‘ELECTRICAL’ ANALOGY AND HYPOTHETICAL UNIVERSE. DYNAMICS.

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Предполагается справедливость второго закона Ньютона для взаимодействий в эфире. С учетом кинематических соотношений, представленных в докладе ««Электрическая» аналогия и гипотетическая вселенная. Кинематика», сделанном на этом же Конгрессе, получены формулы преобразования силы, массы, импульса силы и энергии при переходе из одной инерциальной системы координат в другую при условной синхронизации часов, принятой в специальной теории относительности. Выявлена связь приращений кинетической энергии и массы. Рассмотрен вектор массы и его составляющие.
Korotkov B.A. The validity of the Second Newton’s law for interactions in ether is suggested. Taking into account the kinematics relations presented in the report ``Electrical` Analogy and Hypothetical Universe. Kinematics` at the same Congress, formulas have been obtained for the conversion of the force, mass, impulse of force, and energy in going from one inertial coordinate system to another at conventional clock synchronization adopted in the special theory of relativity. The relation between the kinetic energy and mass increments has been established. The mass vector and its components are considered.

Force, mass, and motion

The hypothetical universe model and terminology are given in the above-mentioned work. The relation between the force F and the acceleration a of an object in ether 2 created by it are determined by the Second Newton’s law $F=ma$, where m is the proportionality coefficient termed the mass. We apply it to a stationary in ether 2 object: $F_0 = m_0 \cdot a_0$.

The force F_0 acts on the surface of a spherical wave forming ether 2 and is perpendicular to the radial direction of motion in the course of the global displaying process. If the object is moving in ether 2 with velocity v, the force $F=F_0$ is still acting on the surface of the spherical wave of the real ether 2, and the directions of the force and velocity vectors are perpendicular. This situation is illustrated in Fig. 1. The force F is directed along the line of intersection of two planes of the real and fictitious ether 2. In the own co-ordinate system of the moving object, in other words, on the surface of the fictitious ether 2, the equation for the stationary object holds. The whole reasoning is carried out at conventional clock synchronization when all laws in different co-ordinate systems manifest themselves in the same manner.

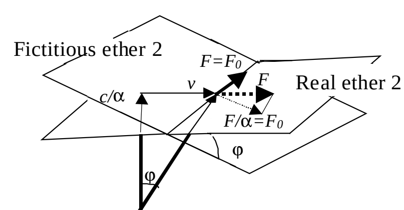

Fig. 1. On the calculation of the transverse and longitudinal mass. Conversion of forces.

In the real ether 2, each component of the applied expression may look differently, although, on the whole, Newton's law should hold. Let us take into account the indicated difference with the aid of the scale factors: $M_F F_0 = M_m m_0 \cdot M_a a_0$. The scale factor $M_F = 1/\alpha$ for the force can be determined proceeding from the fact that in a stationary coordinate system connected with the real ether 2, the action of the force on the object is reduced by a factor of α as compared to such in a moving coordinate system; therefore, $F = F_0/\alpha$.

The scale factor for acceleration was determined in the above-mentioned work: $M_\alpha = 1/\alpha^2$. Consequently, the scale factor for the mass $M_m = \alpha$. The mass $m_\perp = M_m m_0 = \alpha m_0$ is called the transverse mass.

In the presence of the accelerating force F shown in Fig.1 (dotted vector) in the real ether 2 and acting along the velocity vector v of the object, we obtain that on the plane of the fictitious ether 2 this vector will be represented by its projection F/α shown in Fig.1 and due to the α – fold increased duration of the action of this projection the effect of the action of the force will increase as many times. Taking into account both postulates, we obtain $M_F = (1/\alpha) \cdot \alpha = 1$ and $F = F_0$.

The scale factor $M_a = 1/\alpha^3$ for acceleration was determined in the above – mentioned work. As it was done for the action of the transverse force F, we find the scale factor for the mass $M_m = \alpha^3$. The mass $m_{||} = M_m m_0 = \alpha^3 m_0$ is referred to as the longitudinal mass. The difference between the transverse and the longitudinal mass, characterized by the ratio $m_{||}/m_\perp = \alpha^2$, is due to two factors. The first factor is that an attempt to accelerate the already moving object is made with ineffective use of the accelerating force. The second factor is that the scale factors for accelerations differ at α times.

