GALILEAN ELECTRODYNAMICS

Experience, Reason, and Simplicity Above Authority
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CONTENTS

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.

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From the Editor's File of Important Letters:

Entropy and the Expansion of the Universe

Keywords: Homogeneity and isotropism of the Universe; inflation; entropy; expansion of the Universe; gravity; entropy as a cosmological antipole balancing the gravity; entropy as a principle leading to expansion of the Universe; Big Bang; test tube trial; black hole.

Introduction

It is presently believed that, at scales of 10^{26}cm and more, the Universe is homogeneous (its matter is distributed evenly) and isotropic (uniform in all directions). The question is: "Why is there such homogeneity?" A candidate answer is: "Because an entropy process leads to homogeneity and isotropism."

Entropy is understood as a process leading to a greater disorder. For example, let us have a gas sealed in a test tube. This condition can be defined as a particular orderliness. When we open the tube, gas molecules drain out and they try to fill the entire space evenly, for example a room. This condition can be defined as a rise in disorderliness. In my personal opinion, the entropy is rather a process leading to a greater orderliness, which is the homogeneity of the universe. Other laws of physics, for example gravity, then undermine such homogeneity, and thus result in local inhomogeneity – stars and galaxies. This understanding of the entropy principles can lead to an explanation of expansion of the Universe: For the Universe to remain homogeneous at larger scales, the entropy must act as a force that balances the force of gravity, and this force then causes the expansion of the universe.

The Current Story of the Universe

The current belief is that in the earliest phases of the Universe development process (10^{-43} seconds after the Big Bang), a great inflation took place, where the Universe size was multiplied by a factor of 40 to 50 doublings. This is how the information, which was primarily concentrated in small dimension limited by so-called causal horizon (a spherical boundary that determinates an area where the information transfer and causal activity takes place), spreads out into space beyond the today's observable Universe. This is an explanation of homogeneity and isotropy of the universe, but there also rises a concept of pluralistic universe consisting of parts that originate from other areas within the causal horizon – these are areas that may have significantly different properties comparing to our universe and every other one. ([1], 120)

Entropy increase is presently understood as a process leading to greater disorder. For example, consider a gas sealed in a test tube. This condition can be defined as a particular orderliness. When we open the tube, gas molecules drain out, and they try to evenly fill the entire space available; for example, a room. This condition can be defined as a rise in disorder.

The New Idea

The quoted text made me come up with a speculation that Universe is homogeneous and isotropic because of some simple physical principle. In my personal opinion, entropy increase can also be viewed as a process leading to greater *order*liness: the homogeneity of the Universe. Other laws of physics, for example gravity, then undermine such homogeneity, and thus result in local inhomogeneity – stars and galaxies.

Continued on page 28

Quantum Gravity and the Titius-Bode Rule

Dr. Dezso Sarkadi
Research Center of Fundamental Physics
Vaci M. 8., Paks, H-7030, HUNGARY
e-mail dsarkadi@gmail.com

Today, in the areas of theoretical foundation and experimental verification, there is great interest in the properties of a future Quantum Gravity. The ultimate goal of the present research is to contribute to the creation of a definitive, universally acceptable, theory of Quantum Gravity. In the present paper, the two hundred and fifty years of history of the empirical Titius-Bode rule is investigated, under the assumption that this rule is key evidence for a quantum feature in the already long-known classical gravity.

Keywords: Titius-Bode rule, Bohr-Sommerfeld quantization, de Broglie matter wave, Quantum Gravity.

1. Introduction

Currently there is increased interest in the properties of Quantum Gravity, in order to establish its foundation in both theoretical and experimental areas. The currently favored Standard Model, which unifies the basic physical interactions into a single theoretical framework, does not contain the gravitational interaction. The root of this problem is the fact that the most advanced theory of gravity, Einstein's general relativity theory (GRT), cannot, either in vision, or in mathematical formulation, be reconciled with the philosophy of modern quantum mechanics (QM).

In recent decades, most attempts to unify gravity and the other fundamental physical interactions into a common theoretical description have been associated with the various attempts to increase the dimension of the well-known four-dimensional (relativistic) space-time. These so-called string theories and membrane theories use very complicated mathematical tools; in addition, the experimental support can seem hopeless, since its assumed effects appear in unobservably small space-time domains.

By simpler theoretical considerations, the quantum of the gravitational field, if it exists at all, is a spin-2, massless particle that would be called the 'graviton', by analogy with the photon. The direct detection of the graviton has so far been unavailable due to its estimated extremely low energy. It seems that in the other fields successfully used methods of QM and quantum field theories did not lead to breakthrough results. Over time, the recurring failures of these attempts incite us to approach the problem with completely different physical considerations.

About two hundred and fifty years ago, the so-called Titius-Bode rule (T-B rule) for the known planets was found. It describes the approximate distances of the planets from the Sun with an exponentially quantized function [1- 3]. The semi-major axes of the planets in astronomical unit are approximately:

$$a_n \cong 0.4 + 0.3 \cdot 2^n ; \; (n = -\infty, 0, 1, 2, \ldots) \quad . \qquad (1)$$

In the case of the innermost planet (Mercury) the exponent n is minus infinity (in this case the second term is zero), but for the other planets the second term in the formula includes non-negative exponents of integer values. Especially in the case of Earth, $n = 1$, and the formula gives a unit value for the Sun-Earth distance, according to the definition of the astronomical distance unit. For details, we find a lot of information on the Internet.

Table 1 gives the results of T-B rule calculations including the real and calculated planetary distances; the relative errors of the calculated values are shown as percentages. The standard deviation of the calculated distances is very high; it is about 33%.

Table 1. Demonstration of the Titius-Bode rule

planet	real distance	calculated distance	% error
Mercury	0.39	0.4	2.56
Venus	0.72	0.7	2.78
Earth	1	1	0
Mars	1.52	1.6	5.26
Ceres	2.77	2.8	1.08
Jupiter	5.2	5.2	0
Saturn	9.54	10	4.82
Uranus	19.2	19.6	2.08
Neptune	30.06	38.8	29.08
Pluto	39.44	77.2	95.74

The aim of the present work is a new, alternative physical interpretation of T-B rule, which would in the future be the starting point for a Quantum Gravity Theory.

Over the past centuries, and over in recent decades, a number of attempts have been made to decipher of the physical background of T-B rule. Unfortunately disturbing evidence exists that, for the moons of the planets in the Solar System, the T-B rule only partially or not at all satisfied in some cases, but the exponential distribution for distance seems to be their common property [4].

Physicists, astronomers cannot see any new physical law in the T-B rule, since the Solar System developed over billions of years trough chaotic, dissipative processes, a series of random mass collisions, which played a crucial role in the generation of the Solar System. However, some physicists accept the existence of some kind of regularity trends, which are interpreted as 'path resonances' [5]. In their view, this regularity is the direct consequence of the long gravitational couplings between the planets, which produced for the orbital radii simple rational fractions as: 1:2, 2:3, 2:5, *etc*.

Some physicists, including this author, think a deeper physical law lies behind the T-B rule. On the Internet, and in recognized astronomical journals as well, there are many scientific articles related to theoretical modeling of this mysterious behavior of planetary orbits. The present work tryies to explain the T-B rule with a proposed quantum property of the gravity. It should be noted that this author is not the first to combine gravity with macroscopic manifestations of QM; see [6-10].

2. The Exponential Approximation

Many authors conclude that the distribution of the distances of the planets around the Sun has the mathematical essence of a typical exponential distribution [11-13]. Those authors have tried to explain the situation by different physical theories, but no really reassuring and generally accepted theory exists today. The planetary system was formed over billions of years, and we all can agree that in this long time period random processes played a decisive role. However, this long period may also have allowed a presently unknown property of gravity to form the exponential distribution of the distances for the majority of planets and planet's moons, with limited accuracy of course. In this light, it is an obvious task to fit to the known planetary distances an exponential function, which in the recent past has also been realized in many other places. However, we cannot speak about a final canonized result in this respect.

In present work we have carried out the fitting procedure for the planetary distances of the Solar System, assuming the exponential distribution. Using the real distance data from **Table 1**., the obtained best result is:

$$a_n = a_0\alpha^n; \; (n = 1,2,3,\ldots 10) \quad , \tag{2.1}$$

where $n = 1$ belongs to the distance of the most inner planet Mercury (*i.e.* semi-major axis of the ellipse). The further planetary distances belong to the powers $n = 2,3,4,\ldots$ *etc.* The result of the math fitting is:

$$a_0 = 0.2108\ldots; \; \alpha = 1.7078\ldots; \; \sigma = 0.130\ldots = 13\% \quad . \tag{2.2}$$

It cannot be said that the obtained standard deviation σ is too large or too small, but if we insist that the exponential distribution cannot be a coincidence; the 13% standard deviation supports our belief.

Of course, additional examination has been carried out wherin we omitted from the calculation some 'irregular' planets. Regrettably, this way led to no significant improvement of the (2.1) exponential rule. Now we exemplify it with two calculations. In first example we omitted from the calculation Uranus and Neptune:

$$a_0 = 0.2211\ldots; \; \alpha = 1.6799\ldots; \; \sigma = 0.099\ldots = 9.9\% \quad . \tag{2.3}$$

In the second example, we omitted from the calculation five planets: Venus, Mars, Saturn, Uranus, and Neptune. The matching result is:

$$a_0 = 0.2207\ldots; \; \alpha = 1.6778\ldots; \; \sigma = 0.052\ldots = 5.2\% \quad . \tag{2.4}$$

The results obtained indicate that the constants a_0 and α did not change significantly by omitting of 'irregular' planets; however, the accuracy of the fitted exponential model improved noticeably. These facts ultimately contribute to our belief that behind the T-B rule, an unknown, but surely important, real physical law hides.

3. Refining the Titius-Bode Rule

The fitted exponential functions of the planetary distances described in the previous Section contain only one 'quantum number'. In this relation, however, an important question arises: Can there be such exponential functions with two or more quantum numbers which are capable of calculating planetary distances more accurately than the simple exponential formula (2.1)? The mathematical relevance of the question is whether we are able to discover such functions. The other side of this question is far more important; namely, whether there can be found such a multi-quantum-variable function, which, in one way or another, can be connected to a real or perceivably real physical explanation. On the Internet we have found this kind of functions for descriptions of planetary distances completed more or less with the analysis of the physical background; for example [14-17].

