Cognitive bias in physics, with respect to Einstein's relativity, is demonstrated by the famous experiment of Pound and Rebka (1960), which in reality refutes Einstein's general relativity

Reiner Georg Ziefle[a)]
Brunnenstrasse 17, 91598 Colmberg, Germany

(Received 24 July 2021; accepted 12 February 2022; published online 8 March 2022)

Abstract: Einstein's general relativity postulates that, at each position within a gravitational field, we must measure the same frequency f_0, but seen from a distance, the frequency at the position of another gravitational potential is different from f_0. As gravity decreases with the increase in the distance from Earth, in the Pound–Rebka experiment at the top of the tower, the frequency of electromagnetic radiation must be higher than at the bottom. If electromagnetic radiation was able to have the same frequency f_0 at the top of the tower as at the bottom of the tower, an observer at the top of the tower would have to be able to increase gravity to the same level that gravity has at the bottom. But the decrease in gravity with an increase in the altitude cannot be reversed. It is demonstrated that the relativistic interpretation of the Pound–Rekba experiment showing a doubling of the gravitational frequency shift for "two-way" observations violates the principle of energy conservation, whereas the classical interpretation of the experiment identifies the doubling of the gravitational frequency shift as a pure mathematical effect that has no physical reality, which always occurs when we subtract relative differences with opposite algebraic signs from each other. It is shown that Einstein's general relativity only seemingly corresponds with reality; thus, gravitational frequency (time) shifts must be interpreted according to classical considerations. © *2022 Physics Essays Publication*. [http://dx.doi.org/10.4006/0836-1398-35.1.91]

Résumé: La théorie de la relativité générale d'Einstein part du postulat qu'à chaque position d'un champ gravitationnel, nous devons mesurer la même fréquence f_0, mais de loin, la fréquence à l'emplacement d'un autre potentiel gravitationnel est différente de f_0. La gravité diminue au fur et à mesure que la distance par rapport à la Terre augmente. Dans l'expérience de Pound et Rebka, la fréquence des rayonnements électromagnétiques doit être plus élevée en haut de la tour qu'en bas. Si la fréquence des rayonnements électromagnétiques f_0 est la même en haut et en bas de la tour, un observateur en haut de la tour devrait pouvoir augmenter la gravité au même niveau qu'en bas. La baisse de la gravité avec l'augmentation de l'altitude ne peut cependant pas être inversée. L'interprétation relativiste de l'expérience de Pound et Rebka indiquant un doublement du glissement de fréquence gravitationnelle pour des observations dans les deux sens est en violation du principe de conservation de l'énergie, tandis que l'interprétation classique de l'expérience identifie le doublement du glissement de fréquence gravitationnelle comme un effet purement mathématique, sans réalité physique, qui survient toujours lors de la soustraction de différences relatives avec des signes algébriques opposés. Il est démontré que la théorie de la relativité générale d'Einstein ne correspond à la réalité qu'en apparence, les glissements (décalages) de fréquence gravitationnelle doivent donc être interprétés selon des considérations classiques.

Key words: Cognitive Bias in Physics; General Relativity; Gravitational Time Dilation; Gravitational Frequency Shift; Gravitational Redshift and Blue-Shift; Experiment of Pound and Rebka; Pound-Rebka Experiment; Hafele-Keating Experiment; Experiment of Chou *et al*.; Pseudophysics.

I. INTRODUCTION

Gravity decreases with the increase in the radius squared, whereby the distance from the mass defined by the radius also corresponds to a certain height above the surface of the mass, so that for heights that are much smaller than the radius of the mass ($h \ll r$), according to classical considerations, the following equation can be used to calculate the energy change of electromagnetic radiation in dependence of the height, respectively, in dependence of the gravitational potential. According to the postulate of a constant velocity c of light in a vacuum, E_0 stands for the constant energy of electromagnetic radiation that is emitted with a certain wavelength at a certain position in a gravitational field by a resting light source. Therefore, E_0 corresponds to the energy E_e of electromagnetic radiation at the emission position ($E_0 = E_e$)

$$\frac{\Delta E}{E_0} = \pm \frac{g \times h}{c^2},$$

$$\Delta E = \pm \frac{g \times h}{c^2} \times E_0. \tag{1}$$

a)reiner.ziefle@gmail.com

Because the energy of electromagnetic radiation is proportional to the frequency, we obtain for the gravitational frequency shift in dependence of the height, respectively, in dependence of the gravitational potential, where f_0 is the frequency at the emission position ($f_0 = f_e$)

$$\begin{aligned} \frac{\Delta f}{f_0} &= \pm \frac{g \times h}{c^2}, \\ \Delta f &= \pm \frac{g \times h}{c^2} \times f_0. \end{aligned} \tag{2}$$

For the height of the tower that was used in the Pound–Rebka experiment[1] (22.56 m), we obtain for the downward path a gravitational frequency shift of

$$\begin{aligned} \Delta f_{(\mathrm{T}\to\mathrm{B})} &= -\frac{g \times h}{c^2} \times f_0, \\ \Delta f_{(\mathrm{T}\to\mathrm{B})} &= -\frac{9.81 \times \mathrm{m/s^2} \times 22.56 \times \mathrm{m}}{c^2} \times f_0 \\ &= -2.46 \times 10^{-15} \times f_0. \end{aligned} \tag{3}$$

For the height of the tower that was used in the Pound–Rebka experiment[1] (22.56 m), we obtain for the upward path a gravitational frequency shift of

$$\begin{aligned} \Delta f_{(\mathrm{B}\to\mathrm{T})} &= +\frac{g \times h}{c^2} \times f_0, \\ \Delta f_{(\mathrm{B}\to\mathrm{T})} &= +\frac{9.81 \times \mathrm{m/s^2} \times 22.56 \times \mathrm{m}}{c^2} \times f_0 \\ &= +2.46 \times 10^{-15} \times f_0. \end{aligned} \tag{4}$$

