Einstein's relativity falsified: I. The factor γ can take values larger than $\sqrt{2}$, which requires a speed of light $< c$ in moving inertial frames

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Abstract: Considering that an Einstein clock can travel at a speed no greater than c, from the principle of relativity, a kinematic time dilation factor can be derived whose value cannot be greater than $\sqrt{2}$. In fact, however, the kinematic time dilation factor γ can approach an infinite value. This discrepancy demonstrates that the derivation of the kinematic time dilation factor γ in Einstein's special relativity (SR) cannot be physically justified by the principle of relativity, and that it is not physically possible that the speed of light is constant in any frame of reference. The mathematical method of Einstein's SR, which I refer to as the "mathematical method of relativity," allows the calculation of constant physical values from different quantities of any physical unit and is thus scientifically worthless. Accordingly, it is not surprising that it is possible to predict so-called general relativistic phenomena, e.g., the phenomena observed at the binary pulsar PSR B1913 + 16, just by applying Kepler's second law and simple quantum physical considerations [R. G. Ziefle, Phys. Essays **33**, 99 (2020)]. A careful interpretation of interferometer experiments on Earth clearly shows that there is in fact no need for artificial time acceleration by length contraction. However, today's physicists seem to be lost in mathematics. The aim of this paper is to contribute to a physical theory of relativity that does not require mathematical tricks, such as time acceleration (length contraction), space-time curvature, and other mathematical tricks that follow from Einstein's mathematical methods and uphold the illusion that the belief in a constant speed of light c in any frame of reference is physically justified.
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Résumé: Si nous considérons qu'une horloge d'Einstein ne peut se déplacer à une vitesse supérieure à c, il est possible, à partir du principe de relativité, de déduire un facteur de dilatation du temps cinématique dont la valeur ne peut être supérieure à $\sqrt{2}$. En réalité, la valeur du facteur de dilatation du temps cinématique peut γ cependant être proche de l'infini. Cet écart démontre que la dérivée du facteur de dilatation du temps cinématique γ dans le cadre de la relativité spéciale d'Einstein ne peut être justifiée physiquement par le principe de relativité et qu'il n'est pas physiquement possible que la vitesse de la lumière soit constante dans quelque référentiel que ce soit. La méthode mathématique de la relativité spéciale d'Einstein, que j'appelle « méthode mathématique de relativité », permet de calculer des valeurs physiques constantes à partir de différentes quantités de quelque unité physique que ce soit et n'a donc aucune valeur scientifique. Par conséquent, il n'est pas surprenant qu'il soit possible de prévoir des phénomènes relativistes généraux, comme le phénomène observé au niveau du pulsar binaire PSR B1913 + 16, en appliquant la deuxième loi de Kepler et de simples considérations de physique quantique [R. G. Ziefle, Phys. Essays **33**, 99 (2020)]. Une interprétation prudente d'expériences d'interférométrie menées sur Terre indique clairement qu'il n'est pas nécessaire d'accélérer artificiellement le temps par le biais de la contraction des longueurs. Les physiciens d'aujourd'hui semblent cependant perdus. L'objectif du présent document est de contribuer à une théorie physique de la relativité qui ne nécessite pas de tours mathématiques, comme l'accélération du temps (contraction des longueurs), la courbe espace/temps, etc., qui suivent les méthodes mathématiques d'Einstein et maintiennent l'illusion que croire à une vitesse constante de la lumière c dans n'importe quel référentiel est physiquement justifié.

Key words: Special Relativity General Relativity; Michelson–Morley Experiment; Kennedy–Thorndike Experiment; Hafele–Keating Experiment; Lorentz Contraction; Time Dilation factor; Transverse Doppler Shift; Longitudinal Doppler Shift; Ives–Stilwell Experiment.

I. INTRODUCTION

The standard interpretation of the Michelson–Morley experiment seems to confirm the postulate of a constant speed of light c in any reference frame.[1] From the principle

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of relativity and the consideration that an Einstein clock can travel with speed no greater than c, a kinematic time dilation factor can be derived whose value cannot be greater than $\sqrt{2}$. In fact, however, the kinematic time dilation factor γ can approach an infinite value—but this is only possible if a light beam moving vertically up and down in a moving inertial frame can travel at a speed slower than c. A theory of relativity must be able to explain this, as well as the fact that we measure a constant speed of light c on Earth.

II. EINSTEIN INVENTED A MATHEMATICAL METHOD THAT MAKES IT POSSIBLE TO CALCULATE A CONSTANT PHYSICAL VALUE FROM ANY QUANTITY OF A PHYSICAL UNIT THAT DIFFERS FROM THE CONSTANT VALUE

The principle of relativity states that there is no physical way to differentiate between a body moving at a constant speed and a stationary body, and the laws of physics are the same in all frames of reference. The principle of relativity is the theoretical basis of Einstein's theories of special relativity (SR) and general relativity (GR), which claim that the speed of light c and the proper time t_0 measured in any frame of reference must be constant. The theory of SR postulates that observers at rest with respect to a moving inertial frame see "their" time t' pass more slowly than the time t_0 measured in the moving inertial frame, by a factor of γ, the kinematic time dilation factor. However, applying the calculation method of Einstein's SR yields the same proper time t_0 for the moving inertial frame in both frames of observation, which seems to confirm mathematically that the speed of light c is constant in any frame of reference

$$\begin{aligned}\Delta t' &= \frac{d'}{c} = \frac{\gamma \times d_0}{c},\\ \Delta t' &= \gamma \times \Delta t_0 = \frac{\gamma \times d_0}{c},\\ \Delta t' &= \Delta t_0 = \frac{\frac{1}{\gamma} \times \gamma \times d_0}{c} = \frac{d_0}{c}.\end{aligned} \tag{1}$$

In Eq. (1), Einstein's SR defines the time interval $\Delta t'$ twice, first on line 1 with a physical definition of $\Delta t'$ relative to Δt_0, and on line 2 in addition with a theoretical definition of $\Delta t'$ relative to Δt_0, so that the time interval $\Delta t'$ occurs twice in Eq. (1) and the factor γ can be canceled. The reality-bending effect of Einstein's mathematical method of SR, which I call the "mathematical method of relativity," can be demonstrated by an example: Two light signals are sent from a valley station to two nearby mountaintops. The distance to the lower peak is $d_0 = 2917$ m, and the distance to the higher peak is $d' = 5137$ m. We can calculate the time $\Delta t'$ taken for the light signal to travel to the higher peak by expressing the distance d' in terms of the relative factor y,

$$\Delta t' = \frac{d'}{c} = \frac{5137\,\mathrm{m}}{c} = \frac{1.761 \times 2917}{c} = \frac{y \times d_0}{c}. \tag{2}$$

Applying Einstein's mathematical method of relativity and replacing the theoretical symbol $\Delta t'$ with the value relative to Δt_0, we obtain the same travel times (constant travel times) for the light signals that are sent to the two mountaintops. Here, the physical quantity $\Delta t'$ occurs twice in Eqs. (1) and (2), which enables us to mathematically shorten the longer distance d' to the shorter distance d_0,

$$\begin{aligned}\Delta t' &= \frac{y \times d_0}{c},\\ \Delta t' &= y \times \Delta t_0 = \frac{y \times 2917\,\mathrm{m}}{c},\\ \Delta t' &= \Delta t_0 = \frac{\frac{1}{y} \times y \times 2917\,\mathrm{m}}{c} = \frac{2917\,\mathrm{m}}{c}.\end{aligned} \tag{3}$$

