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The Experimental Verification of the Absolute Space-Time Theory—I

The Fundamental Conception of the Absolute Space-Time Theory

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Abstract

The fundamental postulate of our theory is the constancy of light velocity only with respect to absolute space. This postulate was proved right by our recently performed 'coupled-mirrors' experiment (Marinov, 1974). In the present paper it is shown that the so-called (by us) Newtonian and Einsteinian time synchronisations lead respectively to the Galilean and Lorentz transformations. Both types of synchronisation can be practically realised, hence both corresponding transformations describe the physical reality at low as well as at high velocities of the material points. The conception that the Einstein time dilation is an absolute phenomenon and the Lorentz length contraction a fiction is defended.

1. *Introduction*

Our absolute space-time theory (Marinov, in preparation) finds its *experimentum crucis* in the 'coupled-mirrors' experiment recently performed by us (Marinov, 1974). This experiment has undoubtedly shown that the Einstein principle of relativity is invalid and that the hypothetical motionless 'luminiferous ether' of the nineteenth century in which light propagates with velocity c in all directions is a physical reality which we call absolute space.

After the development of the 'coupled-mirrors' experiment, theoretical physics has to thoroughly revise the fundamental space-time concepts defended by conventional physical theory, whose important basis is the theory of relativity, and in many aspects return to the old Newtonian absolute conception.

However, we must emphasise that we also work with the Lorentz transformation and do not reject it. Hence, almost all formulae of conventional physical theory find a place in absolute space-time theory, thus the revision of the mathematical apparatus is very limited.

In this paper we shall expound our basic space-time concept and we shall show how we arrive at the following two very important conclusions:

(a) The Einstein time dilation is an absolute phenomenon (as supposed by Lorentz) and not a relative phenomenon (as supposed by Einstein).

(b) The Lorentz length contraction is pure fiction, i.e., it is neither an absolute phenomenon (as supposed by Lorentz) nor a relative phenomenon (as supposed by Einstein).

2. *Newtonian and Einsteinian Time Synchronisations*

According to our theory light propagates with velocity c along all directions only in absolute space. The definition of absolute space is given in Marinov (1972). Since our 'coupled-mirrors' experiment has not yet given a reliable quantitative value for the absolute earth velocity, and since the astronomers also cannot offer such a reliable value, we shall assume that absolute space is that in which the centre of mass of our Galaxy rests.

It is well known that physics is geometry plus time. Hence any physicist must start with the problem of how time is to be measured.

We shall suppose that we have a clock which operates at the same rate as 'die Räder an der grossen Weltenuhr', i.e., that this clock performs a periodical motion with exactly equal periods. If we want to have at some other place of the used reference frame another 'daughter' clock which would show the same time as our 'mother' clock, i.e., whose pointers show at any *absolute moment* the same reading on its clock-face as the pointers of the 'mother' clock, then we have two possibilities of realizing this:

(a) Between the 'mother' and 'daughter' clocks we place a long *rigid* shaft which is rotating at a constant angular velocity determined, say, by the 'mother' clock. Let us have two cog-wheels on both ends of the shaft and let us number any two cogs which lie against each other on the opposite ends of a given shaft's generation. Let us now suppose that at the beginning of any time interval chosen as a time unit a definite cog of the first cog-wheel comes in touch with the 'mother' clock. If the pointers of the 'daughter' clock show the reading which is 'communicated' by the corresponding cog of the second cog-wheel when it makes contact with the 'daughter' clock, then we say that a Newtonian time synchronisation is maintained between both clocks.

(b) From the 'mother' clock we send a light signal at the beginning of any time interval chosen as a time unit. If the pointers of the 'daughter' clock show the reading which the light signal has 'communicated', plus the time r/c, where r is the distance between both clocks, then we say that an Einsteinian time synchronisation is maintained between both clocks.

When introducing the Einsteinian time synchronisation we make the *assumption* that light propagates with a velocity which has the same numerical value along all directions in *any* inertial frame of reference, i.e., in any frame which moves with a constant velocity with respect to absolute space.

If our 'mother' and 'daughter' clocks rest in absolute space, then their Newtonian and Einsteinian time synchronisations lead to the same result, i.e., two 'daughter' clocks placed at the same space point and synchronised respectively in Newtonian and Einsteinian manner will show the same reading on their clock-face. However, if our clocks move with a certain velocity in absolute space, then two such 'daughter' clocks will show different readings, and from this variance, with the help of r and c, one could determine the component V of the unknown absolute velocity along the line connecting the 'mother' clock to both 'daughter' clocks. This is due to the fact that velocity of light in a frame moving with velocity V in absolute space is equal to $c - V$ along a direction parallel to V and to $c + V$ along a direction antiparallel to V.

In our 'coupled-mirrors' experiment (Marinov, 1974) we have realised for the first time in the history of physics a combination of the Newtonian and Einsteinian time synchronisations and this gave us the possibility of determining the absolute earth velocity.

3. *The Galilean and Lorentz Transformations*

If we have two frames of reference moving with respect to each other, i.e., moving with different velocities respectively to absolute space, then the use of the Newtonian and Einsteinian synchronisations would lead to two different types of transformation formulae for the elements of motion of a given material point whose motion is considered in both frames. The Newtonian synchronisation leads to the Galilean transformation formulae and the Einsteinian synchronisation leads to the Lorentz transformation formulae.

We shall first deduce the Galilean transformation.

Let us have (Fig. 1) two frames K and K' between which there is the case

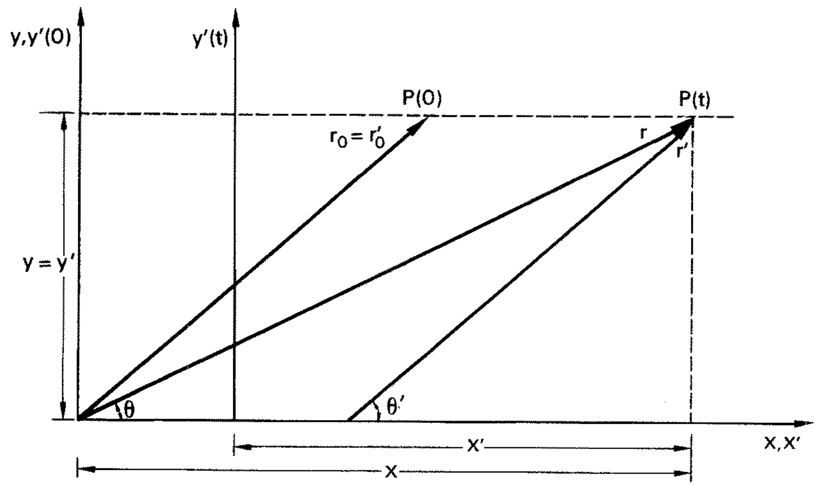

Figure 1.—Two space frames moving with respect to each other, the transformation between being a special one.

of a special transformation, i.e., at the initial zero moment both frames have coincided and frame K' proceeds with velocity V along the positive direction of the x-axis of frame K (or frame K proceeds with the same velocity along the negative direction of the x'-axis of frame K'). For the sake of simplicity we have shown a two-dimensional case in Fig. 1.

