The Faraday Induction Law In Covariant Ether Theories

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The non-invariance of the Faraday induction law, revealed in [1] through calculation of an e.m.f. along a mathematical line, was further analyzed for integration over a conducting closed circuit within special relativity theory [2]. Now this problem is considered within the framework of covariant ether theories [3]. A physical meaning of the non-invariance of the Faraday induction law is revealed, and a possible experimental scheme for measuring an absolute velocity of Earth has been proposed.

Keywords: Faraday induction law, covariant ether theories, Lorentz ether theory, Thomas-Wigner rotation

1. Introduction

It has been shown in ref. [1] that the mathematical expression for the Faraday induction law

$$e = -\frac{d}{dt}\int_S \vec{B}d\vec{S}\ , \tag{1}$$

does not follow from the Maxwell's equation

$$\oint_{\Gamma} \vec{E} d\vec{l} = -\int_{S} \frac{\partial \vec{B}}{\partial t} d\vec{S}, \qquad (2)$$

and, moreover, it is not Lorentz-invariant. At the same time, one can show that the Faraday induction law is always valid for any inertial observer under integration through a closed mathematical line. Hence, the revealed Lorentz non-invariance of the Faraday law signifies a violation of the Einstein relativity principle at the "mathematical" level [1]. However, the relativity principle was formulated not for mathematics, but for physics, which does not operate with "mathematical lines" in space. Therefore, a compatibility of the Faraday induction law and Einstein relativity principle must be analyzed for physical reality, i.e., for closed conducting circuits. This analysis [2] distinguished two general cases: 1- the internal electromagnetic fields from conduction electrons contribute an induced e.m.f.; 2- the internal fields do not give such a contribution. It has been shown that in case 1 the Einstein relativity principle remains valid, while the Faraday induction law is violated. Case 2 makes a conducting circuit similar to a mathematical line, where the Faraday law is always correct, while the Einstein relativity principle should be violated. A special physical problem, confirming this general conclusion, was indeed found [2]: relative motion of a parallel plate condenser to a conducting loop with the side lying inside the condenser. Here the same physical problem is analyzed within the framework of covariant ether theories (CETs). Section 2 represents a short review of CETs. Section 3 applies the ideas of CETs to the physical problem under consideration. Section 4 proposes a new experiment to measure the absolute velocity of Earth, and section 5 contains some conclusions.

2. Covariant ether theories

Covariant ether theories adopt the same general principles as special relativity (space-time homogeneity, space isotropy and causality principle), but replace the Einstein relativity principle with the general relativity principle [3]. This set of the most general physical principles allows the existence of a preferred (absolute) frame K_0. Due to the isotropy of empty space, the geometry of space-time in K_0 is pseudo-Euclidean with a Galilean metric. Since the motion of an arbitrary inertial frame does not influence the geometry of empty space-time, it continues to be pseudo-Euclidean for any moving inertial observer. However, due to possible dependence of space and time intervals on absolute velocity, which is admitted in ether theories, the metric tensor **g** in moving frames is no longer Galilean. This means that physical space-time four-vectors in an arbitrary inertial frame must be linear functions of Minkowskian four-vectors x_L :

$$\left(x_{\mathrm{ph}}\right)_i = B_{ij}\left(x_{\mathrm{L}}\right)^j , \tag{3}$$

where the coefficients B_{ij} do not depend on space-time coordinates of a moving inertial frame; they depend only on its absolute velocity $\vec{v}$. This kind of pseudo-Euclidean geometry has the so-called oblique-angled metric. (Here x_{L} obey the Lorentz transformation **L**: $x_{\mathrm{L}i} = L_{ij} x'^{j}_{\mathrm{L}}$).

In any analysis of space-time with an oblique-angled metric, an essential methodological feature has to be taken into account: namely, the true (physical) values differ, in general, from their magnitudes measured in experiment [3-5]. Hence, we have to separately derive the transformations for physical $\left(x_{\mathrm{ph}}\right)_i$ and "measured" $\left(x_{\mathrm{ex}}\right)_i$ space-time four-vectors, taking into account that in the absolute frame K_0

$$\left(x'_{\rm ph}\right)_i \doteq \left(x'_{\rm ex}\right)_i \doteq \left(x'_{\rm L}\right)_i . \tag{4}$$

