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Letter

Force of Inertia as Sort of Interaction

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Abstract: The interaction of the temporal positions of a moving body with mass is now an experimental fact. Models of this interaction are easily determined by the assumption that time is an imaginary coordinate. As a result, the force of inertia can be presented together with other forces as a form of interaction of time positions - characteristic of any kind of movement. The result confirms the universality of Newton's third law, which served as an additional incentive for real work. In particular, with the gravitational interaction of the two bodies, each of them experiences the force determined by the work of interacting masses. According to Newton's third law, this force is confronted by the power of interaction of the temporal positions of each body. The general expressions of force of inertia in the case of rectangular accelerated movement and movement in the circumference are obtained, which leads to classical formulas in any interval of possible body speeds. These formulas are fully in line with modern relativistic laws, but are their natural development and a more complete description of nature. Important results of the study include the formal definition of the sign of the force of interaction. When considering a rectangular accelerated motion, subtracting the force of the interaction of the final moment of movement, occurring at a greater speed, from the force of the interaction of the initial moment (at a lower speed) leads to a negative sign of the resulting force. The proposed model allows to recognize as superfluous experiments to determine the equality of gravitational and inertial masses, as in both cases we are talking about the same mass, participating in different types of interaction.

Keywords: Force of Inertia, Interaction of Time States, Wheeler Experiment

1. Formula of Inertia Introducing

Newton's second law is clearly different from the classical physical equations, where quantities of one physical nature are equalized. In the left part there is a force (a measure of interaction), and in the right kinematic quantities having a dimension of force. The imperfection of this formula was felt by Newton himself, the first of the physicists who dealt with the problem of the correspondence of gravitational and inert mass and conducted the first experiments to determine their equality. The development of physics, which led to the concept of dualism of particles exhibiting the properties of a wave and a particle, focused the attention of physicists on the unusual behavior of particles during diffraction. At the beginning of the last century, experiments were conducted to prove that the wave is not created by a stream of particles (electrons), but is inherent in the particle itself. The idea of the influence of the time states of a particle (its future state on the present) prompted Wheeler to create a decisive thought experiment, the results of which could be used to decide whether such an influence exists or not.

At the heart of new experiments is Wheeler's thought experiment [1], which tried to solve the problem of elementary particle dualism. The main idea of the author (and this article) is that the behavior of a particle is determined by the influence of its two (borderline) states - both past and future. The interaction of temporary positions of the body is currently an experimental fact [2-10]. The author's previous publication on this topic contained an error leading to unrealistic formulas for the force of inertia.

Previous steps by the author [11, 12] attempts to interpret experiments that reveal the influence of the past and future positions of the body on its condition at any given time. However, on the basis of the formulas proposed in it, it is impossible to create a model that gives a classical expression for the force of inertia at any speed values, while the formula for Einstein's mass, as the work [13] suggests, easily leads to this expression. This removes the question of the interaction of temporary positions. In this paper, an attempt is made to develop the idea of interaction of temporal states, leading to the emergence of the power of inertia.

2. Analysis of Temporary Interaction

Einstein's Special Theory of Relativity is based on the transformation of Lorenz's coordinates, operating with the sum of squares of spatial coordinates, from which the square of the work of increments of time multiplied by the speed of light is subtracted. By imagining time as an imaginary component of a complex number, you can limit yourself to summing up all members in the interval formula. In this case, the speed should be expressed in the form of -jv, and acceleration -a. Thus, time, speed and m pulse are imaginary values, and acceleration, the forces of interaction (e.g., the strength of the elasticity of the R. Hooke) and energy are real values.

The generalization of coordinates raises the question of possible interaction in time. Like any interaction, it must be symmetrical and expressed as a work of indicators that characterize each of the temporal positions of the body. It is logical to assume that the immobile body does not experience any interaction of neighboring positions, and the interaction itself is proportional to the change in the spatial coordinate of the body. Obviously, in the case of the time interval, we are practically talking about the metric coordinate, since the Lorentz interval involves the product of time by the speed of light. This automatically means that the interaction formula must lead to energy, since the ratio of energy to the value of the coordinate gives the value of the force. Einstein's formula for the relationship of energy to body mass in this case is the most adequate form for a measure of interaction. The simplest form that meets these requirements will be the T indicator:

$$T = \sqrt{\frac{mc^2\Delta x}{\sqrt{\Delta x^2+(jc\Delta t)^2}}} \tag{1}$$

m-mass of a particle, c - the speed of light, (Δt and (Δx - small time intervals and coordinates, counted from this position. Indeed, since we are talking about one body, the product of T indicators gives the main characteristic of the body - its mass m, and the Δx in the numerator will provide zero temporary interaction of the stationary body, as well as an increase in interaction with the increase in speed. This is not the first time that physics has used a similar approach - in quantum physics the wave function is a complex number, but the square of its module gives a density of probability of finding a quantum particle in a given area of space at a given point in time. It is also interesting that the indicator contains body energy, calculated according to Einstein's formula. This suggests that the phenomenon of inertia is associated with the transformation of this energy over time.