Because the frequency of electromagnetic radiation is proportional to time measured by frequencies, we obtain for the gravitational time shift in dependence of the height from the surface of Earth, respectively, in dependence of the gravitational potential, where t_0 is the time (so-called "proper time") at the emission position ($t_0 = t_e$)

$$\begin{aligned} \frac{\Delta t}{t_0} &= \pm \frac{g \times h}{c^2}, \\ \Delta t &= \pm \frac{g \times h}{c^2} \times t_0. \end{aligned} \tag{5}$$

For the height of the tower that was used in the Pound–Rebka experiment[1] (22.56 m), we obtain, seen from the bottom of the tower, a gravitational time shift for the top of the tower of

$$\begin{aligned} \Delta t &= +\frac{g \times h}{c^2} \times t_0, \\ \Delta t &= +\frac{9.81 \times \mathrm{m/s^2} \times 22.56 \times \mathrm{m}}{c^2} \times t_0 \\ &= +2.46 \times 10^{-15} \times t_0. \end{aligned} \tag{6}$$

For the height of the tower that was used in the Pound–Rebka experiment[1] (22.56 m), we obtain, seen from the top of the tower, a gravitational time shift for the bottom of the tower of

$$\begin{aligned} \Delta t &= -\frac{g \times h}{c^2} \times t_0, \\ \Delta t &= -\frac{9.81 \times \mathrm{m/s^2} \times 22.56 \times \mathrm{m}}{c^2} \times t_0 \\ &= -2.46 \times 10^{-15} \times t_0. \end{aligned} \tag{7}$$

II. THE RESULT OF THE POUND–REBKA EXPERIMENT DOES NOT CONFIRM EINSTEIN'S GENERAL RELATIVITY

Let us now analyze the famous experiment of Pound and Rebka published in 1960,[1] which is a gravitational redshift experiment. In the experiment, an emitter of γ ray and a receiver were used, which were positioned in a tower at a distance of 22.56 m from each other. The experiment was carried out in two variations, once measuring the frequency shift with the source at the top of the tower and once measuring the frequency shift with the source at the bottom of the tower. They used γ ray with 14.4 keV ($= 3.482 \times 10^{18}$ Hz). The frequency shift associated with the energy shift over a distance of 22.56 m is very small. To carry out the very exact measurements, Pound and Rebka used a variation of a so-called Mössbauer spectroscopy in the experiment. Pound and Rebka[1] measured for the γ ray that moved upwards on average a relative frequency shift of -19.7×10^{-15} and for the downward path, they measured for the relative frequencies shift of -15.5×10^{-15}. The measured quantity was the fractional frequency shift comprising the gravitational frequency shift Δf_{G} and the frequency shift caused by the emitter-absorber offset-bias shift Δf_{Bi} (Bi stands for bias), which must be eliminated by calculating the difference between the two measurements. For the downward path, we obtain, for the gravitational frequency shift measured by the experiment, a relative frequency shift of

$$\begin{aligned} \Delta f'_{(\mathrm{G:T}\to\mathrm{B})} &= \Delta f_{(\mathrm{B}\to\mathrm{T})} - \Delta f_{(\mathrm{T}\to\mathrm{B})}, \\ \Delta f'_{(\mathrm{G:T}\to\mathrm{B})} &= \left[\Delta f_{(Bi)} - \Delta f_{(\mathrm{G:B}\to\mathrm{T})}\right] - \left[\Delta f_{(Bi)}) - \Delta f_{(\mathrm{G:T}\to\mathrm{B})}\right], \\ \Delta f'_{(\mathrm{G:T}\to\mathrm{B})} &= -19.7 \times 10^{-15} \times f_0 - (-15.5 \times 10^{-15} \times f_0), \\ \Delta f'_{(\mathrm{G:T}\to\mathrm{B})} &= -4.2 \times 10^{-15} \times f_0. \end{aligned} \tag{8}$$

With temperature correction, they measured for the gravitational frequency shift downwards

$$\Delta f'_{(\mathrm{T}\to\mathrm{B})} = -5.13 \times 10^{-15} \times f_0. \tag{9}$$

For the upward path, we obtain, for the gravitational frequency shift measured by the experiment, a relative frequency shift of

$$\begin{aligned} \Delta f'_{(\mathrm{G:B}\to\mathrm{T})} &= \Delta f_{(\mathrm{T}\to\mathrm{B})} - \Delta f_{(\mathrm{B}\to\mathrm{T})}, \\ \Delta f'_{(\mathrm{G:B}\to\mathrm{T})} &= \left[\Delta f_{(Bi)} - \Delta f_{(\mathrm{G:T}\to\mathrm{B})}\right] - \left[\Delta f_{(Bi)} - \Delta f_{(\mathrm{G:B}\to\mathrm{T})}\right], \\ \Delta f'_{(\mathrm{G:B}\to\mathrm{T})} &= -15.5 \times 10^{-15} \times f_0 - (-19.7 \times 10^{-15} \times f_0), \\ \Delta f'_{(\mathrm{G:B}\to\mathrm{T})} &= +4.2 \times 10^{-15} \times f_0. \end{aligned} \tag{10}$$

With temperature correction, they measured for the gravitational frequency shift upwards

$$\Delta f'_{(\mathrm{B\to T})} = +5.13\times 10^{-15}\times f_0. \tag{11}$$

To interpret the result of the experiment correctly, we have to recognize that the differences of the frequency shifts are mathematically doubled, but in reality, the measured frequency shifts correspond with the values that are predicted also by classical considerations, which have half of the values of Eqs. (8) and (10), respectively, half of the values of Eqs. (9) and (11)

$$\begin{aligned}\Delta f_{(\mathrm{G:T\to B})} &= \frac{\Delta f'_{(\mathrm{G:T\to B})}}{2} = \frac{-4.2\times 10^{-15}\times f_0}{2}\\ &= -2.1\times 10^{-15}\times f_0,\\ \Delta f_{(\mathrm{G:B\to T})} &= \frac{\Delta f'_{(\mathrm{G:B\to T})}}{2} = \frac{+4.2\times 10^{-15}\times f_0}{2}\\ &= +2.1\times 10^{-15}\times f_0.\end{aligned} \tag{12}$$