The resulting trajectories in ether 1 of the Universe objects exhibit the property of inertia which consists in the ability to preserve their direction. The inertia measure is the mass. It is naturally direct the mass vector tangentially to the resulting trajectory of the object and choose its length equal to the transverse mass $m_\perp = \alpha m_0$, as shown in Fig.2. The fictitious and real ether planes make an angle φ, with $\cos \varphi = 1/\alpha$ and $\sin \varphi = v/c$. At any velocity of the object in ether 2 its mass in the true coordinate system is equal to m_0. This finds reflection in the fact that the mass vector projection on the radial direction for ether 2 is equal to m_0. This postulate is not fortuitous, since in ether 1 the direction of the trajectories of objects that are stationary in ether 2 is radial. The mass vector projection on the direction of velocity v coinciding with the direction of the ox – axis is the impulse p_x divided by the velocity c, since $m_0 \alpha v/c = m_\perp v/c = p_x/c$. It seems natural that the mass vector projection on the ox – axis is proportional to the impulse px. Indeed, the indicated projection may differ from zero only for a moving object. From the kinematics point of view, motion is characterized by direction and velocity. From the point of view of physics, which deals with real physical objects, motion is inseparable from its inertia described as the mass of a moving object. Therefore, the mass vector $m_\perp$ tangent to the resulting trajectory of an object describes the inertia of the resulting motion in ether 1, and its projection on the ox – axis is characterized by impulse px.

The notions on the mass vector are likely to be first introduced by A.A. Sazonov in [1], p.138. His ideas are used in the present work, but they are modified as applied to the adopted space – time model oriented to the Euclidean metric proper.

Impulse of force, work, and energy

If force F is applied to a moving object in the Universe and acts on the ox – axis of its velocity vector v in ether 2, then, assuming that the whole work of this force in time dt_0 is expended in increasing the kinetic energy of motion of the object in ether 2, we obtain that the kinetic energy

$$E = \int F_{\|}dx = \int F_{\|}vdt_0 = \int \frac{m_0}{\sqrt{(1-v^2/c^2)^3}}\cdot\frac{dv}{dt_0}\cdot vdt_0 = \int \frac{m_0 v}{\sqrt{(1-v^2/c^2)^3}}\cdot dv = \frac{m_0c^2}{\sqrt{1-v^2/c^2}} + const.$$

The integration constant can be determined from the natural condition of equality to zero of kinetic energy at a zero velocity of an object in ether 2: $E = 0$, $v = 0$. For kinetic energy E or, to be more precise, for its increment ΔE we finally obtain:

$$E = \Delta E = \frac{m_0c^2}{\sqrt{1-v^2/c^2}} - m_0c^2 = m_0c^2\,(\alpha\text{-}1).$$

Acquisition of kinetic energy is accompanied by increment $\Delta m_{\|}$ of the longitudinal mass and $m_{\perp}$ of the transverse mass of this object:

$$\Delta m_{\|} = \frac{m_0}{\sqrt{(1-v^2/c^2)^3}} - m_0 = m_0\,(\alpha\text{-}1)(\alpha^2+\alpha+1), \quad \Delta m_{\perp} = \frac{m_0}{\sqrt{(1-v^2/c^2)}} - m_0 = m_0\,(\alpha\text{-}1).$$

Substitute into the formula for ΔE the product $m_0\,(\alpha\text{-}1)$, obtained first formula and then from the second formula:

$$\Delta E = c^2\Delta m_{\|}/(\alpha^2+\alpha+1), \qquad \Delta E = c^2\Delta m_{\perp}.$$

The last formula coincides with the known Einstein formula with two refinements: first, the Einstein holds only for the transverse mass increment and, second, in the obtained formula the parameter c has the meaning of the velocity of perturbations propagation in ether 1, but not in ether 2, as is required in the Einstein formula. The previous expression is not found in the theory of relativity. A similar formula was obtained in the remarkable work of E.A. Nelepin [2], p.115, but it also means the traditional sense of velocity c, since in this theory no notions on the triune Universe and ether 1 are introduced.

Consider the transformations of impulse components p_x, p_y, p_z from one coordinate system to another.

By definition of the impulse in the object's own coordinate system we obtain $P_0=F_0t'=m_0u_0$, where u_0 is the seeming relative velocity of the object acquired under the action of the force F_0 in own time t'. The formulas for converting the projections of this velocity from one coordinate system to another are given in the work repeatedly referred to above. In a stationary coordinate system, we have an analogous formula: $P=Ft_0=mu$.