Then, assuming that physical four-vectors $\left(x_{\rm ph}\right)_i$ obey some admissible transformation **A:**

$$\left(x_{\rm ph}\right)_i = A_{ij}\left(x'_{\rm ph}\right)^j , \tag{5}$$

one can prove that measured four-vectors are subject to the Lorentz transformation **L** [3]:

$$\left(x_{\rm ex}\right)_i = L_{ij}\left(x'_{\rm ex}\right)^j , \tag{6}$$

where the primed four-vectors belong to the absolute frame K_0. Further, a transformation between two arbitrary inertial frames K and K" has the form [3]:

$$\left(x_{\rm ex}\right)_i = L_{ij}(\vec{v}_1)[L^{-1}(\vec{v}_2)]^{jk}\left(x''_{\rm ex}\right)_k , \tag{7}$$

$$\left(x_{\rm ph}\right)_i = A_{ij}(\vec{v}_1)[A^{-1}(\vec{v}_2)]^{jk}\left(x''_{\rm ph}\right)_k , \tag{8}$$

where $\vec{v}_1, \vec{v}_2$ are the absolute velocities of the frames K and K," respectively. Thus in contrast to special relativity theory (SRT), in CETs Nature does not "know" a direct relative velocity of two arbitrary inertial frames K and K": it is always composed as a sum $\vec{v}_1 \oplus \vec{v}_2$, where $\vec{v}_1$ and $\vec{v}_2$ are the corresponding velocities of K and K" in the absolute frame K_0. This means, in particular, that direct rotation-free Lorentz transformation between measured space-time four-vectors in K and K" is impossible: according to the general group properties of these transformations, an additional rotation of the co-ordinate axes of the frames K and K" appears at the Thomas-Wigner angle Ω, depending on $\vec{v}_1$ and $\vec{v}_2$. It is quite important that such a rotation occurs in measured space-time coordinates, that is, it can be measured experimentally. At the same time, in physical space-time this rotational effect can be absent. A more detailed analysis of Thomas-Wigner rotation in CETs is presented in Section 3.

Further, we can find a relationship between the matrix **B** in Eq. (3) and matrix **A** in Eq. (5), using transformations (5), (6) and taking the equality (4) into account. Then one can easily obtain that

$$B_{ij}(\vec{v}) = A_i^k(\vec{v}) L_{kj}^{-1}(\vec{v}). \tag{9}$$

The physical meaning of the matrix **B** can be found from the requirement that for v=0, **B** is equal to the unit matrix. This allows one to rewrite Eq. (3) in the form

$$(x_{\text{ph}})_i(\vec{v}) = B_{ij}(\vec{v})(x_{\text{ph}})^j(v=0), \tag{10}$$

which clearly indicates a physical meaning of the matrix **B**: it describes a dependence of physical space and time intervals in a moving inertial frame on its absolute velocity $\vec{v}$.

We notice that the most general physical principles, constituting the basis of CETs, do not allow us to determine the matrix **A** of physical space-time transformation in explicit form. Thus, we are free to choose **A** in different admissible forms, obtaining thereby different versions of CETs. The simplest case corresponds to the choice **A**=**G**, where **G** is the matrix of Galilean transformation: G_{ii}=1, G_{a0}=–v_a, and all others G_{ij}=0. Substituting matrix **G** in place of matrix **A** in Eq. (9), and using the known form of the matrix **L**, one gets the following coefficients of matrix **B**:

$$B_{00} = g\,, B_{a0} = 0, B_{0a} = \frac{v_a}{c^2} g\,, B_{ab} = d_{ab}\, \frac{v_a v_b}{v^2}\left(1 - \frac{1}{g}\right), \tag{11}$$

where d_{ab} is the Kronekker symbol. Further substitution of Eq. (11) into Eq. (10) allows one to determine a dependence of physical space-time four-vectors on the absolute velocity $\vec{v}$ of some arbitrary inertial reference frame K:

$$\vec{r}_{\text{ph}}(\vec{v}) = \vec{r}_{\text{ph}}(v=0) + \frac{\vec{v}\left(\vec{r}_{\text{ph}}(v=0),\vec{v}\right)}{v^2}\left[\sqrt{1-(v^2/c^2)}-1\right], \tag{12}$$

$$t_{\text{ph}}(\vec{v}) = \frac{t_{\text{ph}}(v=0)}{\sqrt{1-(v^2/c^2)}} + \frac{\vec{r}_{\text{ph}}(v=0)\vec{v}}{c^2\sqrt{1-(v^2/c^2)}}. \tag{13}$$