Recognizing that the measured frequency shifts are composed of the gravitational frequency shift Δf_G and the frequency offset-bias shift Δf_{Bi} (Bi stands for bias), we can calculate the offset-bias shift by subtracting the relative gravitational frequency shift at the bottom from the measured composed frequency shift for the upward

$$\begin{aligned}\Delta f_{(Bi)} &= \Delta f_{(\mathrm{B\to T})} - \Delta f_{(\mathrm{G:T\to B})},\\ \Delta f_{(Bi)} &= -19.7\times 10^{-15}\times f_0 - (-2.1\times 10^{-15}\times f_0),\\ \Delta f_{(Bi)} &= -17.6\times 10^{-15}\times f_0.\end{aligned} \tag{13}$$

Inserting in Eq. (8) the real value for the gravitational frequency shift for the upward path and the offset-bias shift, we obtain double the value of the real value for the gravitational frequency shift, which is a mathematical and, therefore, a fictitious gravitational frequency shift

$$\begin{aligned}\Delta f'_{(\mathrm{G:T\to B})} &= \Delta f_{(\mathrm{B\to T})} - \Delta f_{(\mathrm{T\to B})},\\ \Delta f'_{(\mathrm{G:T\to B})} &= \left[\Delta f_{(Bi)} - \Delta f_{(\mathrm{G:B\to T})}\right] - \left[\Delta f_{(Bi)}) - \Delta f_{(\mathrm{G:T\to B})}\right],\\ \Delta f'_{(\mathrm{G:T\to B})} &= \left[-17.6\times 10^{-15}\times f_0 - (+2.1\times 10^{-15})\times f_0\right]\\ &\quad - \left[-17.6\times 10^{-15}\times f_0 - (-2.1\times 10^{-15})\times f_0\right],\\ \Delta f'_{(\mathrm{G:T\to B})} &= -4.2\times 10^{-15}\times f_0.\end{aligned} \tag{14}$$

Inserting in Eq. (10) the real value for the gravitational frequency shift for the upward path and the offset-bias shift, we obtain double the value of the real value for the gravitational frequency shift, which is a pure mathematical and therefore a fictitious gravitational frequency shift

$$\begin{aligned}\Delta f'_{(\mathrm{G:B\to T})} &= \Delta f_{(\mathrm{T\to B})} - \Delta f_{(\mathrm{B\to T})},\\ \Delta f'_{(\mathrm{G:B\to T})} &= \left[\Delta f_{(Bi)} - \Delta f_{(\mathrm{G:T\to B})}\right] - \left[\Delta f_{(Bi)}) - \Delta f_{(\mathrm{G:B\to T})}\right],\\ \Delta f'_{(\mathrm{G:B\to T})} &= \left[-17.6\times 10^{-15}\times f_0 - (-2.1\times 10^{-15})\times f_0\right]\\ &\quad - \left[-17.6\times 10^{-15}\times f_0 - (+2.1\times 10^{-15})\times f_0\right],\\ \Delta f'_{(\mathrm{G:B\to T})} &= +4.2\times 10^{-15}\times f_0.\end{aligned} \tag{15}$$

Physicists are good in mathematics and should know that, subtracting relative differences from each other, the relative differences will mathematically double, when they have opposite algebraic signs. An example: Bob has two apples and Tom has four apples. Bob has two apples less than Tom (−2 apples) and Tom has two apples more than Bob (+2 apples). Subtracting from Tom's relative more apples, the relative less apples of Bob, we mathematically obtain for Tom 4 apples more than Bob's apples. To obtain the real relative difference of apples between Bob and Tom, we have to half the result, where a stands for apples

$$\begin{aligned}\Delta a_{(\mathrm{B\to T})} &= \frac{\Delta a_{(\mathrm{B\to T})} - \Delta a_{(\mathrm{T\to B})}}{2},\\ \Delta a_{(\mathrm{B\to T})} &= \frac{+2a-(-2a)}{2} = +\frac{4a}{2} = +2a.\end{aligned} \tag{16}$$

Therefore, the values that were measured for the gravitational frequency shifts were in realty (temperature corrected)

$$\Delta f_G \approx \frac{\pm 5\times 10^{-15}\times f_0}{2} \approx \pm 2.5\times 10^{-15}\times f_0. \tag{17}$$

The doubled values that were obtained by mathematically eliminating the off-set bias shift are in reality fictitious gravitational frequency shifts.

As Pound and Rebka should have had recognized that only half the value of the gravitational frequency shift was actually measured by the experiment, one gets the impression that Pound and Rebka were not able to recognize this because of a cognitive bias with respect to Einstein's general relativity, which is actually refuted by the Pound–Rebka experiment. An additional example shall explain the mathematical (fictitious) doubling of real relative values. One person (Bob) is 170 cm tall and another person (Tom) is 180 cm tall. Both wear a cap on their head with a height of 5 cm. Without the cap, Bob is 10 cm smaller (−10 cm) than Bob and Tom 10 cm taller (+10 cm) than Bob.

Let us imagine that we can measure the relative size differences only together with the cap (+5 cm). Subtracting the values of the relative differences from each other, which eliminates the height of the cap, we obtain, seen from Bob, for the difference double the relative size difference

$$\begin{aligned}\Delta\mathrm{Size}'_{(\mathrm{B\to T})} &= \left[\Delta\mathrm{Size}_{(\mathrm{B\to T})} + \Delta\mathrm{Size}_{(\mathrm{cap})}\right]\\ &\quad - \left[\Delta\mathrm{Size}_{(\mathrm{T\to B})} + \Delta\mathrm{Size}_{(\mathrm{cap})}\right],\\ \Delta\mathrm{Size}'_{(\mathrm{B\to T})} &= +15\,\mathrm{cm} - (-5\,\mathrm{cm}) = +20\,\mathrm{cm},\\ \{\Delta\mathrm{Size}'_{(\mathrm{B\to T})} &= (+10\,\mathrm{cm} + 5\,\mathrm{cm})\\ &\quad - (-10\,\mathrm{cm} + 5\,\mathrm{cm}) = +20\,\mathrm{cm}\}.\end{aligned} \tag{18}$$

