NEW TRANSFORMATIONS FOR THE THEORY OF RELATIVITY

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1. The purpose of the new transformations is introduction of common standards of time and extent for inertial systems of reference (ISR) *S* and *S'*, moving with a speed *v* relative to each other. The basis for achieving this purpose is *the idea of measuring time with one motion accepted as standard*, which is almost identical to Einstein's postulate on the constancy of speed of light in different ISR. The purpose is achieved by introducing in one ISR a special coordinate system, where for measurement of time the standard motion (speed of light) of the first ISR is used, in which the constancy of the speed of light holds in a Cartesian coordinate system, defined with help of the common standard of extent along its every axis.

2. Necessity of new transformations is dictated by both the known paradoxes of the special theory of a relativity (STR), and contradictions and flaws detected by the author as a result of the carried out analysis of works [1-3]. Namely:

1) Lorenz's transformations (LT) do not fulfill the second of three vector equations (4), corresponding to the coordinate form of the equivalent equation (2) for the light wave front propagation, obtained by substitution in it coordinates and time of two geometrically opposite point-events (x', y', z', t') and $(-x', -y', -z', t')$:

System S		*System S'*	
$x^2 + y^2 + z^2 - c^2t^2 = 0,$	(1)	$x'^2 + y'^2 + z'^2 - c^2t'^2 = 0,$	(2)
$\begin{cases} \vec{r}\cdot\vec{r} = \vec{c}\cdot\vec{c}\cdot t^2, \\ \vec{r}\cdot(-\vec{r}) = \vec{c}\cdot(-\vec{c})\cdot t^2, \\ (-\vec{r})\cdot(-\vec{r}) = (-\vec{c})\cdot(-\vec{c})\cdot t^2, \end{cases}$	(3)	$\begin{cases} \vec{r}'\cdot\vec{r}' = \vec{c}'\cdot\vec{c}'\cdot t'^2, \\ \vec{r}'\cdot(-\vec{r}') = \vec{c}'\cdot(-\vec{c}')\cdot t'^2, \\ (-\vec{r}')\cdot(-\vec{r}') = (-\vec{c}')\cdot(-\vec{c}')\cdot t'^2. \end{cases}$	(4)

2) In deriving LT, the negative value of function $\varphi(v) = -1$ was rejected by Einstein, which had hidden the true meaning of transformation of a sphere *t=const*, determined by the equation (1), into an elongated along the *X*-axis ellipsoid, which in the deformed system *S'* is described by the equation (2).

3) A graphic representation in system *S'* of the set of events $\mathfrak{M}(x, y, z, t=const)$ and roots of the equivalent equations (1, 2) under imposed by Einstein conditions on linear relation between coordinates and time shows, that the coordinate system *S'* is obtained by a homogeneous extension (homotopy) along the *X*-axis of the coordinate system *S* (a Fig. 1). It is seen, that the measurement unit of extent (the standard of extent) along the *X'-axis* of system *S'* is $k = 1/\sqrt{1-(v/c)^2}$ times shorter than both the standard of extent along its other axes, and the uniform standard of extent of system *S*.

4) The ideal Einstein - Langeven clocks [4], consisting of two parallel mirrors fixed on a rigid rod, by virtue of different standards of extent in *S'* will show a different time upon a change of their orientation.

5) In STR, velocity transformation formulae for transition from one inertial system to another determine not the velocity components of an arbitrary material point, but the ones of a point on the light front, because Lorenz's transformations connect not any coordinates and a time of two ISR, but the coordinates and time of light signal propagation. When one defines a relative speed of a particle as the ratio of a distance traveled by it in time $\Delta t'$ to a distance traveled by a light signal in the same direction for the same period of time, one obtains formulae essentially different from those of STR.

Essentially, both Lorenz's and Galilean transformations can be considered as relating same-type coordinate systems, obtained by translating the origin of coordinates into a point moving with respect to the initial system. In Galilean transformations, new coordinates are defined by the same standard of length, and time is taken to be equal to the time of the initial system. As a result, the spatial extent of the standard motion for different directions in the moving coordinate system, at equal time on the clocks, is not the same, and therefore the speed of the standard motion in it is not a constant. The difference of the Lorentz's coordinate transformations is that the initial coordinate system is deformed and the moving coordinate system is considered in it. New coordinates and time in Lorentz's transformations are related via using the standard motion in such a way that the speed of the standard motion in them is constant. However, this results, as shown above, in irresolvable contradictions. Nevertheless, in the special theory of relativity, A. Einstein had put forward the idea of measuring time by the same motion or, in other words, introduced one standard motion for measuring time in different coordinate systems. In developing new, free of contradictions, transformations one should follow this idea, while keeping the principle of simultaneity of events in different coordinate systems.

