GALILEAN ELECTRODYNAMICS

Experience, Reason, and Simplicity Above Authority

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EDITORIAL POLICY

Galilean Electrodynamics aims to publish high-quality scientific papers that discuss challenges to accepted orthodoxy in physics, especially in the realm of relativity theory, both special and general. In particular, the journal seeks papers arguing that Einstein's theories are unnecessarily complicated, have been confirmed only in a narrow sector of physics, lead to logical contradictions, and are unable to derive results that must be postulated, though they are derivable by classical methods.

The journal also publishes papers in areas of potential application for better relativistic underpinnings, from quantum mechanics to cosmology. We are interested, for example, in challenges to the accepted Copenhagen interpretation for the predictions of quantum mechanics, and to the accepted Big-Bang theory for the origin of the Universe.

On occasion, the journal will publish papers on other less relativity-related topics. But all papers are expected to be in the realms of physics, engineering or mathematics. Non-mathematical, philosophical papers will generally not be accepted unless they are fairly short or have something new and outstandingly interesting to say.

The journal seeks to publish any and all new and rational physical theories consistent with experimental fact. Where there is more than one new theory that meets the criteria of consistency with experiment, faultless logic and greater simplicity than orthodoxy offers, none will be favored over the others, except where Ockham's razor yields an overwhelming verdict.

Though the main purpose of the journal is to publish papers contesting orthodoxy in physics, it will also publish papers responding in defense of orthodoxy. We invite such responses because our ultimate purpose here is to find the truth. We ask only that such responses offer something more substantive than simple citation of doctrine.

The journal most values papers that cite experimental evidence, develop rational analyses, and achieve clear and simple presentation. Papers reporting experimental results are preferred over purely theoretical papers of equally high standard. No paper seen to contradict experiment will be accepted. But papers challenging the current interpretation for observed facts will be taken very seriously.

Short papers are preferred over long papers of comparable quality. Shortness often correlates with clarity; papers easily understandable to keen college seniors and graduate students are given emphatic preference over esoteric analyses accessible to only a limited number of specialists. For many reasons, short papers may pass review and be published much faster than long ones.

The journal also publishes correspondence, news notes, and book reviews challenging physics orthodoxy. Readers are encouraged to submit interesting and vivid items in any of these categories.

All manuscripts submitted receive review by qualified physicists, astronomers, engineers, or mathematicians. The Editorial Board does not take account of any reviewer recommendation that is negative solely because manuscript contradicts accepted opinion and interpretation.

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From the Editor's File of Important Letters:

The Mysterious 'c' in Dirac's Continuity Equation

This letter examines the derivation of the Dirac continuity equation for the electron from the viewpoint of the Planck vacuum (PV) theory. Results show that: 1) The c in that equation has its roots in the line element $c\,dt$ associated with a perturbed space-time; and 2) The Pauli spin matrices have their origin in the corresponding PV substructure.

1. Formulation

The Dirac equation that defines the free-electron spinor field $\psi = \psi(\mathbf{r}, t)$ ([1], p. 74) goes:

$$ic\hbar \cdot c^{-1} \frac{\partial}{\partial t} \psi = \left[c \times (\boldsymbol{\alpha} \cdot \hat{\mathbf{p}}) + mc^2 \beta \right] \psi \quad , \tag{1}$$

where $\hat{\mathbf{p}} = -i\hbar\nabla$ is the vector momentum operator, which can be expressed as

$$ic\hbar \left(c^{-1} \frac{\partial}{\partial t} + \boldsymbol{\alpha} \cdot \nabla \right) \psi = mc^2 \beta \psi \quad , \tag{2}$$

where c is the speed of light, $\hbar$ is the reduced Planck constant, and m is the electron mass. The spinor field ψ is a 4×1 column vector, indicated here with 'tr' for 'transpose':

$$\psi = (\psi_1, \psi_2, \psi_3, \psi_4)^{\mathrm{tr}} \quad . \tag{3}$$

There are two 4×4 matrices in (1) and (2), defined by

$$\alpha_k = \begin{bmatrix} 0_{2\times2} & \sigma_k \\ \sigma_k & 0_{2\times2} \end{bmatrix} \quad \text{and} \quad \beta = \begin{bmatrix} I_{2\times2} & 0_{2\times2} \\ 0_{2\times2} & I_{2\times2} \end{bmatrix} \quad , \tag{4}$$

where $k = 1, 2, 3$, $0_{2\times2}$ is the 2×2 null matrix, and $I_{2\times2}$ is the 2×2 identity matrix. The σ_k are the three 2×2 Pauli spin matrices ([1], p. 12):

$$\sigma_1 = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}, \ \sigma_2 = \begin{bmatrix} 0 & -i \\ i & 0 \end{bmatrix}, \ \sigma_3 = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \quad . \tag{5}$$

The operator on the left side of (2) reduces to

$$c^{-1} \frac{\partial}{\partial t} + \boldsymbol{\alpha} \cdot \nabla = c^{-1} \frac{\partial}{\partial t} + \sum\nolimits_{k=1}^{3} \alpha_k \frac{\partial}{\partial x^k} \quad . \tag{6}$$

In its rest frame, the massive electron core $(-e_*, m)$, with its zero-point derived mass m [2], exerts a two-term coupling force on the PV quasi-continuum (Ref. [3], Sec. 7-8):

$$F(r) = \frac{e_*^2}{r^2} - \frac{mc^2}{r} = \frac{(-e_*)(-e_*)}{r^2} - \frac{mm_*G}{r_* r} \quad . \tag{7}$$

Continued on page 9.

Spectral Lines of Atoms, Part 1: Formulae for Energies

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This paper presents a new theory of spectral lines of atoms, which is part of a new unified theory of atoms. The premise of this unified theory is the existence of a spatial fluid that fills the whole space of the universe. Following tradition, we call it 'aether'. All phenomena that we perceive in the material world are manifestations of local changes in density, pressure and energy of that fluid. The theory allows one to describe analytically, calculate, and prove all aether characteristics except for the number of aether particles per unit volume.

The present paper presents the formula that calculates energies of spectral lines of the atoms. The first part of the paper applies the formula to Hydrogen and other ions similar to Hydrogen. The second part calculates energies of non-ionized Helium's spectral lines, and places them into spectral series that are analogous to Hydrogen's spectral series. These results are compared with values of the corresponding lines as obtained experimentally. (See http://physics.nist.gov/PhysRefData/ASD/lines_form.html)

It is to be emphasized that neither analytical calculation of non-ionized Helium energy lines, nor their placement into a series, is possible with either Bohr's theory or contemporary theories. Therefore, the formula, by which these lines are calculated and placed into series, is in itself a strong reason for scientists to seriously rethink Bohr's theory and prominent contemporary theories that deal with atomic and subatomic physics.

1. Introduction

Emission of spectral lines, like that of electromagnetic waves in general, is a consequence of electron's interaction with the aether, to which electrons are transferring energy, or from which electrons are taking energy. Any kind of force performance by which the energy is gained or lost is impossible in an empty space. There is nothing in the Universe that exists as an isolated system. Trough aether and the fields that form in it (electrostatic, electrodynamic, magnetic, gravitational), all particles in the Universe are interconnected; every particle is integral part of the Universe.

The fundamental physical nature of every particle that is perceived in experience or in an experiment (the size, the shape, mass, energy, charge) depends on the conditions of interconnections with the surroundings. It is impossible to explain how the electron forms electrostatic and electrodynamic fields in an empty space. It is also impossible for electron to emit or absorb energy in an empty space without interaction with other particles that are in the area of its influence. The assumption that electron 'is braking itself by stepping on its own tail', like R. Feynman once said, is impossible in a same way as it is impossible that baron Munchausen pulled himself out from the mud by pulling his own hair.

2. Spectral Lines of Hydrogen and Similar Ions

We will start with ions that are similar to Hydrogen because it is the simplest ion. As we know, precisely due to that fact Bohr has developed his theory of atoms on ions that are similar to Hydrogen, where only one electron is circulating around the nucleus. This is the reason why his theory functions well enough on these kinds of ions. For the same reason it can be said that our theory, which is radically new and different in comparison with Bohr's, is not affirmed enough although it works on Hydrogen and ions that are similar to Hydrogen.

However, we have more than enough reasons to claim that our theory is correct. We will name some of them: this theory of spectral lines is a part of unified theory that explains almost every physical phenomenon, and by numerous analytical calculations proves its presumption of existence of spatial fluid – aether. Second, it is a theory much simpler than Bohr's. Third, its functioning does not end with Hydrogen – with formula derived from it we have analytically calculated several hundreds of spectral lines of non-ionized Helium, Lithium, Bromine and so on.

Specifically, we have placed the whole spectrum of non-ionized Helium in a series, by using our formula in analytical calculus, and the resulting values are the same as experimentally measured ones. To publish all that in one paper is impossible, so we are willing to publish it part by part, if there would be interest and a dose of courage from the publisher to print proofs that directly undermine almost every contemporary theory about understanding of the material universe.

Let us begin with basic differences between Bohr's and our understanding of the atom. In Bohr's theory, orbits on which the electrons circulate are different, and the bigger the atom's nuclear charge is, the smaller the orbits are. Our understanding simplifies the situation – the corresponding orbits in all atoms are equal in radius, and the radial increment between the neighboring orbits within any atom are also equal, regardless of the kinds of atom and regardless of the orbit's distance from the nucleus. In other words, electron's orbits in all atoms are equal to integer product of one, basic orbit, the lowest orbit. How is this possible? It is easy, when we correct the main mistake that has been

made by Bohr. To simplify the presentation, we will keep our attention to the energy of the line that is emitted by an ion similar to Hydrogen when it falls from infinity to its lowest orbit. That is also the energy E required to strip all electrons from those kinds of ions. It is measured to be

$$E = Z^2 \times 13.598 \quad .$$

in electron volts, eV.

In Bohr's theory that same energy is given by this formula:

$$E = Z \times e^2 / 2R_1 \quad ,$$

where R_1 is the 'first Bohr's orbit' of Hydrogen, which corresponds to $Z = 1$. However, our theory proved that this formula is incorrect. The correct formula is:

$$E = Z^2 \times 13.598 = Z^2 \, e^4 \big/ 2m_e c^2 \, R_1^2 \quad . \tag{1}$$

It is obvious from these two formulae that the smallest orbit from our formula is far smaller than the 'first Bohr's orbit'. I believe that confirmation of that formula could be established experimentally by comparing the specific weights of different gases in liquid state. The accuracy of formula (1) we will be demonstrated later in the paper, and now we will analyze the consequences that derive directly from it. If we calculate from it the size of that basic orbit we get an interesting result:

$$R_1 = \hbar / m_e c \quad . \tag{2}$$

To avoid any possible misunderstanding – in the numerator on the right side is Planck's constant, and in the denominator is the mass of the electron multiplied by the speed of the light. In our theory, the value from the formula (2) represents the wavelength on which the electron is oscillating, meaning that the distance of the electron from the nucleus in any atom can be equal to one unit or more of its wavelength. Furthermore, if we write the formula (1) in general form, where the electron is placed on any orbit that is equal to an integer product of the basic orbit, we get the following formula:

$$W_{\text{line}} = Z^2 \, e^4 \big/ 2m_e c^2 n^2 R_1^2 \quad . \tag{3}$$

If we take into consideration that in our theory the fraction on the right side of the formula is an analytical expression of Rydberg's constant C_{Rydberg}, which equals 13.598 eV, then the general expression for the line that is emitted when the electron falls from the infinity on some orbit is:

$$W_{\text{line}} = Z^2 C_{\text{Rydberg}} \big/ n^2 \quad . \tag{4}$$

And when the electron falls from the n_2 orbit to the n_1 orbit, energy of the emitted line is equal to difference between energies that are emitted from these orbits when the electron falls on them from the infinity:

$$W_{\text{line}} = Z^2 C_{\text{Rydberg}} \left(1/n_1^2 - 1/n_2^2 \right) \quad . \tag{5}$$

In this way our formula calculates the same result as Bohr's formula. The results are identical and they both corespond to experimentally measured values. However, in the reality the Rydberg's constant is slowly growing as the ordinal number Z is growing. Our theory explains this fact also, but we cannot deal with it now for two reasons – the first one is that the growth of the Rydberg's constant can be explained only when the nature of the electron and its mechanisms of wave lenght's emitting is explained. The second reason is that this explanation would not fit in the scope (prescribed lenght) of this paper.