But Tom cannot have been grown by the calculation of the "two-way height" difference between Bob and Tom. Seen from Tom, the difference between Tom and Bob also doubles to an unreal difference in size

$$\Delta\text{Size}'_{(\text{T}\to\text{B})} = \left[\Delta\text{Size}_{(\text{T}\to\text{B})} + \Delta\text{Size}_{(\text{cap})}\right] - \left[\Delta\text{Size}_{(\text{B}\to\text{T})} + \Delta\text{Size}_{(\text{cap})}\right],$$
$$\Delta\text{Size}'_{(\text{T}\to\text{B})} = -5\,\text{cm} - (+15\,\text{cm}) = -20\,\text{cm},$$
$$\{\Delta\text{Size}'_{(\text{T}\to\text{B})} = (-10\,\text{cm} + 5\,\text{cm}) - (+10\,\text{cm} + 5\,\text{cm}) = -20\,\text{cm}\}. \tag{19}$$

But Bob cannot have been shrunk by the calculation of the two-way height difference between Tom and Bob. To obtain the real relative difference in size, we have to half these values and obtain correctly for the real relative differences

$$\Delta\text{Size} = \pm\frac{\Delta\text{Size}'}{2} \pm \frac{20\,\text{cm}}{2} = \pm 10\,\text{cm}. \tag{20}$$

Today's physicist believe that double the value of Eq. (11) for the gravitational frequency (time) shift of a two-way observation is real because, also according to Einstein's general relativity, this value can be derived by a two-way comparison, which Pound and Rebka called the gravitational frequency (time) shift of a two-way height. But the relativistic two-way value for the gravitational frequency (time) shift is half a fictitious mathematical shift and half a real physical gravitational frequency (time) shift, as it is correctly calculated in Eq. (17). Other experiments like that of Hafele and Keating,[3] as well as by the experiments of Briatore and Leschiutta[2] or of Chou *et al*.[4] and similar experiments that measured the gravitational frequency (time) shift in dependence of the gravitational potential, could not verify the doubling of the gravitational frequency (time) shift calculated by Pound–Rebka.[2–4]

III. EINSTEIN'S GENERAL RELATIVITY IS MATHEMATICAL PSEUDOPHYSICS

The relative frequency at the top of the tower can be calculated more precisely by the following formula using the Schwarzschild radius R_s, where $+h$ is the height of the tower, f_T is the frequency at the top of the tower, f_0 is the frequency at the surface of Earth, M is the mass of Earth, r is the radius of Earth ($r = r_B$, where B stands for the bottom of the tower), G is the Newtonian constant, and c is the velocity of light, where at the surface of the Earth (bottom of the tower), the relative frequency is $1 \times f_0$

$$f_T = \sqrt{\frac{1-\dfrac{R_s}{r+h}}{1-\dfrac{R_s}{r}}} \times f_0 = \sqrt{\frac{1-\dfrac{R_s}{r_B+h}}{1-\dfrac{R_s}{r}}} \times f_0 = \sqrt{\frac{1-\dfrac{2\text{GM}}{(r_B+h)\times c^2}}{1-\dfrac{2\text{GM}}{r\times c^2}}} \times f_0,$$

$$f_T = \sqrt{\frac{1-\dfrac{2\times 6.6743\times 10^{-11}\times\dfrac{\text{m}^3}{\text{kg}\times\text{s}^2}\times 5.792\times 10^{24}\,\text{kg}}{(6\,371\,000\,\text{m}+22.56\,\text{m})\times c^2}}{1-\dfrac{2\times 6.6743\times 10^{-11}\times\dfrac{\text{m}^3}{\text{kg}\times\text{s}^2}\times 5.792\times 10^{24}\,\text{kg}}{6\,371\,000\,\text{m}\times c^2}}} \times f_0,$$

$$f_T = \sqrt{\frac{1-\dfrac{773\,046\,656\,000\,000\times\dfrac{\text{m}^3}{\text{s}^2}}{6\,371\,022.56\,\text{m}\times c^2}}{1-\dfrac{773\,046\,656\,000\,000\times\dfrac{\text{m}^3}{\text{s}^2}}{6\,371\,000\,\text{m}\times c^2}}} \times f_0,$$

$$f_T = \sqrt{\frac{1-1.350\,066\,487\,804\,8\times 10^{-9}}{1-1.350\,071\,268\,451\,5\times 10^{-9}}} \times f_0 = \sqrt{\frac{0.999\,999\,998\,649\,933\,512\,2}{0.999\,999\,998\,649\,928\,731\,5}} \times f_0$$

$$f_T = 1.000\,000\,000\,000\,002\,4\times f_0. \tag{21}$$

This value corresponds with a frequency (time) shift in comparison to the frequency at the ground (bottom of the tower), whereby we have to consider that f_0 and the frequency f_B at the bottom of the tower are identical

$$\Delta f_{(\text{B}\to\text{T})} = +0.000\,000\,000\,000\,002\,4\times f_0,$$
$$\Delta f_{(\text{B}\to\text{T})} = +2.4\times 10^{-15}\times f_0 \to \Delta f_{(\text{B}\to\text{T})} = +2.4\times 10^{-15}\times f_B. \tag{22}$$

When the frequency (time) shift is by a certain small factor larger at a higher altitude (top of the tower) than on the ground (bottom of the tower), the frequency must be *circa* by the same factor lower at the bottom of the tower than at the top of the tower

$$\Delta f_{(\text{T}\to\text{B})} = -2.4\times 10^{-15}\times f_T,$$
$$\Delta f_{(\text{T}\to\text{B})} = -2.4\times 10^{-15}\times 1.000\,000\,000\,000\,002\,4\times f_B,$$
$$\Delta f_{(\text{T}\to\text{B})} = -2.4000\,000\,000\,000\,057\,6\times 10^{-15}\times f_0. \tag{23}$$

But absolutely correct is

$$f_B = f_T - 0.000\,000\,000\,000\,002\,4\times f_0,$$
$$f_B = 1.000\,000\,000\,000\,002\,4\times f_0 - 0.000\,000\,000\,000\,002\,4\times f_0 = f_0,$$
$$\to \Delta f_{(\text{T}\to\text{B})} = -2.4\times 10^{-15}\times f_0. \tag{24}$$