The fact that Einstein's SR in Eq. (1) is able to shorten the longer distance d' to the shorter distance d_0 is the desired result, because it allows the speed of light to be constant in all inertial frames. But is it really possible to mathematically destroy space and time, as suggested in Eqs. (1) and (3)? We can apply the mathematical method of relativity of Einstein's SR to any physical unit and thereby mathematically destroy or create any physical quantity. The prerequisite is that on one side of an equation, we define the quantity of the compared physical unit physically relative to the other quantity and on the other side only theoretically relative to the other quantity, so that now the physical quantity of the compared physical unit appears twice in this equation, and we can cancel the relative factor. One example for neutralizing the quantity of another physical unit by the mathematical method of relativity: The Milky Way has about 1.5×10^{12} solar masses (m_0), while another galaxy has 1.8×10^{12} solar masses (m'). Applying Einstein's mathematical method of relativity, we can calculate m' to be identical to the mass of the Milky Way m_0,

$$\begin{aligned}m' &= 1.8 \times 10^{12}\, M_\odot = 1.2 \times m_0,\\ m' &= 1.2 \times 1.5 \times 10^{12}\, M_\odot,\\ m' &= y \times m_0 = 1.2 \times 1.5 \times 10^{12}\, M_\odot,\\ m' &= m_0 = \frac{1}{y} \times 1.2 \times 1.5 \times 10^{12}\, M_\odot,\\ m' &= m_0 = \frac{1}{1.2} \times 1.2 \times 1.5 \times 10^{12}\, M_\odot = 1.5 \times 10^{12}\, M_\odot.\end{aligned} \tag{4}$$

Is Einstein's mathematics of SR arbitrary or physically justified by the principle of relativity?

III. APPLYING THE PRINCIPLE OF RELATIVITY, WE OBTAIN A KINEMATIC TIME DILATION FACTOR γ' THAT CAN BE NO GREATER THAN $\sqrt{2}$, WHICH IS NOT THE CASE FOR THE FACTOR γ

Using an example from standard literature,[2] we can see that there is a contradiction between the kinematic time dilation factor derived by applying the principle of relativity in an "Einstein clock," and the kinematic time dilation factor derived from interference experiments on Earth. A light beam that moves vertically up and down between two mirrors in a moving vacuum tube (Einstein clock) is shown in

Fig. 1, whereby only the movement of the light beam from bottom to top is shown because the conditions are symmetrical whether the light beam moves from bottom to top or contrariwise from top to bottom in an Einstein clock. Assuming a constant speed of light c in any frame of reference, Anthony P. French (Ref. 2, p. 106) derives the kinematic time dilation factor as shown below based on the path of light traveling up and down in a moving Einstein clock. French defines the distance between the two mirrors of the Einstein clock as the length l_0, while I use the term d_0 in my calculations ($l_0 = d_0$). Equation (5) gives the kinematic time dilation factor due to the longer distance d' of the diagonal light path in comparison to the shorter distance d_0 of the vertical light path[2]

$$c \times \Delta t = 2 \times \sqrt{(l_0)^2 + \left(\frac{v \times \Delta t}{2}\right)^2},\quad \Delta t = 2 \times \frac{l_0}{\sqrt{c^2 - v^2}}. \tag{5}$$

The observer at rest must see the light beam in a moving Einstein clock move at an angle in a diagonal direction. French writes:[2] "But the proper time interval $\Delta t'$ as measured on the moving clock is just $2\,l_0/c$. Therefore":

$$\Delta t = \frac{2 \times l_0}{\sqrt{c^2 - v^2}} \rightarrow \Delta t = \frac{\Delta t'}{\sqrt{1 - \frac{v^2}{c^2}}}. \tag{6}$$

However, when we define the proper time as measured in the moving clock to be t_0 and let t' be the time as seen by the observer at rest with respect to the moving light clock, we obtain

$$\Delta t = \frac{\Delta t'}{\sqrt{1 - \frac{v^2}{c^2}}} \rightarrow \Delta t' = \frac{\Delta t}{\sqrt{1 - \frac{v^2}{c^2}}},\quad \Delta t' = \gamma \times \Delta t \tag{7}$$

This expresses the fact that the moving observer's period $\Delta t'$ as seen by the observer at rest with respect to the moving clock is longer than the period Δt_0, measured in the frame of the clock at rest. In the first line of Eq. (5), taking the speed of light c to be constant in any frame of reference, the kinematic time dilation factor is correctly derived. Equation (5) indicates that the kinematic time dilation factor is caused by the longer distance d′ of the diagonal light path in comparison to the shorter distance d_0 ($= l_0$) of the vertical light path. However, the kinematic time dilation factor derived from the first line of Eq. (5) and based on a constant speed of light c in an Einstein clock, is different from the kinematic time dilation factor γ of the standard interpretation of the Michelson–Morley experiment.[1] From Eq. (5), we calculate as follows:

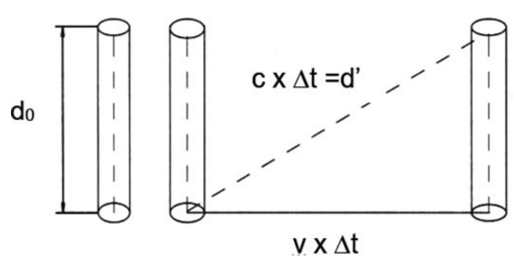

FIG. 1. Einstein clock at rest and in motion. An observer at rest with respect to a moving Einstein clock would see the longer diagonal light path d' ($l_0 = d_0$).

$$\begin{aligned}
2 \times d' &= c \times \Delta t = 2 \times \sqrt{(d_0)^2 + \left(\frac{v \times \Delta t}{2}\right)^2},\\
d' &= \sqrt{(d_0)^2 + (v \times \Delta t)^2}\\
&= \sqrt{(c \times \Delta t)^2 + (v \times \Delta t)^2},\\
(d')^2 &= (c \times \Delta t)^2 + (v \times \Delta t)^2,\\
\frac{(d')^2}{c^2} &= \frac{(c \times \Delta t)^2}{c^2} + \frac{(v \times \Delta t)^2}{c^2},\\
\frac{(d')^2}{c^2} &= (\Delta t)^2 + \left(\frac{v^2}{c^2}\right) \times (\Delta t)^2.\\
(\Delta t')^2 &= (\Delta t)^2 + \left(\frac{v^2}{c^2}\right) \times (\Delta t)^2\\
\frac{(\Delta t')^2}{(\Delta t)^2} &= \frac{\Delta t^2}{(\Delta t)^2} + \frac{\left(\frac{v^2}{c^2}\right) \times (\Delta t)^2}{(\Delta t)^2}\\
\frac{\Delta t'}{\Delta t} &= \sqrt{1 + \left(\frac{v^2}{c^2}\right)}\\
\Delta t' &= \sqrt{1 + \left(\frac{v^2}{c^2}\right)} \times \Delta t
\end{aligned} \tag{8}$$

For the longer distance d' of the diagonal light path (versus the vertical light path d_0), Eq. (8) gives us

$$\begin{aligned}
\Delta t' &= \sqrt{1 + \left(\frac{v^2}{c^2}\right)} \times \Delta t,\\
\frac{d'}{c} &= \sqrt{1 + \left(\frac{v^2}{c^2}\right)} \times \Delta t,\\
d' &= \sqrt{1 + \left(\frac{v^2}{c^2}\right)} \times \Delta t \times c,\\
d' &= \sqrt{1 + \left(\frac{v^2}{c^2}\right)} \times d_0.
\end{aligned} \tag{9}$$

When we set v to the speed of light c, we obtain the maximum possible value for d', based on a constant speed of light c in any frame of reference

$$d' = \sqrt{1 + \frac{c^2}{c^2}} \times d_0 = 1.4142 \times d_0. \tag{10}$$

Considering a light beam moving vertically in an Einstein clock, and realizing that the time t' must arise from a diagonal light path longer than the vertical light path, we see that the time dilation factor γ' cannot be larger than $\sqrt{2}$

$$\frac{d'}{c} = \Delta t' = \frac{\sqrt{1+\frac{v^2}{c^2}} \times d_0}{c},$$
$$\Delta t' = \sqrt{1+\frac{v^2}{c^2}} \times \frac{d_0}{c},$$
$$\Delta t' = \gamma' \times \Delta t_0. \tag{11}$$