Numerical calculation of the spectral lines of Hydrogen will not be presented here because it can be found in any physical textbook. Besides, the formula (5) is so simple that a reader, even without much knowledge of the physics, can calculate the lines from it.

3. Calculation of Non-Ionized Helium Spectral Lines and Energies

We will demonstrate the accuracy of our formula on ions with greater ordinal number, in this case on non-ionized Helium. The calculi will be followed by a table of experimentally measured values that are presented along with the table of values that are analytically calculated by using our formula.

First, we will write the general form of the formula for the spectral line's energy of atoms with higher ordinal number Z:

$$W_{\text{line}} = \frac{1}{2m_e c^2} \left[\left(\frac{Ze^2}{R} - \frac{ze^2}{R_1} \right)^2 - \left(\frac{Ze^2}{R_2} - \frac{ze^2}{R_Z} \right)^2 \right] \quad . \tag{6}$$

The first item in the brackets on the right side of the equation represents electron's kinetic energy on the lower orbit, and the second item in the brackets represents electron's kinetic energy on the upper orbit. This energy is determined from the distance of observed electron from the nucleus and its distance from other electrons, which number is z in general. In Eq. (6), R denotes the distance of the electron from the nucleus when it falls from the upper orbit on the lower orbit, and R_2 distance from the nucleus when electron is located on the upper orbit, before falling to the lower one. As for the distance to other electrons, it is clear that the situation is so complex that quantitative analysis is impossible because the distance to each of the z electrons is probably different, and in addition, it is constantly changing in time. For this reason formula (6) is not absolutely accurate because it does not include the fact that if we have z electrons, then we consequently have z distances to them from our observed electron. To simplify the formula, we took that to all of those electrons is one and the same distance, on the lower orbit R_1 and on the upper R_3.

This assumption will not compromise the accuracy, or the idea of computing energy of the lines, and here is why: the series of spectral lines are generated by electron's falling to a lower orbit from the first following, then the second, the third, and so on. This means that the energy of the lower orbit, at which the

electron falls from higher orbit, represents a constant value for the respective series. If we know, or somehow determine, that energy, we do not have to think about the distance of electron to the nucleus or to the other electrons. It is of great importance to imagine exact picture of the situation in higher orbits. If the upper electron is located far away from the nucleus, its distance to the nucleus differs to a very little extent from the distance to other electrons near the nucleus. This enables us to equalize these distances in our formula, and the concrete calculus will show the validity of this act. When all this is taken into account, then we have $R_2 = R_3 = R_1$ and the formula for calculating the spectral line's energy can be presented in this form:

$$W_{\text{line}} = w_0^2 / 2m_e c^2 - \left(e^4 / 2m_e c^2 R_1^2\right)\left[(Z-z)/n\right]^2 \quad . \qquad (7)$$

Therefore, the first item on the right in Eq. (7) marks a constant value for the specific series. And when we take into account the relation (1), we see that the formula for the energy of the spectral line of a certain series can be written in this form:

$$W_{\text{line}} = W_0 - 13.604\text{eV}\left[(Z-z)/n\right]^2 \quad . \qquad (8)$$

To avoid misinterpretations, we must note that w_0 in Eq. (7) marks kinetic energy of the electron on the lowest orbit of that series on which it falls from upper orbits while forming a spectral series. In formula (8) W_0 marks borderline energy of the spectral series or in other words, energy of the line with the biggest energy which it would have if the electron would fall from the infinity to the lowest orbit of a certain series.

We are also drawing your attention to a fact that Rydberg's constant has slightly bigger value here than in formulas concerning the spectral lines of Hydrogen. It is because, as we have mentioned before, Rydberg's constant is slowly growing as the ordinal number Z is growing.

Now, we have all the necessary elements to form a certain spectral series and we will start from non-ionized Helium. It has two protons in the nucleus. Therefore, the observed electron when is placed on the upper orbit has the same distance from two protons and one electron, so in formula (8) is $Z = 2$, $z = 1$.

If the electron falls from the higher orbit to the lowest orbit (the first) then the series is formed in a way that we set $n = 2, 3, 4$ and so on, in formula (8). W_0 is experimentally measured – it is the energy which electron would emit if it would fall to the lowest orbit from infinite distance.

Of course, the law of energy conservation states that this energy equals to the energy that is needed to be communicated to the electron in order for it to move from this orbit to an infinite distance from the nucleus, and this equals to energy of ionization = 24.587 eV.

$$W_{\text{line}} = \left[\left(24.587 - 13.604\right)/n^2\right]\text{eV} \quad . \qquad (9)$$

Please note that this is an approximate formula, because it did not take into account the fact that the distance between the electrons is not equal to the distance of the upper electron from the nucleus, which falling on the lower orbits leads to radiation of spectral lines. These distances are practically identical when the electron is far from the nucleus, and the closer the electron is getting to the nucleus, the greater difference is between them. Therefore, it is expected that the spectral lines obtained with a greater number n will be calculated completely accurately, and where n is small, we expect a certain disagreement with the measured sizes.

Now we will demonstrate the calculation of the series that occurs when an electron falls on the first orbit from the second, the third, the fourth, and so on… orbit:

$$W_{\text{line 2}} = \left[24.587 - 13.604/2^2\right]\text{eV} = 21.186\ \text{eV} \quad ,$$

(21.218 eV - experimentally measured value)

$$W_{\text{line 2}} = \left[24.587 - 13.604/3^2\right]\text{eV} = 23.075\ \text{eV} \quad ,$$

(23.085 eV - experimentally measured value)

We believe that this is sufficient to demonstrate the calculation, and here is a table of measured values along with the table of calculated values of energies from this series.

measured sizes, eV	calculated sizes, eV
23.742	23.737
24.046	24.043
24.211	24.209
24.311	24.309
24.375	24.374
24.420	24.419
24.450	24.451
24.475	24.475
24.493	24.493
24.507	24.507
24.518	24.518
24.527	24.527

As can be seen from this very simple calculation, noticeable disagreements with the measured values exist only in the first line, which occurs when an electron falls from the second orbit to the first orbit. This is in full accordance with the fact that the difference in the effect of lower electron and atomic nucleus on the upper electron is increasing as the upper electron is closer to the nucleus.

If one wants to validate our formula further, one can always make our calculation more precise by taking into account the difference in the effect of the other electron and one proton in the nucleus on the electron that radiates.

In the approximate formula, we set that the effect is the same but with opposite sign, and is thus annulled. It greatly simplifies the formula, and does not significantly affect the credibility and the accuracy of the calculus. We underline that our primary goal is to prove the accuracy of Eq. (6), and not to absolutely accurately calculate energies of the spectral lines. After all, the very real situation is that there is no absolute prohibition for which the electron would have been unable to slightly depart from the basic orbit, or the primary road on which it goes from orbit to orbit.

Although now is not the time to explain the nature of the electron, or causes that pushes it to the basic and relatively fixed orbits, it is clear that the orbit allows electron to deviate from it. For, if it were not so, the electron would be forever moving on the same orbit, and would not be able to change the orbit. After these remarks, we will now continue with the formation of a series. As we shall see, they are created by electron's falling on a second orbit as a base, from the third, the fourth, the fifth and so on.

Here we encounter some surprises. The first is that there is more than one series with different energies of the lines and different basic constants by which the series are formed. It will be easier to understand this when we form the first series. The formula for calculating the lines of this series is:

$$W_{\text{line}} = W_0 - 13.604 \text{ eV}/(n - 0.068)^2 \quad , \quad n = 3, 4, 5, \ldots$$

measured sizes, eV	calculated sizes, eV
3.1884	3.1866
3.8894	3.8862
4.2099	4.2098
4.3825	4.3825
4.4860	4.4860
4.5529	4.5529
4.5986	4.5986
4.6312	4.6312

$$W_0 = 4.76911 \text{ eV} \quad .$$

It is clear that the size of the orbit is determined from the number $n - 0.068$. The question is how to interpret this. It seems that there is only one logical option: if we imagine that the electron circulates around the nucleus in concentric circles whose radii are an integer multiple of the radius of the smallest circle, what would happen if the proton, which should be located in a common centre of all circles, is shifted from the centre? It is clear that its distance to the electron will vary between maximum and minimum value, one of which is greater than the basic, and the other smaller.

It is impossible to predict analytically in which position the electron will radiate its spectral line when it falls to the lower orbit, because the moment of radiation probably depends also on the relationship with the other electron. Furthermore, moving of the centre of rotation around which the electron rotates happens because one electron impacts the movement of the other, and *vice versa*. No other conclusion is possible.

Let us proceed with the establishment of a series from the second orbit. The second orbit has, not one, but a few series. Our conclusion is that electron on the higher orbits can rotate in different planes in relation to the lower orbit. And since the spatial relationship with the lower electron is determined by a certain angle between their planes of rotation, each of the planes has its particular energy. The question is: can the angle between the planes of rotation be arbitrary, or are there some limitations? The answer to this question shall wait until we determine what other series can be formed.

$$W_{\text{line}} = W_0 - 13.604 \text{ eV}/(n - 0.009)^2 \quad , \quad n = 3, 4, 5, \ldots$$

measured sizes, eV	calculated sizes, eV
2.1100	2.1038
2.7727	2.7704
3.0795	3.0783
3.2460	3.2460
3.3464	3.3461
3.4116	3.4114
3.4563	3.4562
3.4882	3.4882
3.5118	3.5118
3.5298	3.5298

$$W_0 = 3.62445 \text{ eV}$$

$$W_{\text{line}} = W_0 - 13.604 \text{ eV}/(n + 0.01)^2 \quad , \quad n = 3, 4, 5, \ldots$$

measured sizes, eV	calculated sizes, eV
2.4720	2.4716
3.1272	3.1271
3.4310	3.4311
3.5963	3.5965
3.6960	3.6963
3.7608	3.7611
3.8052	3.8055
3.8374	3.8373

$$W_0 = 3.9731 \text{ eV}$$

$$W_{\text{line}} = W_0 - 13.604 \text{ eV}/(n - 0.3)^2 \quad , \quad n = 3, 4, 5, \ldots$$

measured sizes, eV	calculated sizes, eV
1.7548	1.7583
2.6306	2.6307
3.0086	3.0085
3.2057	3.2057
3.3215	3.3213
3.3950	3.3949
3.4447	3.4447
3.4798	3.4798

$$W_0 = 3.62439 \text{ eV}$$

$$W_{\text{line}} = W_0 - 13.604 \text{ eV}/(n - 0.004)^2 \quad , \quad n = 3, 4, 5, \ldots$$

measured sizes, eV	measured sizes, eV
1.8	1.8626
2.5	2.5216
2.8	2.8268
2.9	2.9927
3.0	3.0928
3.1576	3.1578
3.2023	3.2023
3.2342	3.2342

$$W_0 = 3.37013 \text{ eV}$$

This is the last series generated by the electron's falling on the second orbit from the 3rd, 4th, 5th orbit and so on. If we count them we see that there is a total number of six series. Is this a random number? We are convinced it is not, and that it reflects an important fact that will help us to understand the great cosmic mystery called 'electron'.