As seen in figure 1, for the process of propagation of the light wave front in the deformed coordinate system S', the origin of a focal radius vector $\vec{r}_1'$ is determined by location of a focus of the ellipsoid of the isochronous light surface, which at any moment of time coincides with the origin of the moving system S'. If we remove the deformation, then in the non-deformed coordinate system, where we will denote coordinates and time related to the motion of the light wave front by the capital letters, the focal radius vector $\vec{r}_1'$ will turn into the radius vector $\overline{R'}$ of Galilean transformation related to the absolute value of the radius vector R of the isochronous light surface by the following expressions:

$$\left.\begin{aligned} & R' = \lambda R\ , \\ & \lambda = \sqrt{1-(\beta\sin\Theta')^2} - \beta\cos\Theta' = \sqrt{1-2\beta\cos\Theta+\beta^2} \\ & \sin\Theta = \lambda\cdot\sin\Theta', \end{aligned}\right\}, \tag{5}$$

where $\beta = v/c$; Θ' and Θ are angles between the Z'-axis, directed along the path of travel of point O', and radius vectors $\overline{R}'$ and $\overline{R}$ (see fig. 2).

To an observer of the given ISR S', the family of the eccentrical isochronous surfaces with radii R_i should be taken as physically motivated coordinate surfaces, to any point of which a synchronizing signal sent from the origin of coordinates O', comes after an interval of a time $\Delta T = R_i/c$.

Analogs of conic surfaces ($\Theta = const$) with a vertex in the origin of coordinates are the surfaces formed by rotation around the axis Z' of curves L, which emanate from the origin of coordinates and at each point are perpendicular to traversed spherical surfaces, and tangents to which at the end-points make an angle Θ. These curves can be considered as curvilinear analogs of radius vectors of the obtained curvilinear coordinate system, which we will call eccentrical.

A third family of surfaces, as in the usual spherical coordinate system, constitutes the planes $\Phi = const$ passing through the axis Z'.

To all coordinates and to time of this system we will add a subscript "e" to distinguish them from coordinates and time of the usual spherical coordinate system. A wonderful fact is that coordinates and time of any point of a light front in this moving eccentrical system are equal to coordinates and time of initial (considered at rest) coordinate system:

$$R_e = R, \quad \Theta_e = \Theta, \quad \Phi_e = \Phi, \quad T_e = T\ . \tag{6}$$

This assures both equivalence of the equations of propagation of the light wave front (1, 2), and invariance of any laws in both frames of reference. At the same time, to determine the eccentrical coordinates R_e and Θ_e an observer in the moving coordinate system will have to calculate them based on the usual metric coordinates R' and Θ':

$$R_e = R'/\lambda, \quad \Theta_e = Arc\sin(\lambda \cdot \sin\Theta'), \quad \Phi_e = \Phi', \quad T_e = T'. \tag{7}$$

Curved field of central forces is similar to fig.2, where the circles correspond to the lines of constant potential and the perpendicular lines L correspond to the lines of current. The tangents to the lines of current coincide with force lines, which act in the points of tangency. The figure is given under the conditions of constant speed of interaction transfer and constant speed of light. It is implied, that space is a material medium in which moving material bodies differ from medium in interior structure. Possible orbits of a material point are shown in figure 3. Orbits are calculated by virtue of law of conservation of full system energy when attraction takes place. The point moves in the curved field mentioned above. In accordance with symmetry law the elliptic orbits with the eccentricity $e = -\beta$ are the most stable ones. Relation of semiminor axes to semimajor axes is equal to $\sqrt{1-\beta^2}$. This coefficient correspond to seeming shortening in size along motion line in STR. However, in our approach, in case if motional points are electrons rotating around nuclei, the real change of body size will take place (body size in direction of motion will be unchangeable, whereas cross size increases in $k = 1/\sqrt{1-\beta^2}$ times). Average velocity of light signal on there and back way, as it was in Michelson and Morley experiments, measured by an observer inside system, does not depend on direction. Numerical value compared with speed of light in space will be in $1/\left(1-\beta^2\right)$ time less. Nevertheless, we get the same Lorenz's transformation with account of real size moving bodies and postulates of constant speed of interaction transfer and constant speed of light. Under these conditions, Einstein-Langeven clocks will show the same time while their orientation is changing. In general, it can be concluded, that STR gives formally true results, among which is changing of radiation frequency of moving atoms [5-8]. However, physical and philosophical interpretation needs to be revised.

Several years ago, the author had obtained a universal differential law of body interaction with space and with other bodies. The law had been deduced on the basis of a simple model from the postulate about constant speed of interaction transfer in space. Double integration of the law leads to the second law of Newton $F=m\,a$, where relation between force and speed is close to the Einstein's formula. Quadruple integration leads to Newton's law of gravitation. The deviation from Newton's formula does not exceed 0.00003 % if $R/l \leq 0{,}0005$ and increase up to 21% if $R/l = 0{,}5$.