We have given the correct equation using the Schwarzschild radius, which assigns the surface of Earth the frequency f_0, which is used for the γ ray with 14.4 keV ($= 3.482\times 10^{18}$ Hz)

$$f = \sqrt{\frac{1-\frac{R_s}{r}}{1-\frac{R_s}{r}}} \times f_0 = \sqrt{\frac{1-\frac{2\mathrm{GM}}{r\times c^2}}{1-\frac{2\mathrm{GM}}{r\times c^2}}} \times f_0 = 1 \times f_0 = 3.482 \times 10^{18}\ \mathrm{Hz}. \quad (25)$$

For the top of the tower, we obtain this equation

$$\begin{aligned} f_T &= \sqrt{\frac{1-\frac{R_s}{r+h}}{1-\frac{R_s}{r}}} \times f_0 = \sqrt{\frac{1-\frac{2\mathrm{GM}}{(r+h)\times c^2}}{1-\frac{2\mathrm{GM}}{r\times c^2}}} \\ &\times f_0 = 1.000\,000\,000\,000\,002\,4 \times f_0, \\ &= 1.000\,000\,000\,000\,002\,4 \times 3.482 \times 10^{18}\ \mathrm{Hz} \\ &= 3.482\,000\,000\,000\,008\,357 \times 10^{18}\ \mathrm{Hz}. \end{aligned} \quad (26)$$

Einstein's general relativity postulates that each observer must measure the same frequency f_0 and the same proper time t_0 within a gravitational field, independent of the strength of the gravitational potential. According to Einstein's general relativity, an observer at the top of the tower will also measure the frequency f_0, which is used for the γ ray with 14.4 keV ($=3.482\times10^{18}$ Hz), so that Einstein's general relativity postulates that the following equation must also be correct:

$$\begin{aligned} f_T &= \sqrt{\frac{1-\frac{R_s}{r+h}}{1-\frac{R_s}{r}}} \times f_0 = \sqrt{\frac{1-\frac{2\mathrm{GM}}{(r+h)\times c^2}}{1-\frac{2\mathrm{GM}}{r\times c^2}}} \times f_0 \\ &= 3.482 \times 10^{18}\ \mathrm{Hz}. \end{aligned} \quad (27)$$

Therefore, according to Einstein's general relativity, the following equation must also be correct:

$$\sqrt{\frac{1-\frac{2\mathrm{GM}}{r\times c^2}}{1-\frac{2\mathrm{GM}}{r\times c^2}}} \times f_0 = \sqrt{\frac{1-\frac{2\mathrm{GM}}{(r+h)\times c^2}}{1-\frac{2\mathrm{GM}}{r\times c^2}}} \times f_0. \quad (28)$$

Today's physicists claim that Einstein's general relativity is right, which means that they also claim that Eq. (28) must be correct, but everybody who thinks logically can recognize that Eq. (28) is wrong because the correct one is

$$\sqrt{\frac{1-\frac{2\mathrm{GM}}{r\times c^2}}{1-\frac{2\mathrm{GM}}{r\times c^2}}} \times f_0 \neq \sqrt{\frac{1-\frac{2\mathrm{GM}}{(r+h)\times c^2}}{1-\frac{2\mathrm{GM}}{r\times c^2}}} \times f_0. \quad (29)$$

The physical constellation according to Einstein's general relativity is shown in Fig. 1.

For the two-way height, we obtain for the bottom of the tower according to Einstein's relativity, as it is seen from the top of the tower a gravitational frequency (time) shift

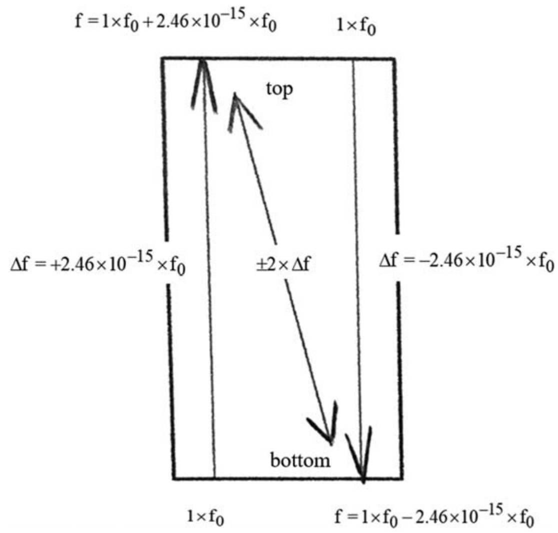

FIG. 1. The physical constellation of the Pound–Rebka experiment according to Einstein's general relativity.

$$\begin{aligned} \Delta f_{(\mathrm{T}\to\mathrm{B})} &= f_{(\mathrm{T}\to\mathrm{B})} - f_{(\mathrm{B}\to\mathrm{T})}, \\ \Delta f_{(\mathrm{T}\to\mathrm{B})} &= 1\times f_0 - 2.46\times10^{-15} \\ &\quad \times f_0 - (1\times f_0 + 2.46\times10^{-15}\times f_0), \\ \Delta f_{(\mathrm{T}\to\mathrm{B})} &= 0.000\,000\,000\,000\,007\,56 \\ &\quad \times f_0 - (+1.000\,000\,000\,000\,002\,46\times f_0), \\ \Delta f_{(\mathrm{T}\to\mathrm{B})} &= -4.92\times10^{-15}\times f_0. \end{aligned} \quad (30)$$

For the two-way height, we obtain for the top of the tower according to Einstein's relativity, as it is seen from the bottom of the tower a gravitational frequency (time) shift

$$\begin{aligned} \Delta f_{(\mathrm{B}\to\mathrm{T})} &= f_{(\mathrm{B}\to\mathrm{T})} - f_{(\mathrm{T}\to\mathrm{B})}, \\ \Delta f_{(\mathrm{B}\to\mathrm{T})} &= 1\times f_0 + +2.46\times10^{-15} \\ &\quad \times f_0 - (1\times f_0 - 2.46\times10^{-15}\times f_0), \\ \Delta f_{(\mathrm{B}\to\mathrm{T})} &= 1.000\,000\,000\,000\,002\,46 \\ &\quad \times f_0 - (+0.000\,000\,000\,000\,007\,56\times f_0), \\ \Delta f_{(\mathrm{B}\to\mathrm{T})} &= +4.92\times10^{-15}\times f_0. \end{aligned} \quad (31)$$