However, it is an issue too important to talk about briefly or hurriedly. Therefore, for now, we will deal with the basic theme only, and that is proving the accuracy of the formula (6). As for the number of six orbits, let us only draw attention to the fact evident from the geometry: if we look how many radiuses of the smallest orbit can be placed on the rim of that orbit, we see that it is exactly 2π, meaning the six whole radiuses can be placed on it. Also one more fact requires reflection upon it.

We saw that the series generated by electron's falling on the first orbit indicates that the radius of the orbit equals exactly nR_1 . nR_0. . . On the other hand, radii of orbits, on which the electron circulates when forming series by falling on the second orbit, all deviate from the basic size to a greater or lesser extent.

It cannot be accidental, and we propose explanation. If electrons coordinate their movements without distracting one another, the orbits do not deform and they move undistracted like good neighbors. However, if they start to interfere with each other, the orbit deforms. In addition, the electrons are forced to avoid moving close to each other.

That would have to be a logical explanation to why the electron with a deformed orbit does not descend to the lowest one. In this kind of situation on the upper orbit, electron moves more freely and because of that, it stays on the upper orbit.

And on the basis of which physical mechanism can electrons influence on mutual relations when moving around the atomic nucleus? This question is closely related to the reasons that force the electron to move on the stationary orbits, and why distances between these orbits are almost the same for all atoms. An answer to these questions is possible only when we clarify the nature of the electron, but this is not the subject of this paper.

The next series are formed by electrons falling on the third orbit from the fourth, the fifth, and the sixth, and so on.

$$W_{\text{line}} = W_0 - 13.604\ \text{eV}/(n-0.069)^2 \quad , \quad n = 4,5,6,\ldots$$

measured sizes, eV	calculated sizes, eV
0.9897	0.9891
1.3101	1.3100
1.4828	1.4828
1.5863	1.5863

$$W_0 = 1.8695\ \text{eV}$$

$$W_{\text{line}} = W_0 - 13.604\ \text{eV}/(n-0.008)^2 \quad , \quad n = 4,5,6,\ldots$$

measured sizes, eV	calculated sizes, eV
0.7292	0.7298
1.0359	1.0358
1.2024	1.2024
1.3028	1.3028
1.3680	1.3680

$$W_0 = 1.5809\ \text{eV}$$

$$W_{\text{line}} = W_0 - 13.604\ \text{eV}/(n-0.003)^2 \quad , \quad n = 4,5,6,\ldots$$

measured sizes, eV	calculated sizes, eV
0.6635	0.6627
0.9698	0.9694
1.1361	1.1359
1.2364	1.2363
1.3015	1.3015
1.3462	1.3462

$$W_0 = 1.51421\ \text{eV}$$

$$W_{\text{line}} = W_0 - 13.604\ \text{eV}/(n-0.003)^2 \quad , \quad n = 4,5,6,\ldots$$

measured sizes, eV	calculated sizes, eV
0.5870	0.5872
0.9652	0.9651
1.1623	1.1622
1.2779	1.2779

$$W_0 = 1.58095\ \text{eV}$$

$$W_{\text{line}} = W_0 - 13.604\ \text{eV}/(n-0.003)^2 \quad , \quad n = 4,5,6,\ldots$$

measured sizes, eV	calculated sizes, eV
0.6631	0.6623
0.9694	0.9690
1.1357	1.1355
1.2360	1.2359
1.3011	1.3011

$$W_0 = 1.51382\ \text{eV}$$

$$W_{\text{line}} = W_0 - 13.604\ \text{eV}/(n-0.004)^2 \quad , \quad n = 4,5,6,\ldots$$

measured sizes, eV	calculated sizes, eV
0.6495	0.6489
0.9561	0.9558
1.1226	1.1225
1.2229	1.2229

$$W_0 = 1.50086\ \text{eV}$$

As we can see, in this case there are also six series of spectral lines, and once more we conclude that this is not accidental. With this nearly all non-ionized Helium lines that are available to us are classified in the series. There are still a few lines, and the occurrence of some of them can be explained somewhat differently. Let us look, for example, a line of 20.9625 eV. Calculus shows that this line can be explained by electron transferring from the level of 3.62445 eV (this level has enabled the formation of one of the six series on the second orbit) to a level of 24,587 eV:

$$W_{\text{line}} = 24.587\ \text{eV} - 3.62445\ \text{eV} = 20.96255\ \text{eV} \quad .$$

In spectra of non-ionized Helium exists a line with energy of 19.821 eV. It can also be explained by electron's transition between the basic energetic level which we have used in ours calculus:

$$W_{\text{line}} = 24.587\ \text{eV} - 4.76911\ \text{eV} = 19.818\ \text{eV} \quad .$$

In a similar way we can obtain a line with the energy of 1.1448 eV, which is in the spectre of non-ionized Helium along with two lines, the energies of which are very close to this one:

$$W_{\text{line}} = 4.76911\ \text{eV} - 3.62445\ \text{eV} = 1.1447\ \text{eV}$$

The value, which is very close to one that is measured, we get also for the line of 0.6024 eV:

$$W_{\text{line}} = 3.97367\ \text{eV} - 3.37056\ \text{eV} = 0.6031\ \text{eV}$$

Since the line of 1.1447 eV occurs by transition from the level of 3.62445 eV to a lower level of 4.76911eV, how did electron previously reached the level of 3.62445 eV? Logically, it was raised from the level of 24,587 eV. And to achieve this, the work equal to the difference between these levels must have been invested. According to this, the mentioned work equals:

$$A = 24.587\ \text{eV} - 3.62445\ \text{eV} = 20.96255\ \text{eV}$$

Indeed, the measured "excitation energy" for the line of 1.1448 eV is exactly this, 20.96 eV. And the same calculus shows how much work needs to be invested to obtain the line of 0.6024 eV. This line forms by electron's falling down from level of 3.37056 eV to a lower level of 3.97367 eV. On the level of 3.37056 eV, the electron had to be raised from the level of 24.587 eV, and to achieve this invested work should equal to the difference between levels:

$$A = 24.587\ \text{eV} - 3.37056\ \text{eV} = 21.216\ \text{eV}$$

Measured 'excitation energy' is 21.21 eV.

Another line of the non-ionized Helium's spectre is interesting, with the energy of 38,698 eV. The question is how is it possible that this energy is bigger than the ionization energy, which is 24.587 eV? At first glance, energy of ionization is the highest possible, when it comes to non-ionized Helium. However, let us suppose that one electron is on orbit 1 and the other on orbit 2. In this situation it is possible for the electron on the orbit 1 to be ejected from the atom, and the electron on the second orbit remains in the atom. According to our formula, the work needed to eject the electron on orbit 1 from the atom is equal to:

$$A = 13.604\ \text{eV} \times (2 - 1/3)^2 = 37.79\ \text{eV} \quad .$$

According to the law of conservation of energy, when electron in the described situation returns from infinity to orbit 1, the same amount of energy must be released. It is close enough to the measured value of 38,698 eV to confirm the validity of the basic formula. And from where the one third appears in the formula? Simply because it is a logical assumption that the electrons in the situation described are at the distance of $3R_1$.$3R_0$.

Again, we will draw your attention to the interesting fact of the actual size of the radius of this basic orbit. It can be easy derived from Eq. (1). We set into Eq. (1) a relation very well known in Theoretical Physics:

$$137 \times e^2 = \hbar c \quad .$$

Recall that by solving the given equation we get an interesting result, as shown in Eq. (2).

We can prove that this result explains one of the fundamental facts of Nature, which can be clarified only when the other fundamental facts of the Nature are clarified, such as mass, radius, charge of the electron, Plank's constant, Gravitational constant and others. Due to their importance, these subjects deserve additional papers.

This result completes the elementary analysis of spectral lines of non-ionized Helium. Chemists can now continue with subtle analyses.

Conclusion

It is of utmost importance to emphasize the fact that on the grounds of Eq. (3), spectral lines of non-ionized Helium and other atoms can be calculated, and on the grounds of Bohr's theory they cannot be calculated. We are of the opinion that this is sufficient proof that our formula is correct. The consequence is that Bohr's postulate that $m_e v_e R = n\hbar$ is incorrect. That postulate is a foundation of contemporary physical theories. Its defense means 'to be or not to be' of the subatomic theory and Quantum Mechanics. This paper proves that this postulate is incorrect, that it is made up to formally derive the formula (5) and by that to reconcile its result with the experimentally measured facts.

One more fact is important. By Bohr's theory the lowest orbit on which the electron is circulating in the Hydrogen atom equals: $R_{\text{Bohr}} = \hbar^2 / m_e e^2$. This paper demonstrated that the smallest orbit, not only in the Hydrogen atom, but in all atoms of the periodic system, must equal: $R_1 = \hbar / m_e c$. From these two relations it can be seen that: $R_{\text{Bohr}} / R_1 = \hbar c / e^2 = 137$. Observe that the difference is huge. Our assumption is that there is possibility to prove this ratio additionally by experimental measurement and analysis of specific weights of liquid gases, assuming that molecules in this condition are placed tightly to one another. If this assumption is even approximately accurate, it could be possible to at least approximately calculate the distance between the molecules, which would then at least approximately correspond to double the size of the smallest orbit's radius. As we picture it, with the help of Avogadro's number it could be possible to calculate how many molecules there are in some specific volume of liquid gas, and by that we could find out what is the volume of the individual molecule.

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The Mysterious 'c' in Dirac's Continuity Equation

Continued from page 2

where e_* is the massless bare charge and $G\ (= e_*^2 / m_*^2)$ is Newton's gravitational constant. The first $(-e_*)$ in (7) belongs to the electron, and the second belongs to the separate Planck particles making up the degenerate PV state. The two terms in (7) represent, first, the Coulomb repulsion between the electron charge and the separate PV charges, and second, their mutual gravitational attraction.

The particle/PV coupling force (7) vanishes at the electron Compton radius $r_C\ (= e_*^2 / mc^2)$. In addition, the vanishing of $F(r_C)$ is a Lorentz invariant constant [4] that leads to the important Compton-(de Broglie) relations

$$r_C \cdot mc^2 = r_{dB} \cdot cp = r_L \cdot E = r_* \cdot m_* c^2 = e_*^2 \ \ (= c\hbar) \quad , \qquad (8)$$

where $r_{dB} = r_C / \beta_0\gamma_0$ is the de Broglie radius, $r_L = r_C / \gamma_0$ is the de Broglie radius in the ct direction, and $r_* = e_*^2 / m_* c^2$ is the Planck particle Compton radius, and m_* is the mass of the Planck particles within the PV state.

