«The priorities of the world science: experiments and scientific debate»

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The Atomic oscillation Frequency Increases in the Field of Gravity: the hypothesis of the Effect of Soloshenko-Yanchilin

The atomic frequency (atomic oscillation frequency) increases in the field of gravity. The value of Planck's constant decreases with the increase of the absolute value of the gravitational potential. According to the Effect of Soloshenko-Yanchilin, time goes faster in the field of gravity. This is the hypothesis of the Effect of Soloshenko-Yanchilin. The authors propose a crucial physical experiment with two high precision atomic clocks to verify their hypothesis.

The challenge to an Intellectual battle

The main goal of this article is to initiate a public scientific discussion. The scientists carried out a joint theoretical discovery of the hypothetical Effect of Soloshenko-Yanchilin (ESY), and offer the scientist community to rebut their hypothesis or to support their position for carrying out a physical experiment. The official prize $ 100 000 is declared by Institute of Special Scientific Investigations (the scientific team of the authors) in the official challenge to Russian Academy of Sciences. The prize will be paid to any person (to the Russian resident or not) for the competent disproof of the effect (ESY) before the experiment. To get the prize see the details [1], [2], [3].

According to Einstein's general theory of relativity (GTR), when considering the phenomenon of gravitation, it is postulated that the atomic frequency decreases in the field of gravity, in other words, time slows down near a massive body (due to the curvature of space-time). GTR postulates time dilation with the increase of the gravitational potential (of its absolute value), the so-called postulate about the temporal process. The theoretical discovery of ESY predicts the opposite phenomenon – the atomic frequency increases in the field of gravity, that means that there is the acceleration of time in the gravitational field (acceleration of the rate of time of an atomic clock, i.e. the frequency of atomic oscillations, with the increase in the gravitational potential). The authors argue that the postulate about the temporal process still does not have a satisfactory experimental verification and that all the experiments described in various scientific publications are indirect (the dilation of time is not proved in spite of the red shift effect and Hefele-Keating experimental results). The essence of the challenge to the intellectual duel is quite simple. If you put the quantum events generators (the high-precision atomic clocks) on the floors of a high tower (building) – for example, on the floor A (top clock) and floor B

(bottom clock). What will happen to the value of the atomic oscillations on the floors (what will be the effect of gravity) when you compare the readings of the clocks after a period of cumulative measurement? Einstein's general relativity predicts that B<A (dilation, deceleration of time, i.e. time slows down in the gravitational field). ESY predicts that B>A (acceleration of time, i.e. time accelerates in the field of gravity).

The Effect of Soloshenko-Yanchilin vs GTR – the comparison of the effects of gravity on the rate of time

The atomic second is considered to be a standard of time in modern physics. By the definition of the measurement standard one atomic second is defined as the time it takes for the atom (cesium-133) frequency to oscillate (9 192 631 770 cycles). Thus the definition of time is tied to the radiation frequency associated with a transition in the atom. So when we raise the question how gravitation influences the rate of time - we just mean the influence of gravity on the radiation frequency of the atom. No more and no less. The rate of time of the atomic clock (atomic clock time rate) is proportional to the radiation frequency of the atom standard that is used in the given equipment (for example cesium atomic clock or the rubidium atomic clock). Therefore the rate of time and the atomic clock time rate is the same thing in modern physics. According to the new theory of our science team the value of the gravitational shift of spectral lines (the red shift) is quite the same as the red shift value in GTR. But the new theory of the science team predicts the reverse value of the rate of time in comparison with GTR. According to GTR the frequency of an atom (and the rate of time of the atomic clock respectively) decreases near a large mass. According to the new theory – just on the contrary, the frequency of the atom increases near a large mass.

So if you place two high-precision atomic clocks functioning synchronously at different heights, on the upper and lower floors of a skyscraper, for example with a difference of 500 m (h), and compare their readings of time rate during few months our science team expect that ESY will be registered (the acceleration of time in the gravitational field) – that is the verse effect to GTR. We predict the time rate of the top clock to go slower in comparison with the bottom clock (so that the bottom clock will go faster). GTR predicts the verse effect (deceleration of time in the field of gravity) - the time rate of the top clock to go faster in comparison with the bottom clock (so that the bottom clock will go slower). The aim of such experiment is to test this difference.

The bottom clock will go slower with a difference equal to the following value if GTR's postulate is true: $g \cdot h/c^2 \approx (10\ msec^{-2} \cdot 5 \cdot 10^2\ m)/(10^{17}\ m^2\ sec^{-2}) \approx 5 \cdot 10^{-14}$ i.e. the gap of the bottom clock from the top clock will be $5 \cdot 10^{-14}$ sec. per second. When the duration of the experiment (total registration time) is 120 days - the gap of the bottom clock from the top clock is expected to be 0.5 microsecond (GTR's value).