For the time interval in a fixed spatial point of the frame K (r_{ph}=0), we obtain the dependence of t_{ph} on $\vec{v}$:

$$t_{\text{ph}}(\vec{v}) = t_{\text{ph}}(v=0)/\sqrt{1-(v^2/c^2)}, \tag{14}$$

which means an absolute dilation of time by factor $\sqrt{1-(v^2/c^2)}$. Furthermore, one obtains from Eq. (12):

$$\begin{aligned}\left(\vec{r}_{\text{ph}}(\vec{v}),\vec{v}\right) &= \left(\vec{r}_{\text{ph}}(v=0),\vec{v}\right)\sqrt{1-v^2/c^2}\\ \left[\vec{r}_{\text{ph}}(\vec{v})\times\vec{v}\right] &= \left[\vec{r}_{\text{ph}}(v=0)\times\vec{v}\right],\end{aligned} \tag{15}$$

which means an absolute contraction of moving scale along a vector of absolute velocity (Fitzgerald-Lorentz hypothesis). Finally, transformation (8) under **A**=**G**

$$\left(x_{\text{ph}}\right)_i = [G_{ij}(\vec{v}_1-\vec{v}_2)]\left(x''_{\text{ph}}\right)^j$$

leads to the Galilean law of addition of velocities for physical light velocity c_{ph}.

Thus, we have a full set of Lorentz ether postulates in their modern form for case **A**=**G** [6]. However, the physical space-time in the Lorentz ether theory is not observable in an arbitrary inertial reference frame, while the measured four-vectors x_{ex} obey the Lorentz transformations in the form of (7). Therefore, we may consider the

Lorentz ether theory as one of CETs defined above, and the simplest among them. That is why in the following section, which again deals with the problem in Ref. [2], we apply the Lorentz ether theory based on the transformation laws (7) and (8), where **A**=**G**.

3. The Faraday induction law, Thomas-Wigner rotation and Lorentz ether theory

In this section we consider a physical problem as described in [2]. Let there be a conducting rectangular loop with elongated segment AB inside a flat charged condenser FC (Fig. 1). The thin vertical wires of the loop enter into the condenser via the tiny holes C and D in its lower plate, so that distortion of the electric field E inside the condenser is negligible. An inertial frame K_1 is attached to the loop, while an inertial frame K_2 is attached to FC. There is an inertial reference frame K_0, wherein the frame K_1 moves at the constant velocity v along the axis x, and the frame K_2 moves at the constant velocity $\vec{V}\{v,u\}$ in the xy-plane (Fig. 2). For this motion diagram, the frame K_2 moves only along the axis y of K_1. We must find an e.m.f. in

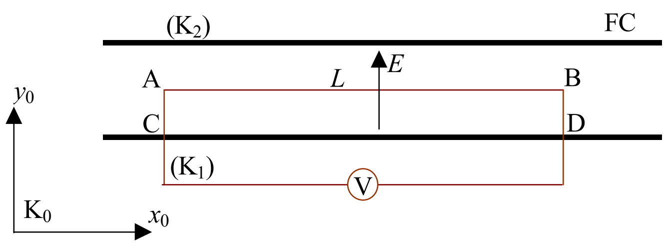

Fig. 1. The inertial frame K_1 is attached to the rectangular conductive loop, while the inertial frame K_2 is attached to the flat condenser. The upper lead AB of the loop lies inside the condenser. The profile leads of loop pass across the tiny holes C and D in the lower plate of condenser.

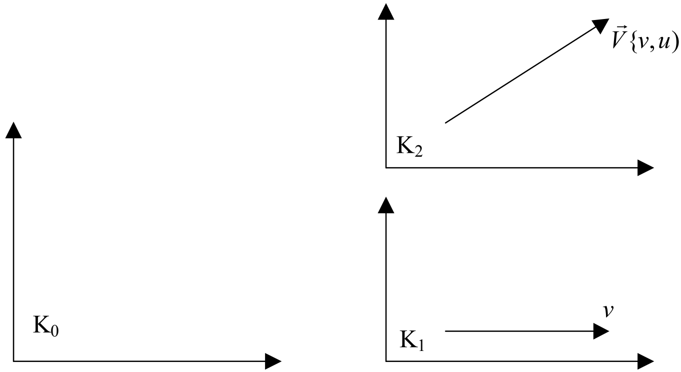

Fig. 2. The motion diagram of inertial reference frames K_1 and K_2 in the third inertial frame K_0 (in CETs K_0 is taken as absolute).

the loop (indication of the voltmeter V).