The ratio of the electron speed v to the speed of light c is β_0, and $\gamma_0 = 1/\sqrt{1-\beta_0^2}$. The relativistic momentum and energy following from the invariance of $F(r_C) = 0$ are $\mathbf{p}\ (= m\gamma_0\mathbf{v})$ and $E\ \ (= m\gamma_0 c^2)$, from which the relativistic energy-momentum relationship $E = \sqrt{m^2c^4 + c^2p^2}$ follows.

Using Eq. (8), Eq. (2) can be expressed as

$$ic_*^2\left(c^{-1}\frac{\partial}{\partial t} + \boldsymbol{\alpha}\cdot\nabla\right) = mc^2\beta\psi \quad , \qquad (9)$$

or

$$ir_C\left(c^{-1}\frac{\partial}{\partial t} + \boldsymbol{\alpha}\cdot\nabla\right) = \beta\psi \quad , \qquad (10)$$

where the partial derivatives within the parentheses are normalized by the Compton radius r_C. The spinor field that is the hermitian conjugate of ψ is the 1×4 row vector $\psi^\dagger = (\psi_1^\dagger, \psi_2^\dagger, \psi_3^\dagger, \psi_4^\dagger)$. Then, pre-multiplying (10) by $\psi^\dagger$ leads to

$$ir_C\psi^\dagger\left(c^{-1}\frac{\partial}{\partial t} + \boldsymbol{\alpha}\cdot\nabla\right)\psi = \psi^\dagger\beta\psi \quad . \qquad (11)$$

Taking the hermitian conjugate of (10) and post-multiplying by ψ, then yields ([1], p. 76):

$$-ir_C\left(c^{-1}\frac{\partial}{\partial t} + \boldsymbol{\alpha}\cdot\nabla\right)\psi^\dagger\psi = \psi^\dagger\beta\psi \quad . \qquad (12)$$

Subtracting (12) from (11) finally leads to the continuity equations for the electron ([1], p. 76):

$$ir_C\left[c^{-1}\partial(\psi^\dagger\psi)/\partial t + \nabla\cdot(\psi^\dagger\boldsymbol{\alpha}\psi)\right] = 0 \quad , \qquad (13)$$

or

$$\frac{\partial(\psi^\dagger\psi)}{c\partial t / r_C} + \sum_{k=1}^{3}\frac{\partial(\psi^\dagger\alpha_k\psi)}{\partial x^k / r_C} = 0 \quad . \qquad (14)$$

From (8), the presence of r_C in these two equations connects the electron core dynamics to a wave traveling within the vacuum state [5].

2. Concluding Comments

Dividing (13) by ir_C yields the equation

$$\partial(\psi^\dagger\psi)/\partial t + \nabla\cdot(\psi^\dagger c\boldsymbol{\alpha}\psi) = 0 \quad , \qquad (15)$$

where the 4×4 matrix $c\boldsymbol{\alpha}$ looks like a velocity operator because of its speed of light c factor. This observation then leads intuitively to the standard continuity equation ([1], p. 76)

$$\partial\rho/\partial t + \nabla\cdot\mathbf{j} = 0 \quad , \qquad (16)$$

where $\rho = \psi^\dagger\psi$ is the probability density and $j^k = \psi^\dagger c\alpha_k\psi$ is the k^{th} component of the probability current density. Integrating (16) over the volume V that contain the electron core $(-e_*, m)$, and using the divergence theorem, leads to ([1], p. 77)

$$\frac{\partial}{\partial t}\int_V d\rho\ d^3\mathbf{x} + \int_S \mathbf{j}\cdot d\mathbf{S} = 0 \quad , \qquad (17)$$

where the surface S surrounds the volume V ([1], p. 77).

So far, so good. But there is a problem: treating $c\boldsymbol{\alpha}$ as a free-space matrix velocity leads to an interpretation of that operator that is tortured, and cries out for a better explanation. Using the PV perspective, that explanation is apparent from Eq. (14)

$$c^{-1}\,\partial(\psi^{\dagger}\psi)\big/\partial(t/r_{\mathrm{C}}) + \sum_{k=1}^{3}\partial(\psi^{\dagger}\alpha_{k}\psi)\big/\partial(x^{k}/r_{\mathrm{C}}) = 0 \quad ,(18)$$

where the Minkowski-like line elements, $c\,dt$ and dx_k as associated with the partial derivatives, are normalized by the electron Compton radius r_{C}. The form of this equation suggests that it is associated with a distorted space-time [6, p. 27] (the distortion coming from the r_{C} and the α_k), rather than a free-space velocity dynamic. Furthermore, the absence of the electron dynamic parameters $\mathbf{p}$ and E from (8), together with the fact that $c\boldsymbol{\alpha}$ is not a recognizable free-space operator, suggest that (14) refers to a PV substructure dynamic [7] (driven by the electron core dynamic), where the normalized ct-gradient of $(\psi^{\dagger}\psi)$ equals the normalized negative divergence of $(\psi^{\dagger}\boldsymbol{\alpha}\psi)$.

Finally, the assumption that the PV is a degenerate state implies that the Planck-particle energy eigenstates are full. So if there is a current wave propagating within the PV, it cannot involve a Planck particle current (because the Planck particles are not free to move macroscopically). Thus $c\boldsymbol{\alpha}$ must refer, in part, to a localized percussion-like spinor wave within that vacuum state, analogous to a wave traveling on the surface of a kettle drum.

Eqs. (13) and (14) and the previous two paragraphs represent the PV view of the Dirac electron continuity equation.

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Does Light Affect Gravity?

A few years ago, a Hungarian gravity researcher experimented with a large physical pendulum. [1] From the beginning, it was clear that, due to its relatively low sensitivity, the physical pendulum was not suitable for the measurement of the known Newtonian gravity. Despite the preliminary estimated low sensitivity, the present author built a complete dumbbell-shaped, vertical orientation physical pendulum with maximum reachable period of about 60-80 seconds. The first realization of this physical pendulum had arms about one meter, and both the lower and upper masses were about 8 kg. This experiment showed: **1)** the accelerating masses act on each other by an as yet by unknown force (named later as 'dynamic gravity') that is significantly stronger than the traditional Newtonian gravity; **2)** this effect can be clearly demonstrated by large-period physical pendulum.

The results of the present author's theoretical investigations related to this experiment are summarized of follows:

1) The Newtonian gravity law is valid (by everyday experience) for the closed gravitational systems, when the energy of system is constant and the systems are in an equilibrium state. This equilibrium states after a certain time and that we can experience it, for example especially in the Cavendish torsion balance experiment (having very slow movement of the torsion pendulum). The static (equilibrium) state of gravity develops slowly, finally when the *gravitational binding energy* has been totally *dissipated*.

2) The dynamic gravity is a special behavior of Newtonian gravity, when the interactive masses relatively quickly change their relative positions due to the act of the outer accelerator forces. It means that the masses' interaction happens in open system and in addition there is no time and other necessary conditions for the dissipation of the gravitational binding energy. In the case of gravity measurement of the Cavendish type, the torsion balance associated with a relatively very slow damping process leading to the total dissipation of the gravitational binding energy. In other words the torsion balance behaves as a strong low-frequency filter for the (static) gravitational interaction.

These experimental and theoretical statements indicate that the study of the dynamic gravity requires faster data sampling and lower friction than the present torsion balance provides.

Dynamic Gravity Measurement

In Physics, the so-called 'math pendulum' or 'simple pendulum' generally is not applied for the measurement of gravity except for the measurement of local gravitational acceleration g.

With the newly explored dynamic gravity properties, it became evident that the simple math pendulum must be a really good instrument for the study of the dynamic gravity. At first glance, it seems that our claim is not supported by everyday experience. But examine the pendulum movement in more detail.

For example, examine a pendulum one meter of length yarn and in amplitude at few millimeters when chaotic motion can be observed, obviously due to outside disturbances. In this situation, we are not sure that this small pendulum motion is caused exclusively by the air draft, mechanical noise, or in addition maybe an unknown dynamic gravitational effect.

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Spectral Lines of Atoms, Part 2: Analytical Derivations of Formulae

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Part 1 proposed a new formula for calculating energies of spectral lines of atoms. The formula is: $W_{\text{line}} = (Z^2e^4 / 2m_e c^2 R_e^2)(1/n_1^2 - 1/n_2^2)$ (n_1 and n_2 being whole numbers). The formula's accuracy was validated empirically with measured energies of spectral lines of non-ionized Helium. In this Part 2, the formula is derived analytically. The derivation uses well-known facts from classic electrodynamics. New ideas are avoided, first because they are not necessary, and second because new ideas are hard for others to accept and follow - it is easier to understand and to follow a presentation that operates with familiar expressions.

1. Introduction

Complete theoretical explanation of our formula is possible only when the nature of the aether and electrons, which emit spectral lines in interaction with atomic nuclei, are explained. However, we will not use the natures of aether and electrons here; those subjects deserve a separate presentation. Here we will just show how the formula for energy W_{line} [1] can be derived from Maxwell's equations.

In doing so, we demonstrate that classic electrodynamics was already halfway to getting the solution for this problem. If the problem had been solved then, today's Physics would certainly look very different. Unfortunately, Niels Bohr offered a rather logical explanation, and one of his assumptions is indeed accurate – an electron circulates only on fixed orbits and emits only by falling to some lower orbit. However, the easiest way to accept falsity is when it is mixed with truth. In the absence of a better solution, scientists have accepted Bohr's, and, basically, they stick to it until today. Bohr's solution is not correct; by using simple calculus, we can show that it is in conflict with the law of conservation of energy. That first mistake has consequently led Physics theory into bigger and bigger mistakes, the biggest of which was removing the aether from theoretical physics.

2. Analytic Derivation of the Energy Formula

Maxwell's equations, which will be used to derive the formula, can be found in any book that deals with electrodynamics. I have in front of me Volume 2, Part 6, of **Feynman's Lectures on Physics** [2], and on page 20 one can see the whole list of these equations. Only this one is needed:

$$\mathbf{E} = -\nabla\Phi - \partial\mathbf{A}/\partial t \quad . \tag{1}$$

(It is expressed in natural units, where $c = 1$)..

Eq. (1) says that electrical field of an electron is equal to minus the sum of the gradient of the electrostatic potential Φ and the derivative with respect to time of the vector-potential $\mathbf{A}$. As is known, $-\nabla\Phi$ represents electrostatic field. From that we can conclude that $-\partial\mathbf{A}/\partial t$ actually represents the electrodynamics field of a moving electron. Therefore, we can calculate from the equation that connects vector potential $\mathbf{A}$ to the density of the electricity flow. [3] That vector-potential of the single moving electron (which represents the smallest possible flow of the electricity) is:

$$\mathbf{A}_e = e\mathbf{v}_e / Rc^2 \quad . \tag{2}$$

In the numerator on the right appear the electron charge e and its velocity $\mathbf{v}_e$. In the denominator we have distance R of the electron from some point in the space and the square of the speed of the light c.

