Contradiction in Einstein's subjective explanation of the gravitational and kinematic time dilation

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Abstract: Einstein's special and general relativity are relics from before quantum physics. If forces are transmitted by quanta, this must also apply to gravity. As light consist of quanta, it is only logical that gravitational quanta interact with light. In my article "Cognitive bias in physics with respect to Einstein's relativity, demonstrated by the famous experiment of Pound and Rebka (1960), which in reality refutes Einstein's general relativity" [R. G. Ziefle, Phys. Essays **35**, 91 (2022)], I could demonstrate that Einstein's "proper time" t_0 does not refer to reference frames but to gravitational potentials. That is why "Newtonian quantum gravity" [R. G. Ziefle, Phys. Essays **33**, 99 (2020)] can predict the correct curvature of a light beam at the surface of the Sun. Also, the phenomena observed at the binary pulsar PSR B1913 + 16 can precisely be predicted by merely applying Kepler's second law. If gravitational quanta move away from masses with the constant speed c of light, this coincides with Einstein's postulate of a constant speed c of light with respect to reference frames, as a mass, such as a star or a planet, can also be defined as a reference frame. Therefore, Einstein's found by chance an artificial and complicated method to calculate changes in space-time caused by motion, which are in reality additional gravitational effects caused by the relative velocity between gravitational quanta emitted by masses and other masses or photons.
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Résumé: Les théories de la relativité générale et de la relativité restreinte d'Einstein remontent à avant la physique quantique. Si les forces sont transmises par le quantum, cela doit également s'appliquer à la gravité. La lumière étant constituée de quantum, il est logique que le quantum gravitationnel interagisse avec la lumière. Dans mon article intitulé "Cognitive bias in physics with respect to Einstein's relativity, demonstrated by the famous experiment of Pound and Rebka (1960), which in reality refutes Einstein's general relativity "[Reiner G. Ziefle, Phys. Essays **35**, 91 (2022)], j'ai pu démontrer que le temps propre d'Einstein, t_0, ne renvoie pas à des cadres de référence mais à des potentiels gravitationnels. C'est la raison pour laquelle l'ouvrage "Newtonian Gravity "[R. G. Ziefle, Phys. Essays **33**, 99 (2020)] peut prédire la courbe correcte d'un faisceau lumineux à la surface du soleil. Le phénomène observé au niveau du pulsar binaire PSR B1913 + 16 peut également être prédit avec précision en appliquant simplement la deuxième loi de Kepler. Si le quantum gravitationnel s'éloigne des masses à la vitesse constante c de la lumière, cela correspond au postulat par Einstein d'une vitesse constante c de la lumière par rapport aux cadres de référence, les masses, telles que les étoiles ou les planètes, pouvant en effet également être définies en tant que cadres de référence. Einstein a donc trouvé par hasard une méthode artificielle et complexe pour calculer les changements de l'espace-temps causés par le mouvement, qui sont en réalité des effets gravitationnels causés par la vélocité relative entre le quantum gravitationnel émis par des masses et d'autres masses ou photons.

Key words: Hafele–Keating Experiment; Experiment of Chou; Hume; Rosenband; and Wineland; Relativity in Dependence of Gravity (RG); General Relativity (GR); Special Relativity (SR); Gravitational Time Dilation; Kinematic Time Shift; Gravitational Frequency Shift; Gravitational Redshift; Experiment of Pound and Rebka.

I. INTRODUCTION

The author already pointed out many contradictions with logic and physical laws of Einstein's theory of special and general relativity in his former articles.[1–4] But in my latest article, I proved that general relativity is empirically refuted by the Pound–Rebka experiment, which is not recognized because of a cognitive bias among physicists with respect to Einstein's relativistic physics.[5,6] It could be shown that the classical interpretation of the gravitational frequency shift is correct, which refers the frequencies of electromagnetic radiation to the absolute strengths of gravitational potentials. From the Hafele–Keating experiment, we can deduce that time is influenced by something that does not rotate with Earth, which Hafele and Keating called an observer who does not rotate with Earth and "looks on the North Pole from a great distance."[7] The only physical phenomenon that does not rotate with Earth and can directly influence each atomic

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clock on Earth, as it is present at the location of each atomic clock, is Earth's gravitational field with its gravitational potentials. Today, the Earth-centered inertial frame (ECI-frame) in near-Earth clock comparisons is used as an "absolute" reference but not as a "relative" reference corresponding to Einstein's relativity, which also moves with Earth through space and does not rotate, exactly fulfilling the characteristics of the gravitational field of Earth. The knowledge that frequencies refer to gravitational potentials enables us to define a new theory of relativity for the propagation qualities of electromagnetic radiation in dependence of gravity (RG).

II. THE CLASSICAL DERIVATION OF THE GRAVITATIONAL FREQUENCY SHIFT OF ELECTROMAGNETIC RADIATION

Because the classical interpretation of the gravitational frequency shift is recognized to be correct, the derivation of the gravitational frequency shift according to classical considerations shall be briefly explained.[5] Gravity decreases with the increase in the radius squared, whereby the distance from the mass defined by the radius also corresponds to a certain altitude above the surface of the mass, so that for altitudes that are much smaller than the radius of the mass ($a \ll r$), according to classical considerations, the following equation can be used, where **g** is the gravitational acceleration on Earth, m is the mass of Earth, and **a** is the altitude ($a \ll r$) of observed electromagnetic radiation:

$$\Delta E = \pm\, m \times g \times \Delta a. \tag{1}$$

For the difference of energy of light beams, we have given

$$\Delta E = \pm h \times \Delta f, \qquad \Delta f = \pm \frac{\Delta E}{h}, \tag{2}$$

where h is the Planck constant and f is the frequency of the electromagnetic radiation. Inserting in Eq. (2), the value for ΔE of Eq. (1), we obtain

$$\Delta f = \pm \frac{\Delta E}{h}, \qquad \Delta f = \pm \frac{m \times g \times \Delta a}{h}. \tag{3}$$

From the equivalence of mass and energy, we obtain

$$m = \frac{E}{c^2} = \frac{h \times f}{c^2}. \tag{4}$$

About a quantum physical derivation of the formula $E = m \times c^2$, see my former article.[8] If we substitute mass in Eq. (3) by the right term of Eq. (4), we obtain

$$\Delta f = \pm \frac{g \times \Delta a}{c^2} \times f. \tag{5}$$

Because of the proportionality of the frequency of a light beam and time measured by frequencies, we get ($a \ll r$)

$$\Delta t = \pm \frac{g \times \Delta a}{c^2} \times t. \tag{6}$$

In the following equations, concerning the gravitational frequency shift of electromagnetic radiation I use the sign **h** for the height above sea level, instead of the sign **a** for the altitude.