Calculated the electric and magnetic fields in the frame K_0 should be the same in SRT and covariant ether theories, if K_0 is taken as the absolute frame in CETs. This conclusion follows from the transformation (6). Then the field transformations [7] from K_2 to K_0 give the following result (to order of approximation c^{-2}) [2]:

$$E_{0x} = -E\frac{uv}{2c^2}; \tag{16a}$$

$$E_{0y} = E + E\frac{v^2}{2c^2}; \tag{16b}$$

$$E_{0z} = 0;\ B_{0x} = 0;\ B_{0y} = 0; \tag{16c}$$

$$B_{0z} = \frac{vE}{c^2}. \tag{16d}$$

Thus, in K_0 the magnetic field inside the condenser is not equal to zero, and its non-vanishing *z*-component is defined by Eq. (16d). Simultaneously one can see that under motion of FC at the velocity $\vec{V}\{v,u\}$, as well as motion of the loop at the velocity *v* along the axis *x*, the area ABDC between the lower plate of FC and upper line of the loop (the grey area in Fig. 3, where the magnetic field B_{0z} exists) decreases with time. Therefore, in the frame K_0 the total time derivative of magnetic flux across the area ABCD decreases with time, too. One can easily find that this time derivative is equal to

$$\frac{d\Phi}{dt} = B_{0z}\frac{dS_{\text{ABDC}}}{dt} \approx -\frac{uvE}{c^2}L\,, \tag{17}$$

where *L* is the length of the side AB. (In the adopted accuracy of calculations a contraction of this length in K_0 is not significant). Hence, the Faraday induction law requires the appearance of e.m.f. in the loop. When calculatomg the e.m.f. we assume that the electric and magnetic fields below the lower plate of FC are negligible, and take into account that due to the scale contraction effect in K_0, the co-

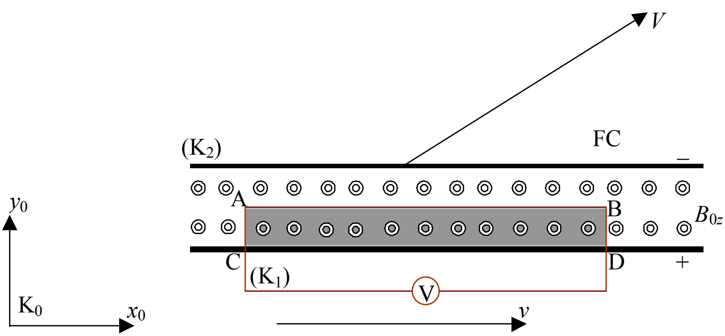

Fig. 3. An observer in the frame K_0 sees that under motion of the frames K_1 and K_2, the gray area ABDC decreases with time and hence, the magnetic flux across the conducting loop also decreases.

ordinate axes of K_2 are turned out at the angle $j = uv/2c^2$ in the opposite rotational directions, as depicted in Fig. 4,a [2]. Then the e.m.f. is equal to [2]

$$e = \oint_{\Gamma} \left(\vec{E} + \vec{v} \times \vec{B}\right) d\vec{l} = \int_{BA} E_x dx + E_y \left(DB - AC\right) \approx \frac{uvE}{2c^2} L + E\left(DB - AC\right). \tag{18}$$

One can find from Fig. 4,b that

$$DB - AC = j L = uvL/2c^2 . \tag{19}$$

Substituting Eq. (19) into Eq. (18), we obtain

$$e = \frac{uvE}{c^2} L \tag{20}$$

in a full accordance with the Faraday induction law (see, Eq. (17)).

Further, let us write a transformation from K_0 to K_1 [7]:

$$E_{x1} = E_{x0}; E_{y1} = g_v \left(E_{y0} - vB_{z0}\right); E_{z1} = g_v \left(E_{z0} + vB_{y0}\right);$$
$$B_{x1} = B_{x0}; B_{y1} = g_v \left(B_{y0} + \left(v/c^2\right)E_{z0}\right); B_{z1} = g_v \left(B_{z0} - \left(v/c^2\right)E_{y0}\right). \tag{21}$$