Let point P be at rest in K'. For the initial zero moment, $t_0 = t'_0 = 0$, the radius vectors $\mathbf{r}_0$ and $\mathbf{r}'_0$ of point P in both frames are equal. For an arbitrary moment t (to which in frame K' the moment t' corresponds) the radius vectors of point P in frames K and K' are respectively $\mathbf{r}$ and $\mathbf{r}'$ (= $\mathbf{r}'_0$). It is obvious that the y- and z-components of $\mathbf{r}$ and $\mathbf{r}'$ are equal, i.e.,

$$y = y', \qquad z = z' \tag{3.1}$$

Only the x-components are different at any different moment. To find the transformation formulae for the x-components let us assume that at the initial zero moment we send a photon from the common frames' origin to the projection of point P on the x-axes. When the Newtonian time synchronisation is used we should find that this photon reaches the projection of P at the moments

$$t = \frac{x}{c}, \qquad t' = \frac{x'}{c - V} \tag{3.2}$$

respectively, if we assume that frame K is attached to absolute space, or at the moments

$$t = \frac{x}{c + V}, \qquad t' = \frac{x'}{c} \tag{3.3}$$

if we assume that frame K' is attached to absolute space.

In both cases it must be

$$\frac{x}{c} = \frac{x'}{c - V}, \qquad \frac{x}{c + V} = \frac{x'}{c} \tag{3.4}$$

respectively, i.e.,

$$t = t' \tag{3.5}$$

From (3.2) and (3.5), as well as from (3.3) and (3.5), we immediately obtain

$$x = x' + V \, . \, t' \tag{3.6}$$

and

$$x' = x - V \, . \, t \tag{3.7}$$

Formulae (3.6), (3.7), (3.1) and (3.5) represent the special Galilean transformation which is the mathematical basis of so-called non-relativistic mechanics.

Let us now deduce the Lorentz transformation. For this purpose the

Einsteinian time synchronisation must be used, and instead of formulae (3.2) and (3.3) we should consider, in both cases,

$$t = \frac{x}{c}, \qquad t' = \frac{x'}{c} \tag{3.8}$$

We see that when the Einsteinian synchronisation is used the couples of formulae (3.2) and (3.3) must be replaced by the unique couple (3.8). Thus we have also to replace both formulae (3.4) by a unique formula. This is done by multiplying formulae (3.4) and taking the square root giving

$$x \,.\, \sqrt{\left(1 - \frac{V}{c}\right)} = x' \,.\, \sqrt{\left(1 + \frac{V}{c}\right)} \tag{3.9}$$

From here, using the second formula (3.8), we get

$$x = \frac{x' + V \,.\, t'}{\sqrt{\left(1 - \frac{V^2}{c^2}\right)}} \tag{3.10}$$

and using the first formula (3.8) we get

$$x' = \frac{x - V \,.\, t}{\sqrt{\left(1 - \frac{V^2}{c^2}\right)}} \tag{3.11}$$

Substituting (3.10) into (3.11) we obtain

$$t = \frac{t' + x' \,.\, V/c^2}{\sqrt{\left(1 - \frac{V^2}{c^2}\right)}} \tag{3.12}$$

and substituting (3.11) into (3.10) we obtain

$$t' = \frac{t - x \,.\, V/c^2}{\sqrt{\left(1 - \frac{V^2}{c^2}\right)}} \tag{3.13}$$

Formulae (3.10), (3.11), (3.1), (3.12), and (3.13) represent the special Lorentz transformation which is the mathematical basis of so-called relativistic mechanics.

At the given deduction of the Lorentz transformation the moments t and t' (for which we have obtained the transformation formulae) are such that a photon sent at the initial zero moment, $t_0 = t'_0 = 0$, from the origins of frames K and K', along their x-axes, just reaches the projections of point P on the x-axes at the moment t (or t').

We shall now suppose the most general case where t and t' are arbitrary. In such a case we send a photon from the origin of the moving frame K' at some initial moment $t_0 \neq 0$ (or $t'_0 \neq 0$) and it reaches the projection of point P on the

x-axes at the arbitrary moment t (or t'). In this general case, if we suppose that the rest frame K is attached to absolute space, we shall have, on the grounds of formulae (3.10), (3.11), (3.12), and (3.13),

$$x - x_0 = \frac{x' + V.(t' - t'_0)}{\sqrt{\left(1 - \frac{V^2}{c^2}\right)}}, \qquad t - t_0 = \frac{t' - t'_0 + \frac{x'.V}{c^2}}{\sqrt{\left(1 - \frac{V^2}{c^2}\right)}}$$
$$x' = \frac{x - x_0 - V.(t - t_0)}{\left(1 - \frac{V^2}{c^2}\right)}, \qquad t' - t'_0 = \frac{t - t_0 - \frac{(x - x_0).V}{c^2}}{\sqrt{\left(1 - \frac{V^2}{c^2}\right)}} \tag{3.14}$$

where x_0 is the x-coordinate of the origin O' of frame K' at the moment t_0 (or t'_0) when the 'photon-runner' is sent from O' along the x-axes; this photon reaches the projection x (or x') of point P at the moment t (or t'). Hence

$$x_0 = V.t_0 \tag{3.15}$$

If we further assume

$$t'_0 = t_0 . \sqrt{\left(1 - \frac{V^2}{c^2}\right)} \tag{3.16}$$

then formulae (3.14) reduce to formulae (3.10), (3.11), (3.12), and (3.13).

This assumption (namely, that time goes at a slower rate according to relation (3.15) in any frame moving at velocity V with respect to absolute space is fundamental in our absolute space-time theory and is called the *absolute time dilation.* We can consider this assumption as a result of the Lorentz transformation, because if we place into (3.12) $x' = 0$, we obtain

$$t' = t . \sqrt{\left(1 - \frac{V^2}{c^2}\right)} \tag{3.17}$$

The opposite assumption (which would follow from (3.13) if we insert $x = 0$) cannot be made because only frame K' (together with the attached K'-clock) can be considered moving with respect to absolute space, but evidently we can *not* make the symmetric opposite assumption that absolute space (together with the attached K-clock reading absolute time) moves with respect to frame K'.

However, we must emphasise that relation (3.17) is not an absolute logical result of the Lorentz transformation because the existence of absolute space *is not imprinted* in the Lorentz transformation formulae which have an absolutely symmetric character from a *mathematical viewpoint*. As a matter of fact, the special theory of relativity, which works with the Lorentz transformation, does not come to the conclusion that the time dilation is an absolute phenomenon and has endeavoured (despite the resistance of the healthy mind of several generations of physicists) to treat the time dilation as a relative phenomenon.

In Section 6 we give further motivations in favour of our absolute time dilation dogma. Other motivations will be given in future papers which are being prepared for printing.