Because gravity decreases with the increase in the distance from Earth, at the top of the tower, the frequency of electromagnetic radiation must be faster than on the ground. If electromagnetic radiation was able to have the same frequency at the top of the tower and on the ground, an observer at the top of the tower would have to be able to increase gravity to the same value that gravity has on the ground. But nobody can create gravity, and gravity is always stronger on the ground than at the top of the tower, which cannot be the other way around. The frequency of electromagnetic radiation cannot be the same on the ground and at a certain altitude, which is postulated by Einstein's general relativity. Using a realistic physics, we have to increase the radius in the numerator when we go out from the frequency at the top of the tower f_T in order to calculate the correct frequency f_B at the bottom of the tower

$$f_B = \sqrt{\frac{1-\dfrac{2GM}{(r_T-h)\times c^2}}{1-\dfrac{2GM}{r\times c^2}}}\times f_0,$$

$$f_B = \sqrt{\frac{1-\dfrac{2\times 6.6743\times 10^{-11}\times \dfrac{\mathrm{m}^3}{\mathrm{kg}\times \mathrm{s}^2}\times 5.792\times 10^{24}\,\mathrm{kg}}{(6\,371\,022.56\,\mathrm{m}-22.56\,\mathrm{m})\times c^2}}{1-\dfrac{2\times 6.6743\times 10^{-11}\times \dfrac{\mathrm{m}^3}{\mathrm{kg}\times \mathrm{s}^2}\times 5.792\times 10^{24}\,\mathrm{kg}}{6\,371\,000\,\mathrm{m}\times c^2}}}$$
$$\times f_0 = 1\times f_0. \tag{32}$$

The physical constellation according to classical considerations is shown in Fig. 2.

The classical single value of the diagonal (two-way) gravitational frequency shift was confirmed by the Pound–Rebka experiment, but not the relativistic diagonal gravitational frequency shift, as it is erroneously claimed by today's physics, thus in reality the Pound–Rebka experiment refuted Einstein's general relativity.

Wrongly not increasing the radius in the numerator when going out from the frequency at the top of the tower, we obtain a value for another tower that reaches 22.56 m below the surface of Earth, respectively, below the bottom of the real tower used in the experiment

$$f_B = \sqrt{\frac{1-\dfrac{2GM}{(r-h)\times c^2}}{1-\dfrac{2GM}{r\times c^2}}}\times f_0,$$

$$f_B = \sqrt{\frac{1-\dfrac{2\times 6.6743\times 10^{-11}\times \dfrac{\mathrm{m}^3}{\mathrm{kg}\times \mathrm{s}^2}\times 5.792\times 10^{24}\,\mathrm{kg}}{(6\,371\,000\,\mathrm{m}-22.56\,\mathrm{m})\times c^2}}{1-\dfrac{2\times 6.6743\times 10^{-11}\times \dfrac{\mathrm{m}^3}{\mathrm{kg}\times \mathrm{s}^2}\times 5.792\times 10^{24}\,\mathrm{kg}}{6\,371\,000\,\mathrm{m}\times c^2}}}$$
$$\times f_0,$$
$$f_B = +0.000\,000\,000\,000\,007\,6\times f_0. \tag{33}$$

But this additional unreal tower under the surface of the Earth (under the bottom of the tower), resulting with the real tower on Earth in a tower with a two-way height, as it is postulated by Pound and Rebka, and today's physics to be real, is mathematical fiction. Using the simplified equation for the gravitational frequency (time) shift, which does not contain the radius of Earth, and not considering the correct frequency ($f_T = 1.000\ 000\ 000\ 000\ 002\ 46\times 10^{-15}\times f_0$) for the top of the tower, the contradiction is hidden, which implies that it

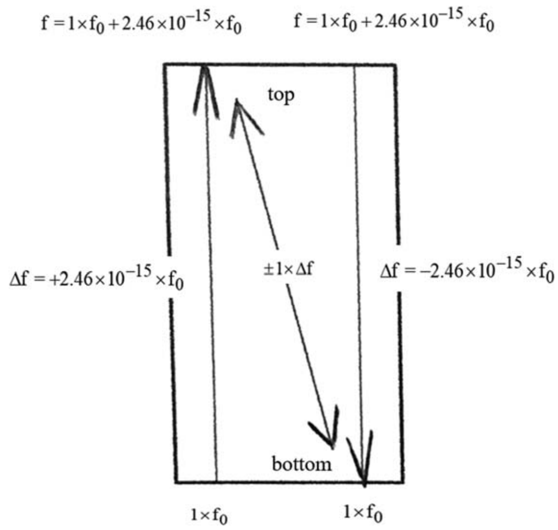

FIG. 2. The physical constellation of the Pound–Rebka experiment according to classical considerations representing real physics.

would be possible to change the direction of the decrease in gravity, which is not possible

$$\begin{aligned} f_{(\mathrm{T}\to\mathrm{B})} &= f_T - \frac{g\times h}{c^2}\times f_0\\ &= f_T - \frac{9.81\times \mathrm{m/s}^2\times 22.56\times \mathrm{m}}{c^2}\times f_0,\\ f_{(\mathrm{T}\to\mathrm{B})} &= f_0 - 2.46\times 10^{-15}\times f_0\\ &= +0.000\,000\,000\,000\,007\,54\times f_0 \neq f_B = f_0. \end{aligned} \tag{34}$$

Other experiments did not confirm the two-way height that was postulated by Pound and Rebka for the gravitational frequency (time) shift measured by their experiment. As we have recognized that Einstein's general relativity must be judged to be mathematical fiction, we must interpret the confirmed gravitational frequency (time) shift by experiments like that of Hafele and Keating,[3] as well as by the experiments of Briatore and Leschiutta[2] or of Chou *et al.*[4] and similar experiments in a classical and not in a general relativistic way.[2–4]

IV. EINSTEIN'S GENERAL RELATIVITY IS MATHEMATICAL PSEUDOPHYSICS BECAUSE IT VIOLATES THE PRINCIPLE OF ENERGY CONSERVATION

To demonstrate that Einstein's general relativity is mathematical pseudophysics, we replace the emitter and receiver in a tower of the same kind as used by Pound and Rebka at the top of the tower by two mirrors, so that the γ ray emitted at the left side of the bottom of the tower is reflected by a mirror at the top of the tower from the left side to the right side of the top of the tower, where they are reflected again toward the bottom of the tower on the right side of the bottom of the tower to a receiver. See Fig. 3.