The time dilation factor γ' derived from the principle of relativity and the assumption of a constant speed of light c in all frames of reference cannot be larger than $\sqrt{2}$, while the time dilation factor γ of SR can approach an infinite value. If we suppose the speed of light to be the constant c in both cases, we once again obtain the time dilation factor γ', which is the result of the first line of Eq. (5), as correctly defined by French in "special relativity"[2]

$$\frac{d'}{c} = \sqrt{1+\left(\frac{v^2}{c^2}\right)} \times \frac{d_0}{c},$$
$$\Delta t' = \sqrt{1+\left(\frac{v^2}{c^2}\right)} \times \Delta t_0. \tag{12}$$

In the first line of Eq. (5), French derives the time dilation factor γ', as calculated in Eq. (8), but he is not interested in the result of his derivation. In the second line of Eq. (5), French simply uses the time dilation factor γ of SR. When a physical derivation starts with arguments that bear no relation to the result that is ultimately presented, we can consider it to be a scientific fraud. If we dispose of the assumption that the light travels at the constant speed c along both paths, and instead assign only the longer, diagonal path a speed of c, while giving the light on the vertical path a speed slower than c, as shown in Fig. 2, we are able to obtain the kinematic time dilation factor γ of the standard interpretation of the Michelson–Morley experiment[1]

$$\frac{d'}{c} = \frac{d_0}{\left(\sqrt{c^2-v^2}\right)} = \frac{\frac{d_0}{c}}{\frac{\left(\sqrt{c^2-v^2}\right)}{c}} = \frac{d_0}{\sqrt{1-\left(\frac{v^2}{c^2}\right)} \times c},$$
$$\Delta t' = \frac{1}{\sqrt{1-\left(\frac{v^2}{c^2}\right)}} \times \frac{d_0}{c},$$
$$\Delta t' = \frac{1}{\sqrt{1-\left(\frac{v^2}{c^2}\right)}} \times \Delta t_0,$$
$$\Delta t' = \gamma \times \Delta t_0. \tag{13}$$

For the kinematic time dilation factor γ to be attributed to the longer diagonal light path as seen by an observer at rest with respect to a moving Einstein clock, we need the distance d' of the diagonal light path to be longer than the vertical light path d_0 between the two mirrors of an Einstein clock by a factor of γ,

$$\Delta t' = \frac{1}{\sqrt{1-\left(\frac{v^2}{c^2}\right)}} \times t_0,$$
$$\frac{d'}{c} = \frac{1}{\sqrt{1-\left(\frac{v^2}{c^2}\right)}} \times \frac{d_0}{c},$$
$$d' = \frac{1}{\sqrt{1-\left(\frac{v^2}{c^2}\right)}} \times d_0. \tag{14}$$

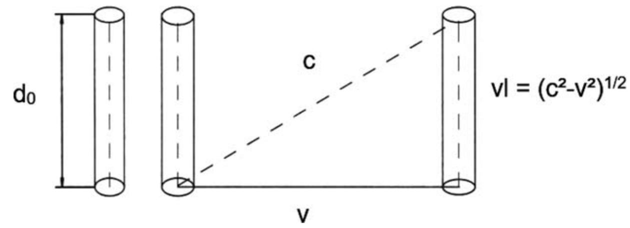

FIG. 2. It only becomes possible to calculate the kinematic time dilation factor γ of SR if we assign the diagonal light path the constant speed of light c, and the vertical light path in the moving inertial frame the velocity $vl < c$.

When we compare the time dilation factor γ' derived from the principle of relativity with the dilation factor γ of SR, it becomes obvious that the speed of light cannot be constant with respect to any frame of reference

$$\Delta t' = \gamma \times t_0 \neq \Delta t' = \gamma' \times t_0,$$
$$\Delta t' = \frac{1}{\sqrt{1-\left(\frac{v^2}{c^2}\right)}} \times t_0 \neq \Delta t' = \sqrt{1+\left(\frac{v^2}{c^2}\right)} \times t_0. \tag{15}$$

Since the factor γ has been proved empirically, unlike the factor γ', the principle of relativity with its postulate of a constant speed of light c in all frames of reference must be false, and thus Einstein's SR and GR must likewise be false, as they are based on this postulate.

IV. EINSTEIN'S MATHEMATICAL METHOD OF SR IS A MERE MATHEMATICAL TRICK TO ACHIEVE A CONSTANT SPEED OF LIGHT *C* IN ALL INERTIAL FRAMES

The basic postulate of Einstein's relativity is that in all frames of reference, the same proper time $t_0 = d_0/c$ must be measured. According to Einstein's SR, the time dilation factor γ is to be justified by the fact that a resting observer watching a light beam moving up and down in a moving inertial frame, e.g., an Einstein clock, must see a longer light path. When the time dilation factor γ is attributed to the fact that the diagonal light path d' is longer than the vertical light path d_0, the distance d' must be longer than d_0 by the same factor γ, and so the time interval $\Delta t'$ of the motion must be the same for both light paths, as shown in Fig. 3.

Equation (16) suggests that due to the time dilation factor γ, the distance d' may approach an infinite value as the velocity of a moving inertial frame (Einstein clock) approaches the speed of light c. However, this is only possible if the speed of light approaches zero in the vertical light path—which cannot be explained by Einstein's special relativity and contradicts the null result of the Michelson–Morley experiment

$$\begin{aligned}\Delta t' &= \frac{d'}{c} = \frac{\gamma \times d_0}{c},\\ d' &= \gamma \times d_0 = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \times d_0,\\ d' &\to \frac{1}{\sqrt{1-\frac{\approx c^2}{c^2}}} \times d_0 \to \infty.\end{aligned} \tag{16}$$

As it is not possible to observe time itself, but only physical processes, an observer at rest must see the light beam in the moving Einstein clock move at a velocity $vl < c$, due to the time dilation giving t' in the moving inertial frame, as already shown in Fig. 2.

Given a vertical light path of 11 m, which was the length of each arm used in the Michelson–Morley experiment,[1] and an Einstein clock with a velocity of 0.99c, we can calculate the diagonal light path that must be traveled by the light beam, which is longer than $d_0 = 11$ m by a factor of γ,

$$\begin{aligned}\Delta t' &= \frac{d'}{c} = \frac{\gamma \times d_0}{c},\\ d' &= \gamma \times d_0,\\ d' &= \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \times 11\,\text{m} = \frac{1}{\sqrt{1-\frac{0.99^2}{1^2}}} \times 11\,\text{m},\\ d' &= 7.088 \times 11\,\text{m} = 77.98\,\text{m}.\end{aligned} \tag{17}$$

For the time interval $\Delta t'$ taken for the light to travel along the longer diagonal path, we obtain a time interval that is longer than the time interval Δt_0 by a factor of 7.088

$$\begin{aligned}\Delta t' &= \frac{d'}{c} = \frac{\gamma \times d_0}{c},\\ \Delta t' &= \frac{\gamma \times 11\,\text{m}}{c},\\ \Delta t' &= \frac{7.088 \times 11\,\text{m}}{c} = \frac{77.98\,\text{m}}{c}\\ &= 7.088 \times \frac{d_0}{c} = 7.088 \times \Delta t_0.\end{aligned} \tag{18}$$