Regarding to the mathematical point of view, we recently found surprisingly good mathematical functions for the high precision description of planetary distances. Each of these has two quantum numbers, which we named as principal quantum number (n) and orbital quantum number (j) by analogy to the well-known quantum numbers of the hydrogen atom. The functions studied to date and considered successful for the quantized distance follow:

1. The first example of the distance function contains two fitting parameters:

$$a_n \cong a_0(\alpha^n + \alpha^j) \quad ; \quad n = 1,2,\ldots N; j = 0,1,\ldots N-1 \quad . \tag{3.1}$$

In the fitting procedure we have taken into account all the distance data from the **Table 1**. The obtained fitting parameters and the standard deviation of the model are:

$$a_0 = 0.143913\ldots; \; \alpha = 1.746846\ldots; \; \sigma = 0.0271\ldots = 2.71\% \quad . \tag{3.2}$$

To understand the above statement correctly, each planet's distance is assigned two quantum numbers that are specific to the given planet. This surprisingly simple formula, depending on only two fitting parameters, gives very good values for the real planetary distances. The only problem with this formula is that in the case $j = 0$, it does not return to the quantized exponential function (2.1) that we studied in the previous Section.

2. The second example of the distance function contains three fitting parameters (**Table 2**.):

$$a_n \cong a_0\alpha^n\beta^{-j}; \; (n = 1,2,\ldots N; j = 0,1,\ldots N-1) \quad . \tag{3.3}$$

It can be seen that in the case $j = 0$, this formula returns the tested exponential function (2.1) in the previous Section. The fitted result is also accurate for the planetary distances; the relative standard deviation is around 2.3%:

$$a_0 = 0.220153..., \ \alpha = 1.813371..., \\ \beta = 1.157176..., \ \sigma = 0.0228... = 2.28\% \quad . \tag{3.4}$$

Table 2. Generalization of T-B rule using the double quantum-numbered calculation model of (3.3).

planet	n	j	real distance	calculated distance	% error
Mercury	1	0	0.39	0.3992	2.36
Venus	2	0	0.72	0.7239	0.55
Earth	3	2	1	0.9804	−1.96
Mars	4	3	1.52	1.5363	1.07
Ceres	5	3	2.77	2.7859	0.57
Jupiter	6	3	5.2	5.0518	−2.85
Saturn	7	3	9.54	9.1608	−3.97
Uranus	8	2	19.2	19.2230	0.12
Neptune	9	3	30.06	30.1236	0.21
Pluto	10	5	39.44	40.7939	3.43

It is important to mention that this latter introduced distance function exactly corresponds to our newly established quantized model of gravity based on the old quantum theory of Bohr-Sommerfeld.

Remark: The fitting procedure of the above shown distance functions has been realized by the Monte-Carlo method. For calculating the standard deviation of the fitted planet distances, we used the usual method:

$$\sigma = \sqrt{\frac{1}{N-1}\sum_{n=1}^{N}\left[(a_n - a'_n)/a_n\right]^2} \quad . \tag{3.5}$$

In this formula the real planet distances are represented by a_n, the calculated planet distances are represented by a'_n, and finally N is the number of the planets have been involved in the calculation.

4. The 'Wave Nature' of the Matter

In the previous Section, the planet's distances were described by a double quantum-numbered formula that reminds us of the quantum mechanical model of the hydrogen atom. The simple fact that the planets occupy approximately exponentially quantized orbits around the Sun does not itself imply any genetic link to the Quantum Mechanics (QM). However, we are going to show that the exponential distribution of the planetary orbits intrinsically connected to the previous version of the QM; namely to the old quantum theory. This new recognition is indeed a possible scientific direction to a really solid foundation of the long-sought quantum theory of gravity. In the following we show that our unusual way leads to the surely real physical interpretation of the Titius-Bode law.

The starting point of the old quantum theory is known as Bohr-Sommerfeld (B-S) quantization theory [19-21]. In the B-S theory, the quantization of a closed physical system can be realized by the following rule:

$$S = \oint p_i dq_i = n_i h; \ (i = 1,2,3,...; \ n_i = 1,2,3,...) \quad , \tag{4.1}$$

where the p_i are the momentum components of the particles, q_i are the coordinates of the particles, i counts the number of degrees of freedom of the system, and h is Planck's constant. The quantum numbers n_i are positive integers, and the integral is taken over one period of the motion at constant energy (as described by the Hamiltonian). The integral S is an area in the so-called 'phase space', and has dimension of 'action', and is quantized in units of Planck's constant. For this reason, Planck's constant was often called *'elementary quantum of action'*.

The initial successes of the B-S theory fed high hopes for understanding quantum phenomena by using this theory. It successfully produced the known quantized energy levels of harmonic oscillator, and perhaps the most important result was the clarification of Bohr's atomic model. A little later, A. Sommerfeld developed a relativistic formulation for Bohr's model, also on the principle of the B-S quantization. The 'relativistic atom-model' led to the interpretation of the fine structure of the hydrogen spectrum, which remains appropriate up to today. At the same time, despite all efforts, the B-S quantization was not suitable for the description of spectra of two- or many-electron atoms. For the general solution we had to wait until the middle of the 1920's, the birth of QM.

The first real breakthrough in this field came in 1925, when appeared the epoch-making article of W. Heisenberg in which he gave a really operable mathematical background for the description of quantum phenomena. Heisenberg assigned infinite-dimensional matrices to the physical quantities (coordinates, momentums); hence, the name of his theory is matrix mechanics. In 1926, E. Schrödinger found another version of QM, which has been named wave mechanics. It was equivalent to the Heisenberg's matrix mechanics, as Schrödinger himself showed from the beginning. The basic idea of wave mechanics came from French physicist Louis de Broglie, who already in 1924 created the theory of electron waves, at that time without any remarkable scientific echo [22]. Today, de Broglie's concept of matter waves is fully accepted by the physicist's community.

De Broglie's idea of matter waves was based on the theory of relativity. In 1900 M. Planck showed that the most experimentally known laws of the thermal (black body) radiation can be interpreted only by quantized energy radiation:

$$E = h\nu \equiv \hbar\omega \quad . \tag{4.2}$$

Here h is Planck's constant, ν is the frequency of the thermal (electromagnetic) radiation, $\hbar = h/2\pi$ and $\omega = 2\pi\nu$. In relativity, the energy and the three components of momentum form a four-vector (c is the speed of light)

$$p_\mu = \left\{ E/c, p_x, p_y, p_z \right\} \quad . \tag{4.3}$$

Planck's law of thermal radiation ties frequency ω to the energy E according to (4.2), in this relation whether what physical quantities can be associated with the momentum components? In the relativity, the electromagnetic wave assigned to the *wave number four-vector* (shortly wave four-vector), which its first component is just equal to the frequency of the electromagnetic ponent is just equal to the frequency of the electromagnetic wave divided by the light speed:

$$k_\mu = \left\{ k_0 = \omega / c,\ k_x = 2\pi / \lambda_x,\ k_y = 2\pi / \lambda_y,\ k_z = 2\pi / \lambda_z \right\} \quad . \tag{4.4}$$

The λ 's are the directional components of the wavelength. The relativistic generalization of Planck's law by the above statements can be only the following (as was recognized by de Broglie):

$$p_\mu = \hbar k_\mu \quad . \tag{4.5}$$

The rest mass of the electromagnetic waves (the mass of photons) is zero; the four-momentum squared satisfies the following equation:

$$p_\mu p^\mu = \hbar^2 k_\mu k^\mu = 0 \quad . \tag{4.6}$$

De Broglie supposed that this equation must also be met for the rest massive particles, especially electrons. According to relativity, the above equation will change into the following form:

$$p_\mu p^\mu = \hbar^2 k_\mu k^\mu = m^2 c^4 \quad . \tag{4.7}$$

In this case this equation associates the mass with some kind of wave, which is called matter wave today. De Broglie's important outcome can be found in the majority of textbooks in a simplified form (this is the de Broglie wavelength):

$$\lambda = h / p = h / mv \quad , \tag{4.8}$$

where p is the momentum, m is the mass and v is the speed of the particle. A simple calculation can easily show that the wavelengths of the macroscopic bodies are unobservably short. However, in the case of the electron having very small mass, its matter wave can be detect with interference experiment [23].

5. The 'Wave-Gravity' Hypothesis

After the overwhelming success of the initial results of the obscured preliminary quantum theory, the Bohr-Sommerfeld (B-S) quantization rule remained only a curiosity of physics history. Understandably, de Broglie's theory of matter waves was not taken into account later in the obsolete B-S quantization method. However, this old quantization method is able to give a new, very interesting physical outcome. Continuing the use of relativistic notation, the B-S quantization of the matter waves can be written in the following simple form:

$$S = \oint p_\mu dx^\mu = \hbar \oint k_\mu dx^\mu = \sum_{\mu=0}^{3} n_{(\mu)} = nh;\ (n = 1,2,3,\ldots) \quad . \tag{5.1}$$

By this condition, the 'action integral' S associated to the matter wave can be only a whole-number multiple of the Planck's constant h. In the usual procedure of the B-S quantization the momentum components must express in function of the coordinates, the only remaining question is what the matter-wave vector dependence on the space-time coordinates is. It is important to note that both sides of Eq. (5.1) have *action dimension* (energy × time), so the *loop integral* can only be a dimensionless quantity. Clearly, the simplest choice of the matter-wave vector satisfying the (5.1) condition is the following:

$$k_\mu \Rightarrow 2\pi \left\{ 1/x_0,\ 1/x_1,\ 1/x_2,\ 1/x_3 \right\} \quad , \tag{5.2}$$

where the space-time four-vector usually has the form:

$$x_\mu = \left\{ x_0,\ x_1,\ x_2,\ x_3 \right\} = \left\{ ct,\ x,\ y,\ z \right\} \quad . \tag{5.3}$$

Using the above definitions, the B-S quantization condition can be written:

$$\begin{aligned} S &= \hbar \oint k_\mu dx^\mu = h \oint dx_\mu / x_\mu \\ &= h \sum_{\mu=0}^{3} n_{(\mu)} = nh;\ (n = 1,2,3,\ldots) \quad . \end{aligned} \tag{5.4}$$