Substituting Eqs. (16) into Eqs. (21), one gets:

$$E_{x1} \approx -E \frac{uv}{2c^2} \tag{22a}$$

$$E_{y1} \approx E\left(1 - \frac{v^2}{2c^2}\right), \tag{22b}$$

$$E_{z1} = B_{x1} = B_{y1} = 0 , \tag{22c}$$

$$B_{z1} \approx 0 . \tag{22d}$$

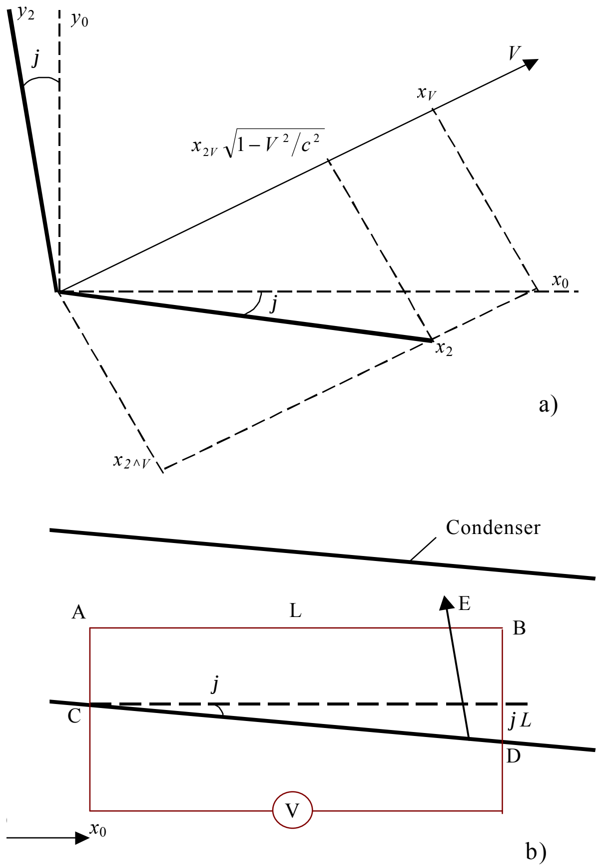

Fig. 4: a – the axes x_2 and y_2 of the frame K_2 are no longer parallel to the corresponding axes of K_0 due to the scale contraction effect in the frame K_0; b – due to this effect, an observer in the frame K_0 fixes that the plates of condenser constitute the negative angle j with the axis x_0 (and with the line AB).

Thus, the magnetic field in the frame K_1 disappears, while the electric field $\vec{E}$ has a non-zero projection onto the axis x_1, Eq. (22a).

As mentioned in Ref. [2], a spatial turn of the vector $\vec{E}$ at the angle $j \approx uv/2c^2$ has a simple physical meaning in special relativity, if we take into account the Thomas-Wigner rotation of the axes of K_1 and K_2 frames for the motion diagram in Fig. 2. The angle of this rotation is [8] $\Omega \approx uv/2c^2 = j$. This means that the vector $\vec{E}$ is orthogonal to the axis x_2 of K_2, and an observer in frame K_1 sees a simple spatial rotation of the condenser, as depicted in Fig. 5. At the same time, as known in electrostatics, rotation of a charged condenser does not induce an e.m.f. in a closed loop passing through the condenser. The same result can be obtained from Eq. (18), if we take into account that the difference *DB*-*AC* changes its sign in the frame K_1 in comparison with K_0 (compare Figs. 4,b and 5):

$$DB - AC = -uvL/2c^2 , \tag{23}$$

and e=0 in Eq. (18). This result, obtained within SRT, is quite contradictory: the e.m.f. exists in the frame K_0, and disappears for an observer in the (laboratory) frame K_1. In addition, it means a violation of causality.

Now we will show that such a non-physical result is avoided in CETs: the e.m.f. exists in both K_0 and K_1 frames in accordance with the Faraday induction law. In order to substantiate this conclusion, let us inspect more closely the effect of Thomas-Wigner rotation in CETs, in particular, in LET.