III. HAFELE AND KEATING HAD TO VIOLATE THE PRINCIPLE OF RELATIVITY TO PREDICT THE TIME SHIFTS MEASURED BETWEEN THE ATOMIC CLOCKS ON THE GROUND AND IN THE AIRCRAFT

It is commonly claimed that the experiment of Hafele and Keating that was carried out in 1971 confirmed Einstein's "relativistic" physics.[7] The Hafele–Keating experiment showed that atomic clocks within commercial aircraft are influenced by gravitational potentials and by motion on Earth within the gravitational field of Earth. The velocity of the aircraft, moving once eastward and once westward, was about 800 km/h on the average, while the flight lasted eastward 41.2 h and westward 48.6 h. Eastward the average height of the aircraft was 8900 m and westward 9400 m. The observers at the atomic clocks in the aircraft we name observer (A), and the observers at the atomic clocks on the ground we name observer (B). Both must, according to Einstein, measure with their atomic clocks the same proper time t_0, so that we would expect that the atomic clocks on the ground and the atomic clocks in the aircraft are not able to measure a different time at all. But there was measured a time difference between the clocks on the ground and in the aircraft. For the eastward flight, they measured on an average a time difference for the atomic clocks in the aircraft of –59 ns, which means that the atomic clocks in the aircraft lost 59 ns in comparison to the atomic clocks on the ground. For the westward flight, they measured on an average a time difference for the atomic clocks in the aircraft of + 273 ns, which means that the atomic clocks in the aircraft gained 273 ns in comparison to the atomic clocks on the ground. Hafele and Keating referred the atomic clocks to a frame of reference that is at rest with respect to the center of the Earth, arguing that this is necessary, because A and B are rotating with Earth and they cannot be used as inertial frames. This means that Hafele and Keating referred the atomic clocks to a third observer C who looks "on the North Pole from a great distance." The experience with satellite clocks, established the praxis of using the ECI-frame in near-Earth clock comparisons, which also does not rotate. As A and B are referred to a third observer C, observer C has absolute qualities for observer A and B. With respect to this third observer C, the velocity of an atomic clock aboard the aircraft moving eastward in the direction of Earth's rotation has the velocity of the aircraft (800 km/h) plus the velocity of Earth's rotation at the equator (1656 km/h). For the velocity of 2456 km/h, a time loss of about 200 ns was predicted for the eastward flight. Considering that the velocity of an atomic clock aboard the aircraft moving westward against the direction of Earth's rotation has in this case the velocity of the aircraft (800 km/h) minus the velocity of Earth's rotation at the equator velocity (1656 km/h), for the velocity of −856 km/h a time gain of about + 100 ns was predicted for the westward flight. Referring motion to the absolute reference of observer C, the kinematic time difference for the eastward flight that observer B on the ground (rotating with respect to observer C with the velocity 1656 km/h = 0.46 km/s) expects in comparison to observer A in the aircraft (rotating with respect to observer C with the velocity 1656 km/h + 800 km/s = 0.6822 km/s) is, multiplying the kinematic time shift by the time of the duration of the eastward flight (41.2 h = 148320 s)

$$\begin{aligned}
\Delta t_{E_A} &= t_A - t_B,\\
\Delta t_{E_A} &= \frac{1}{\sqrt{1-\frac{\left(0.46\frac{\mathrm{km}}{\mathrm{s}}\right)^2}{c^2}}}\times t_0 - \frac{1}{\sqrt{1-\frac{\left(0.6822\frac{\mathrm{km}}{\mathrm{s}}\right)^2}{c^2}}}\times t_0,\\
\Delta t_{E_A} &= 1.000000000001178\times t_0 - 1.000000000002589\times t_0,\\
\Delta t_{E_A} &= -0.000000000001411\times t_0,\\
\Delta t_{E_A} &= -0.000000000001411\times 148320\mathrm{s} = -209\mathrm{ns}.
\end{aligned} \tag{7}$$

This means that the atomic clocks in the aircraft (A) must have lost about 209 ns with respect to the atomic clocks on the ground (B) during the eastward flight, when referring the position of observer A and B to an absolute reference C that does not rotate with the Earth around its axis. This is not a null result, which is the precondition for a relativistic difference of the expected kinematic time shifts because of Einstein's postulate that all observers must measure the same proper time t_0. This indicates that Hafele and Keating did not measure relativistic time shifts, but relative time shifts. Referring motion to the absolute reference of observer C, the kinematic time difference for the westward flight that observer B on the ground (rotating with respect to observer C with the velocity 1656 km/h = 0.46 km/s) expects in comparison to observer A in the aircraft (rotating now with respect to observer C with the velocity 800 km/s –1656 km/h = −0.238 km/s) is, multiplying the kinematic time shift by the time of the duration of the westward flight (48.6 h = 174 960 s)

$$\begin{aligned}
\Delta t_{W_A} &= (t_A - t_B)\times 174960\mathrm{s},\\
\Delta t_{W_A} &= \frac{1}{\sqrt{1-\frac{\left(0.46\frac{\mathrm{km}}{\mathrm{s}}\right)^2}{c^2}}}\times t_0\\
&\quad - \frac{1}{\sqrt{1-\frac{\left(0.2377\frac{\mathrm{km}}{\mathrm{s}}\right)^2}{c^2}}}\times t_0,\\
\Delta t_{W_A} &= 1.000000000002589\times t_0\\
&\quad - 1.0000000000031433\times t_0,\\
\Delta t_{W_A} &= 0.0000000000055\times t_0,\\
\Delta t_{W_A} &= 0.0000000000055\times 174960\mathrm{s} = +96\mathrm{ns}.
\end{aligned} \tag{8}$$