Surprisingly, Planck's constant with its microscopic property 'vanishes' from the relativistic B-S quantization, so its dominant role in the atomic, molecular, nuclear, particle, *etc*., physics, here becomes irrelevant. In this situation, we shall use the B-S quantization rule for macroscopic physical system in the following format:

$$S = D_{(\mu)} \oint dx_\mu / x_\mu = C \sum_{\mu=0}^{3} n_{(\mu)} = Cn > 0;\ (n = 1,2,3,\ldots) \quad , \tag{5.5}$$

where C is an 'action' dimensioned, but as yet unknown, constant having only positive value. Applying the usual space-time metric, this condition can be written:

$$\begin{aligned} S = S_T + S_R = D_{(0)} \oint dx_0 / x_0 \, - \\ D_{(a)} \sum_{a=1}^{3} \oint dx_a / x_a = C_n > 0\ (n = 1 \text{ to } \infty) \quad . \end{aligned} \tag{5.6}$$

This quantum condition is equivalent to the following two conditions:

$$S_T = D_{(0)} \oint dx_0 / x_0 = Cn \quad , \quad (n = n_{(0)} = 1,2,3,..) \quad ; \tag{5.6a}$$

$$\begin{aligned} S_R &= -D_{(a)} \sum_{a=1}^{3} \oint dx_a / x_a \\ &= -C \sum_{a=1}^{3} n_{(a)} \equiv -Cj \quad (j = 0 \text{ to } n-1) \quad . \end{aligned} \tag{5.6b}$$

The requirement for the j quantum variable in (5.6b) assures that the action S in (5.6) will be positive in all circumstances. Firstly we investigate the time-component (5.6a). The loop integral in this case means that the movement is periodical with finite periods

$$S_T = D_T \oint dx_0 / x_0 \equiv D_T \int_{T_0}^{T} \frac{dt}{t} = C_n \quad (n = 1 \text{ to } \infty,\ D_T \equiv D_{(0)}) \quad . \tag{5.7}$$

It is useful to replace the time variable for the distance variable with the help of a simple integral transformation. Supposing that the velocity of the matter wave is equal to a constant v, we can introduce new variables:

$$R_0 = vT_0 \quad ; \quad R_A = vT \quad ; \quad dt = dr / v \quad ; \quad 1/t = v/r \quad . \tag{5.8}$$

This leads to a quantum condition equivalent to (5.7):

$$S_T = D_T \int_{T_0}^{T} \frac{dt}{t} = D_T \int_{R_0}^{R_A} \frac{dr}{r} = C_n \quad , \ (n = 1 \text{ to } \infty) \quad . \qquad (5.9)$$

It is important to mention the transformed integral does not depend on the velocity of the matter wave. On the other hand, knowing that the T-B rule is related to the gravitational central-force Solar System, we can suppose the spatial quantum condition (5.6b) depends on only the radial distance from the gravitational center:

$$S_R = D_{(a)} \sum_{a=1}^{3} \oint \frac{dx_a}{x_a} = D_R \int_{R_0}^{R_B} \frac{dr}{r} = C_j \ \ (j = 0,1,2,...,n-1) \ . (5.10)$$

Based on the above, the total macroscopic action integral will be

$$S = D_T \int_{R_0}^{R_A} dr / r - D_R \int_{R_0}^{R_B} dr / r = C(n-j) > 0 \ (n = 1 \text{ to } \infty, \ j = 0 \text{ to } n-1) \quad . \qquad (5.11)$$

Using $$C_T = C / D_T \quad , \quad C_R = C / D_R \quad , \qquad (5.12)$$

the (5.11) quantum condition takes the simple form:

$$\int_{R_0}^{R_A} dr / r - \int_{R_0}^{R_B} dr / r = C_T n - C_R j > 0 \qquad (5.13)$$

for $n = 1$ to ∞, $j = 0$ to $n-1$ The Evaluation leads to:

$$\ln(R_A / R_B) = C_T n - C_R j > 0 \ (n = 1,2,.., \ j = 0,1,..,n-1) \ . \qquad (5.14)$$

This is equivalent to the following exponential form:

$$R_A = R_B \exp(C_T n - C_R j) = R \ , \ \alpha^n \beta^{-j} \alpha^n = \exp(C_T n) \quad ; \quad \beta^{-j} = \exp(-C_R j) \ , \ (n = 1,2,.., \ j = 0,1,..,n-1) \quad . \qquad (5.15)$$

This final result in case $j = 0$ is the same as we have gotten empirically for the planet's distances in (2.1):

$$a_n = a_0 \alpha^n \quad , \quad (a_n \equiv R_A; \ a_0 = R_B; \ n = 1,2,...) \quad . \qquad (5.16)$$

The entire (5.15) formula is the same as the double quantum-numbered planet distance function that we presented in Sect. 3 with the formula (3.3):

$$a_n = a_0 \alpha^n \beta^{-j} \quad ; \quad (a_n \equiv R_A; \ a_0 = R_B; \ n = 1,2,3,..; \ j = 0,1,2,...,n-1) \quad . \qquad (5.17)$$

With this simple approach we have successfully given the real physical background of the exponential distance distribution of the planets of our Sun System. This solution is based on the old Bohr-Sommerfeld quantum theory. The calculation of the planet's orbits remained on the level of classic mechanics applying gravitational theory of Newton. Nevertheless, our model seems to be more than the classical physics, and may be a first step for the future foundation of the long hoped quantum gravity theory. Having regard to the fact that the essence of our introduced model is closely linked to the de Broglie matter wave theory, we have named our new model 'Wave-Gravitational Theory' (WGT). This term emphasizes that our model is far from the original Quantum Mechanics as known today. At this level, there is no sense to introduce the basic concepts of the QM; however, some initiative exists to do this, for example in [15].

6. Summary

This study has given the Titius-Bode rule a possible physical interpretation that can in the future be a starting point for a final quantum gravity theory. The basis for the presented theory is the relativistic extension of the old Bohr-Sommerfeld quantization. We have involved the well-known matter wave theory of de Broglie for the imposition of the B-S quantum condition; namely, joining the momentum four-vector with the matter wave four-vector. From this simple quantum condition, not surprisingly, the Planck's constant has been eliminated. This fact opens up the possibility for the extension of this quantization method to macroscopic physical systems, especially the Solar System. By this method we have obtained the *allowed orbits* of planets, which have been experienced very much earlier and remained to date an unsolvable mystery named as Titius-Bode rule. We have called this new theoretical construction by short name 'Wave-Gravitational Theory' (WGT), which basically remained on the foundation of classical mechanics. The undeniable simplicity and accuracy of WGT is surprising.

In recent years, in the newly explored 'exosolar systems 'contain 'exoplanets', which also exhibit exponential orbit distributions [24-29]. All the results of this study and the recently observed orbital-distributions of the exoplanets further strengthen our belief in the true physical origin of the T-B rule.

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Entropy and the Expansion of the Universe (from p. 22)

The New Idea

The quoted text made me come up with a speculation that Universe is homogeneous and isotropic because of some simple physical principle. In my personal opinion, entropy increase can also be viewed as a process leading to greater *order*liness: the homogeneity of the Universe. Other laws of physics, for example gravity, then undermine such homogeneity, and thus result in local inhomogeneity – stars and galaxies.

This interpretation of the entropy principles can lead to an explanation of expansion of the Universe: For the Universe to remain homogeneous in larger scales, the entropy must be demonstrated as a force that balances the force of gravity and this force then causes the expansion of the universe.

Note: I have received some objections that the homogeneity of the Universe came into existence due to inflation. The word 'inflation' refers to a process of so-called large inflation of the Universe in its early stages of formation – see the above quoted text. However, in my opinion the inflation was a consequence of the expansion of the universe, which was caused by the entropy process after the Big Bang. I further try to explain the Big Bang in terms of entropy principle.

After all, it is not that important to know, which of the principles leads to a homogeneity of the Universe. For the Universe to remain homogeneous in larger scales, this principle must be seen as a force that balances the force of gravity and this force then causes the expansion of the universe. Expansion of the universe is thus explained as a principle leading to homogeneity of the universe. And the principle leading to the homogeneity of the universe is in my opinion entropy.

In the text above, I have explained the entropy on an example of a tube with a sealed gas. The moment of opening the tube is the Big Bang. Considering the explanation of Big Bang in terms of entropy principle, we can assume that it was induced by environmental unbalance that began to equate (the test tube was opened). The Big Bang is therefore a moment in which, due to entropy, the environment began to equate.

In my opinion that there are two energies in the Universe, acting in an opposite manner: Entropy that leads to a universal homogeneity; and gravity, that collapses everything to a point. ***Entropy balances gravity***. It associates my idea that the mass of the black hole absorbs the matter from the ambient space only to a certain mass, after which the gravity cannot sustain the entropy and the black hole explodes. Alternatively, the Universe may end up in a singularity, wherein the gravity cannot sustain the entropy, thus causing an explosion - a new Big Bang.

A Testable Prediction

If the expansion of the Universe results from the principle of entropy, then gas molecules, after their container is opened, should behave like the galaxies within the Universe – the further they are from each other the faster they fly apart. When we reverse the process of entropy, we get to the phenomenon of gravity. We can explain it again using the example of the gas tube:

* The more molecules of gas are enclosed in a tube, the fiercer they explode into the space after the opening of the tube. It is vice versa as for the gravity: the more mass an object has, the more attractive it is.

• More distant molecules of the gas should draw apart quicker during the entropy. It is *vice versa* for gravity: closer molecules should be moving quicker to each other and attract each other.

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Pavol Dančanin
Trencianska Tepla, SNP 443/21, 914 01, SLOVAKIA
e-mail dancanin@gmail.com

Galilean *vs*. Lorentz Transformation

M. Korneva, V. Kuligin, G. Kuligina
Department of Physics, Voronezh State University, Universitetskaya Sq. 1, Voronezh, 394006, RUSSIA
e-mail victor_kuligin@mail.ru

This paper shows that there exists a Galilean parametrical transformation that keeps light speed invariant in any inertial frames. Relativistic effects are considered. For $V << c$, the Galilean parametrical transformation and the Lorentz transformation yield identical results accurate to $(V/c)^2$ **Key words**: Galilean transformation, Lorentz transformation, relativity; PACS numbers: 03.30.+p

1. Introduction

In [1] we have given a new interpretation of Lorentz transformation. This new explanation was preceded by long search of various transformations. In the present article, we continue this work. We will show that there is a Galilean parametrical transformation of the wave equation. This transformation conserves light speed as an invariant in all inertial frames.