Due to the "slower-moving" time t', an observer at rest will perceive a light beam in the moving Einstein clock move more slowly in the moving inertial frame by a factor of $1/\gamma$. Therefore, for the time interval $\Delta t'$, we obtain a time interval that is longer than Δt_0 by a factor of 7.088

$$\begin{aligned}\Delta t' &= \frac{d_0}{\frac{1}{\gamma} \times c} = \frac{\gamma \times d_0}{c} = \frac{7.088 \times d_0}{c},\\ \Delta t' &= \frac{d'}{c} = \frac{7.088 \times 11\,\text{m}}{c} = \frac{77.98\,\text{m}}{c}\\ &= 7.088 \times \frac{d_0}{c} = 7.088 \times \Delta t_0.\end{aligned} \tag{19}$$

This yields a contradiction of Einstein's relativity: When the time t' in a moving Einstein clock is perceived by an observer at rest to pass more slowly by a factor of γ (as a result of the longer distance traveled by the light beam on the diagonal light path), the time interval $\Delta t'$ must be the same for the diagonal light path and the vertical light path—but this contradicts the postulate of a constant proper time t_0, defined by $\Delta t_0 = d_0/c$. In other words, we have contradicted the postulate of Einstein's relativity that a constant proper time t_0 must be measured in all frames of reference, which underpins Einstein's SR and GR. Einstein's SR uses a simple mathematical method to resolve this contradiction: Einstein introduces time as a physical phenomenon that exists independently of the definition of a physical process; hence, independently of the motion of a light beam. Yet he derived the time dilation factor based on the motion of light beams—a logical contradiction

$$\begin{aligned}\Delta t' &= \gamma \times \frac{d_0}{c},\\ \Delta t' &= \gamma \times \Delta t_0.\end{aligned} \tag{20}$$

In the first line of Eq. (20), the time interval $\Delta t'$ is defined by a physical process, while in the second line of Eq. (20), the time interval $\Delta t'$ is not defined by a physical process, merely by a theoretical value relative to the time interval Δt_0. Consequently, time exists twice, once defined by physical processes, such as the time a light beam needs to travel a certain distance, and once defined independently of physical processes—but this latter is a description of a physically unreal situation. When we substitute the real physical process d'/c in for $\Delta t'$ on the right side of Eq. (21), and then replace it with the physical process $\gamma d_0/c$, at the same time substituting the theoretical value relative to Δt_0 for $\Delta t'$ on the left side of Eq. (21), then $\Delta t'$ appears twice and the factor γ can now be canceled

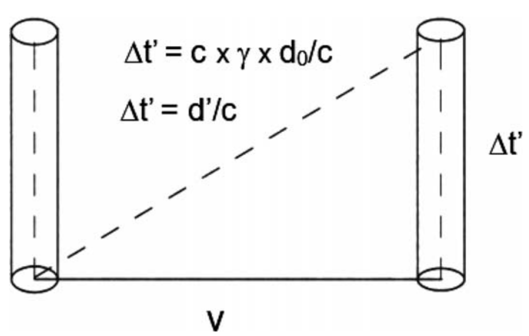

FIG. 3. When the time dilation factor γ is caused by a longer diagonal light path d', the distance d' must be longer than d_0 by the same factor γ, and so the time interval $\Delta t'$ of the motion must be the same for both light paths, thereby contradicting the Michelson–Morley experiment.[1]

$$\Delta t' = \frac{d'}{c} = \frac{\gamma \times d_0}{c} = \frac{\frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \times d_0}{c},$$

$$\Delta t' = \frac{7.089 \times 11\,\mathrm{m}}{c} = \frac{77.98\,\mathrm{m}}{c}, \tag{21}$$

$$\Delta t' = \gamma \times \Delta t_0 = \frac{77.98\,\mathrm{m}}{c},$$

$$\Delta t' = \Delta t_0 = \frac{\frac{7.089 \times 11\,\mathrm{m}}{c}}{7.089} = \frac{11\,\mathrm{m}}{c} = \frac{d_0}{c}.$$

Einstein's introduction of time as an independent physical phenomenon enabled Einstein to shorten the longer diagonal distance d' to the distance d_0, and so to calculate a constant proper time t_0 in all inertial frames, which he correlated with a constant speed of light c in all inertial frames. This mathematical trick enabled Einstein to reconcile his theory with the generally accepted belief in a constant speed of light c in any frame of reference. Using the same mathematical trick for the vertical light path in the moving Einstein clock, we obtain from Eq. (19)

$$\Delta t' = \frac{d_0}{\frac{1}{\gamma} \times c} = \frac{\gamma \times d_0}{c} = \frac{d'}{c} = \frac{\frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \times d_0}{c},$$

$$\Delta t' = \frac{7.089 \times 11\,\mathrm{m}}{c} = \frac{77.98\,\mathrm{m}}{c}, \tag{22}$$

$$\Delta t' = \gamma \times \Delta t_0 = \frac{77.98\,\mathrm{m}}{c},$$

$$\Delta t' = \Delta t_0 = \frac{\frac{7.089 \times 11\,\mathrm{m}}{c}}{7.089} = \frac{11\,\mathrm{m}}{c} = \frac{d_0}{c}.$$

Canceling the factor γ on both sides in Eqs. (21) and (22) is a mathematical trick to calculate equal theoretical results for quantities that physically must be different. Einstein's mathematical trick of SR mathematically destroys space. This trick also mathematically destroys space when the perspective is reversed, i.e., when we exchange the perspectives of the formerly resting observer and the observer formerly in motion, following the principle of relativity. Einstein's mathematical method of SR would also function with the time dilation factor γ' and with every other physical term. For example, consider energy, which can be expressed by a physical definition, or with a theoretical definition relative to some other energy. When we increase the energy $E_0 = h \times f_0$ of electromagnetic radiation by a certain factor y by increasing the frequency and define the higher energy E' without a concrete physical definition on the left side of Eq. (23), instead simply replacing E' with the relative value defined by E_0, we can cancel the factor y, which implies that the two energy values do not differ

$$E' = h \times y \times f_0 > h \times f_0 = E_0,$$
$$E' = y \times E_0 = h \times y \times f_0 > h \times f_0 = E_0, \tag{23}$$
$$E' = E_0 = \frac{1}{y} \times h \times y \times f_0 = h \times f_0.$$

However, we know that energy cannot be destroyed, just as the distance that a light beam must travel (resulting in time dilation) cannot be cancelled, as would be required to mathematically enforce the constancy of the speed of light in all inertial frames. Interpreting the Michelson–Morley experiment,[1] Einstein failed recognize that he had defined the speed of light as the constant c only for the diagonal light path, as seen by an observer at rest in the inertial frame I_S of the Sun, while he defined a slower speed of light for an observer in the inertial frame I_E of Earth, afterward mathematically reintroducing the speed of light as the constant c in both the diagonal and the vertical (perpendicular) directions, as shown in Fig. 4.

For observers at rest who observe an Einstein clock in motion or an interferometer in motion, Einstein's calculations yield a constant speed of light c based on the distance d_0 of the vertical (perpendicular) direction in the moving Einstein clock or interferometer, as shown in Fig. 4. This result corresponds to the standard interpretation of the Michelson–Morley experiment[1] for the perpendicular light path of the Michelson–Morley interferometer; namely, an observer at rest in the inertial frame I_E of Earth and an observer at rest in the inertial frame I_s of the Sun will, according to the postulate of a constant speed of light c in all inertial frames, measure the same proper time t_0,

$$2 \times \Delta t' = \frac{2d_0}{\frac{1}{\gamma} \times c} = \frac{2d_0}{\sqrt{1-\frac{v^2}{c_2}} \times c},$$

$$2 \times \Delta t' = 2 \times \gamma \times \Delta t_0 = \frac{2 \times \gamma \times d_0}{c} = \frac{1}{\sqrt{1-\frac{v^2}{c_2}}} \times \frac{2d_0}{c}, \tag{24}$$

$$2 \times \Delta t' = 2 \times \Delta t_0 = \frac{\sqrt{1-\frac{v^2}{c_2}} \times 2d_0}{\sqrt{1-\frac{v^2}{c_2}} \times c} = \frac{2d_0}{c},$$

$$\Delta t' = \Delta t_0 \rightarrow t' = t_0.$$

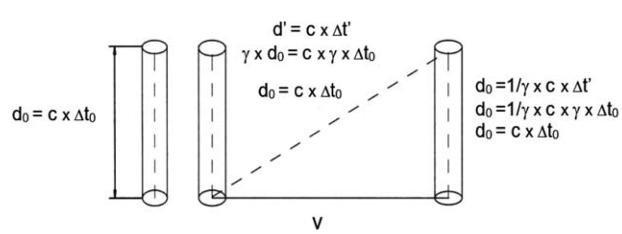

FIG. 4. Einstein's SR leads mathematically to a constant speed of light c in all inertial frames but is based on the false claim that the longer distance d' can be equal to the shorter distance d_0, which he justifies by the principle of relativity.