The similar values in these formulas may differ quantitatively , which is taken into account by the scaling $M_P P_0 = M_F F_0$, $M_t t' = M_m m_0\ M_u u_0$.

When projecting on the x – axis, we will have: $M_{Fx} = F_x / F_{0x} = 1$, $M_{tx} = t_0 / t' = \alpha$, $M_{mx} = m_{||}\ / m_0 = \alpha^3$, $M_{ux} = (u_x\ / u_{0x})\big|_{uox \to 0} = 1/[\alpha^2 (1 + u_{0x} v/c^2)]\big|_{uox \to 0} = 1/\alpha^2$ and, consequently, $M_{Px} = P_x / P_{0x} = M_{Px}\ M_{tx} = M_{mx}\ M_{ux} = \alpha$ or

$$P_x = \alpha P_{0x}.$$

Likewise, we will obtain the following results: $M_{Fy} = M_{Fz} = F_y / F_{0y} = 1/\alpha$, $M_{ty} = M_{tz} = t_0 / t' = \alpha$, $M_{my} = M_{mz} = m_\perp / m_0 = \alpha$, $M_{uy} = M_{uz} = (u_y / u_{0y})\big|_{uox \to 0} = 1/[\alpha(1 + u_{0x} v/c^2)]\big|_{uox \to 0} = 1/\alpha$, and, consequently, $M_{Py} = M_{Pz} = P_y / P_{0y} = M_{Py}\ M_{ty} = M_{my}\ M_{uy} = 1$ or

$$P_y = P_{0y}, \quad P_z = P_{0z}.$$

The results of the dynamics analysis are tabulated in Table 1.

Table 1. The results of the dynamics analysis

Название параметра	***x***	**y**	***z***
Second Newton’s law in MCS, CS	$F_{0x} = m_0 \cdot a_{0x}$	$F_{0y} = m_0 \cdot a_{0y}$	$F_{0z} = m_0 \cdot a_{0z}$
Second Newton’s law in SCS, CS	$F_x = m_{\|\|} \cdot a_x$	$F_y = m_\perp \cdot a_y$	$F_z = m_\perp \cdot a_z$
Seeming force in MCS	F_{0x}	F_{0y}	F_{0z}
Real force in SCS	$F_x = F_{0x}$	$F_y = F_{0y}/\alpha$	$F_z = F_{0z}/\alpha$
Seeming mass in MCS	m_0	m_0	m_0
Real mass in SCS	$m_{\|\|} = \alpha^3\ m_0$	$m_\perp \cdot = \alpha m_0$	$m_\perp \cdot = \alpha m_0$
Seeming impulse in MCS, CS	$P_{0x} = F_{0x} t' = m_0 u_{0x}$	$P_{0y} = F_{0y} t' = m_0 u_{0y}$	$P_{0z} = F_{0z} t' = m_0 u_{0z}$
Real impulse increment in SCS	$P_x = F_x t_0 = m_{\|\|} u_x$	$P_y = F_y t_0 = m_\perp u_y$	$P_z = F_z t_0 = m_\perp u_z$
Real impulse increment in SCS	$P_x = \alpha P_{0x}$	$P_y = P_{0y}$	$P_z = P_{0z}$
Kinetic energy increment at velocity variation from 0 to v	$E = \Delta E = \frac{m_0 c^2}{\sqrt{1 - v^2/c^2}} - m_0 c^2 = m_0 c^2 (\alpha - 1).$		
Mass increment at velocity variation from 0 to v	$\Delta m_{\|\|} = m_0 (\alpha^3 - 1)$	$\Delta m_\perp = m_0 (\alpha - 1)$	$\Delta m_\perp = m_0 (\alpha - 1)$
Relation between kinetic energy and mass increment	$\Delta E = \frac{c^2 \Delta m_{II}}{\alpha^2 + \alpha + 1}$	$\Delta E = c^2 \Delta m_\perp$	$\Delta E = c^2 \Delta m_\perp$

MCS (SCS) – moving (stationary) in ether 2 coordinate system,
AS (CS) – absolute synchronization (conventional synchronization, accepted in the theory of relativity).

References

1 A.A. Sazanov. Minkowski World. Moscow, “Nauka”, Chief ed. Phys.-math. Lit.,1988, 224 p. (Rus).

2 E.A. Nelepin. The Theory of Motion. The Nature of Motion and Device for Demonstrating Relativistic Effects. Publ. LO AN RSFSR, 1992, 268 p.(Rus).