Lorentz transformation and Galilean transformation use the identical model for explanation of the phenomena. This model is in detail described in [1]. Existing distinctions have a quantitative character. Therefore, we won't explain the phenomena in detail. It is important to us to show the similarity of, and distinction between, these models.

2. The Standard Galilean Transformation

Let K_0 be an inertial frame in which point source S is based. This source S generates potential U. The source potential is described by the wave equation:

$$\partial^2U/\partial x_0^2+\partial U^2/\partial y_0^2+\partial U^2/\partial z_0^2-\frac{1}{c^2}\partial^2U/\partial t_0^2=-q(t_0)\delta(\mathbf{R}_0)/\varepsilon \qquad (2.1)$$

The 4-coordinate x_0, y_0, z_0, ct_0 are independent of each other. Generally q in the right side of Eq. (2.1) can depend on t.

Now we consider coordinates of another inertial frame K that moves with respect to frame K_0. In the new frame of the observer, 4-coordinates (x, y, z, ct) are also independent of each other.

Both frames move relative to each other, and they are connected by the standard Galilean transformation:

$$x_0=x-Vt \quad , \quad y_0=y \quad , \quad z_0=z \quad , \quad ct_0=ct \quad . \qquad (2.2)$$

From Eq. (2.2) it follows that x_0 depends on t. Thus we have the well-known result of transformation of Eq. (2.1):

$$\begin{gathered}(1-V^2/c^2)\partial^2U/\partial x^2+\partial U^2/\partial y^2+\partial U^2/\partial z^2\\ -\frac{1}{c^2}\partial^2U/\partial t^2+2\frac{V}{c^2}\partial^2U/\partial x\partial t=-q(t)\delta(\mathbf{R}-\mathbf{V}t)/\varepsilon \quad .\end{gathered} \qquad (2.3)$$

Let us illustrate the process of wave propagation under a traditional Galilean transformation. Let the source be based in frame K_0. The source radiates a light pulse through regular time intervals. We will see concentric spherical surfaces. The spherical radius increases proportionally time $R_n = ct_n$; R_n is the radius of the sphere radiated at time t_k.

The source moves in frame K with a speed V concerning the observer. The observer will see a set of extending concentric spheres. These spheres move relatively the observer. The general centre of these spheres moves with speed V as is shown in Fig. 1.

The situation represented on Fig. 1 can be similar to an explosion. During the initial moment the point source has blown up, and certain particles extensively scatter with a light velocity from it. In frame of observer N the extending spherical front and the explosion centre synchronously move relatively observer N with a speed V. Speed of wave front of a wave depends on a direction of propagation. The speed is determined by the vector sum of the velocity of light $\mathbf{c}$ and veclocity $\mathbf{V}$.

The situation represented on Fig. 1 can be similar to an explosion. At the initial moment, the point source blew up, and particles emerged from it at light speed. In the frame of observer N, the extending spherical front and the explosion center synchronously move relative to observer N with a speed V. The speed of a wave front depends on the direction of propagation. The speed is determined by the vector sum of the velocity of light $\mathbf{c}$ and the veclocity $\mathbf{V}$.

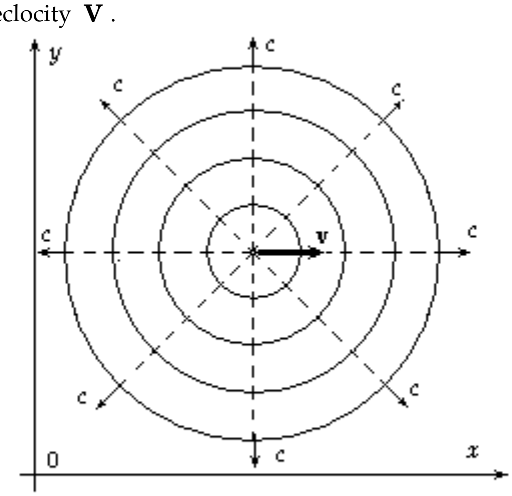

Figure 1. Spherical wavefronts in the source rest frame.

3. The Galilean Parametric Transformation

We return to the same problem. We will consider the transformation in detail, as scientists "have not found" it. There is a transformation that describes displacement of one axis of coordinates concerning another; for instance, $x' = x + a$. The other three independent variables of two inertial frames are connected through other relations:

$$y = y' \quad , \quad z = z' \quad , \quad t = t' \quad . \tag{3.1}$$

These are identities.

These variables do not depend on transformation. Here the number a is the parameter of displacement of the axis x' along the x axis. Changes are absent if a depends on t: $x' = x - a(t)$. So now we consider the unity of time in the compared frames and unity of co-ordinates y and z also. As it has been said, co-ordinates y, z, and time t in the two frames are identical. We have the formal right to write down Eq. (1.1) in the new frame of the observer:

$$\nabla^2 U - \frac{1}{c^2}\partial^2 U\big/\partial t^2 = \frac{1}{\varepsilon} - q(t)\delta(\mathbf{R}_0) \quad . \tag{3.2}$$

We should carry out transformation only on variable x: $x' = x - a(t)$. Let $a(t) = Vt$. Here a product Vt acts as parameter of translation that is independent of x and x'. Partial derivatives of potential with respect to x are now calculated simply enough.

$$\frac{\partial U}{\partial x'} = (\partial U / \partial x)\frac{\partial x}{\partial x'} = \partial U / \partial x \ , \ \partial^2 U\big/\partial (x')^2 = \partial^2 U\big/\partial x^2 \quad . \quad ((3.3)$$

Thus in the new inertial frame, Eq. (1.1) assumes the definitive form:

$$\nabla^2 U - \frac{1}{c^2}\partial^2 U\big/\partial t^2 - q(t)\delta(\mathbf{R} - \mathbf{V}t) / \varepsilon \quad . \tag{3.4}$$

We repeat that it is not necessary to transform times to other coordinates. We have shown that the unity of time in all inertial frames guarantees an invariance of the wave equation. It is necessary to illustrate this unexpected result.

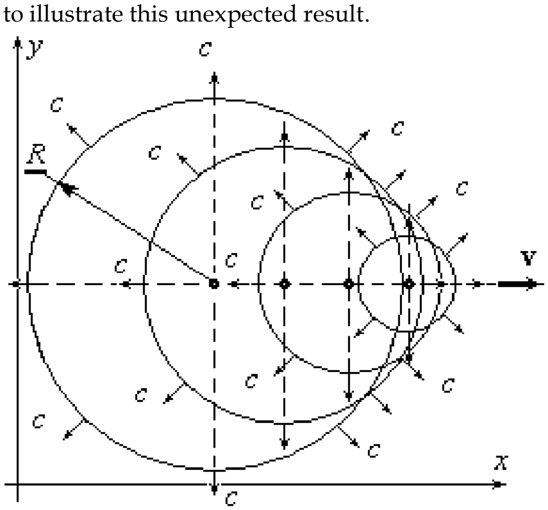

Figure 2. Wavefronts propagated from a source moving at $V > c$.

As in the previous case, let there be a point source that radiates short light pulses at regular time intervals, as shown in Fig. 2. If the observer is based in the source frame, then the picture of the process will be just the same as in standard Galilean transformation. Obviously, standard transformation and parametrical transformation describe different models of wave propagation.

4. Phenomena with Parametric Transformations

Galilean parametrical transformation does not change relative distances upon transition of the observer from one inertial frame to another. Angles between vectors also remain unchanged.

Time t is a transformation parameter. Therefore, observable time intervals change upon transition. Observable 'changes' of parameters in frame of observer N in relation to the same parameters in frame of source S belong to a category of the phenomena. These phenomena are caused by distortions because of finite light speed.

4.1 The Frame of the Moving Observer

For the analysis, we can use the obvious geometrical method that allows discovery of physical meaning. We denote the sizes measured by the observer by an index zero. Sizes calculated by the observer have no index.

We write the equations that connect the sizes of different inertial frames when velocity $\mathbf{V}$ is constant:

$$\mathbf{R}_0 = \mathbf{R} - \mathbf{V}t \quad . \tag{4.1.1}$$

Expression (4.1.1) is the equation of spatial connection between two inertial frames. Sizes measured by the rest observer have no index (R, Θ, δ, *etc.*). We will designate by index zero the calculated sizes for the source frame: (R_0, Θ_0, δ_0, *etc.*).

Geometrical connections are shown on Fig. 3 (left side).

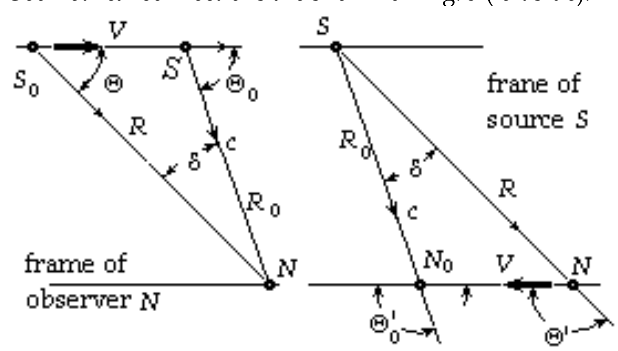

Figure 3. Geometrical relationship between two frames.