Even that simple formula already implies questions for which official theories do not have clear and precise answers. For example, in relation to which reference system do we determine the speed of an electron?

In the present theory, this question is perfectly clear, and it has a clear answer: the only electron speed that counts is its speed in relation to an aether medium. The precise answer from which point on the electron itself the distance to some point in space is measured is not relevant for deriving the formula, so we will leave it aside.

Regarding what we have said, Eq. (2) gives the electrodynamic field of an electron by differentiation of the vector-potential $\mathbf{A}$ with respect to time. If we take into consideration the real situation in which the electron is moving in the area around the atomic nucleus, where speed and acceleration depend exclusively on their electrostatic and electrodynamic interaction, the electrodynamic field that the electron's acceleration and change of the distance R to the nucleus generates is equal to:

$$\mathbf{E}_{\text{e-d int.}} = (e/Rc^2)\partial\mathbf{v}/\partial t + (ev_e / R^2c^2)\partial R/\partial t \quad . \tag{3}$$

Consider this formula for a moment. Notice that the electrodynamic field of the electron has positive sign and electrostatic field has negative sign. Why? Because the charge of the electron is negative, so the electrodynamic field is equal to negative derivative by time of the vector-potential, as can be seen from Eq. (1). In that way, we have two consecutive negative signs, which produces positive sign.

Let us now observe the first term on the right side. It can be written in this form also:

$$\mathbf{E}_{\text{e-d int. 1}} = e\mathbf{a} / Rc^2 \quad . \tag{4}$$

Due to the fact that we are observing an electron that moves in the area of the nucleus, and that acceleration and speed are consequences of the electrons -nucleus interaction, we will assume that atomic nucleus is at the distance R from the electron and that it does not move in relation to the aether medium. In this case, the acceleration of the electron is:

$$\mathbf{a} = (Ze^2 / m_e R^2)\hat{\mathbf{r}} \quad , \tag{5}$$

where $\hat{\mathbf{r}}$ is a unit vector in the direction of the nucleus.

The acceleration $\mathbf{a}$ is caused by electrostatic force that acts between electron and nucleus in the direction of the nucleus. From Eq. (5) it is understood that we are analyzing the simplest situation when only one electron is in the area around the nucleus. In the case of situation with more electrons, the principle stays the same, but the analysis becomes rather complicated due to technical reasons. To simplify the presentation, we will focus on the first case. Now we will set the acceleration from the formula (5) in formula (4) and we get this:

$$\mathbf{E}_{\text{e-d int. 1}} = \frac{e}{Rc^2}(Ze^2 / m_e R^2)\mathbf{r} = (Ze^3 / m_e c^2 R^3)\mathbf{r} \quad . \tag{6}$$

It is important to mention that the real situation when the electron in moving in the area of the atomic nucleus is that the field is always directed in the same way, because the acceleration is always directed in the same way – to the nucleus. Therefore, when the electron is moving towards to the nucleus, and when it is moving away from the nucleus, and when is circulating on the stationary orbit – all physical characteristics of the field stay the same, except, of course, the strength of the field.

Now consider the second component of electrodynamics field in Eq. (3). It shows us that the change of vector-potential in that component of electrodynamics field is a consequence of the change in distance to the atomic nucleus. From this fact we can see that the change of distance to the nucleus depends on the way in which electron is moving in the moment of observation. If it moves toward the nucleus, δR is negative; if it moves on the stationary orbit, δR equals zero; and if it moves away from the nucleus δR is positive. It can be described mathematically as: $\delta R = \delta S \cos\varphi$.

It is clear that φ represents the angle between the path on which the electron moves and radius which connects electron and the atomic nucleus. If we set this relation in second article from the right side of Eq. (3) we get for that component of electrodynamics field the expression:

$$\mathbf{E}_{\text{e-d int. 2}} = (e\mathbf{v} / R^2 c^2)\left(\partial S / \partial t\right)\cos\varphi \quad . \tag{7}$$

This formula shows that this field's component at the location of the atomic nucleus depends on the angle that forms the direction of electron's movement with the radius that connects the electron with the nucleus. When the electron is moving on a circular orbit around nucleus, this field's component at the location of the nucleus equals zero, and when the electron is moving along the radius that connects it with the nucleus, this component has its maximum value.

We can continue the analysis by pointing out that: $\partial S / \partial t = v$. When we insert this into Eq. (7), we get:

$$\mathbf{E}_{\text{e-d int. 2}} = (ev_e^2 / R^2 c^2)\cos(\varphi)\,\mathbf{r} \quad . \tag{8}$$

Note that r from the right side of the previous formula reminds us that vector has direction of $\mathbf{R}$. We can further analyze Eq. (8) by taking into consideration that in the real situation, $v_e^2 = Ze^2 / m_e R$. When we put this relation into Eq. (8), we get:

$$\mathbf{E}_{\text{e-d int. 2}} = (Ze^3 / m_e c^2 R^3)\cos(\varphi)\,\mathbf{r} \quad . \tag{9}$$

This formula shows an interesting fact: the component of electrodynamic field at the location of the atomic nucleus is equal in size and direction to the first component of electrodynamic field, in the situation where the electron is moving along the radius towards the nucleus.

We point to this fact as significant because we found in Feynman's book [4] the notion that this component of electrodynamic field can be ignored for the reason that by formula (8) it decreases inversely with the squared distance R from the electron, which means much faster than the field component from Eq. (4), which decreases inversely with linear distance R. Formulas (6) and (9) show this is not the case in the real situation that we observe. As is known, when classical electrodynamics reviews electron's emitting, it takes into consideration only the field component (4), which is wrong in the case when the electron interacts with the atomic nucleus.

In the previous analysis, not a single new assumption was proposed; there was not a single new idea that could not be found in existing theories. Further mathematical juggling concerning Gauss's theorems, Maxwell's equations or any other differential equations cannot lead to solution of the problem, or to understanding of its physical essence. If solution were possible, mathematicians incomparably better than me would have found it already!

Next consider the electrodynamics field from Eq. (6). As we have explained, this field is a consequence of the electron's accelerated movement in electrostatic field of atomic nucleus. As the formula shows, this electrodynamics field depends only on the distance to the nucleus, and if electron moves on constant orbit the field does not changes, it stays constant. So let us forget for a moment classic electrodynamics and Maxwell's equations, and ask ourselves a question: is it justified to assume that a field that is constant in size is emitted? We are of the opinion that it is not justified, and the strongest argument is the fact that in reality this does not take place.

Regardless of the fact that circular movement is formally oscillating movement, it is fundamentally different from the movement in which the electron would move back and forth, as it is the case, for example, in a radio-antenna or a Hertz's oscillator. In these two examples, the electrodynamic field changes in time, meaning it oscillates between the maximum amplitude and zero. Therefore, we presume that the electrodynamic field ex-

tracts itself in surrounding area in the moment when it disappears in the area of the electron. After all, the conservation energy law demands this, because the energy that is contained in the electrodynamic field in space cannot vanish. When the field disappears in the electron's area, it appears in some other area.

We can further claim that conclusion from the example of sound waves. If some volume of air is accelerating, by the laws of fluid mechanics, in that volume there will appear pressure and density gradients. Is that enough to produce a sound? No, because this pressure and density gradient will be unchanged as long as acceleration of the fluid's volume is constant. However, if acceleration changes direction, in that moment of change the inertial force that holds the change of pressure and density disappears, so the change of pressure and density also disappear. And when it disappears from that place, it must appear in some other place. We can take as exception the case when the body is moving through the air with supersonic speed, then the body itself automatically becomes the source of sound waves. Because the same analogy holds for the electron when it moves through water with speed greater than the speed of the light (the Cherenkov effect), this can only strengthen the assumption that space is filled with fluid that determines the physical nature of electromagnetic waves.

Let us now examine the case when the electron is changing its distance to the nucleus. First off all let us perceive that positive electrodynamics field in the nuclear area is described by Eq. (6). The fundamental law of electromagnetism, by which on every charge in the electric field the electric force is acting, imposes the conclusion that on atomic nucleus, as positive charge, must act electrical force which pushes nucleus in direction opposite to the direction in which the force caused by negative electrostatic field pushes it, which, like the electrodynamics field, generates from the electron.

While the electrostatic force is pushing the nucleus toward the electron, the electrodynamic force is pushing it in the opposite direction, and strives to distance it from the electron. The size of that force, again by the laws of electromagnetism, must equal the product of the field and the charge in the field. So the field from Eq. (6) needs to be multiplied by the charge of the nucleus, and we get formula for electrodynamic force that affects the nucleus and strives to distance it from the electron:

$$\mathbf{E}_{\text{e-d int. 1}} = \left(Z^2 e^4 / m_e c^2 R^3\right)\mathbf{r} \quad . \tag{10}$$

Does this force from Eq. (10), which pushes the atomic nucleus from the electron, also affect the electron? By Newton's law of action and reaction, if the electron is pushing the atomic nucleus through its electrodynamics field in one direction, then the force of the same size but opposite in direction is pushing the electron. But as opposed to the nucleus, which is massive in relation to the electron, and practically doesn't move in their mutual interaction, the electron is moving and changing distance to the nucleus. In that case, the force acts along the traveled way, which changes the energy of the system. Following Newton's mechanical law, formula (10) can be written in this way:

$$\partial W / \partial R = Z^2 e^4 / m_e c^2 R^3 \quad . \tag{11}$$

Luckily, this differential equation is, simple, and it is not a problem to calculate what amount of work is invested when the force acts, for example, from infinity to the orbit with radius R. This work decreases the electron's kinetic energy, which the electron gets under influence of electrostatic force, so this change of kinetic energy has negative sign and it is equal to the integral of Eq. (11) on the way from infinity to orbit R:

$$\Delta W_1 = -Z^2 e^4 / 2 m_e c^2 R^2 \quad . \tag{12}$$

Note that this energy increment is equal to the energy that, using my formula for calculating atomics' spectral lines, the electron would lose by falling from infinity to orbit R. If we presume that R is equal to integer multiple of the basic, smallest orbit, we have formally solved by analytical way the task from the title of this paper. But is it so? If we take into consideration the presumption that energy's emitting on the account of electrodynamic field, which does not change on the orbit, it is not possible; we must presume also that this energy remains in the system. If it is so, this component of the electrodynamic field represents conservative field in which the change of energy along the closed way equals zero.

Assuming that it is so, let us move our attention to the other component of electrodynamics field, described by Eq. (9). If we multiply this field with charge of the nucleus, we get similar formula for electrodynamics force, which pushes the nucleus from the electron and electron from the nucleus:

$$\mathbf{F}_{\text{e-d int. 2}} = \left(Z^2 e^4 / m_e c^2 R^2\right)\cos(\varphi)\,\delta S \quad . \tag{13}$$

Note that $\cos\varphi = \partial R / \partial S$. When we set this into Eq. (13), we get:

$$\mathbf{F}_{\text{e-d int. 2}}\delta S = \left(Z^2 e^4 / m_e c^2 R^3\right)\delta R \quad ,$$

which directly gives:

$$\delta W = \left(Z^2 e^4 / m_e c^2 R^3\right)\delta R \quad . \tag{14}$$

This incremental equation is identical to Eq. (11), so they have the same integral:

$$\Delta W_2 = -Z^2 e^4 / 2 m_e c^2 R^2 \quad . \tag{15}$$

Therefore, the change of electron's kinetic energy on the way from infinity to orbit R is the same, regardless of calculating one or another component of electrodynamics field. However, the character of these forces is significantly different. In the first case, force continues to affect on the stationary orbit also, while in other case force on the stationary orbit falls to zero. It is logical to presume that with the disappearance of the force, the dam for releasing of energy, which has accumulated due to affecting of the force, also disappears. It would be easy to understand if we use the analogy with gas fluid, where the gradient of pressure and density disappears as the force that causes these changes also disappears. We can also compare it with elastic springs, which compresses by acceleration. As soon as the acceleration stops, the accumulated energy will be relieved via stretching and oscillating of the spring.

