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On the Way to the Next Stage of Mechanics

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Abstract: *The results of real experiments according to the Wheeler scheme prove the influence of the future on the behaviour of elementary particles in the present. Interpretation of the results of experiments based on ideas about the interaction of bodies in time leads to the following conclusions: 1. the force of inertia corresponds to the general definition of force as a measure of interaction. 2. Newton's second law becomes a consequence of the third, 3. The problem of correspondence between gravitational and inertial mass has been solved, 4. General expressions for the force of inertia leading at low speeds to the classical formulas of accelerated and circumferential motion are given. Within the framework of the developed method, an expression is given for the force of interaction, which takes on a real value when the body moves at a speed exceeding the speed of light. The expression for this force differs in sign from the force of inertia. A hypothesis is put forward that the nature of such forces is a temporary interaction of charge. In this case, the application of Einstein's formula for a moving mass organically explains the existence of charges of different signs.*
Modulo, both forces are equalized in a range of speeds close to the speed of light. It is supposed to use the adopted approach to describe the nature of elementary particles.
Keywords: *force of inertia; type of interaction; Wheeler's experiment*

I. Introduction

Many problems in physics arose because the time included in the Minkowski space received unequal rights. A favourite idea of physicists, symmetry, should have been considered regarding the time coordinate. It was seen as a segment ending in the present moment. The impact of the future has never been taken seriously. As a result, a stalemate has formed.

The analysis is based on two facts:

1. Over the past decade, real experiments have been carried out according to the Wheeler scheme [1], which have confidently proved the influence of the influence of the future on the behaviour of elementary particles in the present [2..10]. This circumstance radically changes the foundations of physics (mechanics), built on the prediction of the future by the current state of any system and the equations that model its behaviour in time.
2. Newton's fundamental second law equates the force (measure of interaction) and the kinematic parameters of motion. The logical inconsistency of such a conclusion was clear to Newton, who conducted experiments comparing gravitational and inertial mass.

When the concepts of mechanics are extended into the relativistic domain, the force of inertia is also not considered an interaction force. For accelerated motion, its value can be determined by Einstein's formulas:

With an increase in the velocity of the body from v to v + Δv in the case when v" c, a change in mass of the body

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$$\Delta m = m_0\left(\frac{1}{\sqrt{1-\frac{(v+\Delta v)^2}{c^2}}} - \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}\right) \approx \frac{m_0 v \Delta v}{c^2} \quad (1)$$

We get an increment of energy using the relationship between energy and mass.

$$\Delta E = m_0 v \Delta v \quad (2)$$

Given that this energy is equal to the work of the force F on the path vΔt, we obtain the classical expression for the force of inertia.

$$F = \frac{m_0 \Delta v}{\Delta t} \quad (3)$$

Currently, it is postulated that inertial and gravitational masses are different. To determine their compliance, subtle, expensive experiments are carried out [14,15].

The article attempts to describe the temporal interaction of the states of physical bodies in time. The concept of time as an imaginary coordinate is used. As a result, classical formulas for inertial forces in the motion of bodies in a circle and uniformly accelerated motion are obtained. They show that the force of inertia, like other forces, is a measure of interaction, and the inertial mass is the same as the gravitational mass.

The developed method is used to represent the force of inertia as one of the types of interaction.

II. Materials and Method

2.1 Theoretical Analysis of the Interaction of Temporary States of Physical Bodies

Physics, having inherited method and logic from philosophy, is the key to understanding nature. The Standard Model describes all kinds of interactions and the structure of elementary particles. However, some of its provisions look like defects in a great design.

The authors believe that the time of simple models in physics has yet to pass because simplicity is the measure of perfection in nature. The authors use time as an imaginary coordinate and propose a form of interaction between the temporal states of physical objects [11..13].

To determine each of these forces, a communicative form is introduced, characteristic of the forces of interaction, ensuring the fulfilment of Newton's third law:

$$F_{12} = F_{21} = \frac{T_1 T_2}{jc\Delta t_{12}} \quad (4)$$

T_1, T_2 – Indicators of transient states, a $jc\Delta t_{12}$ is the time interval between adjacent states.
T *is* the relative fraction of the real part of the Lorentz interval multiplied by the body's energy, calculated by Einstein's formula.

$$T = \sqrt{\frac{mc^2 \Delta x}{\sqrt{(\Delta x)^2 + (jc\Delta t)^2}}} \quad (5)$$

Thus, a radical form similar to the probability amplitude in quantum mechanics is used for the exponent of the time state.
v –velocity.