We shall also need the formulae for our so-called restricted Lorentz transformation. The restricted transformation has the same character as the special one, with the unique difference that the relative velocity V is not parallel to the x-axes of frames K and K' but has an arbitrary direction. The formulae for the restricted Lorentz transformation can easily be obtained if we consider the radius vector $\mathbf{r}$ of an arbitrary point P as a sum of its vector components $\mathbf{r}_{\parallel}$ and $\mathbf{r}_{\perp}$, which are respectively parallel and perpendicular to $\mathbf{V}$, and if we apply the special Lorentz transformation to $\mathbf{r}_{\parallel}$ and $\mathbf{r}_{\perp}$. We therefore obtain

$$\begin{aligned} \mathbf{r} &= \mathbf{r}' + \left\{ \left(\frac{1}{\sqrt{\left(1 - \frac{V^2}{c^2}\right)}} - 1 \right) . \frac{\mathbf{r}' . \mathbf{V}}{V^2} + \frac{t'}{\sqrt{\left(1 - \frac{V^2}{c^2}\right)}} \right\} . \mathbf{V} \\ t &= \frac{1}{\sqrt{\left(1 - \frac{V^2}{c^2}\right)}} . \left(t' + \frac{\mathbf{r}' . \mathbf{V}}{c^2} \right) \end{aligned} \tag{3.18}$$

and the parallel inverse formulae if we should express $\mathbf{r}'$ and t' by $\mathbf{r}$ and t.

In conclusion, we can say that the Galilean and Lorentz transformations represent two *different* mathematical implements which are used for the description of the *same* physical reality, i.e., they represent two slightly different images of the same object. We do not agree with the conventional opinion that the Galilean transformation represents only a limited case of the Lorentz transformation when $V \ll c$. We defend the assertion that the Galilean transformation is also to be used when high velocity material systems are considered. The difference between these two transformations is determined only by the different character of synchronisation of clocks remote in space.

4. *Space Intervals in Non-Relativistic Mechanics*

Let us take a rod which is at rest in the used reference frame. We can measure its length (i.e., the space interval between both ends), with the help of a standard length, during a specific time, the duration of which is of no importance.

However, if this rod moves in the used reference frame, then we cannot proceed in such a manner. We now have to register the 'track' which the rod would leave for a certain time interval. After measuring this 'track', which represents a 'rod at rest' in the used frame, we can calculate the true length of the moving rod if we know its velocity and the duration of the corresponding time interval. Of course, if the time interval is insignificantly short, then it is not necessary to make such a correction over the measured 'track'.

As an example let us measure the length of a train which moves with velocity v. If we run a certain time t with a velocity c $(c > v)$, parallel with the train from the last carriage to the locomotive, we shall cover a distance

$$r = r_0 + v \cdot t \tag{4.1}$$

where r_0 is the length of the train, which could be measured when resting at the station.

Both ends of distance r can be marked by us relative to the ground (relative to the railway), and, having these two scores, we can measure distance r during specific long time-interval.

But we can run with velocity c on the top of the carriages (as we have seen many times in the movies) and, throwing two stones, mark the 'track' with respect to the railway.

In the first case, i.e., when our velocity c is taken with respect to the ground, we shall have

$$t = \frac{r}{c} \tag{4.2}$$

and, in the second case, i.e., when our velocity c is taken with respect to the train, we shall have

$$t = \frac{r_0}{c} \tag{4.3}$$

Substituting (4.2) and (4.3) into (4.1), we obtain, respectively

$$r = \frac{r_0}{1 - \frac{v}{c}}, \qquad r = r_0 \cdot \left(1 + \frac{v}{c}\right) \tag{4.4}$$

We note that these two relations differ within second-order terms of v/c. This is a result of the two different assumptions concerning velocity c, namely that in the first case c is the velocity of the 'runner' with respect to the ground, and in the second case c is the velocity of the 'runner' with respect to the train. If in the first formula of (4.4) we put $c + v$ instead of c, we should obtain the second formula of (4.4), and if in the second formula we put $c - v$ instead of c, we should obtain the first formula.

Let us now consider the most general case, where the velocity of the moving rod is not parallel to its length (see Fig. 2). Similar results could be obtained if we want to know the distance between a point q, moving with an arbitrary velocity v, and a point P_0 which rests in the used reference frame.

There are two possibilities of measuring the length of the moving rod P_0Q_0, or the distance between the rest point P_0 and the moving point q when the latter crosses the space point Q_0:

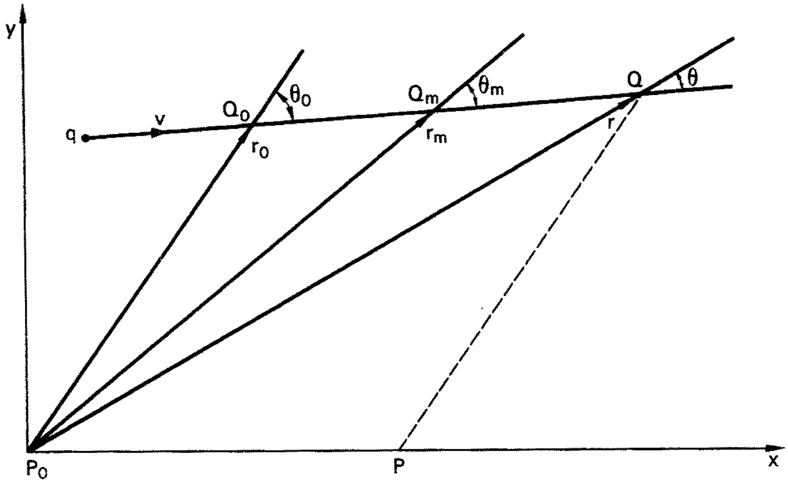

Figure 2.–A 'photon-runner' going 'there' or 'back'.

(a) either to start from point q (when it crosses Q_0) at the moment t_0, which we shall call the *emission moment*, and covering with velocity c the distance $r_0 = Q_0P_0$ to arrive at point P_0 at the moment

$$t = t_0 + \frac{r_0}{c} \tag{4.5}$$

which we shall call *reception moment*;

(b) or to start from point P_0 at the emission moment t_0 and covering with velocity c the distance $r = P_0Q$ to catch point q (when it crosses Q) at the reception moment

$$t = t_0 + \frac{r}{c} \tag{4.6}$$

We have to use the relation

$$\mathbf{r} = \mathbf{r}_0 + \mathbf{v}\,.(t - t_0) \tag{4.7}$$

If into this equation we first place (4.7), we should obtain, using Fig. 2,

$$r = r_0\,.\sqrt{\left(1 + 2\,.\frac{v}{c}\,.\cos\theta_0 + \frac{v^2}{c^2}\right)} \tag{4.8}$$

or

$$r = r_0\,.\left(\sqrt{\left(1 - \frac{v^2}{c^2}\,.\sin^2\theta\right)} + \frac{v}{c}\,.\cos\theta\right) \tag{4.9}$$

where θ_0 is the angle between $\mathbf{v}$ and $\mathbf{r}_0$ (the vector connecting point P_0 with point q at the emission moment) and is called the *emission angle*, while θ is the angle between **v** and **r** (the vector connecting point P_0 with point q at the reception moment) and is called the *reception angle.*

If now into equation (4.7) we place (4.6), we should obtain, using Fig. 2,

$$r = \frac{r_0}{\sqrt{\left(1 - \frac{v^2}{c^2} \cdot \sin^2 \theta_0\right)} - \frac{v}{c} \cdot \cos \theta_0} \tag{4.10}$$

or

$$r = \frac{r_0}{\sqrt{\left(1 - 2 \cdot \frac{v}{c} \cdot \cos \theta + \frac{v^2}{c^2}\right)}} \tag{4.11}$$

The distance r_0 can be called the *emission distance* and the 'track' distance r can be called the *reception distance.*

Let us now find the relation between r_0 and r when the 'runner' covers, with velocity c, some *middle distance* r_m, starting at the emission moment t_0 from Q_m (or from P_0) and arriving at the reception moment

$$t = t_0 + \frac{r_m}{c} \tag{4.12}$$

at P_0 (or at Q_m).