By dividing into $jc\Delta t$, we get

$$T = \sqrt{\frac{-jmc\,v}{\sqrt{1-(\frac{v}{c})^2}}} \tag{2}$$

Force of interaction of two time position body may be calculated as

$$F = \frac{T_1T_2}{jc\Delta t_{12}} \tag{3}$$

Let us consider the case of rectilinear uniformly accelerated motion. A body moving with speed v and T_0 will be affected by the difference in forces from the temporary positions $T+$ and T-, which are interacted in time with the position T_0. In the first two states, the body has a velocity ($v + \Delta v$) and ($v - \Delta v$), respectively. Obviously, the forces corresponding to the temporal interaction are repulsive forces, otherwise, when moving around a circle, the sum of the forces would be differently directed towards the center.

$$F_m = \frac{T_+\,T_0}{jc\Delta t} - \frac{T_-\,T_0}{jc\Delta t}, \text{ or}$$

$$F_m = \frac{-m}{\Delta t}\sqrt{\frac{v}{\sqrt{1-(\frac{v}{c})^2}}}\left(\sqrt{\frac{v+\Delta v}{\sqrt{1-(\frac{v+\Delta v}{c})^2}}} - \sqrt{\frac{v-\Delta v}{\sqrt{1-(\frac{v-\Delta v}{c})^2}}}\right) \tag{4}$$

At speed $\Delta v \ll v$

$$F_m = \frac{-m}{\Delta t}\frac{\sqrt{v}}{\sqrt{\sqrt{1-(\frac{v}{c})^2}}}\left(\frac{\sqrt{v}\left(1+\frac{\Delta v}{2v}\right)}{\sqrt{\sqrt{1-(\frac{v+\Delta v}{c})^2}}} - \frac{\sqrt{v}\left(1-\frac{\Delta v}{2v}\right)}{\sqrt{\sqrt{1-(\frac{v-\Delta v}{c})^2}}}\right) \tag{5}$$

Assuming that for small relative values of Δv,

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

Formula (6) is a particular case of general formula (5) for relatively small speed increments. It is quite remarkable that when the body leaves the state of complete rest, this law is violated, since at zero velocity in the initial position, the interaction force is zero.

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

When moving in a circle between adjacent temporal positions, separated from each other by a temporal distance $j\Delta t$, a force arises equal to the product of indicators divided by this interval.

$$F_m = \frac{-mv}{\Delta t\sqrt{1-(\frac{v}{c})^2}} \quad (7)$$

The centrifugal force in this case arises due to the deviation of each of the forces from the vertical at an angle equal to $\frac{v\Delta t}{2R}$.

As rezult

$$F_m = \frac{-mv^2}{R\sqrt{1-(\frac{v}{c})^2}} \quad (8)$$

It should be noted that with a temporary effect, the force of attraction, which is usual for the interacting masses, changes to the force of repulsion. Thus, the accepted formalism of describing the behavior of a particle when moving with acceleration and movement along a circle leads to results observed in everyday life and known since the time when physics, as a science, did not yet exist and self-confidently did not take on the role of an almighty mentor.

3. Conclusions

The offered model allows:

1. Interpret the results of experiments carried out according to Wheeler's scheme,
2. Use a harmonious form for the Lorentz interval,
3. Apply a unified definition for force as a measure of interaction - Newton's second law in the accepted representation means equality of forces of spatial and temporal interaction,
4. Concept for force as a measure of interaction - Newton's second law in the accepted representation means equality of forces of spatial and temporal interaction,
5. To confirm the universality of Newton's third law.
6. To obtain general expressions for the force of inertia, leading at low speeds to the classical expressions for accelerated motion and motion in a circle. Formulas lead to negative values of the force of interaction of temporary states observed in practical life since prehistoric times.
7. To recognize as superfluous experiments to determine the equality of gravitational and inertial masses, since in both cases we are talking about the same mass participating in different types of interaction [14, 15].

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