3. Discussion

If the results given in this paper were to be adopted, Eq. (15), and the way we derived it, would be enough to prove that our theory of spectral lines is correct. However, no theory has much scientific significance if it applies to just one phenomenon, regardless of importance of that phenomenon. The solution of this one question immediately opens up many others, and we will show how this process goes on until the answers on those questions will spontaneously lead to radically new, proven, and what is also important - simple theory about the nature of the universe. We have also started our quest precisely from the spectral lines. Futile attempts to synchronize our explanation of spectral lines with adopted theories in theoretical physics have forced us to explore new paths.

At the end of this paper we will point out a few questions. The first is, why the electron moves only on orbits which are equal to integer multiple of the basic, smallest orbit, which is equal to electron's own wavelength on which the electron is oscillating? Second question is – if we stick to the analogy with gravitational field, electron should lose half of its kinetic energy that it accumulates on the way from infinity to a certain orbit, because if it would not be so, the electron could not remain on that orbit and it would return to infinity. Therefore, if this energy is not lost by emitting, it has to remain in the system, so it must be explained where it is. These two questions impose as primary issues, but there is a lot more that need answers too. It is impossible to answer any of them on the grounds of contemporary theories.

Quantum numbers, Schrödinger's equation, Pauli's principle, Dirac's equation, uncertainty relation, *etc.*, – all these terms the physical essences of which are not known, represent desperate attempts to insert some order and meaning into confusion that started with Bohr's theory of the atom. It is impossible to explain any question concerning the physical world without aether as the basis of all physical phenomena. Before that, of course, the nature of aether needs to be explained. However, this is not the subject of this paper.

Due to everything mentioned, we will now give a brief qualitative explanation of two problems in question. Why does the electron place itself on the distance from the atomic nucleus which is integer multiple of its own wavelengths? Because this is determined by the nature of the electron, which is characterized, among other things, by the system of standing waves of aether which oscillate in electron's electrostatic field. The existence of these waves is the very reason of existence of electrostatic field. These waves of aether by its pressure are diluting aether in the area where they are oscillating, and electron's electrostatic field *is* a field of diluted aether.

Because there are standing waves in question, they have peaks and nodes that alternate in space, and the first peak is located in the central zone of the electron's electrostatic field. The next peaks occur at distance of half a wavelength. The oscillation of aether is the strongest in the peak, and aether's dilution in increased, so the strength of electron's electrostatic field is also bigger than in the wave's node. Therefore, the nucleus with its positive charge, which characterizes the field of thickened aether, places itself in the peak of standing aether's wave. An electron, when it is placed in the field of another electron, strives to place itself in wave's node, because aether's dilution in the node is smaller than in the peak.

I have presented to you a qualitative image; precise analysis, which implies mathematical calculus with regard to experimental facts, will be the subject of another paper.

Regarding the second question – where is that half of the electron's kinetic energy that the electron, depicted as miniature planet, must lose to stay on a certain orbit? Bohr's theory implies that electron loses this energy by emission, which our theory proves it is wrong.

This question can be answered only if it is understood that the electron does not circulate in an empty space, but rather in a space that is filled with aether. The electrostatic field, by its motion, drags the surrounding aether, which movement manifests as electron's magnetic field. Therefore, the magnetic field is basically nothing more than open or closed convection flow of the aether. This insight easily explains the connection between magnetic and electric fields. Every change of the speed of the flow in the electricity of gas fluid must result with the change of fluid's density in the field where the speed of the flow is changing, the same way as every change in density of the filed must cause the change of the flow.

These phenomena are consequences of the law of conservation of matter. This contains everything that Faraday discovered and Maxwell mathematically described. Classical electrodynamics knows well that magnetic field has energy, although it does not know the nature of that energy. It also knows that the energy of the current flow depends on the inductance of the conductor, and not only on the number of electrons that form electricity. All this points to the fact that electron's kinetic energy does not depend only on the electron's speed, but also on the circumstances in which the electron is moving. It is logical to assume that electron's circulation around the atomic nucleus creates a vortex of aether that can take energy that would prevent electron's staying on the orbit.

4. Conclusion

This paper has presented an analytical derivation of the formula for calculating energies of spectral lines. Note that the derivation was based almost entirely on the achievements of classical electrodynamics. Corrections have been relatively small, and ideas used in the paper cannot be considered new.

We have demonstrated that the electrodynamic field is the main condition for emitting of electromagnetic waves. However, while classical theory says that is a sufficient condition, we believe we have presented reasons strong enough to disagree with that assessment. The electrodynamic field is a necessary condition for an electron to radiate, but it is not sufficient. The necessary and sufficient condition is that electrodynamic fields be changing in time. Only in this way, by disappearing from the area where electron's movement creates it, can it appear in some other place.

Other interesting and important tasks remains: we need explanations about the mechanism whereby the electron radiates waves, and about the 'quantification' of wave energy. Such could be the subject of a later Paper.

Acknowledgment

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Does Light Affect Gravity?

Continued from page 10

The disturbing effect of air movement can be terminated if we put the pendulum into a closed box. The effect of external vibrations can be reduced significantly if there is a narrow resonance curve of the pendulum. This latter condition is not achieved with a single pendulum; a series of weakly coupled pendulums must be used. Finally we have established a simple instrument for detection of the dynamic gravity containing only two weakly coupled pendulums:

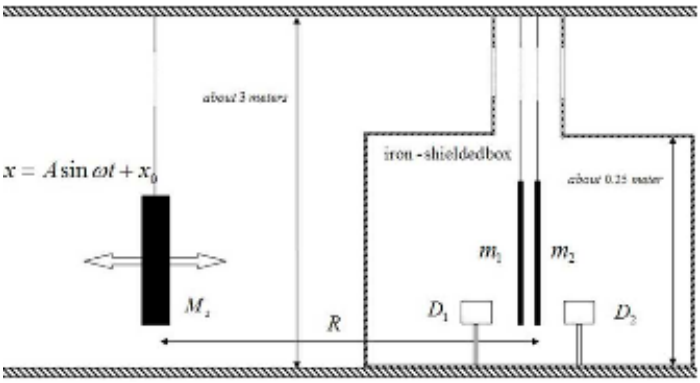

Figure 2.1. Measuring dynamic gravity by weakly coupled pendulums (principal scheme).

The dynamic gravity detector (receiver) is realized by two plan parallel ceramic tiles sus- pended to the ceiling with fishing lines about *3 meter* longs ($T \approx 3.5$ *s*). The tiles form coupled pendulums with *narrow resonance curve* avoiding any caption of the environmen- tal mechanical noise. The mass of the tiles is about *150-150 grams* with dimensions *120 x 120 x 5 mm*. The gap between the tiles is about *5 mm*. The weak mechanical coupling between the tiles is realized by the air gap inside them. D_1 and D_2 are optical displacement detectors without any mechanical contacts with the tiles. The signals of the detectors are processed by a personal computer working in real-time regime. The typical amplitude of the ceramic tiles is about 20 microns in normal ground state.

The gravitational transmitter is a simple pendulum with the same frequency as the receiver coupled pendulum. The transmitter mass *Ms* is about 0.25 kg made of lead. The distance between the transmitter and receiver is about $R = 5$ meters. After a little pushing the transmitter mass the receiver gives a disturbance signal to the computer. In case of resonance the amplitude of the tiles rises up to 100 – 150 microns. Appropriate shielding of the gravitational receiver is very important. The optimal condition of the successful experiment is a poor vibration and gravity noise environment.

The measurement arrangement (shown in Fig. 2.1**)** gives an experimentally proved remarkable possibility for the *gravitational communication* with the help of the newly explored dynamic gravity.

Light Causes Dynamic Gravity

Big surprise: the successfully tested new gravity detector is sensitive not only for the moving masses, but rather for variable intensity of light and heat as well. In addition, this dynamic gravity detector is sensitive also for a small grinding machine when is turned on and off, or especially GSM telephone calls, reception as well. This simple instrument can detect a wind storm, even from distance of 50-100 km, with increased swing amplitude. This phenomenon is obviously due to the dynamic gravitational effect of movement of huge air masses.

Fig. 3.1 shows a successfully realized dynamic gravity experiment with flashing lamp (5 W power in $R = 5$ m distance) which services as a source of dynamic gravity. The flashing frequency was suited to reach maximum amplitude of the coupled pendulums:

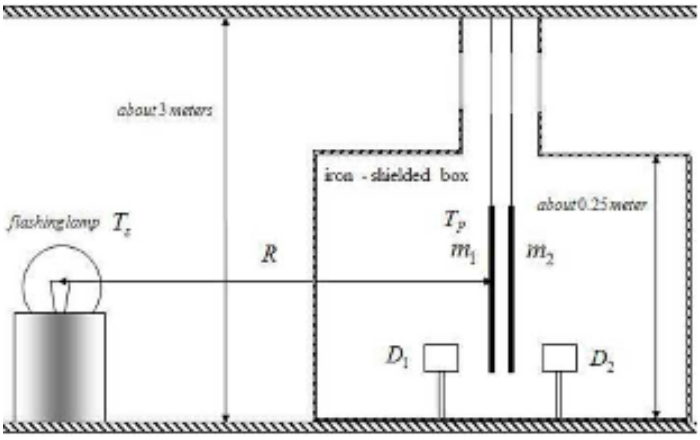

Figure 3.1. Measuring dynamic gravity caused by flashing lamp (principal scheme).

In summary, the new gravity detector sensitive for *all energy density changes* of its surrounding space caused by any kinds of time-dependent energy sources even from long distances, too.

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Explanation of SRT in Relation to GRT: Part 1 of a Unified Theory for Physics

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This paper discusses Special Relativity Theory (SRT) in relation to the gravitation of a black hole. The point of departure is the equivalence between two situations: **A)** Body B moves inertially with respect to body A in a region with no gravitational field, and the light propagates with respect to the two bodies; **B)** An electromagnetic wave is captured on the event horizon of a black hole, and the light propagates with respect to the two bodies falling into the black hole, body B moving inertially with respect to body A against the direction of the fall. For simplicity we analyze a homogeneous gravitational field, *i.e.* a case where the gravity does not increase under the event horizon. The equivalence of these two situations implies three equivalence principles (Theorems 1, 2 and 3), which clarify the gravitation of the black hole, and gravity in general, as a phenomenon inverse to the propagation of the light. This implies a unified explanation of the propagation of the light and gravitation.