Pound and Rebka, as well as today's physicists, believe that if an observer looks from the bottom of the tower vertically to the top of the tower ("one-way" observation), he will

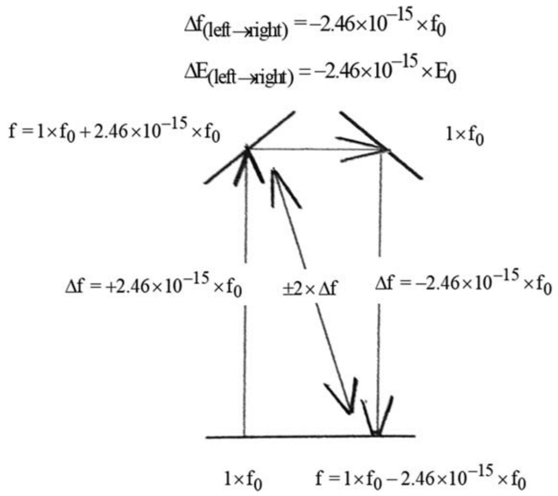

FIG. 3. Einstein's general relativity violates the principle of energy conservation, here shown for γ ray that moves from the left side of the bottom of the tower to the right side of the bottom of the tower, reflected at two mirrors at the top of the tower.

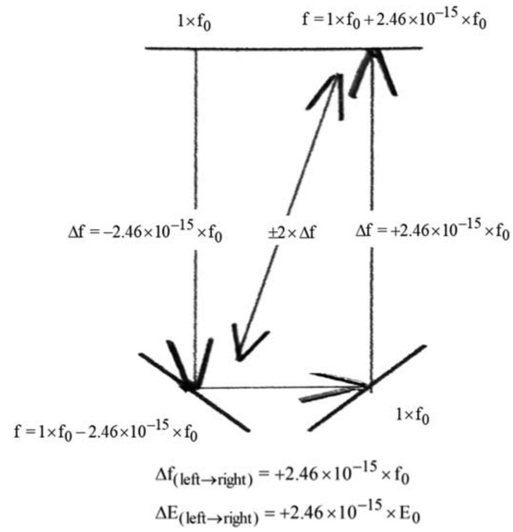

FIG. 4. Einstein's general relativity violates the principle of energy conservation, here shown for γ ray that moves from the left side of the top of the tower to the right side of the top of the tower, reflected at two mirrors at the bottom of the tower.

see that at the top the frequency is $1 \times \Delta f$ faster than at the bottom, but if an observer looks diagonally from the bottom to the top of the tower (two-way observation) he will see that the frequency is $2 \times \Delta f$ faster than at the bottom. To obtain the postulated double value for the gravitational frequency shift for the two-way observation of the γ ray, the γ ray must lose on the way between the mirrors from the left side to the right side of the top of the tower the same frequency as the frequency difference between the top of the tower and the bottom of the tower, so that double the value of the gravitational frequency shift can occur

$$\begin{aligned} \Delta f_{(\mathrm{B\to T\to B})} &= \Delta f_{(\mathrm{left\to right})} + \Delta f_{(\mathrm{T\to B})}, \\ \Delta f_{(\mathrm{B\to T\to B})} &= (-2.46 \times 10^{-15} \times f_0) \\ &\quad + (-2.46 \times 10^{-15} \times f_0), \\ \Delta f_{(\mathrm{B\to T\to B})} &= -4.92 \times 10^{-15} \times f_0. \end{aligned} \tag{35}$$

Because frequency is proportional to energy, this means that on the way from the left side to the right side at the top of the tower γ ray must lose energy

$$\Delta E_{(\mathrm{left\to right})} = -2.46 \times 10^{-15} \times E_0. \tag{36}$$

If we install an emitter at the left side of the top of the tower that sends γ ray down to a mirror at the bottom of the left side of the tower, where they are reflected to another mirror at the right side of the bottom of the tower, where the second mirror reflects the γ ray to a receiver at the right side of the top of the tower, the γ ray would have to gain energy between the mirrors at the bottom of the tower, see Fig. 4.

Pound and Rebka, as well as today's physicists, believe that if an observer looks from the top of the tower vertically to the bottom of the tower (one-way observation), he will see that at the bottom of the tower, the frequency is $-1 \times \Delta f$ slower than at the top of the tower, but if an observer looks diagonally from the top of the tower to the bottom of the tower (two-way observation), he will see that the frequency is $-2 \times \Delta f$ slower than at the top of the tower. To obtain the postulated doubled value for the gravitational frequency shift, the γ ray must gain on the way between the mirrors from the left side to the right side of the bottom of the tower the same frequency, as the frequency difference between the bottom and the top of the tower, so that double the value of the gravitational frequency shift can occur

$$\begin{aligned} \Delta f_{(\mathrm{T\to B\to T})} &= \Delta f_{(\mathrm{left\to right})} + \Delta f_{(\mathrm{B\to T})}, \\ \Delta f_{(\mathrm{T\to B\to T})} &= (+2.46 \times 10^{-15} \times f_0) \\ &\quad + (+2.46 \times 10^{-15} \times f_0), \\ \Delta f_{(\mathrm{T\to B\to T})} &= +4.92 \times 10^{-15} \times f_0. \end{aligned} \tag{37}$$