We write the equations in the expanded form for the frame of the observer (Fig. 3).

$$R\cos\Theta = R_0\cos\Theta_0 + VT_0,\ T_0 = R_0 / c,\ R\sin\Theta = R_0\sin\Theta_0 \quad . \tag{4.1.2}$$

The following proportions can be found from (4.1.2):

$$\sin\Theta = \sin\Theta_0\Big/\sqrt{1 + 2(V/c)\cos\Theta_0 + (V/c)^2} \quad ;$$
$$\cos\Theta = \left(\cos\Theta_0 + V/c\right)\Big/\sqrt{1 + 2(V/c)\cos\Theta_0 + (V/c)^2} \quad ; \tag{4.1.3}$$

$$\cos\Theta_0 = -(V/c)\sin^2\Theta + \cos\Theta\sqrt{1 - (V/c)\sin^2\Theta} \quad ; \tag{4.1.4}$$

$$\sin\Theta_0 = \left[(V/c)\cos\Theta + \sqrt{1 - (V/c)^2\sin^2\Theta}\right]\sin\Theta \quad . \tag{4.1.5}$$

Expressions (4.4) and (4.5) are limited by the inequalities

$$-\arcsin(V/c) \le \Theta \le \arcsin(V/c) \quad .$$

Here we will consider the phenomena only for speeds $V < c$. The factor of distortion of the parametrical transformation is

$$n_g = \sin\Theta \big/ \sin\Theta_0 = 1\Big/\sqrt{1+2(V/c)\cos\Theta_0 + (V/c)^2} = \\ = 1\Big/\left[(V/c)\cos\Theta + \sqrt{1-(V/c)^2\sin^2\Theta}\right] \quad . \tag{4.1.6}$$

The basic quantities are connected by this factor, as in Lorentz transformation:

$$R/R_0 = f/f_0 = 1/n_g \quad ,$$

where R_0 is the distance between source S and observer N at the time of reception t_{rec} and f_0 is source frequency.

The critical angle of observation is

$$\Theta_{\text{cr}} = \arccos(V/2c) \quad . \tag{4.1.7}$$

The aberration angle δ is defined by relationship

$$\tan\delta = (V/c)\sin\Theta_0 \Big/ \left[1-(V/c)\cos\Theta_0\right] \quad . \tag{4.1.8}$$

4.2 Frame of the Source

Galilean transformation (4.1.1) keeps equality of triangles. Triangles SS_0N (Fig. 3) and SNN_0 (Fig. 3) are equal to each other. This transformation turns a triangle through angle 180^0. However orientation vector $\mathbf{V}$ is changed as is shown in Fig. 3 (the right triangle). To write the equations it is necessary to make changes. The angle Θ is replaced by $\Theta' = \pi - \Theta$; the angle Θ_0 is replaced by $\Theta_0' = \pi - \Theta_0$.

Now we have the following equations

$$R\cos\Theta' = R_0\cos\Theta_0' - VT_0 \;,\; T_0 = \frac{R_0}{c} \;,\; R\sin\Theta' = R_0\sin\Theta_0' \quad . \tag{4.2.1}$$

Obviously expressions (4.2.1) coincide with expressions (4.1.2). We have, respectively, the same consequences. The same situation occurs for Lorentz transformation.

5. Comparison Between Transformations

Now we can compare results of Galilean parametrical transformation and Lorentz transformation. We compare data of source frame S in both transformations in the source frame. The data are given in Table 1.

Table 1. Comparison Between Candidate Transformations.

Phenomenon:	Galilean Parametrical Transformation:	Lorentz Transformation, new Interpretation:
distortion factor	$n_g = 1\Big/\left[(V/c)\cos\Theta + \sqrt{1-(V/c)^2\sin^2\Theta}\right]$	$n_f = -(V/c)\cos\Theta + \sqrt{1+(V/c)^2}$
approximate expression	$n_g \approx 1-(V/c)\cos\Theta$	$n_f \approx 1-(V/c)\cos\Theta$
distortion of observed distance	$R = R_0/n_g$	$R = R_0/n_f$
Doppler effect	$\omega = \omega_0/n_g$	$\omega = \omega_0/n_f$
tranverse Doppler effect	$\omega = \omega_0\sqrt{1-(V/c)^2}$	$\omega = \omega_0/\sqrt{1+(V/c)^2}$
critical angle	$\Theta_{\text{cr}} = \arccos(V/2c)$	$\Theta_{\text{cr}} = \arccos\left\{\left[\sqrt{1+(V/c)^2}-1\right]\Big/(V/c)\right\}$

This Table shows that results are qualitatively similar. Results of Lorentz transformation and Galilean parametrical transformation coincide for $V < c$. The coincidence helps to give correct explanations of the phenomena within the limits of Lorentz transformation.

6. Generalizations and Problems

6.1 Curvilinear Movement

Parametrical character of transformation allows generalizing this transformation for any moving.

$$\mathbf{R}' = \mathbf{R}(t) = \mathbf{R}_0(t) - \mathbf{a}(t) \quad , \tag{6.1.1}$$

where $\mathbf{a}(t)$ is some vector with time dependence.

6.2 Relationship between Distances

Now we discuss a source traveling in the inertial frame of the observer (Fig. 4).

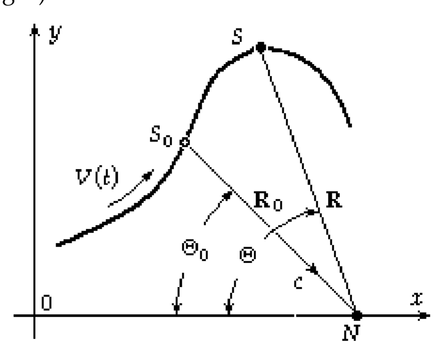

Figure 4. Curvilinear motion of the light source.

Light source S moves on a unique trajectory. Distances $R(t)$ and $R_0(t)$ connect observer N with a real light source S and virtual light source S_0 at the same time. For $V < c$ we can therefore write the relationship

$$\mathbf{R}(t) = \mathbf{R}_0\left(t + R_0(t)/c\right) \quad . \tag{6.2.1}$$

Expression (6.2.1) is exact for $V < c$. Expression (6.2.1) implies:

$$\cos\delta = \mathbf{R}(t)\cdot\mathbf{R}_0(t)/R(t)R_0(t) \quad , \quad n_g = R(t)/R_0(t) \quad . \tag{6.2.2}$$

Expression (6.2.2) is important for astronomical calculations. For example, if we have measured movement of planet $\mathbf{R}_0(t)$ experimentally, we can calculate real movement $\mathbf{R}(t)$ in its orbit.

6.3 Common Situation

For $V < c$, parametrical transformation of spatial vectors does not touch time t. Therefore, we can make a second extension that extends the parametrical transformation for rotary motion.

$$x'_\alpha = b_{\alpha\beta}(t)x_\beta - a_\alpha(t) \quad , \det|b_{\alpha\beta}| = 1 \quad , \tag{6.3.1}$$

where $b_{\alpha\beta}(t)$ is a rotation matrix; $\alpha,\beta = 1,\ 2,\ 3$. Notice that partial derivatives are calculated in the standard way without time [see expression (3.3)]. More-over, parametrical transformation does not change vector lengths, like R, and keeps invariant angle between vectors, like that between $\mathbf{R}(t)$ and $\mathbf{R}_0(t)$. Lorentz transformation has problems. Article [1] shows that standard Lorentz transformation can be used only if $\mathbf{V}$ is constant. We should study special transformations of the Lorentz type for each curvilinear trajectory.

For $V > c$, an interesting phenomenon occurs. The speed of the light source exceeds the speed of light. There is formed a conic envelope of wave front (see Fig. 2). If the wave front has not reached the observation point, the observer cannot see the light source. At the moment of contact to the conic wave front, the observer will see the virtual image of the source emerge from 'nothing'. The further description corresponds to the phenomena qualitatively described earlier. Such phenomena should be considered specially.

7. Discussion

So we have considered Galilean parametrical transformation. Maxwell's equations keep their form at transition of the observer from one inertial frame to another. The speed of light is invariant in all inertial frames. Galilean parametrical transformation is an alternative to Lorentz transformation. Experiments are necessary to make the correct choice. We want to note the qualitative similarity of explanations within the limits of these transformations. The common space for all inertial frames is Euclidean, and time is unique. However we don't reject parametrical transformation, even if experiment will support Lorentz transformation. First of all, the mathematical formalism allows us to explain the physical phenomena easily. We can use it for a qualitative explanation of Lorentz transformations at $V < c$. Secondly, quantitative results of both transformations coincide for $V < c$. Here parametrical transformation can be used as an approximation of Lorentz transformation. The new interpretation of all relativistic phenomena will lead to an audit of modern mechanics, electrodynamics and astronomy. This is an extensive work.

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CBR – Evidence of a 'Liquid' Phase of Aether?

Some of traditional thermodynamics invites a new understanding in terms of an 'aether' similar to more familiar substances that have various phases. Suppose that aether can be viewed as similar to an ideal gas. Call it aether-1, to distinguish it from another form, aether-2, whose particles rotate, and create the particles of aether-1.

We have already calculated the transition temperature, the heat, and the entropy under which aether-1 changes its gas-like phase and comes into phase of 'super-heated vapor', or better to say into the plasma phase. This phase transition in particular explains the Purcell-Pound's experiment [1], in which particle spin reverses in a magnetic field under very high temperature.
An earlier supposition about negative temperature was adopted to explain this fact. The point is that phase transition takes place in this case: aether gas transitions into an oversaturated form in which entropy dependence on temperature changes, as it occurs for water and vapor for instance.

The qualities of background radiation detected by Penzias and Wilson [2] leads to the conclusion that there exists a minimum temperature under which calorie decreasing leads to entropy decreasing and transition of gas-like aether into a liquid-like phase. This note is devoted to consideration of this problem.

2. Aether Phase Transition

Previously we came to the conclusion that gas-like aether into oversaturated phase when

$$T_0 = 3.67\times10^{-5}\ \mathrm{m}^2/\mathrm{s} = 1.89\times1.89\times10^{-9} \quad . \tag{1}$$

The temperature (1) corresponds to

$$\omega_0 = 7.8\times10^{20}\ \mathrm{rad/s} \quad . \tag{2}$$

The entropy at this point is

$$S_0 = 2.12\times10^{25}\ \mathrm{rad/m}^2 = 9.9\times10^{-24}\mathrm{cal/K} \quad . \tag{3}$$

Equalities (1)–(3) characterize the gas-like aether particle at the moment of transition into 'plasma' or 'oversaturated' phase. These terms are conditional and should not mislead the reader. Aether plasma and used down liquid-like states can essentially differ from traditional plasma and liquid.

Continued on page 36

Hypothesis of Relativistic Inertial Force

Pavol Dančanin
Trencianska Tepla, SNP 443/21, 914 01, SLOVAKIA
e-mail dancanin@gmail.com

This paper is a follow-up to the article [1], where I proposed that SRT be understood in relation to the gravitation of a black hole. Here, I postulate the equivalence principle: A frame moving at speed c should be equivalent to a frame persisting on the event horizon of a black hole (Theorem 1). At speed c, the body would be in a frame equivalent to the event horizon of a black hole, *i.e.* in a non-inertial frame. 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?