This means that the atomic clocks in the aircraft (A) must have gained about 96 ns with respect to the atomic clocks on the ground (B) during the westward flight, when referring the position of observer A and B to an absolute reference C that does not rotate with the Earth around its axis. This is not a null result, which is the precondition for a relativistic difference of the expected kinematic time shifts because of Einstein's postulate that all observers must measure the same proper time t_0. This indicates again that Hafele and Keating did not measure relativistic time shifts, but relative time shifts. Hafele and Keating had introduced an absolute reference by a third observer C for observer A in the aircraft and for observer B on the ground who does not rotate in order to calculate the kinematic time shifts. In the following in their calculations of the gravitational time shifts, Hafele and Keating referred their calculations only to the perspective of observer B and the atomic clocks (B) on the ground, which means nothing else than introducing an absolute reference by a third observer C who looks from below toward the atomic clocks in the aircraft (A). This corresponds with classical considerations explaining the gravitational frequency (time) shift. In my latest article, I proved that Einstein's interpretation of the gravitational frequency (time) shift by general relativity is refuted by the Pound–-Rebka experiment, and that gravitational frequency (time) shifts explained by classical considerations are confirmed by the Pound–Rebka experiment.[6] For measurements of gravitational time shifts on Earth, we can instead of Φ/c^2 use the following simplified equation, as already derived above:

$$\frac{\Phi}{c^2} = \frac{\mathrm{GM}\times m}{r\times c^2} \approx \frac{g\times h}{c^2}. \tag{9}$$

After having introduced a third observer C as an absolute reference for both observers A and B, which is located on the surface of Earth, where also observer B and his atomic clocks (B) are located, so that $t_0 = t_C = t_B$, we obtain the correct values that are needed to confirm the experimental results of the Hafele–Keating experiment. In this case, an observer C on the ground expects no difference against observer B, as observer B and observer C are located at the same height ($\Delta h = 0$)

$$\begin{aligned}
\Delta t_B &= t_C - t_B,\\
\Delta t_B &= \frac{g\times\Delta h}{c^2}\times t_0,\\
\Delta t_B &= \frac{g\times 0m}{c^2}\times t_0 = 0.
\end{aligned} \tag{10}$$

Observer B and observer C who are located at the same height will expect for the atomic clocks (A) in the aircraft a time shift of

$$\begin{aligned}
\Delta t_A &= t_C - t_A,\\
\Delta t_A &= \frac{g\times(+\Delta h)}{c^2}\times t_0,\\
\Delta t_A &= +\frac{g\times\Delta h}{c^2}\times t_0.
\end{aligned} \tag{11}$$

Referring observer A and observer B to the absolute reference C on the ground, for the difference of both time shifts, we obtain

$$\Delta t = \Delta t_{\mathrm{A}} - \Delta t_{\mathrm{B}},$$
$$\Delta t = \frac{g \times (+\Delta h)}{c^2} \times t_0 - 0, \qquad (12)$$
$$\Delta t = +\frac{g \times \Delta h}{c^2} \times t_0.$$

Because the observer B on the ground is located at the same height as the absolute observer C, observer B expects the same value for the time shift with respect to observer A in the aircraft. Observer B and observer C expect that the atomic clocks in the aircraft (A) go faster than the atomic clocks on the ground (B). For the eastward flight, we obtain now a relative difference of the measured times, which is not a relativistic difference, as claimed by Hafele and Keating because they have referred their calculations to an absolute reference C, which is located at the position of reference B

$$\Delta t_{\mathrm{E_A}} = \frac{g \times (+\Delta h)}{c^2} \times t_0 = +\frac{g \times \Delta h}{c^2} \times t_0,$$
$$\Delta t_{\mathrm{E_A}} = +\frac{9.81\mathrm{m/s^2} \times 8900\mathrm{m}}{c^2} \times 41.2\mathrm{h}, \qquad (13)$$
$$\Delta t_{\mathrm{E_A}} = +\frac{9.81\mathrm{m/s^2} \times 8900\mathrm{m}}{c^2} \times 148320\mathrm{s}$$
$$= +1.44 \times 10^{-7}\mathrm{s} = +144\mathrm{ns}.$$

For the westward flight, we obtain now the relative difference of the measured times, which is not a relativistic difference, as claimed by Hafele and Keating because they have referred their calculations to an absolute reference C, which is located at the position of reference B

$$\Delta t_{\mathrm{W_A}} = t_{\mathrm{A}} - t_{\mathrm{B}},$$
$$\Delta t_{\mathrm{W_A}} = \frac{g \times (+\Delta h)}{c^2} \times t_0 = +\frac{g \times \Delta h}{c^2} \times t_0,$$
$$\Delta t_{\mathrm{W_A}} = +\frac{9.81\mathrm{m/s^2} \times 9400\mathrm{m}}{c^2} \times 48.6\,\mathrm{h}, \qquad (14)$$
$$\Delta t_{\mathrm{W_A}} = +\frac{9.81\mathrm{m/s^2} \times 9400\mathrm{m}}{c^2} \times 174960\mathrm{s}$$
$$= +1.79 \times 10^{-7}\mathrm{s} = +179\mathrm{ns}.$$

In this case, we obtain the values for the gravitational time shifts that are needed to correctly predict the result of the Hafele–Keating experiment. After we have recognized that Hafele and Keating did not measure relativistic time shifts, but relative time shifts, we want to combine the kinematic and the gravitational time shifts. We obtain for the eastward flight

$$\Delta t_{\mathrm{E}} = -209\mathrm{ns} + 144\mathrm{ns} = -65\mathrm{ns}. \qquad (15)$$

Hafele and Keating measured −59 ns for the eastward flight, which means that the atomic clocks in the aircraft lost −59 ns during the eastward flight. Combining the kinematic and gravitational time shifts, we obtain for the westward flight

$$\Delta t_{\mathrm{W}} = +96\mathrm{ns} + 179\mathrm{ns} = +275\mathrm{ns}. \qquad (16)$$

Hafele and Keating claimed that Einstein's relativistic physics was confirmed by their experiment, but for their calculations of the kinematic and the gravitational time (frequency) shifts, they introduced in both cases an absolute observer C, which means that they just measured relative time shifts, but not relativistic time shifts.