We can now write (see Fig. 2)

$$\frac{r_m}{c} = \frac{r \cdot \cos \theta - r_0 \cdot \cos \theta_0}{v} \tag{4.13}$$

When the 'runner' covers distance r_0 between the emission and observation moments, it is

$$\frac{r_0}{c} = \frac{r \cdot \cos \theta - r_0 \cdot \cos \theta_0}{v} \tag{4.14}$$

from where

$$r = r_0 \cdot \frac{v/c + \cos \theta_0}{\cos \theta} \tag{4.15}$$

and when the 'runner' covers distance r between the emission and reception moments, it is

$$\frac{r}{c} = \frac{r \cdot \cos \theta - r_0 \cdot \cos \theta_0}{v} \tag{4.16}$$

from where

$$r = r_0 \cdot \frac{\cos \theta_0}{\cos \theta - v/c} \tag{4.17}$$

Relations (4.15) and (4.17) differ within second-order terms v/c and can be called non-relativistic relations between r_0, r, θ_0, θ, v, and c because, until now, we have worked only with the Newtonian concept.

Let us now find a relation between r_0, r, θ_0, θ, v, and c which would correspond to condition (4.13). For this reason we have to define an expression for r_m through r_0, r, θ_0, θ, v, and c, substantially different from (4.13), and, putting this expression into (4.13), obtain a suitable relation between r_0, r, θ_0, θ, v, and c. We have made many mathematical efforts to do this, without success, and we found the following to be the most reasonable path: Let us multiply formulae (4.15) and (4.17) and let us take the square root: we obtain

$$r = r_0 \cdot \sqrt{\left(\frac{v/c + \cos\theta_0}{\cos\theta - v/c} \cdot \frac{\cos\theta_0}{\cos\theta}\right)} \tag{4.18}$$

We can now call (4.18) the relativistic expression between r and r_0, because the way in which we pass from both non-relativistic formulae (4.15) and (4.17) to the unique formula (4.18) is similar to how we passed from both non-relativistic formulae (3.4) to the unique relativistic formula (3.9). However, the mathematical essence of relation (4.18) is now *very transparent and clear from a non-relativistic point of view*, because it is obvious that relation (4.18) corresponds to the case where the 'runner' covers some middle distance r_m between the emission and reception moments.

From Fig. 2 we have

$$\frac{r_0}{r} = \frac{\sin\theta}{\sin\theta_0} \tag{4.19}$$

and from (4.18) and (4.19) we obtain the following relations between the angles θ_0 and θ

$$\cos\theta = \frac{\cos\theta_0 + v/c}{1 + \frac{v}{c} \cdot \cos\theta_0}, \qquad \cos\theta_0 = \frac{\cos\theta - v/c}{1 - \frac{v}{c} \cdot \cos\theta} \tag{4.20}$$

From formulae (4.19) and (4.20) we find

$$r = r_0 \cdot \frac{1 + \frac{v}{c} \cdot \cos\theta_0}{\sqrt{\left(1 - \frac{v^2}{c^2}\right)}}, \qquad r = r_0 \cdot \frac{\sqrt{\left(1 - \frac{v^2}{c^2}\right)}}{1 - \frac{v}{c} \cdot \cos\theta} \tag{4.21}$$

from where

$$r = r_0 \cdot \sqrt{\left(\frac{1 + \frac{v}{c} \cdot \cos\theta_0}{1 - \frac{v}{c} \cdot \cos\theta}\right)} \tag{4.22}$$

From (4.21) we get

$$\left(1+\frac{v}{c}\,.\cos\theta_0\right).\left(1-\frac{v}{c}\,.\cos\theta\right)=1-\frac{v^2}{c^2} \tag{4.23}$$

Since it is approximately

$$\cos\theta_0=\cos\theta_m+a, \qquad \cos\theta=\cos\theta_m-a \tag{4.24}$$

where a is a positive or negative quantity and θ_m is the angle between $\mathbf{v}$ and $\mathbf{r}_m$ (the vector connecting point P_0 with point q at the *middle moment* t_m between the emission and reception moments), which is called the *middle angle*, then we can write (4.22) approximately in the form

$$r=r_0\,.\sqrt{\left(\frac{1+\frac{v}{c}\,.\cos\theta_m}{1-\frac{v}{c}\,.\cos\theta_m}\right)} \tag{4.25}$$

We must emphasise that formulae (4.21) are *identical*, while formulae (4.8) and (4.9), on the one hand, and formulae (4.10) and (4.11), on the other hand, are *different*. So for the longitudinal case $\theta_0=\theta=0$, instead of the two formulae (4.4), obtained when proceeding, respectively from formulae (4.10) and (4.11) and formulae (4.8) and (4.9), we obtain the unique formula

$$r=r_0\,.\sqrt{\left(\frac{1+v/c}{1-v/c}\right)} \tag{4.26}$$

when proceeding from formulae (4.21).

However, it is important to note that for the transverse case $\theta_0=\pi/2$ formulae (4.21), (4.10) and (4.8)–the last within an accuracy of second order in v/c–give the same result:

$$r=\frac{r_0}{\sqrt{\left(1-\frac{v^2}{c^2}\right)}} \tag{4.27}$$

and for the transverse case $\theta=\pi/2$ formulae (4.21), (4.9) and (4.11)–the last within an accuracy of second order in v/c–again give the same result:

$$r=r_0\,.\sqrt{\left(1-\frac{v^2}{c^2}\right)} \tag{4.28}$$

Thus the difference between the non-relativistic formulae (4.8), (4.9), (4.10) and (4.11) and the relativistic formulae (4.21) is not so drastic.

It is clear that the problem, which formulae correspond better to reality–the non-relativistic or the relativistic–cannot be posed. These slightly different formulae correspond to slightly different conditions under which the 'runner' covers with velocity c the distance between points P_0 and q, and they all correspond to reality.

However, when the 'runner' is a photon, then, as nature shows (this can be seen in the Michelson–Morley experiment and in the longitudinal Doppler effect experiments), the relativistic formulae (4.21) correspond to reality and the non-relativistic formulae do not. Thus we have to assume that during the emission and reception moments the 'photon-runner' covers the middle distance with velocity c. In our opinion, this conclusion, as a matter of fact, is a result of the absolute time dilation dogma.

Let us now suppose that the reference frame in Fig. 2 is attached to absolute space and thus point q moves with velocity v in absolute space. If we denote by c_0 the velocity of the 'photon-runner' with respect to point q, then instead of formula (4.5) we have to write the following one

$$t = t_0 + \frac{r_0}{c_0} \tag{4.29}$$

and now formulas (4.6) and (4.29) will be valid *together*. In this case we can immediately obtain from formulas (4.21), (4.6), and (4.29)

$$c_0 = c \cdot \frac{\sqrt{\left(1 - \frac{v^2}{c^2}\right)}}{1 + \frac{v}{c} \cdot \cos\theta_0} = c \cdot \frac{1 - \frac{v}{c} \cdot \cos\theta}{\sqrt{\left(1 - \frac{v^2}{c^2}\right)}} \tag{4.30}$$

Those are the formulas for the velocity of light in a moving frame of reference in relativistic mechanics, according to our absolute space-time conceptions.