Keywords: Special Relativity Theory of (SRT); black hole; event horizon; electromagnetic wave; principles of equivalence; principle of light propagation; hypothesis of gravitation; unified explanation of the propagation of the light and gravitation; General Relativity Theory (GRT); co-moving inertial frame.

1. Introduction to the Unified Theory

This paper clarifies the analogy between the laws of the light propagation and gravity. In this author's opinion, both phenomena share the same principle, which can be called 'relativistic motion'; the gravity and the propagation of the light are mutually inverse phenomena.

1.1 Principles of Equivalence

SRT is usually explained in terms of mutual inertial motion of two frames outside the region with gravitational field. It is difficult to understand SRT on this ground. In addition, such an explanation has no impact on the explanation of gravity. However, there is an example when SRT is in direct relationship with gravitation, which *has* impact on the explanation of gravity, and at the same time it allows us to better understand SRT.

The following two situations are equivalent:

A) Body B is moving inertially with respect to body A outside the gravitational field, and we are interested in the propagation of light with respect to the two bodies.

B) The electromagnetic wave is captured on the event horizon of a black hole and we are interested in how the wave propagates with respect to the two bodies falling into a black hole. We treat body A as a body at rest, body B is moving inertially against the direction of the fall. For the sake of simplicity, when the gravitation does not get stronger under the event horizon we consider the gravitational field homogeneous.

The benefit of the second view B is that we can explain why the body (massive particle) cannot move inertially at speed c with respect to another body. In order to keep body B moving at the speed c, it is necessary to keep it on the event horizon, together with the captured electromagnetic wave, which is impossible without providing energy.

The conditions specified above imply the following:

Theorem 1: General Principle of Equivalence (GPE) of light propagation and gravitation of the event horizon of a black hole (in short, General Principle of Equivalence, or GPE): The frame associated with the electromagnetic wave is equivalent to the ***frame persisting on the*** event horizon of a black hole.

Remark: according to SRT, there is no energy that could keep a massive particle in these frames; a massive particle in these frames cannot be at rest, it can only fall.

The GPE has implications for a unified explanation of gravity and the propagation of light. Roughly speaking, the gravitation on the event horizon is implied by the principle of the light propagation. This topic is discussed further below.

The GPE implies two additional equivalence principles. These derive from the two situations in which a massive particle can be on the event horizon.

The first situation has a massive particle held on the event horizon. According to SRT, no massive particle can be held on the event horizon, so this is an unrealistic case. It serves only for the purpose of explanation. A particle on the event horizon would experience gravitational force, and this force is of interest for us because the same force should act on the particle even if we eliminate the black hole from our considerations, because of the equivalence of situations A) and B). In such a case the electromagnetic wave would propagate together with material particle with the speed c in the free space. However, in this case it is not a gravitational force anymore, because of the absence of the black hole. Instead it is the force that acts on the massive particle when it is moving with the speed c; see Figures 1a and 1b. Let it be called *relativistic inertial force.* With this name I distinguish it from the classical force of inertia, which acts on bodies in acceleration.

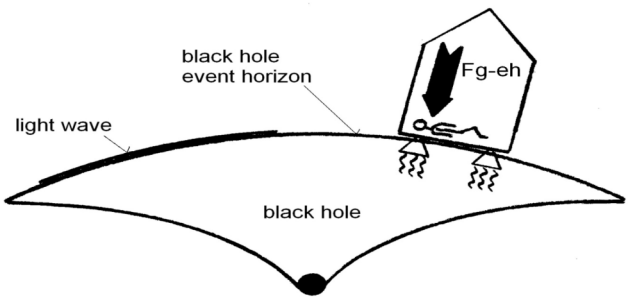

Figure 1a. We immerse the rocket into the event horizon and provide energy in order to keep it there (the motors of the rocket are switched on). The rocket is now kept aligned with the electromagnetic wave, which cannot escape. The observer on the event horizon (**eh**) in the rocket experiences gravitational force **Fg.** This force will be denoted by **Fg-eh**.

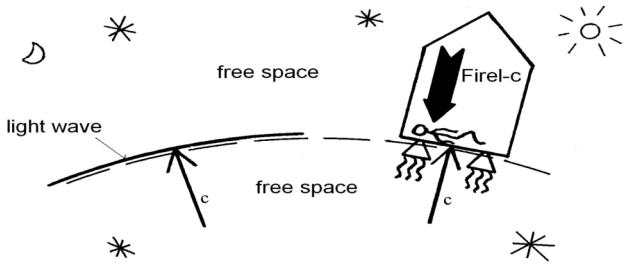

Figure 1b. When we remove the black hole, the situation does not change: the rocket with the motors being switched on is still aligned with the wave, but now it is moving with the speed c in the open space. The observer in the rocket experiences the same force, but because of the absence of the black hole, now it is the relativistic inertial force (**Firel**) acting in the presence of the speed ***c***. This force is denoted by **Firel-c**.

The relationship **Fg-eh = Firel-c** leads to the following:
Theorem 2. Principle of equivalence between relativistic inertial force and gravitational force**.**

Any body moving with the speed c experiences the relativistic inertial force that acts against the direction of the motion. This force is equivalent to gravitational force experienced by any body located at the event horizon.

The second situation to be considered is a realistic one. Now we do not add the energy to a body located at the event horizon, so that the body is falling into a black hole. On the other hand, in the frame associated with the electromagnetic wave it is falling in the same way. Both these frames are equivalent and the fall of the body is a consequence of the same principle.

This implies Theorem 3: The Principle of Equivalence between the laws of propagation of the light and the gravitation of the event horizon of a black hole:

A massive body falls back behind the light wave as if it would fall under the event horizon of a black hole = law of propagation of light = gravitation of the event horizon of black hole.

Consider this theorem closely: If the light is propagating with respect to a body (or bodies) outside the region with gravitational field, they are dragged behind the light in the same way as if they were falling under the event horizon of black hole. This is the law of propagation of light. If the electromagnetic wave is captured on the horizon, the bodies fall under the event horizon = gravitation of the event horizon of black hole. This implies the conclusion: it is sufficient to compensate the energy of light; this happens on the event horizon and the gravitation then follows from the law of propagation of the light.

The Principle of the Equivalence between propagation of light and the gravitation of the event horizon allows us to understand the freefall of a massive particle under the event horizon in terms of the law of motion of the frame equivalent to the frame associated with the electromagnetic wave.

Using these three Theorems, the gravitation of a black hole is next explained as a relativistic motion of its mass that is inverse to the propagation of the light.

1.2 The Principle of Light Propagation

The propagation of light is connected to the energy. The energy of light, however, does not manifest itself by gravitation, but by its propagation into the space. In order to propagate at the constant velocity *c* with respect to all bodies, the light needs energy equal to energy that allows the electromagnetic wave to persist on the event horizon. In the frame associated with the wave, all bodies, regardless of their relative motion, are dragged behind the wave in the same way as if they were falling under the event horizon. Thus, the speed of light remains constant with respect to these bodies.

The difference between ***inertial motion of a body*** and what we can call here ***the "relativistic" motion of light*** can be elucidated by a simple example: Let us place the light wave on the event horizon of a black hole. The light wave struggles to escape this position, but the gravity pull of the black hole is so strong, that is exactly compensates the energy of the light wave, whereby keeping the light wave trapped stationary on the horizon. Now, let us place on the event horizon a material body. In the place, where the light wave remains at a standstill the body falls into the black hole.

1.3 Gravity & Light Propagation: a Unified Explanation

Conjecture 1:

Theorem 1: The GPE states that the frame associated with the electromagnetic wave is equivalent to the frame persisting on the event horizon of a black hole. Based on this theorem we can formulate a simple conjecture:

The energy of the matter is opposite compared to the energy of the electromagnetic wave. On the event horizon, the energies compensate each other.

Conjecture 2:

Theorem 2: The Principle of equivalence between relativistic inertial force and gravitational force is asserted in order to unify the explanation of gravitation and the propagation of light.

The event horizon is a layer of gravitational field of a black hole, gravity of which compensates the energy of light, so that the electromagnetic wave positioned here is neither absorbed nor can escape. Using the Theorem 2, we can treat the event horizon as the frame moving ***virtually*** (as if) at the speed *c* relative to the bodies being absorbed. Gravitation then follows from the laws of

motion of this frame (the layer of gravitational field). The gravitational force present at the event horizon is in fact relativistic inertial force acting in the frame moving virtually with speed c.

The Principle of equivalence between relativistic inertial force and gravitational force allows us to understand intuitively the propagation of light and gravitation as mutually inverse phenomena. In other words, we can regard the gravitation of the event horizon as the relativistic inertial force acting during the relativistic motion of the black hole's mass, which is analogous to the motion of the electromagnetic wave / the light particle. More precisely, this motion is inverse, so that the mass of the black hole remains static in the space and its relativistic motion is manifested by the creation of gravitational field and by absorbing the matter from the ambient space. (See Figs. 2a and 2b for the analogy of light propagation and absorption of matter by a black hole.)

In order to explain gravity we proceed as follows. First we explain the gravity on the local basis: we divide the inhomogeneous gravitational field (*i.e.* diminishing with the square of the distance from the body) into the layers of approximately equal gravitation. Next we can ***regard the layers of gravitational field as the frames moving virtually with relativistic speed, i.e. We will regard the layer of the field as the frame which, to some extent, compensates the energy of the light.*** Consequently, physical bodies inside these frames experience relativistic inertial force, or, equivalently, they experience gravitational force.

Inhomogeneity of the gravitational field follows from the fact that the energy of the matter is decomposed into the content of gravitational field, so that the gravitation either decays or increases with the square of the distance from the center of a body.

Conjecture 3:

Theorem 3: In our explanation of gravitation and the propagation of light we can use the Principle of Equivalence of the laws of light propagation and gravitation of the black hole event horizon.

The light propagates from the mass point (body) in a way such that the wavefronts form the surface of the sphere. In terms of the frame with the wave, the body inertially lags behind the light from all directions to the center, exactly as if it was falling under the event horizon of a black hole. This is the basis of gravitational field. A body is inertially falling behind the light from every side towards the center - the inertia drags the body from all directions into the center. The bigger the mass that lags behind the light is, the bigger the inertial force by which the body acts on itself – a gravitation - is.

After all, the gravity affects the propagation of the light. Indeed, the light is propagation uniformly with respect to each particle, and thus the bigger the mass that lags behind the light, the more energy must be supplied by the light, which again has the same consequences as the existence of gravity.

2. Situations Illustrating the Unified Theory

2.1 From GRT to a Unified Theory

GRT is based on Einstein's Principle of Equivalence (PE) for gravitational and inertial force. This Principle is implied by the two observations:

1) The effect of gravitational force is (in the same way as the effect of inertial force) universal: it affects all physical phenomena in the same way.

2) Gravitational mass of each body is equal to its inertial mass. This implies that gravitational force by which the body is attracted to another body is equal to its resistance against the acceleration**.** ([1], p. 60)

Einstein's PE allows us to investigate the gravitational force in the same way as we investigate the inertial force. GRT describes the gravity as the inertia of the body in the curved spacetime. ([1], p. 67)

Within the framework of the unified theory, the layer of the gravitational field is understood to be a frame, the energy of which compensates, to some extent, the energy of the light, *i.e.* it is a frame moving virtually with ***relativistic speed***. The gravitation is then the inertia of the body in this frame and gravitational force is relativistic inertial force. Hence, in the unified theory, the curvature of the spacetime is a consequence of relativistic motion of the mass of the body and the curvature of the spacetime = laws of motion of a frame moving virtually at some relativistic speed. This point of view would clarify the essence of Einstein's equivalence principle; we would explain the gravity as the inertia and, at the same time, we would unify the gravity and the propagation of light on the basis of the same laws of motion, *i.e.* we would explain both gravity and the propagation of light using the same principle which I refer to as the "relativistic motion".