Keywords: black hole; light (electromagnetic) wave; speed c; equivalence principles; relativistic inertial force; force of gravity; inertial / non-inertial frame; the first and the second assumption of my hypothesis; classical mechanics; special theory of relativity; co-moving inertial frame.

Introduction

In the companion paper [1], I proposed that Special Relativity Theory (SRT) be understood in relation to the gravitation of a black hole. In the present paper I will place the electromagnetic wave on the event horizon of a black hole, and investigate its relationship to two bodies falling into the black hole, which move inertially with respect to each other in the direction of their fall. Consider the body A to be at rest and the body B moving with respect to the body A in the direction directly opposite to the direction of the fall. For the purpose of simplification, assume the gravitational field to be homogeneous, meaning that the gravitational pull does not grow with the fall of the bodies below the event horizon of the black hole.

The advantage of this view is that we can explain why the body B (material particle) cannot continue to move inertially at speed c. In order for it to move at speed c, we would have to maintain it on the event horizon of the black hole, together with the captured electromagnetic wave, and this is not possible without supplying energy! If we supplied body B with energy, by which we would maintain it on the event horizon of the black hole, it would be affected by gravitational force on the event horizon of the black hole, otherwise known as **Relativistic Inertial Force (RIF)**, which affects it at speed c (See Theorem 2 in [1]).

At speed c, body B would persist on the event horizon, ergo, in a non-inertial frame. 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 problem is addressed next.

A certain solution would be the effects of RIF also at speeds lower than speed c. Between bodies A and B, which move inertially with respect to each other in the direction of the fall, there should be an effect of an RIF, which would slow down their mutual motion. In the case of speed c, the following is evident: If the body B moves with respect to the body A at speed c (it would persist together with an electromagnetic wave on the event horizon), in the direction against the motion, it would be subject to an RIF equivalent to the gravitational force on the event horizon of the black hole. However, according to this hypothesis, RIF should have an effect between two bodies moving inertially with respect to each other, even at speeds lower than c, and should be proportional to their mutual velocity based on the relationships of Lorentz Transformations [See Note 1] in such a way that at zero speed it would be zero, and at speed c it would be equal to the gravitational force on the event horizon of the black hole. It can be explained in our example: When body B is calm in relation to body A, there is no force in effect between them. However, when body B begins moving in respect to body A in the direction against the fall at a certain speed (but not accelerated, since a classic inertial force is active at that time), then theoretically in the direction against the free fall RIF begins to have an effect on it, which is at apeed c is equivalent to the gravitational force on the event horizon of the black hole

The Hypothesis of RIF (HRIF) leads to two Predictions:

1) The frame associated with the electromagnetic wave - moving at speed c is equivalent to the frame persisting on the event horizon of the black hole, meaning that in this frame is in effect an RIF equivalent to the gravitational force on the event horizon of the black hole. (Note: The first expectations are Theorem 1, Theorem 2 and Theorem 3 in [1].

2) The RIF will also have an effect at speeds lower than c.

To make the things a little bit clearer:

1) According to the First Assumption, keeping a material body at speed c in view of the inertial (reference) frame is not possible without supplying energy – the material particle must be supplied constantly with energy, with which we would maintain it on the event horizon of the black hole.

2) According to the Second Assumption, keeping a material body at a speed lower than c with respect to the inertial frame is not possible without supplying energy – the material particle must be supplied constantly with energy, with which we would maintain it at a constant speed.

In case the second Assumption holds true and the RIF is in effect between the bodies moving inertially in respect to each other even at speeds lower than c, we cannot still determine which body is moving and which remains at rest; *i.e.*, the relativity principle [See Note 2] remains in force, albeit in a slightly modified form:

Theorem 1 – The new Relativity Principle:

Between the two material bodies moving with respect to each other in an inertial manner (*i.e.*, without any supply or action of energy) there is the RIF acting on the said bodies in the direction against their motion that is proportional to their relative speed, according to Lorentz transformations, which at speed c is equal to the gravitational force at the event horizon of a black hole. This force slows down the relative inertial motion of the two bodies but it is impossible to determine which of the two bodies is moving and which is at rest.

The manifestations of the RIF are described in:

Theorem 2 – Manifestations of the RIF: The RIF acting upon the two material bodies moving with respect to each other should manifest itself in the following ways:

2.1 By slowing of mutual inertial motion of material bodies: a particle moving in the inertial manner with respect to the inertial **frame should keep losing its energy due to the effect of the RIF** and its velocity should keep decreasing.

2.2 At constant velocity of a material body, *e.g.* at the rectilinear uniform motion with respect to an inertial frame, the RIF should manifest itself as its weight acting against the direction of motion; which should be proportional to its velocity according to the Lorentz transformations and at speed c it should be equivalent to the weight of the body in question positioned at the event horizon of a black hole. Therefore, to keep a material body moving at a constant velocity with respect to an inertial frame, certain energy should be exerted to compensate its weight.

The mechanism of the action of the RIF is elucidated by the following example: The car moves inertially along the road at velocity of 100 km/h and inside the car a lamp is turned on. From the point of view of the frame at rest both the car and the light inside the car are subject to the action of the RIF that slows down the car and reduces the energy of light along the direction of the motion. Therefore, light in a frame at rest, with respect to the road, propagates not at the speed $c+v$, but only at speed c. However, as the action of the RIF is ***universal*** – it acts, from the point of view of the frame at rest, equally on the light to which it reduces its energy in direction of motion of the car as well as on the car itself by reducing its energy and slowing down its motion – inside the frame in motion (inside the car) the light propagates normally, just as in the frame at rest. If the car moves, due to supply of energy, at a uniform velocity with respect to the road, the RIF would manifest itself inside the frame in motion, *i.e.* inside the car. (Fig. 1)

The validity of the second assumption of the HRIF – the action of the RIF between the bodies moving inertially with respect to each other at a speed lower than speed c contradicts the law of inertia standing at the very foundations of both the classical mechanics and Special Relativity Theory, where the inertial motion is defined as a rectilinear uniform motion. Contrary to these two concepts, according to the second assumption of the HRIF the inertial motion should be subject to the phenomenon of slowing down due to action of the RIF. At low speeds, the action of the RIF remains negligible and the two bodies moving relative to each other move in an inertial manner at a relatively constant speed. However, according the Theorem 2.2 (in principle) to keep a body at a constant speed with respect to an inertial frame, *e.g.* during the rectilinear uniform motion, it is necessary to supply energy necessary to compensate its ***weight***. This sets this theorem apart from the dynamic laws of both classical mechanics and special theory of relativity, where keeping a body in a uniform rectilinear motion with respect to the inertial frame no energy is required!

The second Assumption of the HRIF contradicts both the Galilean and Special Relativity Principles [See Note 2]. Both of these principles state that the frame moving with respect to the inertial frame in a uniform rectilinear motion is equivalent to the frame at rest, *i.e.* these two frames are indistinguishable from each other. According the second Assumption of the HRIF, in this frame the RIF should manifest itself. Let us clarify the issue using the following example: The rocket is moving in gravity-free vacuum uniformly and rectilinearly with respect to the inertial frame at the velocity close to the velocity of light, *e.g.* $0.999\,c$. If the Galilean and Special-Relativity Principle holds, the rocket keeps this velocity due to its inertia – the rocket engines are turned off – and the observer inside the rocket is experiencing the weightless state. Contrary to this, according to the Second Assumption of the HRIF, the rocket can persist in this state only owing to energy being supplied to the rocket body – *i.e.* the engines must be turned on – and the observer inside the rocket should be subject to a devastating pressure of the RIF pushing him against the floor of the rocket cockpit (Fig. 2).

However, the validity of the second Assumption remains quite doubtful as it posits a gradual reduction of velocity of the two bodies moving in the inertial manner with respect to each other (especially at high velocities) as a result of the effect of the RIF. Any such phenomenon should have not escaped attention had it indeed existed; no such effect has been observed as yet.

Testable prediction: The effect of the RIF should be evident at velocities close to light speed c. Here the validity of the second assumption can be verified. As long as the second assumption holds, a particle with non-zero rest mass in inertial motion (*i.e.* without any supply or action of energy) in vacuum with respect to the inertial frame at the velocity close to speed c should be losing its energy due to influence of the RIF and the particle should keep losing its velocity. If this particle keeps moving at a constant velocity, with respect to the inertial frame, there is no RIF acting upon such particle and **the Second Assumption of the HRIF does not hold!**

Physicist Vojtěch Ullmann wrote to me: The velocity of the inertial motion of particles, accelerated to the velocities close to that of the velocity of light, is constant and no reduction of velocity has ever been observed.

I consider the second assumption of the HRIF as being null and void! The Theorem 1 and Theorem 2 do not hold!

Regarding the first Assumption It is apparent from SRT that at a greater speed relativistic phenomena occur: from the point of view of the frame at rest the length of a frame in motion measured in the direction of motion becomes shorter (contraction of length), time in the frame in motion flows more slowly with respect to the time in the frame at rest (time dilation), and the inertial mass of the body in motion increases and thus to accelerate it further requires ever growing amount of energy (mass grows). However, as long as both the Galilean and Special Relativity Principle hold, the two frames in rectilinear uniform motion relative to each other are equivalent and mutually interchangeable and therefore the relativity phenomena should take place in a reciprocal manner (this is valid both ways): from the point of view of the frame at rest in the frame in motion and vice versa. As long as both the Galilean and Special Relativity Principle hold then even at very high velocities, say $0.999\,c$, the two frames are indistinguishable from each other, *i.e.* it is impossible to decide which of the two frames is at rest and which is in motion. This should be true in principle also at speed c. According to classic mechanics as well as the special theory of relativity, the frame bound to the electromagnetic wave moving in respect of the inertial frame at speed c should be inertial and therefore equivalent to the frame at rest (the observer in it should be in a weightless state). However, according to the **First Assumption** of the HRIF, this frame is not inertial: in its interior there is an active RIF equivalent to the gravitational force on the event horizon of the black hole (the observer in it would be crushed by the force). Therefore, at speed c even the **First Assumption** of the HRIF contradicts the Galilean and SRT Principles.