The same formulas can be also obtained when proceeding from the Lorentz transformation. Let us suppose that frame K in Fig. 1 is at rest in absolute space and frame K' is the moving one. If the 'photon-runner' is sent from the coinciding origins of K and K' at the initial zero moment, $t_0 = t_0' = 0$, and if it catches point P respectively at the moments t and t', we should have (see (3.8))

$$\frac{r}{t} = c \qquad \frac{r'}{t'} = c \tag{4.31}$$

i.e., the velocity of light in both frames has the same numerical value when time in these frames is not the same but is to be transformed according to the Lorentz transformation formulas. However if we should measure the velocity of light in both frames in the *same absolute time*, we have to write

$$\frac{r}{t} = c, \qquad \frac{r'}{t} = c_0 \tag{4.32}$$

Substituting t from the second formula (3.18) into the second formula (4.32), we get, keeping in mind the second relation (4.31),

$$c_0 = \frac{r'}{t} = \frac{r'}{t'} \cdot \frac{\sqrt{\left(1 - \frac{V^2}{c^2}\right)}}{1 + \frac{\vec{r}_i' \cdot \vec{V}}{t' \cdot c^2}} = c \cdot \frac{\sqrt{\left(1 - \frac{V^2}{c^2}\right)}}{1 + \frac{V}{c} \cdot \cos\theta'} \qquad (4.33)$$

Obviously, we cannot express t through $\vec{r}'$ and $\vec{t}'$, but $\vec{r}'$ through $\vec{r}$ and t according to the formula inverse to the first formula (3.18) and use the first relation (4.31). The calculation in this case is more complicated and we obtain

$$c_0 = \frac{r'}{t} = \frac{\sqrt{(\vec{r}'^2)}}{t} = \frac{r}{t} \cdot \frac{1 - \frac{\vec{r} \cdot \vec{V}}{t \cdot c^2}}{\sqrt{\left(1 - \frac{V^2}{c^2}\right)}} = c \cdot \frac{1 - \frac{V}{c} \cdot \cos\theta}{\sqrt{\left(1 - \frac{V^2}{c^2}\right)}} \qquad (4.34)$$

5. *Space Intervals in Relativistic Mechanics*

In this section we proceed from the Lorentz transformation formulae and intend to show to which results they lead concerning the space interval between two points moving with velocity V together, or one with respect to the other. When referring to a 'rod', we will also have in mind the second case.

Let us consider the problem about the length of a 'rod', using first the *Einsteinian time synchronisation*. Hence the measurement of the length of a 'rod' is to be performed by sending a light signal from one of its ends to the other. Then the distance between both scores left in the rest frame K is to be measured and the real length (distance), if we know the relation V/c, calculated.

Let us have a 'rod' which has an arbitrary position in frame K' (use Fig. 1) and let us find its 'track' in frame K. We proceed from formulae (3.10) and (3.1) and build the differences $x_2 - x_1, y_2 - y_1, z_2 - z_1$, where (x_1, y_1, z_1) and (x_2, y_2, z_2) are the coordinates of the scores left in frame K when a light signal is sent at the moment t_1 (t_1') from one end of the 'rod' to its other end, which is covered by the signal at the moment t_2 (t_2'). Let us square these differences and add, respectively, their left and right sides. Taking the square root from the equation obtained, and substituting there

$$t_2' - t_1' = \frac{1}{c} \cdot \sqrt{[(x_2' - x_1')^2 + (y_2' - y_1')^2 + (z_2' - z_1')^2]} = \frac{r'}{c} = \frac{r_0}{c} \qquad (5.1)$$

we obtain the following relation (cf. (4.21))

$$r = r_0 \cdot \frac{1 + \frac{V}{c} \cdot \cos\theta_0}{\sqrt{\left(1 - \frac{V^2}{c^2}\right)}} = r_0 \cdot \frac{1 + \frac{\mathbf{n}_0 \cdot \mathbf{V}}{c}}{\sqrt{\left(1 - \frac{V^2}{c^2}\right)}} \tag{5.2}$$

where we have used the notation

$$\frac{x_2' - x_1'}{r'} = \cos\theta' = \cos\theta_0 \tag{5.3}$$

and $\mathbf{n}' = \mathbf{n}_0$ is the unit vector pointing from the initial to the final end of the 'rod' in frame K'.

In the same way, proceeding from formula (3.11) and the inverse formulae (3.1) and using the condition

$$t_2 - t_1 = \frac{1}{c} \cdot \sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2]} = \frac{r}{c} \tag{5.4}$$

we obtain the following relation (cf. (4.21))

$$r_0 = r \cdot \frac{1 - \frac{V}{c} \cdot \cos\theta}{\sqrt{\left(1 - \frac{V^2}{c^2}\right)}} = r \cdot \frac{1 - \frac{\mathbf{n} \cdot \mathbf{V}}{c}}{\sqrt{\left(1 - \frac{V^2}{c^2}\right)}} \tag{5.5}$$

where we have used the notation

$$\frac{x_2 - x_1}{r} = \cos\theta \tag{5.6}$$

and $\mathbf{n}$ is the unit vector pointing from the initial to the final end of the 'track' of our 'rod' in frame K.

Relations (5.2) and (5.5) can also be obtained, proceeding from the formulae for the restricted Lorentz transformation.

Indeed, proceeding from the first formula (3.18), let us build the difference $\mathbf{r}_2 - \mathbf{r}_1$, where $\mathbf{r}_1$ and $\mathbf{r}_2$ are the radius vectors of the scores left in frame K when a light signal is sent at the moment t_1 (t_1') from one end of our 'rod' to its other end which is covered by the signal at the moment t_2 (t_2'). Squaring both sides of the equation obtained, taking the square root, using the notations

$$\mathbf{r}_2 - \mathbf{r}_1 = r \cdot \mathbf{n}, \qquad \mathbf{r}_2' - \mathbf{r}_1' = r' \cdot \mathbf{n}' = r_0 \cdot \mathbf{n}_0 \tag{5.7}$$

and introducing the conditions

$$t_2 - t_1 = \frac{r}{c}, \qquad t_2' - t_1' = \frac{r'}{c} = \frac{r_0}{c} \tag{5.8}$$

we obtain formula (5.2).

In a similar way, proceeding from the inverse formula to (3.18), we can obtain formula (5.5).

We shall now write formulae (5.2) and (5.5) in different notations.

Let us consider again the point q proceeding with an arbitrary velocity $\mathbf{v}$ in the rest frame of reference K (see Fig. 3 and compare it with Fig. 2). When q crosses the space point Q' a light signal (a 'photon-runner') is sent towards point P, which we shall call the reference point. This light signal, covering distance r', reaches P at the moment t, called the *observation moment*, when q crosses point Q. At this very moment a light signal is sent from P which, covering distance r'', catches q when it crosses point Q''.