IV. A THEORY OF RELATIVITY FOR THE PROPAGATION QUALITIES OF ELECTROMAGNETIC RADIATION IN DEPENDENCE OF GRAVITATIONAL POTENTIALS IS DEDUCED FROM THE HAFELE–KEATING EXPERIMENT

According to the Hafele–Keating experiment, there exists an absolute observer C to which an observer B on the ground and an observer A in the aircraft must refer to, when comparing their kinematical and gravitationally influenced time. To obtain the correct kinematic time shift, Hafele and Keating had to refer their calculations to a clock of a third absolute observer C who does not rotate with Earth and who "looks on the North Pole from a great distance." The absolute observer C must correspond to an objective physical phenomenon that does not rotate with Earth. The only objective physical phenomenon that does not rotate with Earth and can directly influence each atomic clock on Earth because it is present at each atomic clock on Earth is Earth's gravitational field with its gravitational potentials. Today, the ECI-frame in near-Earth clock comparisons is used as an absolute reference, but not as a relative reference corresponding to Einstein's relativity, which also moves with Earth through space and does not rotate, exactly fulfilling the characteristics of the gravitational field of Earth. Already in my article "Refutation of Einstein's relativity on the basis of the incorrect derivation of the inertial mass increase violating the principle of energy conservation. A paradigm shift in physics,"[8] I could show that it would contradict the principle of energy conservation if the velocity c of light would not orient on gravitational potentials. To calculate the so-called time dilation, which is in reality a slowing down of physical processes, the same equations can be used that are also used by Einstein's special relativity. For details read my former article.[8] Therefore, according to the new theory of relativity, the predominant gravitational field of Earth causes the kinematic and gravitational time shifts, so that for each strength of a gravitational potential, we must define a "proper time" t_0, which does not rotate with Earth. Each proper time must be defined by a coordinate of a spherical coordinate system representing the gravitational field of Earth, in which's center Earth is located. According to that, the proper time t_0 in the aircraft we define as the proper time $t_{0\mathrm{A}}$ and the proper time on the ground we define as $t_{0\mathrm{B}}$. As long as the atomic clocks are at rest against the not rotation gravitational field, the atomic clocks in the aircraft (t_{Ar} is the time reference of the atomic clocks in the aircraft) and the atomic clocks on the surface of the Earth aircraft (t_{Br} is the time reference of the atomic clocks on the ground) would not measure any difference with respect to the proper time $t_{0\mathrm{A}}$, respectively, the proper time $t_{0\mathrm{B}}$, which are defined by the not rotating gravitational potential at the position of the atomic clocks, whereas the proper time is the same for all coordinates of Earth's gravitational field at the same gravitational potential (height)

$$t_{\mathrm{Ar(gravitational)}} = t_{0A},\quad t_{\mathrm{Br(gravitational)}} = t_{0B}. \tag{17}$$

This meets the logical necessity that an atomic clock can only display a single time. Considering that the proper time $t_{0\mathrm{B}}$ on the ground must be defined to be slower than the proper time $t_{0\mathrm{A}}$ in the aircraft because of the stronger gravitational potential on the ground, we obtain for the proper times $t_{0\mathrm{AE}}$ and $t_{0\mathrm{BE}}$ during the eastward flight

$$\begin{aligned} t_{0\mathrm{A_E}} &= t_{0\mathrm{B_E}} + \frac{g \times \Delta h}{c^2} \times t_{0\mathrm{B_E}},\\ t_{0\mathrm{A_E}} &= t_{0\mathrm{B_E}} + \frac{9.81 \times 8900\mathrm{m}}{c^2} \times t_{0\mathrm{B_E}},\\ t_{0\mathrm{A_E}} &= t_{0\mathrm{B_E}} + 9.71 \times 10^{-13} \times t_{0\mathrm{B_E}},\\ t_{0\mathrm{A_E}} &= 1.000000000000971 \times t_{0\mathrm{B_E}}. \end{aligned} \tag{18}$$

For the proper time t_{B0E} at the gravitational potential on the ground during the eastward flight, we obtain in comparison to the proper time t_{A0E} at the gravitational potential at the aircraft

$$\begin{aligned} t_{0\mathrm{A_E}} &= 1.000000000000971 \times t_{0\mathrm{B_E}},\\ t_{0\mathrm{B_E}} &= \frac{t_{0\mathrm{A_E}}}{1.000000000000971},\\ t_{0\mathrm{B_E}} &= 0.999999999999029 \times t_{0\mathrm{A_E}}. \end{aligned} \tag{19}$$

For the difference between the proper time t_{A0} and the proper time $t_{0\mathrm{B}}$, as they are defined by the not rotating gravitational potentials of Earth's gravitational field, we obtain for the proper time at a weaker gravitational potential at the aircraft (A) in comparison to the proper time at a stronger gravitational potential on the ground (B)

$$\begin{aligned} \Delta t_{0\mathrm{B_E}} &= t_{0\mathrm{A_E}} - t_{0\mathrm{B_E}},\\ \Delta t_{0\mathrm{B_E}} &= 1.000000000000971 \times t_{0\mathrm{B_E}} - t_{0\mathrm{B_E}},\\ \Delta t_{0\mathrm{B_E}} &= +9.71 \times 10^{-13} \times t_{0\mathrm{B_E}}. \end{aligned} \tag{20}$$

For the difference between the proper time $t_{0\mathrm{B}}$ and the proper time t_{A0} defined by the not gravitational potentials of Earth's gravitational field, we obtain for the proper time at a stronger gravitational potential on the ground (B) in comparison to the proper time at a weaker gravitational potential at the aircraft (A)

$$\begin{aligned} \Delta t_{0\mathrm{A_E}} &= t_{0\mathrm{B_E}} - t_{0\mathrm{A_E}},\\ \Delta t_{0\mathrm{A_E}} &= t_{0\mathrm{B_E}} - 1.000000000000971 \times \Delta t_{0\mathrm{B_E}},\\ \Delta t_{0\mathrm{A_E}} &= -9.71 \times 10^{-13} \times t_{0\mathrm{B_E}}. \end{aligned} \tag{21}$$

Considering that the proper time $t_{0\mathrm{B}}$ on the ground must be slower than the proper time $t_{0\mathrm{A}}$ in the aircraft because of the stronger gravitational potential on the ground, we obtain for the proper time $t_{0\mathrm{AW}}$ in comparison to the proper time $t_{0\mathrm{BW}}$ during the westward flight

$$\begin{aligned} t_{0\mathrm{A_W}} &= t_{0\mathrm{B_W}} + \frac{g \times \Delta h}{c^2} \times t_{0\mathrm{B_W}},\\ t_{0\mathrm{A_W}} &= t_{0\mathrm{B_W}} + \frac{9.8 \times 9400\mathrm{m}}{c^2} \times t_{0\mathrm{B_W}},\\ t_{0\mathrm{A_W}} &= t_{0\mathrm{B_W}} + 1.026 \times 10^{-12} \times t_{0\mathrm{B_W}},\\ t_{0\mathrm{A_W}} &= 1.000000000001026 \times t_{0\mathrm{B_W}}. \end{aligned} \tag{22}$$