In the physical space-time of LET, where the rotation-free Galilean transformations are valid, the spatial rotation of co-ordinate axes is absent. We will show that the Thomas-Wigner rotation appears in LET as illusional effect (i.e., for measured space-time coordinates), caused by the combined action of the absolute contraction of moving scales and anisotropy of physical light velocity in moving inertial frames. Then, this principal difference in

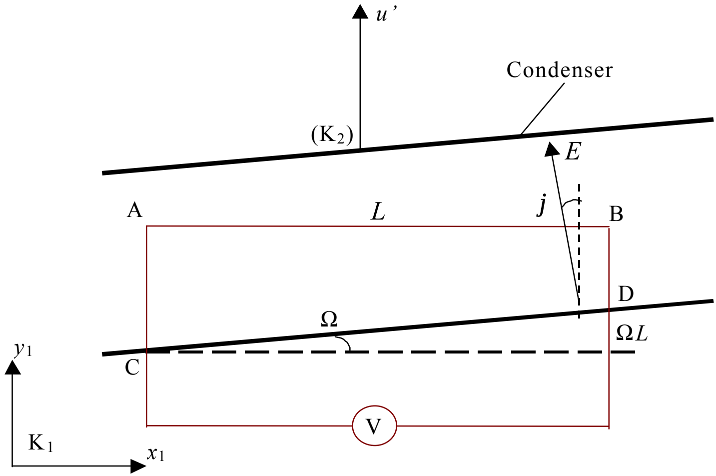

Fig. 5. Due to the Thomas-Wigner rotation between the frames K_1 and K_2, an observer in K_1 sees the space turn of condenser at the positive angle $\Omega = uv/2c^2$.

interpretation of the Thomas-Wigner rotation in STR and in LET will lead to different values of integral (18), in spite of the same field transformations in both these theories.

First of all, we take the inertial reference frame K_0 in Fig. 2 as absolute. This means that Fig. 4a, depicting the directions of the coordinate axes of the frame K_2 for an observer in K_0, remains valid. Due to the absolute contraction of the moving scale in LET (transformations (15), the same Fig. 4a holds true for the observer in K_1, whose coordinate axes remain parallel to the coordinate axes of the absolute frame K_0. However, due to the light velocity anisotropy along the axis x_1 of the frame K_1 ($c_{+x} = c - v$, $c_{-x} = c + v$ in accordance with the Galilean law of velocity composition in physical space-time), the true (black) position of the axis x_2 of K_2 transforms to

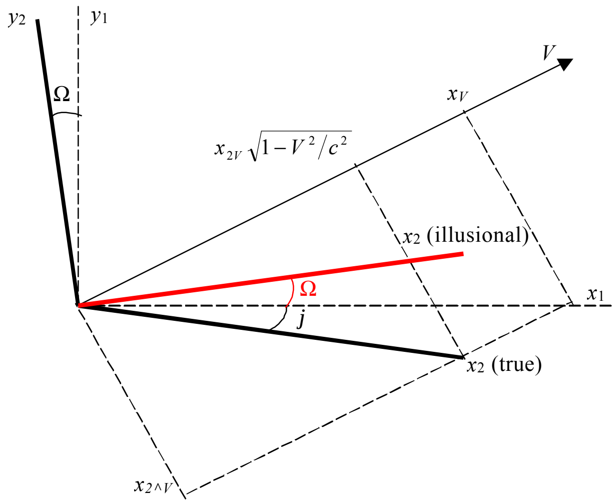

Fig. 6. For the illusionary (red) position of the axis x_2 of K_2 frame, an observer in K_1 fixes a common spatial rotation of the frame K_2 at the angle $\Omega = uv/2c^2$ (Thomas-Wigner rotation).

the "illusionary" (measured) red position of this axis for the observer in K_1 (see, Fig. 6).

We can understand the appearance of this illusion, analyzing a procedure of measurement of inclination of the axis x_2 of K_2 from the axis x_1 of K_1. In this measurement we can put two distant clocks Cl_1 and Cl_2 along the axis x_1 of K_1 and look for a difference in their readings at the instant when they touch the moving axis x_2 of K_2 frame (see, Fig. 7).

A true angle between the axes x_1 and x_2, in accordance with Fig. 6, is equal to $j \approx -uv/2c^2$. Hence, if the distance between two clocks is L, that the true time difference between the instants of their operation is

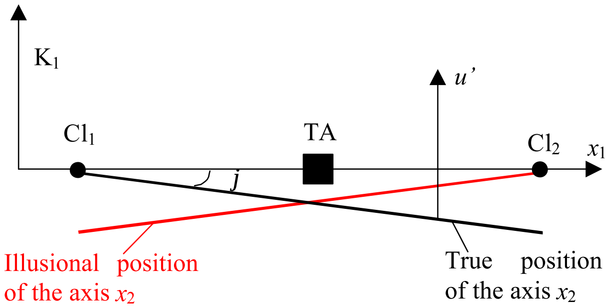

Fig. 7. For observer in K_1 the true (black) position of the axis x_2 of K_2 appears as the illusionary (red) position of this axis due to the light velocity anisotropy in the frame K_1. TA is the time analyzer.