The moment

$$t' = t - \frac{r'}{c} \tag{5.9}$$

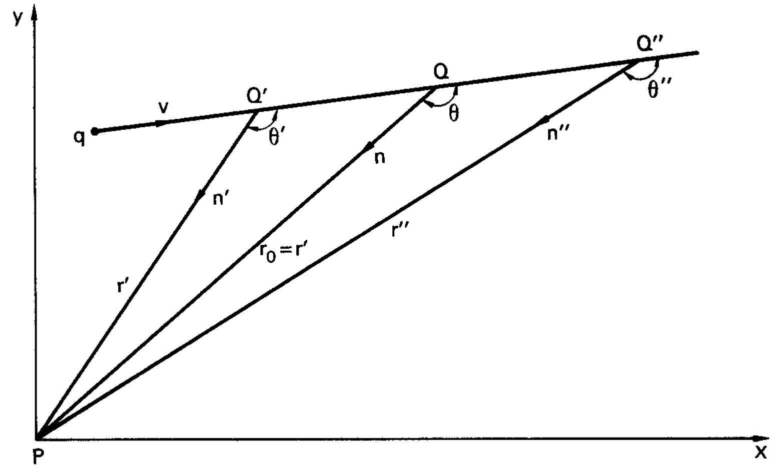

Figure 3.—A 'photon-runner' going 'there' and 'back'.

at which a light signal is sent from q when it crosses point Q' is called the *advanced moment*.

The moment

$$t'' = t + \frac{r''}{c} \tag{5.10}$$

at which a light signal sent from P reaches q when it crosses point Q'', is called the *retarded moment*.

Slightly different values for the advanced and retarded moments should be obtained if in formulae (5.9) and (5.10) we write r_0 instead of r' and r''.

We call r', r'', and r_0, respectively, the *advanced, retarded*, and *observation distances*.

When comparing Fig. 3 with Fig. 2 we must take into account that the triangle Q_0P_0Q corresponds *either* to the triangle $Q'PQ$ *or* to the triangle

QPQ''. Take also into account that in Fig. 2 the radius vectors $\mathbf{r}_0$ and $\mathbf{r}$ (i.e., the unit vectors $\mathbf{n}_0$ and $\mathbf{n}$) point from the rest point P to the moving point q, while in Fig. 3 the unit vectors $\mathbf{n}'$, $\mathbf{n}$, and $\mathbf{n}''$ point from the moving point q to the rest point P. We also see immediately that if the emission moment is the advanced moment, then the reception moment is the observation moment, and if the emission moment is the observation moment, then the reception moment is the retarded moment.

Thus, writing in formula (5.2)

$$r = r_0, \qquad r_0 = r', \qquad \mathbf{n}_0 = -\mathbf{n}', \qquad \theta_0 = \theta', \qquad \mathbf{V} = \mathbf{v} \tag{5.11}$$

and writing in formula (5.5)

$$r_0 = r_0, \qquad r = r'', \qquad \mathbf{n} = -\mathbf{n}'', \qquad \theta = \theta'', \qquad \mathbf{V} = \mathbf{v} \tag{5.12}$$

we obtain, respectively,

$$\begin{aligned} r_0 &= r' . \frac{1 - \dfrac{\mathbf{n}' . \mathbf{v}}{c}}{\sqrt{\left(1 - \dfrac{v^2}{c^2}\right)}} = r' . \frac{1 - \dfrac{v}{c} . \cos \theta'}{\sqrt{\left(1 - \dfrac{v^2}{c^2}\right)}} \\ r_0 &= r'' . \frac{1 + \dfrac{\mathbf{n}'' . \mathbf{v}}{c}}{\sqrt{\left(1 - \dfrac{v^2}{c^2}\right)}} = r'' . \frac{1 + \dfrac{v}{c} . \cos \theta''}{\sqrt{\left(1 - \dfrac{v^2}{c^2}\right)}} \end{aligned} \tag{5.13}$$

Let us now consider the problem about the length of a 'rod' using *Newtonian time synchronisation*. Hence the length of a given 'rod' moving in frame K with velocity $\mathbf{v}$ is to be established, registering the scores which both its ends leave in frame K at a given absolute moment.

We must emphasise that according to our absolute space-time conception, at a given moment the 'rod' has the *same length* in any frame of reference. However, if we use Newtonian time synchronisation in the Lorentz transformation formulae, then a certain peculiarity appears which will now be analysed.

The 'momentary' length of a 'rod' will be called the *distance* between both its ends and will be denoted

$$r = \sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2]} \tag{5.14}$$

where (x_1, y_1, z_1) and (x_2, y_2, z_2) are the coordinates of both ends of the 'rod' which are registered in frame K at the same moment

$$t_1 = t_2 = t \tag{5.15}$$

If we compare (5.14) with (5.4), we must take into account that in (5.4) r is the 'track' distance left by the 'rod' in frame K during a definite time interval $t_2 - t_1$, while r in (5.14) is a 'momentary track' left by the 'rod' in K at a given instant.

Let us now write the length of this 'rod' in frame K'. Supposing that the 'rod' rests in K', we shall have

$$r' = r_0 = \sqrt{[(x'_2 - x'_1)^2 + (y'_2 - y'_1)^2 + (z'_2 - z'_1)^2]} \tag{5.16}$$

where (x'_1, y'_1, z'_1) and (x'_2, y'_2, z'_2) are the coordinates of both ends of the 'rod' which are registered in frame K'. Since the 'rod' rests in K', then these coordinates concern every moment there.

Using formula (3.11) and the inverse formulae (3.1) into (5.16), and remembering condition (5.15), we find

$$r_0 = \frac{1}{\sqrt{\left(1 - \frac{v^2}{c^2}\right)}} \cdot \sqrt{\left\{(x_2 - x_1)^2 + \left(1 - \frac{v^2}{c^2}\right) . [(y_2 - y_1)^2 + (z_2 - z_1)^2]\right\}} \tag{5.17}$$

If we use here notations (5.6) and (5.14) we get

$$r_0 = r . \frac{\sqrt{\left(1 - \frac{v^2}{c^2} . \sin^2 \theta\right)}}{\sqrt{\left(1 - \frac{v^2}{c^2}\right)}} \tag{5.18}$$

where θ is the angle between the line along which the 'rod' lies and its velocity.

We call r_0 the *proper distance* of the moving 'rod'.

For $\theta = \pi/2$ we obtain

$$r_0 = r \tag{5.19}$$

and for $\theta = 0$ we obtain

$$r_0 = \frac{r}{\sqrt{\left(1 - \frac{v^2}{c^2}\right)}} \tag{5.20}$$

According to our absolute conception the difference between the distance r and the proper distance r_0 is *not* a result of some physical length contraction (commonly called the Lorentz contraction). This is a result of the interference of the two slightly different mathematical apparatus—the non-relativistic and the relativistic.