The new theory of our science team predicts (ESY) - that the gap will be equal to the following value

$$\frac{c^2(h)}{c^2(0)} - 1 = \frac{c^2(0) - 2gh}{c^2(0)} - 1 = -\frac{2gh}{c^2} \approx -10^{-13}$$

That is that the effect has a different sign and moreover it is exactly twice bigger. When the duration of the experiment (total registration time) is 120 days - the gap of the top clock from the bottom is expected to be 1 microsecond. These calculations are theoretical and the accuracy of the measured results can vary from the original calculation. The main expectation with respect to the results of such experiment is that the bottom clock will go faster with the difference value that is in excess of the permissible statistical error (that will proof the acceleration of time in the gravitational field).

The new theory basic elements

The new theory includes Mach's principle - the objective outlined by Richard Feynman in his lectures on the theory of gravity. To include Mach's principle it is necessary to consider the dependence of space-time scales (i.e. the values of $c, \hbar, m$) from the distribution of matter in the Universe: $c^2 + \Phi = 0$; $\hbar^2 \Phi = \text{const}$; $m^2\Phi = \text{const}$. Where Φ – is a negative scalar function, which depends on the distribution of matter in the universe and tends to zero away from all the masses. In the case of the weak gravitational field its change is exactly twice more than the parameter of Newtonian potential. In contradistinction to GTR the new theory states that the speed of light, Planck's constant and the rest mass of elementary particles depend on the distribution of all matter in the Universe (the value of the gravitational potential). According to the new theory of gravitation, the value of the speed of light is determined by the total gravitational potential $|\Phi|$ that is created by the whole mass of the Universe $c^2 = -\Phi$. The gravitational energy of a body of mass **m** in the gravitational field with the gravitational potential Φ is equal to $U=m\cdot\Phi$. According to Einstein's formula, the total energy E is equal to $E = m\cdot c^2$ and that leads to $E+U=0$ i.e. the sum of the total energy of a body and the potential energy of that body is equal to zero (0). Thus the motion of any physical object is the result of gravitational interaction of that object with the whole mass of the Universe. Any body possesses energy only because it interacts gravitationally with all the other bodies of the Universe. The total energy of a body of mass **m** is exactly the result of its gravitational interaction with the whole mass of the Universe and the total energy is equal to its potential energy in the gravitational field of the Universe: $m\cdot c^2 = -m\cdot\Phi$. Because the value of the gravitational potential does not depend on the motion of an observer the speed of light does not depend on of the motion of an observer too. The inertial and gravitational masses are equal $m_{in} = m_{gr}$ and $m_{in}\cdot c^2 = -m_{gr}\cdot\Phi$. Taking into account the constancy of the fine-structure constant, the value of Planck constant depends on the value of the gravitational potential $\hbar = \boldsymbol{e}^2/(\alpha\sqrt{-\Phi})$ where $\boldsymbol{e}$ is the value of the electron charge, α is the fine-structure constant – they are both independent of the value of the gravitational potential.

The value of Planck's constant decreases near the large mass and therefore the speed of all physical processes increases (frequency of any spectral line that determines the rate of time is inversely proportional to the value of Planck's constant in the third degree), including the speed of light. The rest mass of an elementary particle is reduced near the large mass. As a result any time scale and the length varies. The change of Planck's constant $\Delta\boldsymbol{\hbar}$ is determined by the formula $\boldsymbol{\Delta\hbar/\hbar = \Delta\Phi/(2c^2)}$. So in case for the height of 200 m above the Earth it is equal to $\Delta\hbar/\hbar \approx 10^{-14} (\approx gH/2c^2$ where $g \approx 10\ m/c^2$ - acceleration of gravity). In the first approximation (i.e. when $\Delta\hbar \ll \hbar$, $\Delta c \ll c$) in the new theoretical model this effect can be regarded as the curvature of space-time. In the gravitational field the speed of light and Planck's constant change from one point in space to another. The larger the absolute value of the gravitational potential of the Universe Φ is (the larger the depth of the Universe gravitational ocean) - the smaller the value of Planck's constant $\boldsymbol{\hbar}$. The value of Planck's constant determines the uncertainty in the motion of the particles. The larger the value of Planck's constant is - the uncertainty is larger in the motion of the particles. Thus, the uncertainty in particles motion increases with decrease of the modulus of the gravitational potential of the Universe. And we have to point out that the new theory predicts the red shift effect that is the same as GTR, but the rate of time in the field of gravity is absolutely different and its value has the opposite sign to GTR (acceleration of time vs deceleration of time). This system is the basis of a fundamentally new model of space-time, gravity and motion and it provides the new way to understand physics of gravitation and the opportunity for the gravitation control technology to be created.

[1] Soloshenko M.V., Yanchilin V.L. The Effect of Soloshenko-Yanchilin. Gravitation and Time. Scholars' Press, 2015.
[2] http://www.is-si.ru/atomic-pp.pdf
[3] http://www.is-si.ru/project_offer.pdf