2.2 Differences Between the Unified Theory & Classical Mechanics & SRT

In both Classical Mechanics (CM) and SRT, the frame moving ***uniformly*** with respect to any inertial frame is defined to be ***inertial*** and thus equivalent to a frame at rest. This should hold true even for the speed c, if we ignore the fact that in SR the body / mass particle can move at a random speed smaller than c. ***The motion with the speed c should theoretically be inertial according to both classical mechanics and SRT.***

By contrast, according to the unified theory, the frame moving at the speed c is not inertial: it is equivalent to a frame persisting on the event horizon of a black hole. I will clarify this point using the following example. In classical mechanics or SR, if the mass body, the rocket, say, would reach the speed c, it would continue moving inertially at this speed and the observer inside the rocket would be in the weightless state. According to the unified theory, in order to maintain this speed it is necessary to continuously supply the energy which is equal to the energy needed to keep a body on the event horizon of a black hole. The observer in such a frame would be crushed by the relativistic inertial force. ***The unified theory implies that the motion at the speed c is not inertial.***

Note: The speed of light is reachable only by an electromagnetic wave that maintains this speed by its own energy.

2.3 From Inertial, Sub-*c* to Non-Inertial, At-*c*

At speed c, body B (Sect. 1.1) would persist on the event horizon; ergo, in a non-inertial frame. The question is: How can the transfer of inertial frames gradually approaching the limit of speed c to the non-inertial frame moving at speed c be resolved?

The following example illustrates a candidate solution. Consider a rocket with a motor of limitless capacity. Inside the rocket is an observer holding a table tennis ball. If the rocket were moving at speed c, it had to be supplied with energy to persevere on the event horizon of a black hole. This energy, however, from the point of view of the frame at rest would no longer manifest through acceleration of the rocket, but it would manifest through keeping the rocket at the constant speed c with respect to the frame at rest.

But what does it look like from the point of view of the inner beholder? The relativistic inertial force / force of gravity will be present inside the rocket. What happens when the observer drops the ball inside the rocket? For a moment, the ball becomes a co-moving inertial frame (which means that it is moving inertially together with the rocket), but a moment later this statement is not valid, because the ball falls behind the rocket due to the relativistic inertial force. At speed c, the acceleration of rocket with respect to the co-moving inertial frame (ball) = gravity acceleration on the event horizon.

We are, however, more concerned about this: How can the transfer of inertial frames gradually approaching the limit of speed c to the non-inertial frame moving at speed c be resolved? This is not possible without a continuous supply or acting of energy! Frames in inertial motion gradually approaching the limit of velocity c (where there is a weightless state for the beholder) are always just co-moving inertial frames; *i.e.*, frames that fall behind the light when we drop the ball inside the rocket that is moving at the speed c. Only such a particle/rocket that is kept on the event horizon by supplying the particle with necessary energy can move at speed c. (Note: This is not relevant for light, as it maintains its speed c by its own energy.)

The observer in a frame at rest sees that the light (the rocket) is spreading, also with respect to co-moving inertial frame (the ball), at speed c.

2.4 Light Speed as a Limit

According to SRT, the speed of light is limit and this means that the relativistic phenomena acquire an infinite value at this speed: it comes to an infinite time dilation, length contraction and to an increase in inertial mass at this speed. As regards the SR, a higher speed is not possible, because time in a moving system would be turning back from the aspect of a system at rest and space would be contracted under the level of a point. However, there is still a physical object that has more energy than an electromagnetic wave – this is a black hole that absorbs the electromagnetic wave under the event horizon. Therefore, under the event horizon dwells energy greater, than that of the electromagnetic wave, and the time lapse is here slower, than on the event horizon or at the speed of light. Since it is possible to achieve energy greater than light has, and time dilatation greater than at the speed *c*, the speed *c* cannot be limit!

The limit speed of light implies the prediction of SRT, that to keep a material body on the event horizon of a black hole is possible only by delivering an infinite amount of energy. This seems to me to be untrue, because to keep a material body under the event horizon we would need still more energy. This, in my opinion, is *contradictio in adiecto*, because the definition of the infinite does not allow for a greater infinite.

The limit speed of light implies that the mass of a black hole can absorb mass from the surrounding Universe only at the speed lower than c. However, in my opinion, the bodies being absorbed reach the speed *c* on the event horizon of the black hole. As a layman, I imagine the whole situation as follows: The gravitation of the black hole keeps the electromagnetic wave immobile, at rest with respect to the surrounding Universe. The light moves with respect to any material body at the speed c and therefore, when the matter falling into the black hole meets the light trapped on the event horizon, the falling matter reaches the speed c, since it is able to meet the light only at speed c; the mutual speed of the light and the falling matter must be c. That is to say, it is of no importance whether the light wave propagates onto the bodies outside the gravitational field or if it persists trapped on the event horizon of the black hole and moves reversely with respect to the bodies being absorbed (since the situation A is equivalent to the situation B); with respect to the bodies it retains the speed c in both cases.

Even though, according to SRT, the black hole can absorb material bodies only at speeds lower than c, I am convinced that my simple reasoning is correct. In my opinion, the electromagnetic wave has a finite energy and the black hole has more energy than the electromagnetic wave. Therefore, SRT ceases to be valid on the event horizon of the black hole, where the energy of black hole compensates the energy of light. At this borderline, the falling bodies reach the speed of light. And because the excess of energy causes the increase of velocity, the absorbed bodies below the horizon of the black hole move at velocities exceeding that of the speed of light. But according to the unified theory, it is not the absorbed bodies that moves in the described manner; it is the matter of the black hole that moves, and the absorption of matter by the black hole is understood as a manifestation of its motion with respect to the surrounding Universe

See Figs. 2a and 2b for the analogy between light propagation and absorption of matter by a black hole**;** *i.e.*, the absorption of matter represents a kind of 'negative photographic print' of the 'positive reality' of the hole's motion. Thus, the matter of the black hole moves with respect to the surrounding Universe at a speed higher than c.

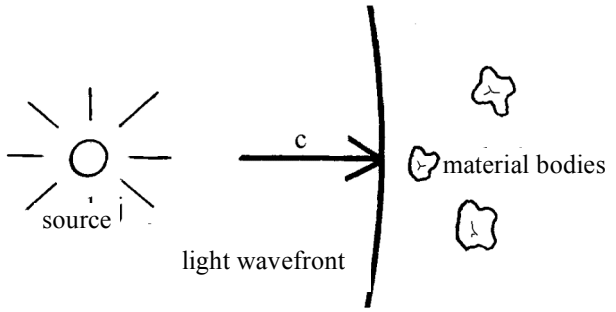

Figure 2a. Light propagates with the respect to all material body at the constant speed *c*.

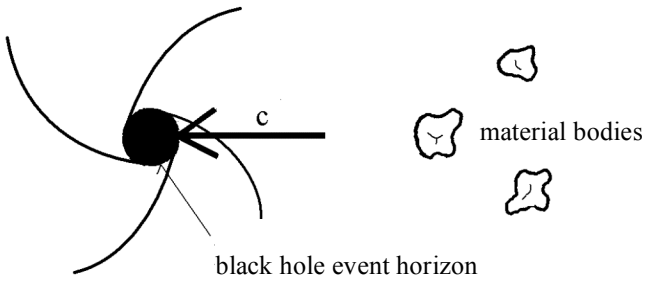

Figure 2b. Event horizon of a black hole absorbs matter at the constant speed c.

2.5 Neutrinos Discovered at CERN

According to the unified theory, the light propagates at the speed c, because the particle of light / electromagnetic wave has particular energy: it is the energy that keeps the wave on the event horizon of the black hole. If we discover particles with higher energy (I have on mind neutrinos discovered in CERN), they would be kept deeper under the horizon or they would move with the speed higher than c.

3. Conclusion

Physicist Vladimír Balek wrote: The author of the paper intends to describe gravitational interaction in a way which is different from the description provided by General theory of relativity (GR). He does not state that GR is in conflict with observations (correctly, because it is not), but he believes that GR is not "unified" enough, as it does not give a unified description of gravitational interaction and the propagation of light. When stated in this general way, he is correct. Even Einstein himself was looking for a unification of GRT with classical electrodynamics, which explains the light as the electromagnetic wave. Presently, the biggest open problem in physics is the unification of GRT with quantum mechanics. In quantum mechanics, the light is explained as a stream of particles, photons. Many scientists think that this unification should be based on some new PHYSICAL principle, similar to the principle of equivalence in GR and equally clear and simple. The string theory, which is the most serious candidate to unified theory of all interactions, however, is missing such a principle. (...)

Dančanin: As a starting point of the unification, I propose to treat SRT together with its relationship to gravitation of the black hole: the unified theory is built upon the equivalence of situations A) and B) (Sect. 1.1). I believe that this is the SIMPLE PHYSICAL PRINCIPLE on which the unification can be based. From the equivalence of situations A) and B), I derive three equivalence principles (Theorems 1, 2 and 3). These principles help me to clarify the gravitational force of a black hole, and gravitation in general, as a phenomenon inverse to the propagation of the light. This implies a unified explanation of the propagation of both light and gravitation.

Afterword

The key to understanding the unified theory is the General Principle of Equivalence, GPE: The frame bound to the light wave is equivalent to the frame persisting on the event horizon of a black hole. This is demonstrated in thought experiment; see Figs. 1a and 1b:

Let us say, we have a rocket with a motors of limitless capacity that we are keeping with motors turned on on the black hole event horizon. The rocket remains stationary here with respect to the light wave that cannot escape from here. The observer inside the rocket is subject to the force of gravity. What is going to happen if, in our thought experiment, we remove the black hole from the scene? The rocket with motors turned on is still keeping along with the light wave, however, now it is moving at speed c in open space. Because the rocket has its motors turned on, the observer inside is subject to force of inertia, the same force as (force of gravity) on the event horizon. However, since the supplying of energy is no longer manifested by the acceleration of the rocket, but, with regard to inertial frame, by keeping its speed c, it is not the classic force of inertia acting on bodies at acceleration, it is 'relativistic inertial force' acting at speed c.

It is important to understand that the rocket is able to move at speed c only if its motors are turned on, in the same way as when it persists on the event horizon, and so the observer inside the rocket is subject to force equivalent to the force of gravity on the event horizon. Whether the rocket is moving along with the light wave in open space, or it stays trapped on the event horizon of the black hole, nothing changes for the observer inside, because these situations are equivalent.

Reference

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Does Light Affect Gravity?

Continued from page 15

4. Conclusion

The background noise of the new gravity detector is higher by day than by night. The simple reason of this fact is the strong dynamic gravity effect of the changing *sunshine intensity* outside of the laboratory.

A significant further improvement is now needed for deeper investigations of the newly discovered phenomenon of the dynamic gravity. Potential sponsors are sought.

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