It is impossible to verify the First Assumption, because in order to accelerate the material particle to speed c, according to the special theory of relativity we would need endless energy, which means that it cannot be achieved, so the first assumption is only that, an assumption. We can only argue for or against.

I asked physicist Vojtěch Ullmann a question:

Dančanin: We have a frame bound to an electromagnetic wave moving at speed c. Is there an active RIF equivalent to gravitational force on the event horizon of a black hole inside this frame, or is there not, and the observer in the frame is in a weightless state? I still think that the force is in effect there.

Vojtěch Ullmann: A clear answer to a clear question: In this frame, there will be a 'weightless state' for the observer. Of course this is only a thought experiment that cannot be proved, but we can get to it in a limit of gradually faster and faster inertial frames, where the weightless state remains.

But this does not mean that you cannot theoretically also deal with 'alternative' scenarios, and draw some testable conclusions from them.

I asked physicist Stanislav Tokár:

Dancanin: What is your opinion? Is a frame bound to an electromagnetic wave and moving at speed c inertial, or is it equivalent to a frame persisting on the event horizon of a black hole?

Stanislav Tokár: From the point of view of an external observer both frames – the one bound to the electromagnetic wave and the one persisting on the event horizon of the black hole – have in common, that the processes in them (for an external observer) run endlessly slowly and thus the time stands still there, and therefore information is not obtained from them.

This is an argument in favor of the equivalence of these frames. According to the HRIF, neither of these frames is inertial, and the same force is present in both of them.

Conclusion

I assume, that for a material particle to be (theoretically) moving at speed c, it must shift from an inertial motion into a non-inertial motion that corresponds to its perseverance on the event horizon of a black hole. In short, the material particle can be moving inertially at any velocity lower than c, however, it cannot move inertially at speed c!

The question is: How can the transfer of inertial frames gradually approaching the limit speed c to the non-inertial frame moving at speed c be resolved? I have come to a certain solution which I am going to explain in an example: Here we have a rocket with a motor of limitless capacity. Inside the rocket is a beholder 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 RIF/the 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 RIF. 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 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 speed 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 like when we drop the ball inside the rocket that is moving at the speed c. Only such a material particle/rocket that is continuously being supplied with energy to keep it on the event horizon of a black hole can move at speed c. (Note: This is not relevant for light, as it maintains its velocity 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 the speed c.

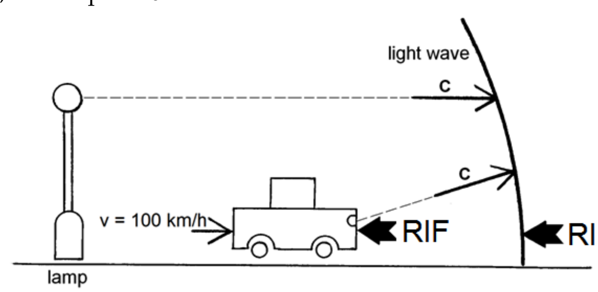

Figure 1. Universal effect of the RIF.

On Fig. 1, a car moves inertially in relation to a street lamp at speed $v =$ 100 km/h. From the point of view of the frame at rest bound to the lamp, the light beamed from the car, in the direction against the motion of the car, is affected by RIF, $\mathbf{F}_{\text{ri}}$, and therefore the light is propagated relative to the street lamp. not at speed $c+v$, but only at speed c. However, since the effect of RIF is universal – it has an effect in the direction against the motion of the car on the light, which energy it reduces, as well as on the car, which energy it reduces too, and slows down its motion – in respect of the car the light is also spread at speed c.

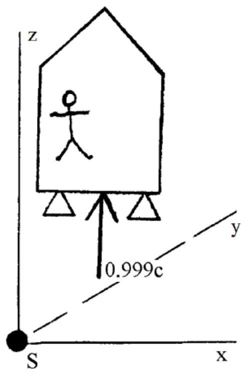

Figure 2a. inertial frame

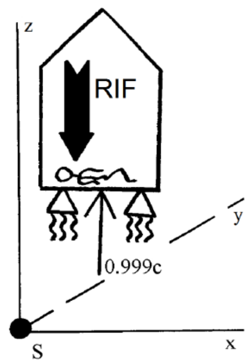

Figure 2b. non-inertial frame

About Fig. 2a: As long as both the Galilean and Special Relativity Principles hold, the rocket moving with respect to the inertial reference frame rectilinearly at a constant velocity of 0.999 c does not require any energy to sustain this velocity due to its inherent inertia – the rocket has its engines turned off. The observer inside the rocket would experience the weightless state. This frame is equivalent to the frame at rest, *i.e.* it is indistinguishable from it. In principle, this should apply also to the motion at speed c .

About Fig. 2b: According to the second assumption of HRIF to keep the rocket at rectilinear motion at the constant velocity of 0,999 c with respect to the inertial reference frame the energy is required – the rocket has the engines turned on. Inside the rocket acts a RIF that pushes the observer against the rocket floor. At speed c the observer would be pushed against the floor of the rocket by the RIF equal to the gravitational force on the event horizon of the black hole.

Notes:

1. ΣΡΤ ρεφεχτεδ τηε Γαλιλεαν τρανσφορματιον υσεδ ιν χλασσιχαλ μεχηανιχσ ανδ υσεσ τηε Λορεντζ τρανσφορματιονσ ινστεαδ το χαλχυλατε ρελατιϖιστιχ πηενομενα.

2. The relativity principle was discovered by Galileo Galilei while performing experiments on floating ship and found out that as long as the ship moves rectilinearly at a constant speed, it is impossible to determine by any mechanical experiment whether the ship moves or not, and all of the experiments were conducted as if the ship was anchored at the port. Therefore, if the ship is moving rectilinearly at a uniform velocity, from the mechanical point of view it is not possible to distinguish whether the ship is moving with respect to the port or the port is moving with respect to the ship. Both frames are equivalent and mutually interchangeable, therefore it does not matter which of the two frames is considered to be at rest. This fact has become known as the Galilean Relativity Principle. Albert Einstein expanded the validity of the Gallilean Relativity Principle also to include electromagnetic phenomena, *i.e.* light (and all physical laws): if the frame moves rectilinearly at a uniform velocity in respect of the inertial frame at rest, the light within spreads in the same manner as in the inertial frame at rest and it does not matter which of them we consider to be at rest. This principle is referred to as the Special Relativity Principle.

Reference

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Entropy and the Expansion of the Universe

Continued from page 28

A Testable Prediction

If the expansion of the Universe results from the principle of entropy, then gas molecules in a tube should behave as the galaxies within the Universe – the further they are from each other the faster they fly apart. When we reverse the process of entropy, we get to the phenomenon of gravity. We can explain it again using the example of the gas tube:

* The more molecules of gas are enclosed in a tube, the fiercer they explode into the space after the opening of the tube. It is vice versa as for the gravity: the more mass an object has, the more attractive it is.

• More distant molecules of the gas should draw apart quicker during the entropy. It is *vice versa* for gravity: closer molecules should be moving quicker to each other and attract each other.

Reference

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Pavol Dančanin
Trencianska Tepla, SNP 443/21, 914 01, SLOVAKIA
e-mail dancanin@gmail.com

CBR – Evidence of a 'Liquid' Phase of Aether?

Cont. from page 32

Gas-like aether possesses many features of ideal gas. In particular when temperature increases in the interval less T_0 entropy depends on temperature logarithmically

$$\Delta S = S_1 \ln(T / T_1) \quad , \quad T_1 < T < T_0 \quad . \tag{4}$$

Here T_1 is the transition temperature for gas-like aether changing into liquid-like phase, and S_1 is the entropy at the moment of such transition.

Note that the convex (up) character of logarithmic function is the cause of the fact that sum of two volumes of gases with different temperatures have entropy larger than mean sum entropy of these volumes: a straight line joining two points of any convex function lies below its graph. In other terms, the assertion of inevitable entropy increase is the consequence of the convexity of the entropy-temperature dependence. This is true for an ideal gas and for all the media on the basis of which this assertion was adopted. But if there is a medium (perhaps aether in another phase) with another dependence between entropy and temperature (for instance quadratic, *i.e.* concave down), the n experiments with such a medium will lead to the opposite conclusion.

Concluded on page 40

Is Lorentz Transformation Absurd?

Yinling Jiang and Ji Qi
School of Electronic Engineering, Northeast Petroleum University , Department of Physics , Daqing 163318 , CHINA
e-mail qiji8111@163.com

The views of space and time in Classical Physics and in Relativity Theory have been at issue for a century. Which view is more reasonable? This paper deals with this question. Lorentz transformation is the mathematical expression of relativity theory, so Lorentz transformation is discussed in detail. The essence of relativity is revealed, and a different understanding of time is offered. With this new view, true clarity can be returned to physics.

Keywords: Time; Lorentz transform; Time dilation; Time Trap; Twins Paradox

1. Introduction

What *is* time? The question goes back to antiquity. The Analects of Confucius says: It was by a stream that the Master said --Thus do things flow away! That image for Time is a rushing river ceaselessly on the move. And it's like the water of Yellow River from the sky, which flushes into the sea without ever turning around.

The idea that time is just as an immensely long river flowing from the antiquity to the future is discussed in [1, 2]. There is a problem with the river idea. Even the great Yellow River, the flow of which *can* conceivably dry up, cannot compare with time, which never stops.

So then is time the sun and stars in the sky rising in the east and setting in the west, day after day? Should it be the immense Milky Way going around and around ceaselessly forever?

That idea also is not true. Even the great Milky Way is small compared with the huge wheel of time.

Lei Yuanxing said that the gear wheel of time joggles the whole universe, and drives all galaxies to hover into to the everlasting future [3].

And Newton said, "The absolute, real or mathematical time, itself and to the extent of its nature, always lapses uniformly, having nothing to do with any outside body." [4].

Time is the most essential objective being in the universe, or time is the reflection of the total existence and changes in the whole universe. And time is the most essential foundation stone of the physics.

Time is our sole measurement tool for the process of universal existence and changes. Of course, this grand kind of measurement is regulated by a time system familiar to us on Earth's surface – and potentially quite inadequate!

Why has the concept of time, being so pronounced, been changed in the 20th century? The reason lies in the Lorentz transformation in relativity theory. And it can be said that Lorentz transformation is the magic weapon of relativity theory, which can bring you into a logically strange loop and let you experience the relativity completely.