The situation is confusing, and we need to start from sure physical knowledge. The distance d' of the diagonal direction in Fig. 4 must be longer than the distance d_0 of the vertical (perpendicular) direction, and this cannot be different when defining the converse relative motion, i.e., with the formerly moving observer now at rest and the formerly resting observer now in relative motion

$$\begin{aligned} &d' > d_0, \\ &\gamma \times d_0 > d_0. \end{aligned} \tag{25}$$

Since the diagonal light path d' is a factor of γ longer than the vertical (perpendicular) light path d_0, we have to assume the following:

$$\begin{aligned} &\Delta t_{\text{diagonal}} > \Delta t_{\text{vertical}}, \\ &\frac{\gamma \times d_0}{c} > \frac{d_0}{c}. \end{aligned} \tag{26}$$

On the left side of Eq. (26), we have the time interval $\Delta t'$ for the diagonal direction, and on the right side, we have the time interval Δt_0 for the vertical (perpendicular) direction. However, if this were to hold true, the light beams would not arrive simultaneously at the screen of the Michelson–Morley experiment. Einstein had the idea to introduce a second "time" quantity as a separate physical entity, in addition to the physical definition of time

$$\begin{aligned} \Delta t' &= \Delta t_{\text{diagonal}} > \Delta t_{\text{vertical}} = \Delta t_0, \\ \Delta t' &= \frac{\gamma \times d_0}{c} > \frac{d_0}{c} = \Delta t_0, \\ \gamma \times \Delta t_0 &= \frac{\gamma \times d_0}{c} > \frac{d_0}{c} = \Delta t_0, \\ \Delta t_0 &= \frac{d_0}{c} = \frac{d_0}{c} = \Delta t_0, \\ \Delta t_{\text{diagonal}} &= \Delta t_{\text{vertical}}. \end{aligned} \tag{27}$$

Einstein defined time twice: (1) Time, as defined by a physical process; (2) Time, as defined by theoretical time units. Hence, Einstein raised theoretical time units to the status of physical reality. This enabled Einstein to cancel factors of the physically defined time by factors of the theoretical time units, thereby changing the reality of physics to make it compatible with the preferred theory, which clung to the belief in a constant speed of light c in all frames of reference.

However, Einstein's SR violates the physical fact that the distance d' of the diagonal direction seen by an observer at rest in the inertial frame I_s of the Sun must be longer than the distance d_0 of the vertical (perpendicular) direction seen by an observer at rest in the inertial frame I_E of Earth. In other words, the distance d' cannot be shortened to the distance d_0. Performing a physically consistent calculation, we obtain

$$\begin{aligned} &\Delta t_{\text{diagonal}} > \Delta t_{\text{vertical}}, \\ &\frac{d'}{c} > \frac{d_0}{c}, \\ &\frac{\gamma \times d_0}{c} > \frac{d_0}{c}. \end{aligned} \tag{28}$$

However, in this case, the light beams would not be able to arrive simultaneously at the screen of the Michelson–Morley interferometer. As the distance d' is greater than d_0 and the speed of light for the diagonal direction on the left side of Eq. (28) is defined by the value c, the term on the left side of Eq. (28) cannot be changed. Furthermore, since the arms of the interferometer have a defined length, the distance d_0 of the vertical (perpendicular) direction, as seen by an observer resting in the inertial frame I_E of Earth, is also fixed. Consequently, the only quantity that can be adjusted to obtain the desired null result is the speed c on the right side of Eq. (29). Modifying as follows, the light beams now arrive simultaneously at the screen of the Michelson–Morley interferometer:

$$\begin{aligned} \Delta t_{\text{diagonal}} &= \Delta t_{\text{vertical}}, \\ \frac{d'}{c} &= \frac{d_0}{\frac{1}{\gamma} \times c}, \\ \frac{\gamma \times d_0}{c} &= \frac{d_0}{\frac{1}{\gamma} \times c}, \\ \frac{\gamma \times d_0}{c} &= \frac{\gamma \times d_0}{c}, \\ \Delta t' &= \Delta t'. \end{aligned} \tag{29}$$

However, this result contradicts the fact that we always measure the speed of light on Earth as the constant c. Inspired by the mathematician Ernst Mach, Einstein took the mathematical symbol t for time, which was used to indicate the duration of processes, and raised it to the status of an independent physical entity. This enabled Einstein to cancel the factor γ, the factor by which the diagonal light beam in Fig. 4 must be longer than d_0. However, it is not possible in a physical sense to destroy a distance that has to be traveled by a light beam. This fact is the simple logical proof of why time units or time crystals cannot physically exist, although they can be mathematically defined. Despite this simple truth, Einstein mathematically enforces a constant speed of light c in all inertial frames. However, special relativity cannot provide a physical explanation for the null result of the Michelson–Morley experiment by applying the time dilation factor γ, as the factor γ of special relativity can result in values larger than $\sqrt{2}$, which requires a speed $< c$ in moving inertial frames, and thus contradicts the postulate of a constant speed of light c in all inertial frames.

V. THE POSTULATE OF A CONSTANT SPEED OF LIGHT *C* WAS DISPROVED BY THE EMPIRICAL CONFIRMATION OF THE TIME DILATION FACTOR γ THAT REQUIRES A SPEED OF LIGHT < *C* IN MOVING INERTIAL FRAMES

If Einstein's SR does not describe a constant speed of light c in all inertial frames, then what does SR describe? Einstein believed that the speed of light must be the constant c in any frame of reference, which is the basis of his theory of general relativity. The Hafele–Keating experiment confirmed the time dilation factor γ of Einstein's SR by assigning the constant speed of light c to a frame of reference that does not rotate with Earth, or as Hafele and Keating put it, an observer who is "looking down on the North Pole from a great distance."[3] The only physical phenomenon that does not rotate with Earth and can directly influence every atomic clock on Earth is Earth's gravitational field with its gravitational potentials, as this field is present at the locations of every atomic clock. Today, the Earth-centered inertial frame (ECI frame) is used as an "absolute" reference for near-Earth clock comparisons. This frame moves with Earth through space and does not rotate, i.e., it has exactly the characteristics of the Earth's gravitational field. The moving atomic clocks in the aircraft must be assigned a speed of light less than c, as otherwise the experiment fails to yield the time dilation factor γ. However, Earth cannot be considered exempt from the laws of physics, and so we have to postulate that photons must assume the speed of light c with respect to the gravitational potentials of the predominant gravitational fields, on Earth, that means the Earth's gravitational field. Einstein failed to recognize that his theory of SR is in fact describing the constancy of the speed of light c with respect to predominant gravitational fields. In his interpretation of the Michelson–Morley experiment, he assigned the constant speed of light c to the stronger or predominant gravitational field of the Sun, which is associated with the reference frame of the Sun, while he assigned the weaker or subordinate gravitational field of Earth, which is associated with the reference frame of Earth, a speed of light that is different from c. Let us transfer Einstein's speed of light c in the predominant gravitational field of the Sun to Earth's predominant gravitational field. In this case, a light beam emitted by a moving source within the gravitational field of Earth is found to have a speed of light slower than c, but the speed of light must still take the constant value c with respect to the predominant gravitational field of Earth. The predominant gravitational field of Earth moves with Earth through space and therefore corresponds to the reference frame of Earth, but we have to consider that the gravitational field does not rotate with Earth; hence, the reference frame of Earth and the frame of Earth's gravitational field differ slightly from each other. Photons do not have a rest mass, but they have a mass equivalence because of mass-energy equivalence, and so should also be affected by gravity. If photons moved more slowly with respect to the gravitational potentials of the predominant gravitational field, the photons would lose energy, which would contradict the principle of energy conservation. If photons were to move faster than c with respect to the gravitational potentials of the predominant gravitational field, the photons would need more energy, which would contradict the principle of minimum energy.