For the proper time t_{B0W} at the gravitational potential on the ground during the westward flight, we obtain in comparison to the proper time t_{A0W} at the gravitational potential of the aircraft

$$\begin{aligned} t_{0\mathrm{A_W}} &= 1.000000000001026 \times t_{0\mathrm{B_W}},\\ t_{0\mathrm{B_W}} &= \frac{t_{0\mathrm{A_W}}}{1.000000000001026},\\ t_{0\mathrm{B_W}} &= 0.999999999998974 \times t_{0\mathrm{A_W}}. \end{aligned} \tag{23}$$

For the difference between the proper time t_{A0} at the weaker gravitational potential in the aircraft and the proper time t_{B0} at the stronger gravitational potential on the ground, as it is defined by the not rotating gravitational potentials of Earth's gravitational field, we obtain during the westward flight for the proper time at the weaker gravitational potential at the aircraft (A) in comparison to the proper time at the stronger gravitational potential on the ground (B)

$$\begin{aligned} \Delta t_{0\mathrm{B_W}} &= t_{\mathrm{A0_W}} - \Delta t_{0\mathrm{B_W}},\\ \Delta t_{0\mathrm{B_W}} &= 1.000000000001026 \times t_{0\mathrm{B_W}} - t_{0\mathrm{B_W}},\\ \Delta t_{0\mathrm{B_W}} &= +1.026 \times 10^{-12} \times \Delta t_{0\mathrm{B_W}}. \end{aligned} \tag{24}$$

For the difference between the proper time t_{B0} at the stronger gravitational potential on the ground and the "proper reference time" t_{A0} at the weaker gravitational potential in the aircraft, as it is defined by the not rotating gravitational potentials of Earth's gravitational field, we obtain during the westward flight for the proper time at the stronger gravitational potential on the ground (B) in comparison to the proper time at the weaker gravitational potential at the aircraft (A)

$$\begin{aligned} \Delta t_{0\mathrm{A_E}} &= t_{0\mathrm{B_W}} - t_{0\mathrm{A_W}},\\ \Delta t_{0\mathrm{A_E}} &= \Delta t_{0\mathrm{B_W}} - 1.000000000001026 \times t_{0\mathrm{B_W}},\\ \Delta t_{0\mathrm{A_E}} &= -1.026 \times 10^{-12} \times t_{0\mathrm{B_W}}. \end{aligned} \tag{25}$$

Calculating the kinematic effect on time, only the velocity of an atomic clock against a certain not rotating gravitational potential of Earth's gravitational field is relevant. For the relative reference time t_{Br} that we measure on the surface of the Earth, which is our usual relative reference time, we obtain

$$\begin{aligned} t_{\mathrm{Br(kinematic)}} &= \gamma \times t_{0\mathrm{B_{E/W}}} = \frac{1}{\sqrt{1 - \frac{\left(0.46\frac{\mathrm{km}}{\mathrm{s}}\right)^2}{c^2}}} \times t_{0\mathrm{B_{E/W}}},\\ t_{\mathrm{Br(kinematic)}} &= 1.000000000001178 \times t_{0\mathrm{B_{E/W}}}. \end{aligned} \tag{26}$$

This value is valid during the eastward flight and the westward flight, as the atomic clock on the ground rest with respect to the surface of the Earth. With other words, as a clock resting on the surface of the Earth goes slower than the proper time t_{B0} defined for the gravitational potential at the surface of the Earth, because it moves (rotates) with the velocity of 1656 km/h (= 0.46 km/s) against the not rotating gravitational potentials of Earth's gravitational field, when we measure one second on the ground, this corresponds to less than one second of the proper time t_{B0} that is defined for the not rotating gravitational potential on the ground

$$t_{0B_{E/W}} = \frac{1}{1.000000000001178} \times t_{Br_{E/W}(\text{kinematic})}, \quad t_{0B_{E/W}} = 0.999999999998822 \times t_{Br_{E/W}(\text{kinematic})}. \tag{27}$$

For an atomic clock in an aircraft that flies once eastward and once westward, we obtain two different values for the time measured in the aircraft in comparison to the proper time t_{A0} defined by the not rotating gravitational potential at the height of the flying aircraft. Also in this case, only the velocity against the not rotating gravitational potentials is relevant, so that we obtain for the relative reference time t_{ArE} for the aircraft flying eastward, which moves with the velocity 2456 km/h = 1656 km/h + 800 km/h (= 0.6822 km/s) against the not rotating gravitational potentials of the gravitational field of Earth

$$t_{Ar_E(\text{kinematic})} = \gamma \times t_{0A_E} = \frac{1}{\sqrt{1-\frac{\left(0.6822\frac{\text{km}}{\text{s}}\right)^2}{c^2}}} \times t_{0A_E}, \quad t_{Ar_E(\text{kinematic})} = 1.000000000002589 \times t_{0A_E}. \tag{28}$$

With other words, as the clocks in the flying aircraft go slower than the proper time t_{A0E} defined by the gravitational potential at the height of the flying aircraft, because it moves with the velocity of 2456 km/h (= 0.68 km/s) against the not rotating gravitational potentials of Earth's gravitational field, when we measure one second on the ground, this corresponds to less than one second of the proper time t_{0B} that is defined for the ground

$$t_{0A_E} = \frac{1}{1.00000000000259} \times t_{Ar_E(\text{kinematic})}, \quad t_{0A_E} = 0.9999999999974 \times t_{Ar_E(\text{kinematic})}, \tag{29}$$

For the kinematic aspect on time measured by the atomic clocks on the ground and the atomic clocks in the aircraft, caused by motion against the gravitational potentials of the gravitational field of Earth, we have given two equations for the eastward flight

$$t_{Ar_E(\text{kinematic})} = 1.000000000002589 \times t_{0B_{E/W}}, \quad t_{Br_E(\text{kinematic})} = 1.000000000001178 \times t_{0B_{E/W}}. \tag{30}$$

To calculate the time shift during the eastward flight, we can use the proportionality of both values

$$\frac{t_{Ar_E(\text{kinematic})}}{t_{Br_E(\text{kinematic})}} = \frac{1.000000000002589 \times t_{A0_E}}{1.000000000001178 \times t_{B0_E}}, \tag{31}$$

or in general terms,

$$\frac{t_{Ar_E}}{t_{Br_E}} = \frac{\gamma \times t_{0A_E}}{\gamma \times t_{0B_E}} = \frac{\frac{1}{\sqrt{1-\frac{v_A^2}{c^2}}} \times t_{0AE}}{\frac{1}{\sqrt{1-\frac{v_B^2}{c^2}}} \times t_{0B_E}}, \quad \frac{t_{Ar_E}}{t_{Br_E}} = \frac{\sqrt{1-\frac{v_B^2}{c^2}} \times t_{0AE}}{\sqrt{1-\frac{v_A^2}{c^2}} \times t_{0B_E}}. \tag{32}$$

