs of equation (16)

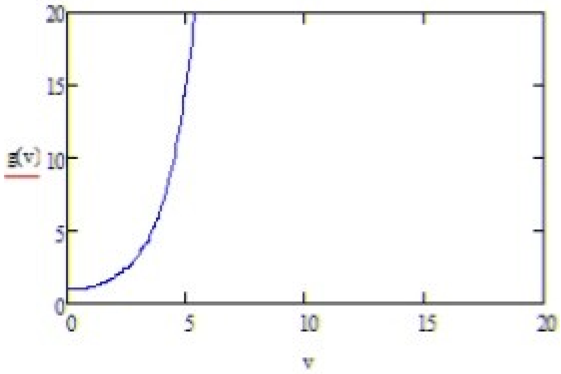
at:

a=1, f(0)=1, f'(0)=0

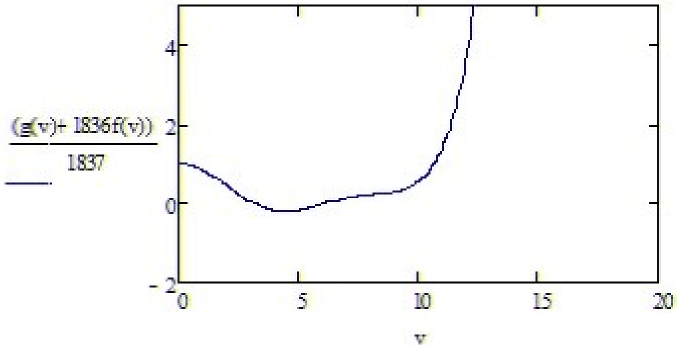


at:

a= -1, g(0)=1, g'(0)=0



Let's add these two graphs with coefficients proportional to the masses of the electron and proton: (g(v)+1836*f(v))/1837:



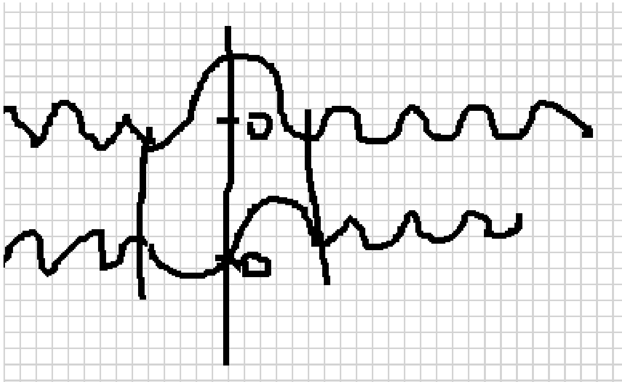
(this resembles the Higgs potential). If we take into account the Higgson lifetime, then the speed on the graph will be transformed into the radius of action. And no scalar fields (new ethers) are needed. Everything is determined by the internal structure of elementary particles. In this case, the proton and the electron. And from this it follows that there is no Higgson. This also happens. There are no particles in the thermodynamic distribution.
And since there is no Higgs boson, this function should not be potential energy from r, but kinetic energy from v. There should be a minimum in kinetic energy not only at v=0.

In short, I don't know how to explain it, it feels like the particle is there, but in reality it isn't. It's a joke particle.
Well, indeed, if Higgson were a particle, then time would be needed for its birth, action and decay. Kinetic processes would be discrete and jerky. The mass would jerk. And as a consequence, Galileo's principle of relativity would not be fulfilled, from which it all began.

Friends!
A discovery has been made in calculations on quantum mechanics, confirming my method for obtaining the Higgs Field: https://nplus1.ru/news/2023/03/15/EDFT

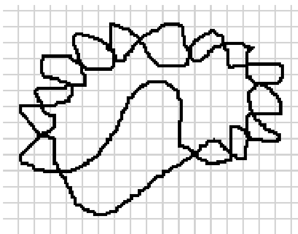
And from equation (16) it follows that at the zero of the velocity the zero of the function is lost, if it were strictly periodic. This can be interpreted as a loss of π in phase. In the wave function this is interpreted as a spin of 1/2. And bosons are obtained in the form of derivatives, and their losses are already 2 π, and the spin is equal to 1.

On the top graph is a fermion, and on the bottom is a boson as its derivative:



Why fermions with spin ½ have to make 2 revolutions to completely return to their original state is shown in the figure. In one revolution, the central maximum turns into a minimum and, due to the phase shift, the maxima turn into minima, and the spin +1/2 into -1/2.

In fact, there should be an even number of half periods for half the total wave function. Which is what happens. Plus a half period on a loss of 0.



If we consider not 2, but 3 or more particles, then nothing significant in 3-dimensional space is obtained. With 3 particles, we get 4 terms of the form (16) with 4 constants. When a larger number of particles collide, there will be even more such components, but their general form will be the same.