In spite of the fact that derivation of Newton's laws were carried out without consideration of bending of the field, the results confirm our theory which can be called eccentrical theory of interaction.

3. Development of the idea of A. Einstein about measurement of time in different coordinate systems by the same motion allows to create new, free from contradictions, transformations in which the principle of coincidence of the events occurring in different frames of reference is kept, as is the invariance of both the laws of electrodynamics and any other laws associated with coordinates and time. The new transformations, which use a special coordinate system called eccentrical, will lead to reconsidering the theory of relativity and can be fruitful for studying processes involving propagation of interactions through space.

The literature

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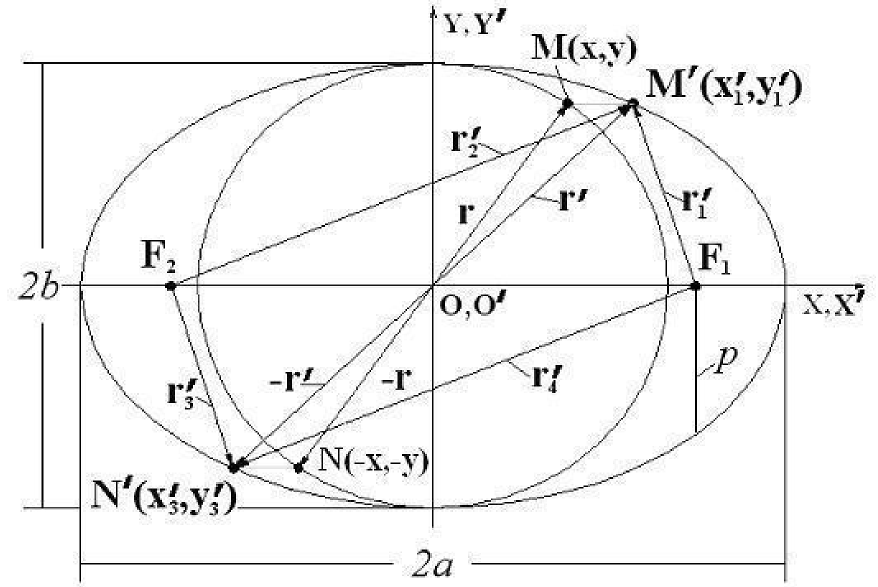

Fig. 1. A graphic representation in system S' of the set of events $\mathfrak{M}(x, y, z, t{=}const)$ and roots of the equivalent equations (1, 2):

$$\begin{cases} t' = \pm kt \pm k(v/c^2)x, \\ x' = \pm k(x - vt), \\ y' = \pm y, \\ z' = \pm z. \end{cases} \quad \text{or} \quad \begin{cases} r' = \pm kr \pm k\beta x, \\ x' = \pm k(x - \beta r) \\ y' = \pm y, \\ z' = \pm z, \end{cases}$$