VI. IF THE SPEED *C* OF LIGHT IS CONSTANT IN PREDOMINANT GRAVITATIONAL FIELDS, THE TIME DILATION FACTOR γ CAN BE DERIVED WITHOUT A LENGTH CONTRACTION (TIME QUICKENING) FACTOR

If the speed c of light is constant on Earth with respect to the nonrotating gravitational field of Earth, there must be a longitudinal Doppler effect (blueshift) when a light beam moves in the same direction as an interferometer in motion on Earth because the wavelength must decrease. If the speed c of light is constant on Earth with respect to the nonrotating gravitational field of Earth, there must be a longitudinal Doppler effect (redshift) when a light beam moves in the opposite direction to an interferometer in motion on Earth because the wavelength must increase. However, for a light beam that moves back and forth in a moving interferometer the longitudinal blue shift and the longitudinal redshift cancel each other, which simulates a constant speed c of light for moving interferometers. When a physical process that happens with the speed c of light has no wavelength, for example, intra-elemental processes that happen with the speed c of light, which are also involved when oscillating atoms of atomic clocks move within the predominant gravitational field of Earth, a larger and a smaller wavelength cannot neutralize each other; hence, there must remain the time dilation factor γ also for motion back and forth in elemental particles or atoms. Einstein did not know that he described a constant speed c of light in predominant gravitational fields when interpreting the horizontal light path in the Michelson–Morley experiment and wrongly subtracted parts of the light path, as shown by the penultimate line of the following equation:

$$
\begin{aligned}
\Delta t'_h &= \frac{d_0}{(c-v)} + \frac{d_0}{(c+v)} = \frac{d_0 \times (c+v)}{(c-v)\times(c+v)} \\
&\quad + \frac{d_0 \times (c-v)}{(c+v)\times(c-v)}, \\
\Delta t'_h &= \frac{d_0 \times (c+v)}{c^2 - v^2} + \frac{d_0 \times (c-v)}{c^2 - v^2} \\
&= \frac{\dfrac{d_0 \times (c+v)}{c^2}}{\dfrac{c^2 - v^2}{c^2}} + \frac{\dfrac{d_0 \times (c-v)}{c^2}}{\dfrac{c^2 - v^2}{c^2}}, \\
\Delta t'_h &= \frac{\dfrac{d_0 \times (c+v)}{c}}{\left(1 - \dfrac{v^2}{c^2}\right) \times c} + \frac{\dfrac{d_0 \times (c-v)}{c}}{\left(1 - \dfrac{v^2}{c^2}\right) \times c}, \\
\Delta t'_h &= \frac{d_0 \times \left(1 + \dfrac{v}{c}\right)}{\left(1 - \dfrac{v^2}{c^2}\right) \times c} + \frac{d_0 \times \left(1 - \dfrac{v}{c}\right)}{\left(1 - \dfrac{v^2}{c^2}\right) \times c} \\
&= \frac{d_0 + d_0 \times \dfrac{v}{c} + d_0 - d_0 \times \dfrac{v}{c}}{\left(1 - \dfrac{v^2}{c^2}\right) \times c}, \\
\Delta t'_h &= \frac{2d_0}{\left(1 - \dfrac{v^2}{c^2}\right) \times c} = 2 \times \frac{1}{\left(1 - \dfrac{v^2}{c^2}\right)} \times \frac{d_0}{c}.
\end{aligned}
\tag{30}
$$

Although there is no absolute space, it is not allowed to cancel a physical light path. A real physical light path that is defined by the reference frame of Earth's gravitational field that moves with Earth through space and must be referred to the reference frame of Earth cannot be subtracted without changing the reality of physics. Therefore, we have to calculate with the geometric mean of the distances involved, which results in a shorter distance than the distance calculated by Einstein. We obtain for the correct time of the two light paths the time dilation factor γ, without the need for a length contraction factor $1/\gamma$,

$$\Delta t'_h = \frac{\left(1+\frac{v}{c}\right)\times d_0}{\left(1-\frac{v^2}{c^2}\right)\times c} + \frac{\left(1-\frac{v}{c}\right)\times d_0}{\left(1-\frac{v^2}{c^2}\right)\times c},$$

$$\Delta t'_h = \frac{\sqrt{\left(1+\frac{v}{c}\right)\times\left(1-\frac{v}{c}\right)}\times d_0}{\left(1-\frac{v^2}{c^2}\right)\times c} + \frac{\sqrt{\left(1+\frac{v}{c}\right)\times\left(1-\frac{v}{c}\right)}\times d_0}{\left(1-\frac{v^2}{c^2}\right)\times c},$$

$$\Delta t'_h = 2\times\frac{\sqrt{\left(1-\frac{v^2}{c^2}\right)}\times d_0}{\left(1-\frac{v^2}{c^2}\right)\times c} = 2\times\frac{d_0}{\sqrt{\left(1-\frac{v^2}{c^2}\right)}\times c},$$

$$\Delta t'_h = 2\times\frac{\frac{1}{\sqrt{\left(1-\frac{v^2}{c^2}\right)}}\times d_0}{c} = 2\times\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}\times\frac{d_0}{c} = 2\times\gamma\times\frac{d_0}{c}. \tag{31}$$

When we assign the speed c of light to predominant gravitational fields, which must themselves be referred to as the frames of references of stars, planets, moons, or smaller massive objects, we do not need the mathematical construct of a time quickening factor $1/\gamma$ that corresponds to a length contraction factor $1/\gamma$, which is necessary because Einstein mathematically shortened the real physical light path by just subtracting parts of the real physical light path. When atoms or ions move within the predominant gravitational field of Earth and emit electromagnetic radiation, we have to consider that the emission process, before electromagnetic radiation leaves the light source in a straight line, must be a circular process. Therefore, by the motion of a light source on Earth the emission process must be slowed down by the factor γ, which must result in an increase in the wavelength of the emitted electromagnetic radiation by the dilation factor γ. Recognizing that the emission process of electromagnetic radiation is a circular process, an increase in the wavelength of the emitted electromagnetic radiation by the dilation factor γ can occur in all emission directions. However, after the emission process of electromagnetic radiation, the speed c of light is constant in the gravitational field of Earth, which moves with Earth through space, but does not rotate with Earth, see Table I for the mean slowdown of physical processes.