Equal to each other, forces of interaction of the current state with uniform rectilinear motion are given to the form:

$$F = \frac{-mv}{\Delta t\sqrt{1-(\frac{v}{c})^2}} \tag{6}$$

At the same time, Newton's first law for uniform rectilinear motion describes the equilibrium situation of the current temporary state - the vectors of the forces of influence of the past and future state of the body are equal.

Note that the minus sign signals the opposite of the vector of force and velocity.

Let us consider the case of rectilinear uniformly accelerated motion. A body moving at a velocity v at time t0 will be affected by the difference in forces from the temporal positions t_+ and t_-. In adjacent states, the body has a velocity ($v + \Delta v$) and (v - Δv), respectively. The forces corresponding to the temporal interaction are repulsive; otherwise, when moving around a circle, the sum of the forces would be directed towards the centre. As a result, we introduce the designation of this force as F_{attr}.

$$F_{attr} = \frac{T_+ T_0}{jc\Delta t} - \frac{T_- T_0}{jc\Delta t} = \frac{-m}{\Delta t}\sqrt{\frac{v}{\sqrt{1-(\frac{v}{c})^2}}}\left(\sqrt{\frac{v+\Delta v}{\sqrt{1-(\frac{v+\Delta v}{c})^2}}} - \sqrt{\frac{v-\Delta v}{\sqrt{1-(\frac{v-\Delta v}{c})^2}}}\right) \tag{7}$$

if $\Delta v \ll v$

$$F_{attr} = \frac{-m}{\Delta t}\frac{\sqrt{v}}{\sqrt{\sqrt{1-(\frac{v}{c})^2}}}\left(\frac{\sqrt{v}\left(1+\frac{\Delta v}{2v}\right)}{\sqrt{\sqrt{1-(\frac{v+\Delta v}{c})^2}}} - \frac{\sqrt{v}\left(1-\frac{\Delta v}{2v}\right)}{\sqrt{\sqrt{1-(\frac{v-\Delta v}{c})^2}}}\right) \tag{8}$$

As a result,

$$F_{attr} = \frac{-m\frac{\Delta v}{\Delta t}}{\sqrt{1-(\frac{v}{c})^2}} \tag{9}$$

As a result, we come to the classical expression for the force of inertia but based on ideas about it as a force of interaction. Formula (9) is a special general formula (7) case for relatively small velocity increments. It is remarkable that when the body comes out of a state of complete rest, this law is violated since the interaction force is zero at zero velocity in the initial position.

Of course, an important result of the study is the negative value of the inertial force since the calculation algorithm assumed subtracting the force of interaction between the future state and the present state from the force of interaction between the present and past state of the particle (body).

For further analysis, let us determine the force of inertia for the case of motion of a body in a circle. In this case, the forces of interaction of the present time state with the past and future states are equal, but the resulting force arises from the difference in the direction of these forces.

When the body moves in a circle between adjacent temporary positions, separated from each other by a time distance $jc\Delta t$, the force is equal to the product of indicators divided by this time interval, calculated according to equation (6).

In this case, the centrifugal force arises due to the deviation of each force from the vertical at an angle. $\alpha=\frac{v\Delta t}{2R}$ (Figure 1).

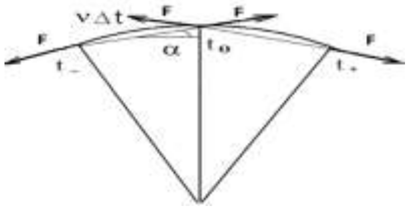

Figure 1. *Diagram of the interaction of time states when the body moves in a circle.*

As a result,

$$F_{attr} = -\frac{mv^2}{R\sqrt{1-(\frac{v}{c})^2}} \qquad (10)$$

It should be noted that the force acting on the body when moving in a circle also has a negative value, paradoxically different from the force of the gravitational interaction of masses. Thus, the accepted form of describing the behaviour of a particle when moving in a circle leads to the results observed in everyday life. Note that during the temporary interaction, the attractive force usual for the interacting masses changes to the repulsive force.

The adopted method has several disadvantages:

1. Only symmetric temporal states are considered. At the same time, it cannot be ruled out that any interaction by its nature is associated with symmetry breaking.
2. Discrete positions of the body in time are tacitly introduced.