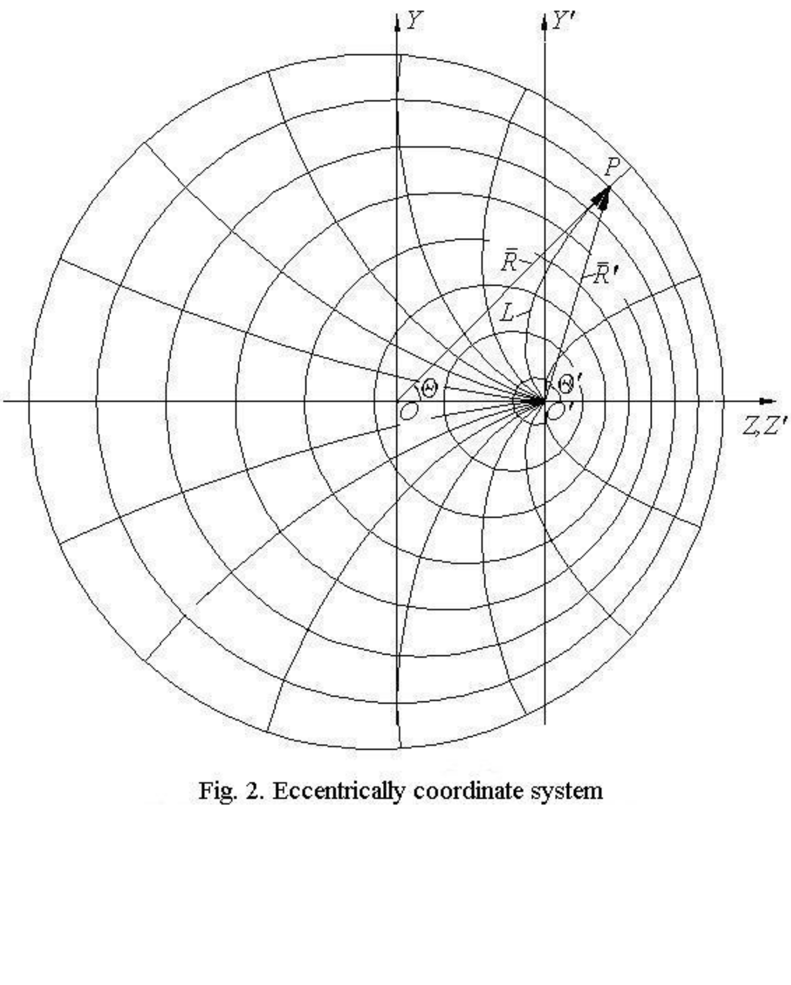

Fig. 2. Eccentrically coordinate system

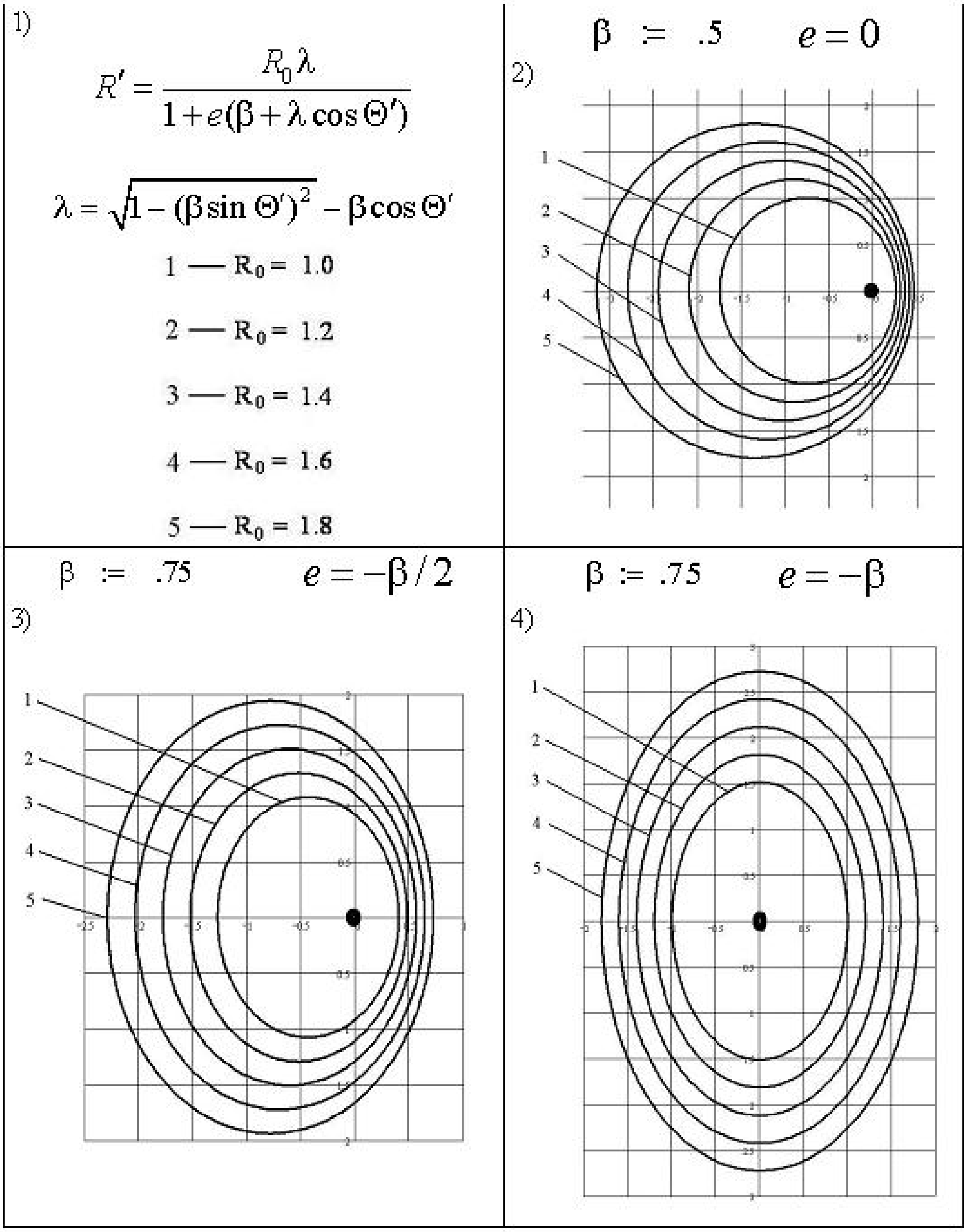

Fig. 3. Possible orbits of the material point in a curved field of central forces