Combining the kinematic effect on time and the gravitational effect on time caused by different gravitational potentials during the eastward flight, we have to replace t_{0AE} on the right side of equation by the result of Eq. (18), so that we obtain

$$\frac{t_{Ar_E}}{t_{Br_E}} = \frac{\sqrt{1-\frac{v_B^2}{c^2}} \times t_{0AE}}{\sqrt{1-\frac{v_A^2}{c^2}} \times t_{0BE}},$$

$$\frac{t_{Ar_E}}{t_{Br_E}} = \frac{\sqrt{1-\frac{v_B^2}{c^2}} \times \left(t_{0B_E} + 9.71 \times 10^{-13} \times t_{0B_E}\right)}{\sqrt{1-\frac{v_A^2}{c^2}} \times t_{0BE}},$$

$$\frac{t_{Ar_E}}{t_{Br_E}} = \frac{\sqrt{1-\frac{v_B^2}{c^2}} \times \left(1 + 9.71 \times 10^{-13}\right) \times t_{0B_E}}{\sqrt{1-\frac{v_A^2}{c^2}} \times t_{0BE}} \times t_{Br_E},$$

$$t_{Ar_E} = \frac{\left(1 + 9.71 \times 10^{-13}\right) \times \sqrt{1-\frac{v_B^2}{c^2}}}{\sqrt{1-\frac{v_A^2}{c^2}}} \times t_{Br_E}. \tag{33}$$

From the different velocities of the atomic clocks on the ground and in the aircraft with respect to the not rotating gravitational potentials of the Earth's gravitational field, we obtain for the reference time t_{Ar} in the aircraft during the eastward flight, when inserting the reference time of the atomic clocks on the ground (t_{Br} = 148 320 s)

$$
\begin{aligned}
t_{\mathrm{Ar_E}} &= \frac{(1+9.71\times10^{-13})\times\sqrt{1-\frac{v_{\mathrm{B}}{}^2}{c^2}}}{\sqrt{1-\frac{v_{\mathrm{A}}{}^2}{c^2}}}\times t_{\mathrm{Br_E}},\\
t_{\mathrm{Ar_E}} &= \frac{1.000000000000971\times1.000000000001178}{1.000000000002589}\\
&\quad\times 148320\mathrm{s},\\
t_{\mathrm{Ar_E}} &= \frac{1.00000000000215}{1.000000000002589}\times148320\mathrm{s},\\
t_{\mathrm{Ar_E}} &= 0.99999999999956\times148320\mathrm{s},\\
t_{\mathrm{Ar_E}} &= 148319.999999935\mathrm{s}.
\end{aligned}
\tag{34}
$$

For the difference between the time measured by the atomic clocks in the aircraft (A) and the atomic clocks on the ground (B), we obtain during the eastward flight

$$
\begin{aligned}
\Delta t_{\mathrm{E}} &= t_{\mathrm{ArE}} - t_{\mathrm{BrE}},\\
\Delta t_{\mathrm{E}} &= 148319.99999935\mathrm{s} - 148320\mathrm{s},\\
\Delta t_{\mathrm{E}} &= -0.65\times10^{-7}\mathrm{s} = -65\mathrm{ns}.
\end{aligned}
\tag{35}
$$

Also for the atomic clocks in an aircraft that fly westward only the velocity against the not rotating gravitational potentials of Earth's gravitational field is relevant, so that we obtain the relative reference time t_{ArW} for a flying aircraft flying westward and rotates (moves) with the velocity 1656 km/h–800 km/h (= 0.2377 km/s) against the not rotating gravitational field of the Earth

$$
\begin{aligned}
t_{\mathrm{Ar_W(kinematic)}} &= \gamma\times t_{\mathrm{A0_W}} = \frac{1}{\sqrt{1-\frac{\left(0.2377\frac{\mathrm{km}}{\mathrm{s}}\right)^2}{c^2}}}\times t_{\mathrm{A0_W}},\\
t_{\mathrm{Ar_W(kinematic)}} &= \frac{1}{\sqrt{1-\frac{\left(0.2377\frac{\mathrm{km}}{\mathrm{s}}\right)^2}{c^2}}}\times t_{\mathrm{A0_W}},\\
t_{\mathrm{Ar_W(kinematic)}} &= 1.00000000000031433\times t_{\mathrm{A0_W}}.
\end{aligned}
\tag{36}
$$

The atomic clocks in the flying aircraft go slower than the proper time t_{A0} at the altitude of the flying aircraft, because the aircraft moves with the velocity of 856 km/h (= 0.2377 km/s) against the not rotating gravitational potentials of Earth's gravitational field

$$
\begin{aligned}
t_{\mathrm{A0_W}} &= \frac{1}{1.00000000000031433}\times t_{\mathrm{Ar_W(kinematic)}},\\
t_{\mathrm{A0_W}} &= 0.9999999999968567\times t_{\mathrm{Ar_W(kinematic)}}.
\end{aligned}
\tag{37}
$$

But with respect to the atomic clocks on the ground that move with the velocity of 1656 km/h (= 0.46 km/h) against the not rotating gravitational potentials of Earth's gravitational field, the atomic clocks in the aircraft go faster. To calculate the time shift during the westward flight, we can use again the proportionality of both values

$$
\frac{t_{\mathrm{Ar_W(kinematic)}}}{t_{\mathrm{Br_W(kinematic)}}} = \frac{1.00000000000031433\times t_{\mathrm{A0_W}}}{1.00000000001178\times t_{\mathrm{B0_W}}},
\tag{38}
$$

or in general terms

$$
\begin{aligned}
\frac{t_{\mathrm{ArW}}}{t_{\mathrm{BrW}}} &= \frac{\gamma\times t_{\mathrm{0A_W}}}{\gamma\times t_{\mathrm{0B_W}}} = \frac{\frac{1}{\sqrt{1-\frac{v_{\mathrm{A}}{}^2}{c^2}}}\times t_{\mathrm{0AW}}}{\frac{1}{\sqrt{1-\frac{v_{\mathrm{B}}{}^2}{c^2}}}\times t_{\mathrm{0BW}}},\\
\frac{t_{\mathrm{ArW}}}{t_{\mathrm{BrW}}} &= \frac{\sqrt{1-\frac{v_{\mathrm{B}}{}^2}{c^2}}\times t_{\mathrm{0AW}}}{\sqrt{1-\frac{v_{\mathrm{A}}{}^2}{c^2}}\times t_{\mathrm{0BW}}}.
\end{aligned}
\tag{39}
$$