VII. HOW EINSTEIN'S RELATIVITY MANIPULATES NATURE

Applying the calculation method of SR, according to the standard interpretation of the Michelson–Morley experiment, time dilation by the factor γ is calculated for the perpendicularly aligned light path because the light path, as seen by an observer in the inertial frame I_S of the Sun, is longer than the light path in the inertial frame I_E of Earth

$$\begin{aligned} 2\times d' &= 2\times\gamma\times d_0, \\ \frac{2\times d'}{c} &= \frac{2\times\gamma\times d_0}{c}, \\ 2\times\frac{d'}{c} &= 2\times\gamma\times\frac{d_0}{c}, \\ \Delta t' &= \gamma\times\Delta t_0. \end{aligned} \tag{32}$$

By Einstein's mathematical method (trick), which postulates time as an independent physical entity, the time intervals $\Delta t'$ and Δt_0 are equaled by shortening the distance d' by the factor $1/\gamma$ to the distance d_0, so that the time interval $\Delta t'$ is accelerated by the factor $1/\gamma$ to the time interval Δt_0,

$$\begin{aligned} \Delta t' &= \frac{2\times d'}{c} = \frac{2\times\gamma\times d_0}{c}, \\ \Delta t' &= \gamma\times\Delta t_0 = \frac{2\times\gamma\times d_0}{c}, \\ \Delta t' &= \Delta t_0 = \frac{\frac{1}{\gamma}\times\gamma\times 2d_0}{c} = 2\times\frac{d_0}{c}\rightarrow t' = t_0. \end{aligned} \tag{33}$$

TABLE I. The so-called kinematic time dilation factor γ is a slowdown factor of physical processes. Values calculated for an object that moves with a velocity of 0.9c on Earth. The angles 90°/270° represent the special case that is used by Einstein's SR.

α (emission angle)	Factors of dilation ($v = 0.9$)	Mean factor of dilation (γ) Ø
0°/180°	$1:[(1-0.9)\times(1+0.9)]^{1/2}$	=2.294 157 3
30°/210°	(4.082 275 8 + 0.506 038 7) : 2	=2.294 157 3
60°/240°	(3.326 528 2 + 1.261 786 5) : 2	=2.294 157 3
90°/270°	**(2.294 157 3 + 2.294 157 3) : 2**	= 2.294 157 3
120°/300°	(1.261 786 5 + 3.326 528 2) : 2	= 2.294 157 3
150°/330°	(0.506 038 7 + 4.082 275 8) : 2	= 2.294 157 3
		Sum = Ø 2.294 157 3

Applying the calculation method of SR, according to the standard interpretation of the Michelson–Morley experiment, time dilation by the factor γ^2 is calculated for the horizontal light path

$$\begin{aligned} 2d' &= 2\times\gamma^2\times d_0,\\ \frac{2d'}{c} &= \frac{2\times\gamma^2\times d_0}{c},\\ 2\times\frac{d'}{c} &= 2\times\gamma^2\times\frac{d_0}{c},\\ \Delta t' &= \gamma^2\times\Delta t_0. \end{aligned} \tag{34}$$

By Einstein's mathematical trick, which postulates time as an independent physical entity, the time interval $\Delta t' = \gamma^2\times\Delta t_0$ is changed into the time interval $\gamma\times\Delta t_0$ by shortening the distance d′ by the factor $1/\gamma$ to the distance $\gamma\times d_0$, so that the time interval $\Delta t'$ is accelerated by the factor $1/\gamma$ to the time interval $\gamma\times\Delta t_0$,

$$\begin{aligned} \Delta t' &= \frac{2\times d'}{c} = \frac{2\times\gamma^2\times d_0}{c},\\ \Delta t' &= \gamma\times\Delta t_0 = 2\times\gamma^2\times\frac{d_0}{c},\\ \Delta t' &= \Delta t_0 = 2\times\frac{1}{\gamma}\times\gamma^2\times\frac{d_0}{c}\\ &= 2\times\gamma\times\frac{d_0}{c} \neq 2\times\frac{d_0}{c} \to t' \neq t_0. \end{aligned} \tag{35}$$

To let the vertical (perpendicular) and horizontal light beams arrive at the same time at the screen of the Michelson–Morley interferometer, a second time acceleration is needed for the horizontal light path, which Einstein realizes by a second length shortening by the factor $1/\gamma$ that is called length contraction (Lorentz contraction)

$$\begin{aligned} \Delta t' &= 2\times\frac{d'}{c} = 2\times\frac{\gamma^2\times\frac{1}{\gamma}\times d_0}{c},\\ \Delta t' &= \gamma\times\Delta t_0 = 2\times\gamma^2\times\frac{1}{\gamma}\times\frac{d_0}{c},\\ \Delta t' &= \Delta t_0 = 2\times\frac{1}{\gamma}\times\gamma^2\times\frac{1}{\gamma}\times\frac{d_0}{c} = 2\times\frac{d_0}{c} \to t' = t_0. \end{aligned} \tag{36}$$

VIII. THE TRANSVERSE DOPPLER SHIFT AND MAGNETISM MUST BE REINTERPRETED

Consider the physical law for electromagnetic radiation at the emission position, when the light source is at rest with respect to the gravitational potentials of Earth's predominant gravitational field

$$f_0 = \frac{c}{\lambda_0}. \tag{37}$$

When a light source moves on Earth, the frequency of a light beam can change either due to a change in wavelength caused by a change in the distance between pulses of electromagnetic radiation, or due to a change from c in the velocity vl of light. We can define transverse Doppler effects observed not only for the motion of a light source in a certain linear direction but also for the scenario in which a receiver (observer) moves in a circle around a light source at the center of the circle. In the latter case, a blueshift of the frequency is observed. According to Einstein's relativistic physics, a frequency shift can occur only as the result of a change in wavelength due to a change in distance between pulses; never due to a change in the constant speed of light c. However, in the case of the observer moving around a light source, the light source is at rest with respect to the pulses of the emitted electromagnetic radiation, so no change in wavelength can occur. The blueshift can therefore only result from an increase in the relative velocity of the receiver (observer) with respect to the light beams being emitted from the center, as the receiver (observer) moves against the emitted pulses of the electromagnetic radiation, which increases the observed frequency. This contradicts the relativistic postulate that the speed of light c must be constant with respect to all observers. In another scenario, a light source (emitter) moves in a circle around a receiver (observer) located at the center of a circle. In this case, a redshift is observed because the wavelength between the emitted pulses increases due to the motion of the light source. Kündig performed an experiment in 1962 with an ultracentrifuge rotor with a Mössbauer absorber that was placed at a radius of 9.3 cm from the axis of the rotor, while the source was mounted on a piezoelectric transducer at the center of the rotor. Kündig measured a redshift of the wavelength by the factor γ, which he interpreted as the "transverse Doppler shift."[4] However, Kündig's experiment did not measure the transverse Doppler shift, which is wrongly equated with the "relativistic Doppler shift." As the speed of light c is constant on Earth, a transverse Doppler shift cannot be measured by an absorber resting on Earth; hence, the experiment measured the slowdown of the emission process of electromagnetic radiation by the factor $1/\gamma$; that is, a dilation of the emission process of electromagnetic radiation by the factor γ, caused in this case by the movement of the atoms in the rotating light source within the predominant gravitational field of Earth. Ives and Stilwell[5] were able to measure indirectly, and Hasselkamp[6] would later succeed in measuring directly, the so-called relativistic Doppler shift, which is wrongly equated with a transverse Doppler shift. As the speed of light c is constant on Earth, these experiments cannot measure a "transverse" Doppler shift on Earth; hence, the experiments must have measured the slowdown of the emission process of electromagnetic radiation by the factor $1/\gamma$; that is, a dilation of the emission process by the factor γ, caused in this case by the movement of the emitting light sources (ions or atoms) within the predominant gravitational field of Earth. When an emitter (light source) and a receiver (observer) are placed on opposite ends of a rotor, the formerly described blueshift and redshift cancel out, since the higher rate of electromagnetic pulses arriving at the receiver is neutralized by the slowdown of the emission process at the emitter, which is a result of the motion of the emitter in

Earth's predominant gravitational field. As a result, no Doppler shift can occur between the emitter and receiver.[7] Magnetism does not result from a length contraction of elemental charges; it results from changes in the relative velocities between moving charged particles and emitted charged fields, which expand with the speed of light c if the charged particles are at rest within a predominant gravitational field, but expand with a speed $< c$ if the charged particles are moving within the predominant gravitational field, i.e., the charge effects are only small.