Indeed, using Fig. 3 and performing a purely non-relativistic calculation, we shall have

$$r' - \frac{r'}{c} . v . \cos \theta' = \sqrt{\left[r^2 - \left(\frac{r'}{c} . v . \sin \theta'\right)^2\right]} \tag{5.21}$$

But according to the law of sines it is

$$\frac{r'}{\sin (\pi - \theta)} = \frac{r}{\sin \theta'} \tag{5.22}$$

so that we can write (5.21) in the form

$$r = r' \cdot \frac{1 - \frac{v}{c} \cdot \cos\theta'}{\sqrt{\left(1 - \frac{v^2}{c^2} \cdot \sin^2\theta\right)}} \tag{5.23}$$

This formula, and the first formula (5.13) lead immediately to relation (5.18).

We must emphasise that when writing equation (5.21) we have assumed that the 'photon-runner' covers the emission (i.e., the advanced) distance. If we should assume that the 'photon-runner' covers the reception (i.e., observation) distance, another relation between r_0 and r can be obtained which will lead to a 'length dilation'.

Hence we must look to the distance r as a 'non-relativistic' observation distance and to the proper distance r_0 as a 'relativistic' observation distance. These two distances are connected by relation (5.18). This permanent contradiction between the distance r and the proper distance r_0 appears, not as a result of some peculiar property of space and time, which the theory of relativity has tried to introduce into physics, despite the resistance of the healthy human mind, but as a result of the fact that in non-relativistic mechanics we assume that between the moments of emission and reception the 'photon-runner' covers either the emission or the reception distances, while in relativistic mechanics we assume that the 'photon-runner' covers the middle distance. We shall repeat (see the end of Section 4), in the basis of this contradiction lies the absolute time dilation.

6. *Time Intervals*

Let us have (Fig. 4) two so-called light clocks, one of which (clock A) is at rest in the used reference frame attached to absolute space and the other (clock B) performing a rotational motion in such a manner that its 'arm' always remains perpendicular to the linear velocity of rotation.

If clocks A and B have the same 'arms' they will go exactly at the same rate when being at rest, i.e., two photon packages left together, say, from their left mirrors, will reach the mirrors at the same time.

However, if clock B performs the above-mentioned rotational motion, its photon package will always arrive, with a specific time delay, later than the corresponding photon package in clock A. Indeed, the photon packages have to cover the distance $2 \cdot r_0$ between two reflections in clock A and the distance

$$2 \cdot r = \frac{2 \cdot r_0}{\sqrt{\left(1 - \frac{v^2}{c^2}\right)}} \tag{6.1}$$

in clock B, where r_0 is the length of the light clock's 'arm'.

This formula can be obtained from the first formula of (4.21)—or from formulae (4.8) and (4.10)—at the condition $\theta_0 = \pi/2$, as well as from the second formula of (4.21)—or from formulae (4.9) and (4.11)—at the condition $\cos\theta = v/c$ (see Fig. 4).

Thus if we choose the unit of time as the time between two successive reflections of a photon package in a light clock with a given 'arm' r_0, then the light clock A will have

$$n_0 = \frac{2 \,.\, r_0}{c} \tag{6.2}$$

absolute seconds in a unit of time.

The light clock B will also have n_0 absolute seconds in a unit of time when being at rest and

$$n = \frac{2 \,.\, r}{c} = \frac{2 \,.\, r_0}{c \,.\, \sqrt{\left(1 - \frac{v^2}{c^2}\right)}} \tag{6.3}$$

absolute seconds in a unit of time when being in motion.

From (6.2) and (6.3) we draw the conclusion that clock B goes at a slower rate and if, for a certain absolute time interval, say for one revolution of clock B, the reading of clock A is t A-time-units, then the reading of clock B will be

$$t_0 = t \,.\, \sqrt{\left(1 - \frac{v^2}{c^2}\right)} \tag{6.4}$$

B-time-units, since it is $t_0/t = n_0/n$. We call t *time interval* and t_0 *proper time interval*.

This deduction of the time dilation has an entirely non-relativistic character. It is clear from Fig. 4 that clock B moves with respect to absolute space and clock A is at rest. In the opposite case we have to assume that the whole world rotates about clock B; obviously, this is nonsense.

In Fig. 4 the motion of clock B is non-inertial during the whole period of separation from clock A. We shall now show that we will also obtain the same effect of time dilation when the motion of clock B is inertial during the predominant part of the separation time.

Indeed, let us have (Fig. 5) a light clock A, which is at rest in absolute space, and an identical light clock B which passes near it (at point b) with velocity v. Until the point b' the light clock B moves inertially with the same velocity v. From point b' to point b'' its velocity reduces to zero, and from point b'' to point b' its velocity increases again to v however oppositely directed. Clock B then begins to move inertially and, with this velocity v, again passes near clock A.

Now assuming that the time of non-inertial motion is insignificantly short with respect to the time of its inertial motion, we can obtain, in a purely non-

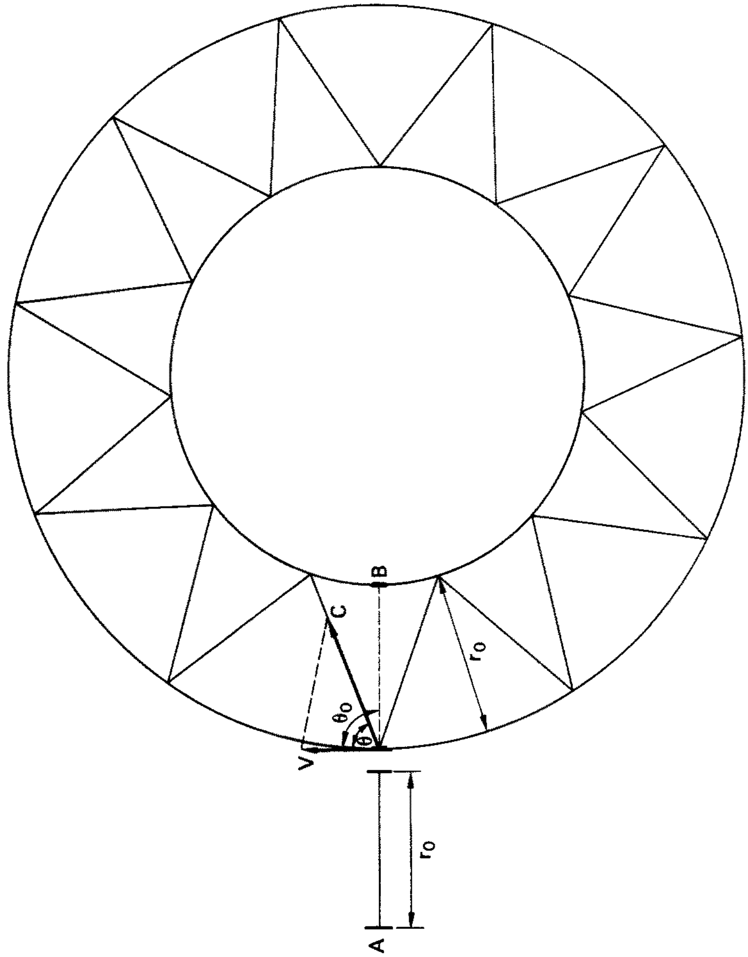

Figure 4.–Two light clocks, the second of which performs a circular motion.