$$\Delta t = \frac{L\frac{-uv}{2c^2}}{u} = -\frac{Lv}{2c^2},$$

i.e., the "stop" clock Cl_1 operates earlier than "start" clock Cl_2 (Δt is negative). At the moment of touching each clock emits a short light pulse to strike the time analyzer TA at the middle between Cl_1 and Cl_2. Due to anisotropy of physical light velocity along the axis x_1 ($c_+=c-v$, $c_-=c+v$), the time analyzer measures the difference between two pulses:

$$\Delta t = -\frac{Lv}{2c^2} + \frac{L}{2(c-v)} - \frac{L}{2(c+v)} \approx \frac{Lv}{2c^2}.$$

The plus sign means that the light pulse from Cl_2 (the "start" clock) arrives earlier than the pulse from Cl_1 ("stop" clock) to TA. Since an observer in K_1 does not know about anisotropy of light velocity along the axis x_1 of his frame (measured light velocity is equal to c in LET and in any other CET), he concludes that the inclination angle of the axis x_2 of frame K_2 (measured direction of this axis) is positive, i.e., it has the reverse sign with respect to the x_1 axis of frame K_1 in comparison with its true (negative) inclination angle. That is why the physical (black) position of the axis x_2 of frame K_2 in Figs. 6, 7, due to the light velocity anisotropy in K_1, appears as the red axis x_2 (illusionary position). It occurs due to inversion of the sign of the inclination angle for the illusionary direction of the x_2 axis relative to its true direction. As a result, the observer in K_1 frame erroneously concludes that both x_2 and y_2 axes are turned out at the same positive angle $\Omega = uv/2c^2$, which means a simple spatial rotation through angle Ω of the frame K_2 with respect to the frame K_1 (Thomas-Wigner rotation in SRT, Fig. 6). In the author's opinion, this physical explanation of the Thomas-Wigner rotation, which does not require the action of any torque, represents an important advantage of LET (and CETs) in comparison with SRT, where this effect is not explained. One can add that the Thomas precession (appearance of a multiplier ½ in the expression for spin-orbit interaction in atoms), considered as a strong experimental confirmation of the Thomas-Wigner rotation, finds alternative explanations in LET [4, 9].

The revealed principal difference between LET's and STR's interpretations of the Thomas-Wigner rotation is a cornerstone for explanation of the Faraday induction law in the frame K_1. Namely, in LET the condenser moving in K_1 has a true position according to Fig. 4,b, while in SRT the condenser has the true position depicted in Fig. 5. Note that in both Figs. 4, 5 the angle of $\vec{E}$ with the axis x_1 of K_1 is the same. However, the difference of the lengths of segments DB and AC has opposite signs for true and illusionary positions of the x_2 axis of frame K_2 (or lower plate of the condenser). For the illusionary position of the lower plate we get the difference DB and AC according to Eq. (23). For the true position of the plate (which should be used in LET calculations), the difference is positive, as in the frame K_0 (see Eq. (19):

$$DB - AC = |j|L = \frac{uvE}{2c^2}L. \tag{24}$$

Substituting Eq. (24) into Eq. (18), one gets for the frame K_1:

$$e = \frac{uvE}{2c^2}L + E(DB - AC) = \frac{uvE}{c^2}L, \tag{25}$$

which is the same value as in the frame K_0 (see, Eq. (20)) with the adopted accuracy of calculation.

Thus, within LET the e.m.f. in the circuit exists in both frames K_0 and K_1, while for SRT we derived a result in contradiction with the causality principle: the e.m.f. exists in the frame K_0 and disappears in the frame K_1.

In the next section we will describe a possible experimental scheme to detect an absolute velocity of Earth on the basis of the calculations carried out above.

4. The proposed experiment to test special relativity and covariant ether theories

The possible scheme of the experiment is shown in Fig. 8. Moving system MS, resting in a laboratory, provides an oscillating harmonic motion of the charged flat condenser at the angular frequency *w*:

$$y = y_0 \sin wt,$$

where y_0 is the amplitude of oscillation. The velocity of oscillation is

$$u = y_0 w \cos wt.$$

The side AB of the multi-turned conductive rectangular loop at rest in the laboratory passes across the inner volume of the condenser.