Combining the kinematic effect and the gravitational effect on time caused by different gravitational potentials during the westward flight, we have to replace t_{0AE} on the right side of equation by the result of Eq. (22), so that we obtain

$$
\begin{aligned}
\frac{t_{\mathrm{ArW}}}{t_{\mathrm{BrW}}} &= \frac{\sqrt{1-\frac{v_{\mathrm{B}}{}^2}{c^2}}\times t_{\mathrm{0AW}}}{\sqrt{1-\frac{v_{\mathrm{A}}{}^2}{c^2}}\times t_{\mathrm{0BW}}},\\
\frac{t_{\mathrm{ArW}}}{t_{\mathrm{BrW}}} &= \frac{\sqrt{1-\frac{v_{\mathrm{B}}{}^2}{c^2}}\times\left(t_{\mathrm{0B_W}}+1.026\times10^{-12}\times t_{\mathrm{0B_W}}\right)}{\sqrt{1-\frac{v_{\mathrm{A}}{}^2}{c^2}}\times t_{0BW}},\\
t_{\mathrm{ArW}} &= \frac{\sqrt{1-\frac{v_{\mathrm{B}}{}^2}{c^2}}\times(1+1.026\times10^{-12})\times t_{\mathrm{0BW}}}{\sqrt{1-\frac{v_{\mathrm{A}}{}^2}{c^2}}\times t_{\mathrm{0BW}}}\times t_{\mathrm{BrE}},\\
t_{\mathrm{ArW}} &= \frac{(1+1.026\times10^{-12})\times\sqrt{1-\frac{v_{\mathrm{B}}{}^2}{c^2}}}{\sqrt{1-\frac{v_{\mathrm{A}}{}^2}{c^2}}}\times t_{\mathrm{BrE}}.
\end{aligned}
\tag{40}
$$

From the different velocities of the atomic clocks on the ground and in the aircraft with respect to the not rotating gravitational field of the Earth, we obtain for the reference time t_{Ar} in the aircraft during the westward flight ($t_{\mathrm{Br}} = 174\,960$ s)

$$
\begin{aligned}
t_{\mathrm{ArW}} &= \frac{(1+1.026\times10^{-12})\times\sqrt{1-\frac{v_{\mathrm{B}}{}^2}{c^2}}}{\sqrt{1-\frac{v_{\mathrm{A}}{}^2}{c^2}}}\times t_{\mathrm{BrE}},\\
t_{\mathrm{ArW}} &= \frac{1.000000000001026\times1.000000000001178}{1.0000000000003143}\\
&\quad\times 174960\mathrm{s},\\
t_{\mathrm{ArW}} &= \frac{1.000000000002}{1.0000000000003}\times174960\mathrm{s},\\
t_{\mathrm{ArW}} &= 1.00000000000169\times174960\mathrm{s},\\
t_{\mathrm{ArW}} &= 174960.0000003\mathrm{s}.
\end{aligned}
\tag{41}
$$

For the difference between the time measured by the atomic clocks in the aircraft and the atomic clocks on the ground, we obtain

$$\Delta t_{W} = t_{ArW} - t_{BrW},$$
$$\Delta t_{W} = 174960.0000003\text{s} - 174960\text{s}, \quad (42)$$
$$\Delta t_{W} = +3 \times 10^{-7}\text{s} = +300\text{ns}.$$

The values calculated for the kinematic and gravitonal time shift, we expect according to my nonrelativistic theory of relativity for the eastward and westward flight correspond very well with the time differences that were measured by the experiment of Hafele and Keating.[7]

V. WRONG CONCLUSIONS THAT MIGHT BE DRAWN FROM THE HAFELE–KEATING EXPERIMENT

When calculating the time differences of the atomic clocks in the aircraft and the atomic clocks on the ground in Eqs. (33) and (40) for the eastward flight, respectively, the westward flight, the "proper times," which are defined by not rotating gravitational potentials, are cancelling out and only the reference times on the ground and in the aircraft remain. This might lead to the wrong impression that only relative times are relevant, and one can chose each clock to represent the proper time, no matter of its motion within Earth's gravitational field, which simulates relativistic conditions. But also Hafele and Keating had to refer their calculations to an absolute clock at a third observer C who does not rotate with Earth and who "looks on the North Pole from a great distance." Hafele and Keating could insert the time measured on the ground as the proper time, although they had formerly calculated for the clock on the ground a time that differs from the proper time in dependence of Earth's rotation, gives the wrong impression that a clock could measure two times, which is of course not possible. That Hafele and Keating could wrongly use the time measured by a clock on the ground as the proper time and, nevertheless, obtained the correct results has a simple explanation. For the clock on the ground, Hafele and Keating calculated a time that differs from the proper time

$$t_{Br_{E/W}} = \frac{1}{\sqrt{1 - \frac{\left(0.46\frac{\text{km}}{\text{s}}\right)^2}{c^2}}} \times t_{0B}, \quad (43)$$
$$t_{Br_{E/W}} = 1.000000000001178 \times t_{0B}.$$

Inserting the value for t_{0B} from Eq. (27), we obtain two equations from which we can calculate the correct proper time t_{0B} on the ground for the eastward flight

$$t_{Br_E} = 1.000000000001178 \times t_{0B},$$
$$t_{Br_E} = 1.000000000001178 \times 0.999999999998822 \times t_{Br_E}. \quad (44)$$

For the correct proper time t_{0B} defined by the not rotating gravitational potential on the surface of Earth, we obtain during the eastward flight

$$1.000000000001178 \times t_{0B_E} = 1.000000000001178 \times 0.999999999998822 \times t_{Br_E},$$
$$t_{0B_E} = 0.999999999998822 \times 148320\text{s},$$
$$t_{0B_E} = 148319.999999825\text{s}. \quad (45)$$

Hafele and Keating inserted for the proper time during the eastward flight the wrong value of $t_0 = 148\,320$ s instead of the correct value for the proper time defined by the not rotationg gravitational potential on the surface of Earth ($t_{0BE} = 148\,319.999\,999\,825$ s), which makes no relevant difference. Taking the result of Eq. (7), we obtain -209 ns, which is the same result, although we used the wrong proper time that must be defined by not rotating gravitational potentials of Earth's gravitational field at a certain altitude

$$\Delta t_{E_A} = -0.000000000001411 \times t_{0B_E},$$
$$\Delta t_{E_A} = -0.000000000001411 \times 148319.999999825\text{s} = -209\text{ns}. \quad (46)$$