IX. A MISSING INTERFERENCE SHIFT IN MOVING INERTIAL FRAMES IS ERRONEOUSLY EQUATED WITH A CONSTANT SPEED *C* OF LIGHT IN ALL INERTIAL FRAMES

According to "relativity depending on gravity," the speed of light on Earth is always c with respect to the gravitational potentials on Earth that are predominant on Earth. The frequency we measure on Earth for electromagnetic radiation with a certain wavelength that is emitted by a light source resting on the ground is $f_{(\mathrm{Earth}).}$ When the emitter (light source) in a moving interferometer moves exactly in the direction of the emitted light beam (emission angle $\theta = 0$), the light beam has only the relative velocity of light $c - v$ with respect to the emitter and the wavelength is compressed and the wavelength is shortened by the factor $1 - v/c$, resulting in a blueshift. As the light beam has also the relative velocity of light $c - v$ with respect to the receiver, which moves ahead of the light beam, the frequency at the receiver must decrease by the factor $1 - v/c$ so that a redshift results, which corresponds to the so-called longitudinal redshift. For the path of the light beam from the emitter (light source) to the receiver, we obtain on the whole for the frequency at the receiver (f_r), where v is the relative velocity of the emitter and the receiver with respect to the gravitational potentials of the predominant gravitational field of Earth and θ is the angle between the direction of velocity v of the interferometer on Earth and the emission direction of the photon. When we consider in addition the so-called second-order Doppler-shift, which is wrongly also called relativistic Doppler-shift, expressed by the Lorentz factor γ at the denominator, respectively, the inverse Lorentz factor $1/\gamma$ at the nominator, we obtain at the receiver (f_r) for the frequency (emission angle $\theta = 0$), where $\cos 0 = +1$

$$
\begin{aligned}
f_r &= \left(\frac{1}{1-\frac{v}{c}\times\cos\theta}\times 1-\frac{v}{c}\times\cos\theta\right)\times\frac{1}{\gamma}\times f_{\mathrm{Earth}},\\
f_r &= \left(\frac{1}{1-\frac{v}{c}}\right)\times\left(1-\frac{v}{c}\right)\times\sqrt{1-\frac{v^2}{c^2}}\times f_{\mathrm{Earth}},\\
f_r &= \sqrt{1-\frac{v^2}{c^2}}\times f_{\mathrm{Earth}}.
\end{aligned}
\tag{38}
$$

A constant speed c of light is hereby only simulated and Einstein's relativity of inertial frames seems to be experimental verified. With other words, the velocity $c - v$ with respect to the emitter (light source) causes a smaller wavelength and the velocity $c - v$ with respect to the receiver causes a lower frequency, so that both effects are canceling at the receiver. When the emitter (light source) in a moving interferometer moves in the opposite direction than the emitted light beam ($\theta = \pi$), the light beam has the relative velocity of light $c + v$ with respect to the emitter and the wavelength is prolonged by the factor $1 + v/c$, resulting in a redshift. As the light beam has also the relative velocity of light $c + v$ with respect to the receiver, which moves in the direction of the light beam, because of the faster velocity than c, the frequency at the receiver must increase by the factor $1 + v/c$, so that a blue shift results, which corresponds to the so-called longitudinal blueshift. For the path of the light beam from the emitter (light source) to the receiver, we obtain on the whole for the frequency at the receiver (f_r), where v is the relative velocity of the emitter and the receiver with respect to the gravitational potentials of the predominant gravitational field of Earth and θ is the angle between the direction of relative velocity v and the emission direction of the photon. When we consider in addition the so-called second-order Doppler-shift, which is wrongly also called relativistic Doppler-shift, expressed by the Lorentz factor γ at the denominator, respectively, the inverse Lorentz factor $1/\gamma$ at the nominator, we obtain at the receiver (f_r) for the frequency (emission angle $\theta = \pi$), where $\cos \pi = -1$

$$
\begin{aligned}
f_r &= \left(\frac{1}{1-\frac{v}{c}\times\cos\theta}\right)\times\left(1-\frac{v}{c}\times\cos\theta\right)\\
&\quad\times\frac{1}{\gamma}\times f_{\mathrm{Earth}},\\
f_r &= \left(\frac{1}{1+\frac{v}{c}}\right)\times\left(1+\frac{v}{c}\right)\times\sqrt{1-\frac{v^2}{c^2}}\times f_{\mathrm{Earth}},\\
f_r &= \sqrt{1-\frac{v^2}{c^2}}\times f_{\mathrm{Earth}}.
\end{aligned}
\tag{39}
$$

A constant speed c of light is hereby only simulated and Einstein's relativity of inertial frames seems to be experimental verified. With other words, the velocity $c + v$ with respect to the emitter (light source) causes a smaller wavelength and the velocity $c + v$ with respect to the receiver causes a lower frequency, so that both effects are canceling at the receiver. That's why physicists are misled in judging experiments that examine light in moving inertial frames on Earth and they think that the speed c of light must be constant on Earth with respect to inertial frames, as no frequency shift can be measured. However, seen by an observer at rest with Earth's inertial frame, the longitudinal redshift and the longitudinal blueshift can be observed when light sources move on Earth.

X. CONCLUSIONS

In his theories of SR and GR, Einstein invented "mathematical methods of relativity" that made it possible to calculate a constant speed of light c and a constant proper time t_0 in all frames of reference. In SR, Einstein had to mathematically neutralize space; in GR, he mathematically neutralized gravity, so that the motion of photons cannot be affected and the speed of light c can remain mathematically constant in all frames of reference. The latter made it necessary to reintroduce gravity to the theory, this time with the mathematical model of space-time curvature. Einstein failed to recognize that he was describing a constant speed of light c in superordinate gravitational fields when he interpreted the Michelson–Morley experiment[1] by assigning the speed of light c to the inertial frame of the Sun and a speed of light slower than c to the subordinate gravitational field of Earth. Famous experiments with interferometers, e.g., the Michelson–Morley experiment and the Kennedy–Thorndike experiment,[8] do not verify the postulate that the speed of light is the constant c in all frames of reference, but only verify the postulate that the speed of light is the constant c in the predominant gravitational field of Earth. Alväger *et al.* in 1963 proved that the speed of light cannot be faster than c on Earth, which indirectly proves that the speed of light must be constant with respect to Earth's predominant gravitational field.[9] The null result of the Michelson–Morley experiment, along with the kinematic and gravitational time dilation, must be explained by a constant value c for the speed of light with respect to the gravitational potentials of predominant gravitational fields, a consequence of the principles of minimum energy and energy conservation. Einstein claimed that there is no such thing as "absolute space" and that therefore the principle of relativity must apply to physical laws. While there is some truth in this, it is not the whole truth. Everywhere in the universe, there are gravitational potentials, against which physical bodies can move at different velocities by expending a certain amount of energy. However, photons have upper and lower limits to their speed that cannot be changed by supplying energy. A speed of light faster than c relative to the gravitational potentials of the predominant gravitational fields would violate the principle of minimum energy, while a speed of light slower than c relative to the gravitational potentials of the predominant gravitational fields would violate the principle of energy conservation. This means that there is in fact an absolute space for photons, which must be defined for each photon by the gravitational potentials of the locally predominant gravitational field—on Earth, this is Earth's gravitational field. The underlying physical phenomena that are today described by Einstein's special and general relativity must physically be interpreted by "relativity depending on gravity" (RG).[10–12] After Einstein's special and general relativity used mathematics to artificially manipulate the nature of physics, mathematics ceased to be just a tool to explain physical reality; now mathematics creates its own physical reality.

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