The high voltage, applied to the plates of the condenser, is equal to U. The distance between the plates of the condenser is l_0, and the length of the plates along the axis x is L. The output of the loop is connected with narrow-banded (near the frequency w) amplifier A. The output of amplifier is connected with the oscilloscope to measure a possible e.m.f. in the loop.

According to SRT, we are dealing with relative motion of the condenser and the loop, and the velocity u of this motion is co-linear to the vector $\vec{E}$ inside the condenser. This motion does not create a magnetic field inside the condenser, and no e.m.f. is induced in the circuit.

Considering this experiment within LET, we assume that the laboratory (Earth) moves at the constant "absolute" velocity v along the axis x. Due to the transformations (7), (8), there is no relative velocity between two arbitrary inertial reference frames in CETs, and all calculations should be carried out for their "absolute" velocities. This means, in particular, that in the absolute frame K_0 the loop moves at the "absolute" velocity v along the axis x, while the condenser moves at the absolute velocity $\vec{V} = \vec{u} \oplus \vec{v}$. For this motion diagram, Fig. 2 becomes relevant, and the e.m.f. in the loop can be defined according to Eq. (25) (for a single turn), with a single correction: if the profile sides of the loop lie very far from the boundaries of the condenser (Fig. 8), L denotes the length of plates of the condenser along the axis x, but not the length of sides of the loop. Substituting into Eq. (25) the following numerical values: $w=6\cdot 10^2$ Hz ($\nu \approx 100$ oscillations per second), $U=4\cdot 10^3$ V (an acceptable value for laboratory conditions), $L=0.2$ m, $l_0=2$ mm, $x_0=l_0/2=1$ mm (the maximum value of amplitude of oscillation for given l_0), $v\approx 10^{-3}c$ (typical velocities of Galactic objects). we estimate the maximum value of e.m.f. as

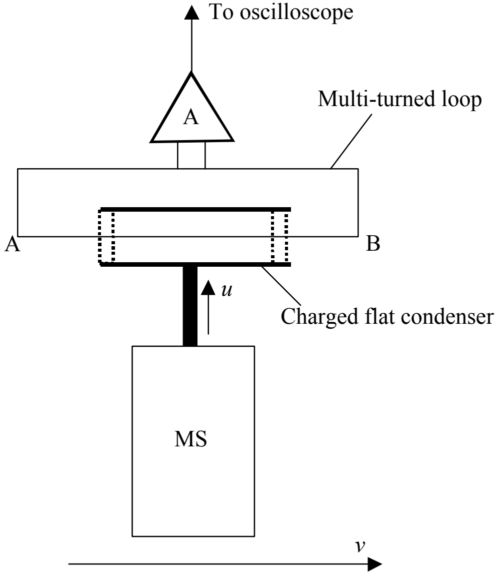

Fig. 8. Proposed scheme for an experimental test of SRT and LET.

$$e = \frac{x_0 w v U}{c^2 l_0} L = \frac{wLvU}{2c^2} = 10^{-3} \frac{wL}{2c} U \approx 0.8mV .$$

An attractive feature of the Faraday induction experiments is the possibility of multiplying the e.m.f. by a number of turns *n* of the loop. In particular, for *n*=100, we obtain

$$e \approx 80mV .$$

For the amplifying coefficient of the amplifier A about 10^3, we get the amplitude of e.m.f.

$$e \approx 80mV ,$$

which can be easy measured by oscilloscope. If CETs are correct, 24-hour and yearly variations of amplitude of e.m.f. should be detected.

5. Conclusions

Thus, a contradictory result, obtained within the framework of SRT for the problem considered in ref. [2] (a relative motion of parallel plate condenser and conducting loop with the side lying inside the condenser), is closely related to a relativistic interpretation of the Thomas-Wigner rotation as real spatial rotation of the co-ordinate axes of the reference frames involved into successive space-time transformations. This incorrect result signifies that an e.m.f. exists in one inertial reference frame, and disappears in another inertial frame. Recovery of causality (the e.m.f. exists for any inertial observer) occurs in Lorentz ether theory (one of the CETs), where the Thomas-Wigner rotation represents an illusional phenomenon, caused by the absolute scale contraction effect, as well as by anisotropy of physical light velocity for an arbitrary inertial observer. A principal difference in the interpretation of Thomas-Wigner rotation in SRT and LET makes it possible to perform and *experimentum crucis* to decide between two these theories. It rejects a wide-spread opinion that these two theories are indistinguishable at the experimental level.

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