In any case, the analysis gives several useful consequences:

- The force of inertia falls under the general definition of force,
- Newton's second law corresponds to the third,
- The problem of correspondence between inertial and gravitational masses disappears. Only the types of interaction (temporal and spatial) differ [14,15].

2.2 The Second Form of Temporal Interaction

The method found can (and should) be applied to another interval component. By analogy, let's write down the force of interaction when moving around a circle.

The interaction rate in this case is similar

$$T = \sqrt{\frac{mc^2\, jc\Delta t}{\sqrt{(\Delta x)^2+(jc\Delta t)^2}}} = \sqrt{\frac{mc^2}{\sqrt{1-(\frac{v}{c})^2}}} \qquad (11)$$

By analogy, we calculate the value of such an interaction force when moving around a circle

$$F_{cf} = +\frac{mcv}{jR\sqrt{1-(\frac{v}{c})^2}} \qquad (12)$$

The force of the interaction will make a real difference when the body's speed becomes greater than the speed of light.

Note that, unlike the force of inertia, this form of force corresponds to the attraction of temporary states of the body.

Figure 2 shows the dependence of the modulus of the temporal interaction forces normalized by magnitude (mc^2 /R) on the relative velocity. The second is given with the opposite sign to compare the moduli of forces.

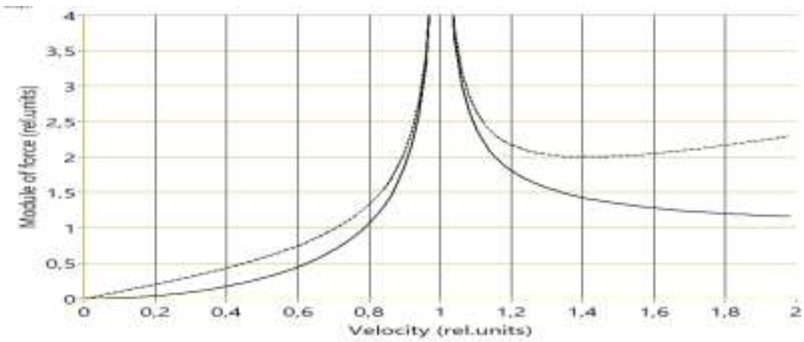

Figure 2. Rice. 2 Dependence of the relative modulus of the temporal interaction forces.

The graph of the force of inertia tends to linear asymptote, and the graph of the force of the second kind tends to unity with increasing velocity

III. Results and Discussion

In the presence of two different forces that change the sign at the speed of light, models of elementary particles can be constructed with an average speed of components equal to the speed of light. The oscillatory nature of the motion of these components will explain the manifestation of the dualism inherent in elementary particles.

Note that when the body's speed exceeds the speed of light, its properties change dramatically, and the mass turns into a charge.

The second type of interaction thus describes the temporal interaction of the charge, which is as paradoxical as the temporal interaction of mass: attraction instead of repulsion. In this case, the application of Einstein's formula for a moving mass organically explains the existence of charges of different signs.

With the conventionality of the sign of the force of gravitational interaction, it can be assumed that it changes during the interaction of bodies with ordinary mass and bodies with negative mass (assuming that such bodies exist). The sign of the force of the Coulomb interaction is a consequence of our understanding of the nature of charges (bodies moving at a speed exceeding the speed of light). Coulomb's rule for the interaction of charges of different signs is given a natural explanation. Thus, the laws of gravitational (Newtonian) and Coulomb interactions are described in one form.

Note that the presence of the spin of a proton indicates the movement of its mass component along a closed trajectory at a speed close to the speed of light. Based on the ratio of mass and energy, with a known proton radius, a rough estimate of the forces of interaction corresponds to the nuclear forces.

IV. Conclusion

The proposed model allows:

1. The general nature of mass and charge and the uniformity of the forms of Newtonian and Coulomb interaction of objects of nature.
2. Interpret the results of experiments conducted according to the Wheeler scheme,
3. Use a harmonious form for the Lorentz interval,
4. Apply a single definition of force as a measure of interaction - Newton's second law, in the accepted view, means the equality of the forces of spatial and temporal interaction,
5. Confirm the universality of Newton's third law.
6. Obtain general expressions for the force of inertia, resulting at low speeds, to classical expressions for accelerated and circular motion.

7. Solve the problem of correspondence between gravitational and inertial mass,Since in both cases, we are talking about the same mass involved in different types of interaction.

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