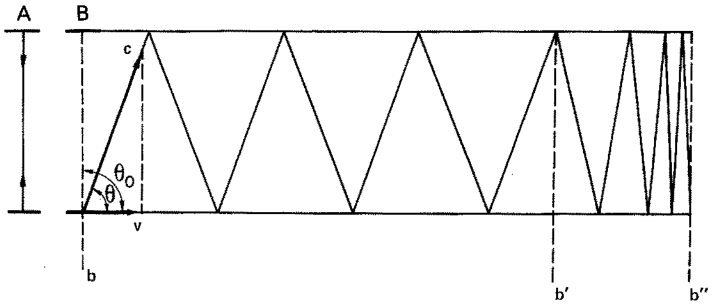

Figure 5.—Two light clocks, the second of which performs a 'there and back' motion.

relativistic way, the relation (6.4) between the time reading t_0 of clock B and the time reading t of clock A for the whole time of separation.

Here again clock B is in motion; in the opposite case we have to assume that when the mutual velocity of clocks A and B change, then clock B would not change its velocity with respect to the whole world but the whole world would have to change its velocity with respect to clock B; again this is nonsense.

Until now we have supposed that the 'arm' of the moving light clock B is always perpendicular to its velocity. Now we shall show that the same result could be obtained if we assume that the 'arm' of clock B is parallel to its velocity.

Indeed, in such a case the photon packages have to cover the distance $2 . r_0$ between two successive reflections on the same mirror in clock A and the distance

$$2 . r = r_0 . \frac{1 + \dfrac{v}{c}}{\sqrt{\left(1 - \dfrac{v^2}{c^2}\right)}} + r_0 . \frac{1 - \dfrac{v}{c}}{\sqrt{\left(1 - \dfrac{v^2}{c^2}\right)}} = \frac{2 . r_0}{\sqrt{\left(1 - \dfrac{v^2}{c^2}\right)}} \qquad (6.5)$$

in clock B. This result can be obtained from formulae (4.21) under the conditions $\theta_0 = \theta = 0$ and $\theta_0 = \theta = \pi$.

The non-relativistic relations (4.8), (4.9), (4.10), and (4.11) lead to two formula with different terms of second order in v/c, whose geometrical mean gives the result (6.5).

Thus we have shown that any light clock moving arbitrarily with respect to absolute space goes at a slower rate than an identical light clock which rests in absolute space; the relation between their readings for a definite absolute interval of time is given by formula (6.4).

We can generalise this conclusion and assume that the time of any clock (i.e., of *any material system*) which moves with respect to absolute space advances with a slower rate than absolute time. We suppose that this close connection between the light clock and any other clock (i.e., any other periodic process) is due to the empirical fact that the velocity of light is a universal constant which gives the numerical tie between space and time.

We record here that the results obtained in this section immediately give the explanation of the historical Michelson-Morley experiment.

Indeed, if the lengths of the mutually perpendicular 'arms' in the Michelson interferometer are r_0 and R_0, then the absolute time intervals spent by two photon packages to cover these 'arms' there and back will be

$$\Delta t = \frac{2 . r_0}{c . \sqrt{\left(1 - \frac{v^2}{c^2}\right)}}, \qquad \Delta T = \frac{2 . R_0}{c . \sqrt{\left(1 - \frac{v^2}{c^2}\right)}} \tag{6.6}$$

The corresponding proper time intervals, i.e., those which will be read on a clock attached to the interferometer, will be (see (6.4))

$$\Delta t_0 = \frac{2 . r_0}{c}, \qquad \Delta T_0 = \frac{2 . R_0}{c} \tag{6.7}$$

For their difference, which calls forth an eventual shift in the interference fringes when rotating the interferometer with respect to the absolute velocity v of the interferometer or when changing the velocity v, we obtain

$$\Delta t_0 - \Delta T_0 = \frac{2}{c} . (r_0 - R_0) = \text{const.} \tag{6.8}$$

Hence, not only the Michelson-Morley experiment (where $r_0 = R_0$), but also the Kennedy-Thorndike experiment (where $r_0 \neq R_0$) must give zero results, as was practically observed.

7. *Some Results*

With the help of formulae (5.13) we can immediately obtain expressions for the so-called Liénard-Wiechert potentials.

Indeed, according to our absolute conception, the electromagnetic 4-potential of a point charge q at a reference point distant r (see formula (5.14)) from it is

$$\overleftrightarrow{A} = \frac{q}{c} . \frac{\overleftrightarrow{v}_0}{r_0} \tag{7.1}$$

$$\overleftrightarrow{v}_0 = (\vec{v}_0, i . \bar{v}_0) = \left(\frac{\vec{v}}{\sqrt{\left(1 - \frac{v^2}{c^2}\right)}}, i . \frac{c}{\sqrt{\left(1 - \frac{v^2}{c^2}\right)}} \right) \tag{7.2}$$

is the proper 4-velocity of the charge, $\vec{v}$ is its velocity at a given moment of observation and r_0 (see formula (5.17)) is the proper moment of observation and r_0 (see formula (5.17)) is the proper distance between charge and reference point at this very moment; i is the imaginary unit; with the sign $\leftrightarrow$ we denote a 4-vector, with the sign $\rightarrow$ its space part and with the sign $-$ its time part.

Substituting formulae (5.13) into (7.1), we obtain the electromagnetic 4-potential of the charge q in the form of Liénard–Wiechert

$$\overleftrightarrow{A} = \frac{q}{c} \cdot \frac{\overleftrightarrow{v}}{r' \cdot \left(1 - \frac{\vec{n}' \cdot \vec{v}}{c}\right)}, \qquad \overleftrightarrow{A} = \frac{q}{c} \cdot \frac{\overleftrightarrow{v}}{r'' \cdot \left(1 + \frac{\vec{n}'' \cdot \vec{v}}{c}\right)} \tag{7.3}$$

where $\overleftrightarrow{v} = (\vec{v}, i \cdot c)$ is the 4-velocity of the charge, r' is the advanced distance and r'' is the retarded distance.

In our absolute space-time theory we do not introduce drastic differences between electricity and gravitation. All formulae with which we work are identical if the electric charges are replaced by masses and the inverse electric constant (which in the system CGS is equal to unity) by the gravitational constant taken with a negative sign.

Hence on the basis of (7.1) we obtain that the gravitational potential of a point mass m, moving with velocity $\vec{v}$ with respect to the reference point distant r from it, is to be presented in the form

$$\phi = -\frac{k^2 \cdot m}{r_0 \cdot \sqrt{\left(1 - \frac{v^2}{c^2}\right)}} \tag{7.4}$$

where k^2 is the gravitational constant and r_0 the proper distance.

The gravitational energy of mass m and a mass M which rests at the reference point will be $U = M \cdot \phi$. Using this form for the gravitational energy we obtain (in Part IV of our manuscript (Marinov, in preparation) dedicated to gravitation):

(a) For the perihelion displacement of the planets a result which represents half of the result given by general relativity.

(b) For the angular deflection of a light beam passing near the sun a result which represents half of the result given by general relativity.

(c) For the gravitational frequency shift (the so-called 'red shift') a result which is the same as that given by general relativity.

In our opinion the experimental check of the first two results is not sufficiently reliable, so it is impossible to decide whose predictions best correspond to reality. As a decisive *experimentum crucis* in favour of our theory we now consider only the 'coupled-mirrors' experiment (Marinov, 1975).

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