On the dimensionality of space. When equation (15) was obtained from (9) and (13), then in n- dimensional space we would obtain the equation:

$$\frac{\partial^2 f}{\partial|\vec{v}|^2}+\frac{n-1}{|\vec{v}|}\cdot\frac{\partial f}{\partial|\vec{v}|}+\alpha f=0 \qquad (32)$$

And to obtain the Hamiltonian, as in the derivation of "2.3 Wave Equations", it would be necessary to subtract the Einstein Lagrangian from n-1 kinetic energy. And since n-1 is equal to 2 everywhere , the space is 3-dimensional. (True, the potential energy is a bit of a bummer, but it is also a bummer in STR.)

Also, if we take n not equal to 3, then Einstein's STR, Quantum Mechanics and the Gibbs distribution do not work at all.

I don't remember who, but one of the wise ones said that all potential energy should be reduced to kinetic energy. And so it was reduced.

It seems that the space outside the universes is filled with some kind of matter, possibly ether. So the universes absorb this matter and process it through "Big Bangs", Collapses and Explosions. Maybe these are the Remnants of other universes, or maybe it has always been like this.

Conclusion: If everything comes from Galileo's Principle of Relativity, then why is it so important?

And it is important because Space is the same in all directions and at all speeds. It is also unlimited by anything. Therefore, Space is Emptiness. And, as a trifle, this proves that there is no ether.

On the other hand, they claim that to define Space, it is necessary to establish material reference points in it, but then it will be possible to establish whether one body moves relative to another or vice versa, and this contradicts Galileo's Principle of Relativity. And therefore, Space exists separately from matter. After all, it is always possible to determine whether a material point is attached to a point in Space. In the same way, with ether, it is possible to establish whether it moves or not. Therefore, refuting this, Galileo's Principle of Relativity sets the Principles of Space and Matter, and rejects ether.

Also, equation (16) can have an infinite value at zero v. This can explain, on the one hand, hyperinflation, when the expansion speed became enormous at the Big Bang; and on the other hand, the Heisenberg uncertainty principle in quantum mechanics, when a particle cannot be at rest (that is, when the momentum and coordinate are simultaneously determined). There is a third case, when, at zero speed, equation (16) can have a negative infinite value, then everything can stop and stick together into a point.

Let us consider the complete equation (14) $\frac{\partial^2 f}{\partial|\vec{v}|^2}+\frac{2}{|\vec{v}|}\cdot\frac{\partial f}{\partial|\vec{v}|}+\alpha f=\beta$ at $\alpha=0$. His solution :

$$f=const_1\left(\frac{1}{|\vec{v}|}+2\beta|\vec{v}|\right)+const_2 \tag{33}$$

And this already resembles the potential of the gluon field. Here is the article:

http://nuclphys.sinp.msu.ru/students/quarks/index.html

It is interesting that (33) is obtained from (14) when $\alpha=0$, and $\alpha=\frac{1}{c^2}$, when deriving Einstein's STR. It is quite possible that the gluon field can propagate at a superluminal speed.

2.8 Rotation and isotropy of space

In fact, what is needed here is an understanding of time, and this does not exist even in mathematics yet.

2. 9 Generated Conservation Laws.

Equation (10) does not contain a function, and its derivatives generate new conservation laws: $\frac{\partial^2 f}{\partial|\vec{v}|^2}-\frac{1}{|\vec{v}|}\cdot\frac{\partial f}{\partial|\vec{v}|}=0$

f – classical kinetic energy and its conservation;

$\frac{\partial f}{\partial\vec{v}}$- classical impulse and its conservation;

$\frac{\partial^2 f}{\partial\vec{v}^2}$- classical mass and its preservation.

But in equation (14) $\frac{\partial^2 f}{\partial|\vec{v}|^2}+\frac{2}{|\vec{v}|}\cdot\frac{\partial f}{\partial|\vec{v}|}+\alpha f=\beta$

taking into account: $\frac{\partial f}{\partial v_x}=\frac{\partial f}{\partial|\vec{v}|}\cdot\frac{d|\vec{v}|}{d v_X}=\frac{\partial f}{\partial|\vec{v}|}\cdot v_x$

Let's calculate the "pulses" of this equation:

$$\frac{\partial f}{\partial|\vec{v}|}\cdot\vec{v}=const_1\cdot f\cdot\left(const_2-\frac{1}{|\vec{v}|}\right)\cdot\vec{v} \qquad (34)$$

And so on.

The function f , the derivative and the second derivative are interconnected via (14) . In addition, for the derivatives of the third and higher, there is a repetition of dependencies, only the number of terms and constants is doubled. Therefore, the generation of new conservation laws does not occur.