Because frequency is proportional to energy, this means that on the way from the left side to the right side at the bottom of the tower, the γ ray must gain energy

$$\Delta E_{(\mathrm{left\to right})} = +2.46 \times 10^{-15} \times E_0. \tag{38}$$

But destroying or creating energy violates the principle of energy conservation, thus Einstein's general relativity is revealed as mathematical psdeudophysics. It is also illogical to assume that electromagnetic radiation, which moves from the left side to the right side of the top of the tower will lose energy $(-1 \times \Delta E)$, while electromagnetic radiation, which moves from the left side to the right side of the bottom of the tower will gain energy $(+1 \times \Delta E)$. As demonstrated in another article, the relativistic explanation of the inertial mass increase also violates the principle of energy conservation.[5] If we interpret the Pound–Rebka experiment correctly, we are able to recognize that Einstein's general relativity is just mathematical fiction, and that we have to explain the gravitational frequency (time) shift according to classical considerations. The mathematical doubled gravitational frequency shift we also obtain when calculating the difference of the frequency (time) shifts that we have calculated according to classical considerations before.

Seen from the top of the tower the difference between both gravitational frequency shifts with opposite algebraic signs, we obtain a gravitational frequency (time) shift that is composed half of a physical value and half of a fictitious mathematical value

$$\begin{aligned}\Delta f'_{(\mathrm{T}\to\mathrm{B})} &= \Delta f_{(\mathrm{T}\to\mathrm{B})} - \Delta f_{(\mathrm{B}\to\mathrm{T})},\\ \Delta f'_{(\mathrm{T}\to\mathrm{B})} &= -2.46\times10^{-15}\times f_0 - (+2.46\times10^{-15}\times f_0)\\ &\approx -5\times10^{-15}\times f_0.\end{aligned} \tag{39}$$

Seen from the bottom of the tower the difference between both gravitational frequency shifts with opposite algebraic signs, we obtain a gravitational frequency (time) shift that is composed half of a physical value and half of a fictitious mathematical value

$$\begin{aligned}\Delta f'_{(\mathrm{B}\to\mathrm{T})} &= \Delta f_{(\mathrm{B}\to\mathrm{T})} - \Delta f_{(\mathrm{T}\to\mathrm{B})},\\ \Delta f'_{(\mathrm{B}\to\mathrm{T})} &= +2.46\times10^{-15}\times f_0 - (-2.46\times10^{-15}\times f_0)\\ &\approx +5\times10^{-15}\times f_0.\end{aligned} \tag{40}$$

While Einstein and today's physicists think that these gravitational frequency (time) shifts are completely real, classical physics is able to recognize double the value of the gravitational frequency (time) shift correctly as mathematical fiction. According to classical considerations, it does not matter if you look diagonally or vertically from the bottom to the top of the tower and contrariwise, in each case an observer will see the same frequency shift, which is real physics, in contrast to Einstein's general relativity, which is mathematical pseudophysics.

V. CONSIDERATIONS AND CONCLUSION

Einstein's general relativity postulates that at each positon within a gravitational field, we must measure the same frequency f_0, but seen from a distance the frequency at the position of another gravitational potential is different from f_0. As gravity decreases with the increase in the distance from Earth, at the top of the tower the frequency of electromagnetic radiation must be faster than on the ground. If electromagnetic radiation was able have the same frequency at the top of the tower and on the ground, an observer at the top of the tower would have to be able to increase gravity to the same value that gravity has on the ground. But nobody can create gravity, and gravity is always stronger on the ground than at the top of the tower, which cannot be the other way around. The decrease in gravity with increase in the altitude cannot be reversed. It has been shown in this article that the Pound–Rebka experiment actually confirmed only the value for the gravitational frequency shift, which is also predicted by classical considerations. The calculations carried out to eliminate the offset-bias shift, which artificially double the measured gravitational frequency shifts, gave the wrong impression that double the value of the gravitational frequency shift would have been really measured by the experiment. As a theory cannot be once mathematical fiction and once real, we must recognize that Einstein's general relativity must be mathematical fiction on the whole, which provides very precise predictions. The theory of gravity "Newtonian Quantum Gravity"[5] of the author needs, besides Newton's theory of gravity and Kepler's second law, only the additional postulate that gravity is transmitted by gravitational quanta, which move away from a mass, to predict so-called general relativistic phenomena, e.g., the curvature of a light beam at the surface of the Sun, the correct precession of Mercury's perihelion or the phenomena observed at the binary pulsar PSR B1913 + 16. Einstein's general relativity needs many additional postulates to predict these phenomena and is, therefore, recognized already by Occam's razor to be an unrealistic theory, although GR (general relativity) is generally accepted today and most physicists believe that it describes the mentioned phenomena in a realistic way. Other experiments examining gravitational frequency (time) shifts did not confirm the relativistic doubling of the height that Pound and Rebka needed to predict the gravitational frequency shifts measured by their experiment.[2–4] The failure of Einstein's special and general relativity I already demonstrated in my former articles.[6–9] During the last 60 years, it was not recognized that the Pound–Rebka experiment in reality disproves Einstein's general relativity. This can only be explained by a cognitive bias among today's physicists, making mathematical judgments about the world around us and thinking that they are objective, logical, and capable of taking in and evaluating all the information that is available to them. Unfortunately, these biases tripped them up, leading to wrong judgments about the reality of our physical world.

[1]R. V. Pound and G. A. Rebka, Phys. Rev. Lett. **4**, 337 (1960).
[2]L. Briatore and S. Leschiutta, Nuovo Cimento B **37**, 219 (1977).
[3]J. C. Hafele and R. E. Keating, Science **177**, 166 (1972).
[4]C. W. Chou, D. B. Hume, T. Rosenband, and D. J. Wineland, Science **329**, 1630 (2010).
[5]R. G. Ziefle, Phys. Essays **33**, 99 (2020).
[6]R. G. Ziefle, Phys. Essays **33**, 466 (2020).
[7]R. G. Ziefle, Phys. Essays **31**, 279 (2018).
[8]R. G. Ziefle, Phys. Essays **32**, 216 (2019).
[9]R. G. Ziefle, Phys. Essays **32**, 451 (2019).