For the correct proper time t_{0BW} defined by the not rotationg gravitational potential at the surface of Earth, we obtain during the westward flight

$$1.000000000001178 \times t_{0B_W} = 1.000000000001178 \times 0.999999999998822 \times t_{Br_W},$$
$$t_{0B_W} = 0.999999999998822 \times 174960\text{s},$$
$$t_{0B_W} = 174959.999999794\text{s}. \quad (47)$$

Hafele and Keating inserted for the proper time during the westward flight the wrong value of $t_0 = 174\,960$ s, instead of the correct value for the proper time defined by the not rotating gravitational potential at the surface of the Earth ($t_{0BW} = 174\,959.999\,999\,794$ s), which makes no relevant difference. Taking the result of Eq. (8), we obtain the same result, which is the same result, although we used the wrong proper time that must be defined by not rotating gravitational potentials of Earth's gravitational field at a certain altitude

$$\Delta t_{W_A} = 0.0000000000055 \times t_{0B},$$
$$\Delta t_{W_A} = 0.0000000000055 \times 174959.999999794\text{s} = +96\text{ns}. \quad (48)$$

In quantitative terms, the kinematic time shifts of Einstein's relativistic theory of relativity and the nonrelativistic theory of relativity of the author do not relevantly differ, but they differ much in qualitative terms.

VI. DISCUSSION AND CONCLUSION

There are many logical and empirical reasons why Einstein's relativistic physics has to be rejected, only few shall be mentioned here: (1) Because Einstein's special relativity is not able to explain the Michelson–Morley experiment[9] for light that moves only in one direction.[4] (2) Because atomic clocks cannot display the proper time t_0 and at the same time infinite different times for observers at different motion and different gravitational potentials, as it is necessary according to relativistic considerations. (3) Space contraction cannot exist, because it only enables to explain the constancy of the velocity of light beams that move back and forth, but not when light beams move only in one direction. To claim that space contraction is, nevertheless, a real phenomenon is illogical.[5] (4) Einstein's general relativity is empirically disproved by the Pound–Rebka experiment, which was misinterpreted because physicists were not differentiate between a mathematically correct and a physically correct interpretation. (5) Because pseudoscientific explanations are needed to explain empirical results: After the flight of the aircraft, Hafele and Keating shall have read on the displays of the atomic clocks on the ground the unchangeable proper time t_0 that the atomic clocks must not measure because, if the atomic clocks on the ground had measured the unchangeable proper time, also the atomic clocks in the aircraft would have had to measure the same unchangeable proper time t_0 and no time difference between the times measured by the atomic clocks would have been possible. From the time they read on the display of the atomic clocks on the ground after the flight (in the opinion of Hafele and Keating the unchangeable proper time t_0), they calculated the time that the atomic clocks on the ground should have had actually measured according to Einstein, which the atomic clocks on the ground must not display, as otherwise the unchangeable proper time t_0 could not have been read from the display of the atomic clocks on the ground. By doing the impossible, they predicted the measured time shifts quite well and impressed the scientific community, which did not see through this "magic trick." From the Hafele–Keating experiment, we learn that time is influenced by something that does not rotate with Earth, which Hafele and Keating called an observer who does not rotate with Earth and "looks on the North Pole from a great distance." The only physical phenomenon that does not rotate with Earth and can directly influence each atomic clock on Earth, because it is present at the location of each atomic clock, is Earth's gravitational field. That is why I postulated in all of my former articles that fundamental physical processes must orient on predominant gravitational fields because on Earth no other gravitational field can be more relevant than that of the Earth. To explain the result of the Hafele–Keating experiment according to empirical results, we have to refer the proper time not to observers on the ground or in the aircraft, but to gravitational potentials.[5] Einstein claims that there is no absolute influence of masses on electromagnetic waves, but gravitational fields have a clearly absolute relation to masses. Of course, all gravitational fields of all massive objects penetrate each other in the universe, but there is a difference to us and all other physical objects on Earth between the gravitational field of the Earth and the gravitational fields caused by other massive objects, for example, by other planets or stars. On Earth, the gravitational potentials of the predominant gravitational field of the Earth are relevant and not gravitational potentials of gravitational fields of other massive objects in the universe. Some physicists claim that there cannot exist an absolute influence of gravitational fields on light rays, as all gravitational fields are penetrating each other, so that there is only one gravitational field in the universe, to which all massive objects contribute. Absolute means in this context that for photons on Earth, the gravitational potentials of Earth's gravitational field must be relevant, as for all other objects on Earth, but not gravitational potentials of gravitational fields of other massive objects like other planets, the Sun or stars. If we consider gravitational potentials of two different predominant gravitational fields caused by two massive objects at their location and their influence on photons, there is of course no longer the possibility of an absolute relation to gravitational potentials of one predominant gravitational field and a relativistic constellation is simulated. The idea that all gravitational fields have to be treated equally, because all gravitational fields penetrate each other and that there shall exist only one gravitational field in the universe that is equal relevant to all observers in the universe, is an unrealistic idea. The author introduced a new theory of relativity of electromagnetic radiation in RG, which meets the logical necessity that an atomic clock can only display a single time, which was confirmed by the experiment of Hafele and Keating in 1971,[7] as well as by the experiment of Chou in 2010[10] and Pound and Rebka in 1960.[6] According to the new theory of relativity in RG, each strength of a gravitational potential, which does not rotate with Earth, must have its on proper time, which is defined by a certain coordinate of a spherical coordinate system, in which's center the rotating Earth is located. Proper times assigned to coordinates of this spherical coordinate system that are located at the same altitude (height) have the same value. What really stands behind the theoretical term "gravitational potential" we can understand when we know how gravity works, which shall be the subject of a further article. We have to give up the erroneous relativistic belief that the velocity of light is influenced by distant observers, even if observers are lightyears away from a certain clock. A realistic physics must acknowledge that the local gravitational potentials of predominant gravitational fields are relevant for the energy and motion of "photons" and that the kinematic time (frequency) shifts are caused by motion against gravitational potentials of predominant gravitational fields and gravitational time (frequency) shifts are caused by different strengths of gravitational potentials within predominant gravitational fields. The kinematic and the gravitational time (frequency) shifts are in reality quantum physical gravitational effects that have nothing to do with Einstein's concept of special and general relativity.[1,7,8,11]

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