Well then, does there exist a contradiction within Lorentz transformation itself?

We don't need to make the round of it, let's go back to the basic springboard of Lorentz transformation.

2. The Time Standard in Physics

Before the main argument below, the standard of time used in dealing with physical problems should be defined exactly.

The time system is uniform within any one frame of reference. So if we refer to a certain time in the same frame of reference, are all the spatial points in the same frame at the same time or not? Of course, the answer is yes.

We can take an even more pronounced example: suppose that all the clocks in China have been synchronized. When the clock in some place is at 12 o'clock of Beijing standard time, are all the clocks at different places in China at the same time? Of course, the answer is yes.

The time of the every spatial point in the same frame of reference is completely the same, equal to the time of the frame of reference.

It needs to be emphasized that Einstein in The theory of relativity Clearly acknowledged it, and discussed how to synchronize the time at various points in the same frame of reference.

3. The Lorentz Transformation

First of all, let us investigate Lorentz transformation, which is the mathematical foundation for relativity theory. In that context, it is assumed that the relationship between space-time coordinates of the same point (*e.g.* Point P) in different inertial frames of reference can be described by Lorentz transformation.

Fig. 1 shows two inertial frames of reference, K and K'. The frame K' is moving in the positive direction along the x axis of the frame K with a velocity of υ relative to the frame K. When the two coordinate origins O and O' are at the state of superposition, we suppose that the time in the two frames is zero, *i.e.* $t' = t = 0$.

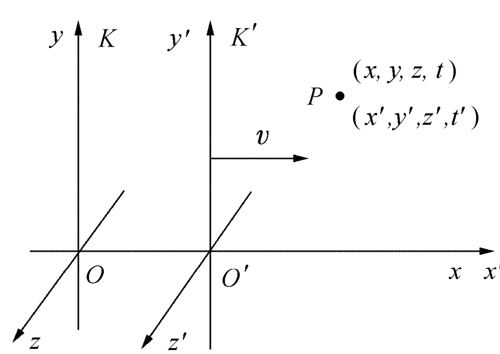

Figure 1 A sketch map of the Lorentz Transformation.

Now we describe the space-time coordinates of point P in different space inertial frames. In the K system, the space-time coordinates of point P are (x, y, z, t). In the K' system, the space-time coordinates of point P are (x', y', z', t'). The Lorentz transformation is as follows:

$$x' = (x - \upsilon t)\Big/\sqrt{1 - \upsilon^2 / c^2} = \gamma(x - \upsilon t) \quad ,$$

$$y' = y \quad , \quad z' = z \quad ,$$

$$t' = \left[t - (\upsilon / c^2)x\right]\Big/\sqrt{1 - \upsilon^2/c^2} = \gamma\left[t - (\upsilon / c^2)x\right].$$

The corresponding inverse Lorentz transformation is as follows:

$$x = (x' + \upsilon t')\Big/\sqrt{1 - \upsilon^2/c^2} = \gamma(x' + \upsilon t') \, ,$$

$$y = y' \quad , \quad z = z' \quad ,$$

$$t = \left[t' + (\upsilon / c^2)x'\right]\Big/\sqrt{1 - \upsilon^2/c^2} = \gamma\left[t' + (\upsilon / c^2)x'\right] \quad .$$

Emphasis:

The relationships of the space-time coordinates of the same point in different frames of reference are described with Lorentz transformation, and the Lorentz transformation and inverse Lorentz transformation are of the same form, differing only by sign [5, 6].

4. The Time Trap

After the investigation of Lorentz transformation, let us look at Fig.1 again. In relativity theory, it is said that when the two coordinate origins O, O' are in the state of superposition, we suppose that the time in the two reference frames is zero, *i.e.* $t' = t = 0$. That is to say, the time at every point in both frames of reference is zero at that moment; *i.e.*, the time of the points in frame K is $t = 0$, and $t' = 0$ in K'.

However, when $t = 0$, according to the equation of Lorentz transformation:

$$t' = \gamma\left[t - (\upsilon / c^2)x\right] = -\gamma(\upsilon / c^2)x$$

$$x' = \gamma(x - \upsilon t) = \gamma x$$

we get the time of every point in frame K'

$$t' = -(\upsilon / c^2)x' \quad . \tag{1}$$

It is obvious that the time of every point in the frame K' is completely different, which is inconsistent with the assumption at the beginning of the argument.

At the same time, when $t' = 0$, according to the equation of Lorentz transformation:

$$t = \gamma\left[t' + (\upsilon / c^2)x'\right] = \gamma(\upsilon / c^2)x'$$

$$x = \gamma(x' + \upsilon t') = \gamma x'$$

we get the time of every point in frame K

$$t = (\upsilon / c^2)x \tag{2}$$

It is obvious that the time of every point in frame K is completely different, which is inconsistent with the assumption at the beginning of the argument; namely, that within a given frame of reference, the time at every spatial point is the same. Einstein acknowledged this, and provided the instructions to synchronize all clocks throughout the reference frame.

To sum it up, Lorentz transformation has dropped into a time trap at the beginning.

5. The Twins Paradox

In terms of the logical problem of relativity theory, the Twins Paradox has been paramount for more than one century. To confound the supporters of relativity theory, let us put the problem forward more rigorously.

As shown in Fig. 2, the twins A and B are flying away from Earth by airships in the opposite directions with the uniform velocity simultaneously. Some years later, they turn around simultaneously, flying towards Earth at the same velocity and landing simultaneously (the accelerating process is neglected).

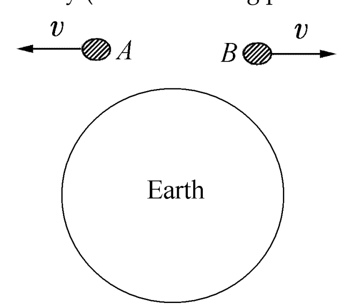

Figure 2. A sketch map of the Twins Paradox

Which of the twins is younger?

According to New Physics, the motions of A and B to the no-shape substance space are equivalent. Therefore, the twins would be at the same age. But what conclusions can we draw from relativity theory? We can obtain the conclusions as follows:

1) From the perspective of A alone, it looks as if that B is younger because B is moving and its clock is slower.

2) From the perspective of B alone, it looks as if that A is younger because A is moving and its clock is slower.

Therefore, is relativity theory self-contradictory or not? When the twins stand together face to face, if only they had a normal thinking, they should not side with relativity theory for that the fact might only have two results.

1) Both of them are at the same age.

That is to say that neither of the observing results according to relativity theory is trustable.

2) One of them is younger than the other. Then which one is younger?

No matter in physics or mathematics, there are not values that can produce the result that A is bigger than B while B is bigger than A. Therefore, we can take it for granted that there are antinomies like the above one in all the problems about the time transformation in relativity theory.

5.1 Illustrations

It is common for most supporters of relativity theory to invoke general relativity to resolve the problems of Twins Paradox. Because the turn-around involves acceleration, the influence of acceleration on time and that of velocity on time happen to counteract each other, however far you fly.

What is more, a number of incompatible formulas are put forwards by many supporters of relativity theory to prove Twins Paradox strictly. However, a great of experiments demonstrate that the acceleration has nothing to do with time dilation.

There are many experiments including an accelerating process in experiments validating the time dilation. And the range of the acceleration is very wide. For example, in the experiment of atomic clock sailing around the world, the centripetal acceleration on the clock is $10^{-3}g$, where g is the acceleration of gravity on Earth's surface; in the running-disk experiment, the acceleration centripetal of the light source extends to $10^5 g$; in the experiment investing on the temperature dependence of Mossbauer effect, the vibrating acceleration of the nucleus in the crystal lattice and the acceleration centripetal of the meson moving in circle are both larger than $10^{16}g$. Although the range of the acceleration is so wide, almost all the experiments get the result consistent with time dilation caused by the speed, which is predicted by special relativity. This fact indicates that, the acceleration has no contribution to time dilation in the experiment. Even if we admit the existence of the effect of time dilation, it can only say that the effect is caused by the speed instead of the acceleration [7, 8].

The problem of Twins Paradox is the logical contradiction that relativity theory cannot avoid.

6. The Paradox of the Earth Year

It can be shown in Fig. 3, a series of clocks such as A', B' and C' are resting at the frame K'. It is obvious that they are synchronous and the time of them is t' in the frame K', where the clock A' is located at the point of O'.

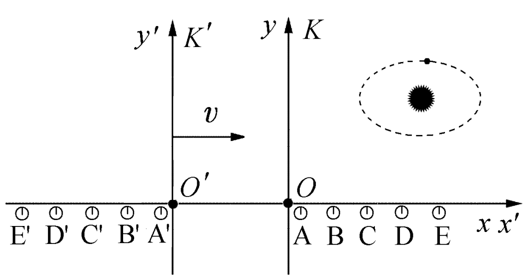

Figure 3. The different observables of the same event.

In the same way, a series of clocks such as A, B and C are resting at the frame K. It is obvious that they are synchronous and the time of them is t in the frame K, where the clock A is located at the point O.

According to relativity theory, when the origins of coordinates O and O' coincide with each other, it is supposed that the time of the coordinate systems is zero, *i.e.* $t' = t = 0$.

— —when the clock A' encounters the clock A, $t' = t = 0$.

In the following, the relationships of time in the two systems are analyzed using the principles of relativity theory.

Firstly, the clock A' is supposed to be the starting point.

The event that the clock A' encounters the clock A is referred to as the first event ($t'_1 = t_1 = 0$). The event that the clock A' encounters the clock B (or the clocks that are resting in the frame K such as the clock C) is referred to as the second event. It is obvious that the two events occur at the same point (the point of O') in the frame K', where the time interval of the two events is intrinsic time.

$$\tau_0 = \Delta t' = t'_2 - t'_1 = t'_2 - 0 = t'_2$$

$$\tau = \Delta t = t_2 - t_1 = t_2 - 0 = t_2$$

According to the time formula

$$\tau = \tau_0 \Big/ \sqrt{1 - \upsilon^2 / c^2}$$

It can easily be obtained that:

$$t_2 = t'_2 \Big/ \sqrt{1 - \upsilon^2 / c^2} \tag{3}$$

Obviously, what is described by t_2 is the time of coordinate system K at the moment and what is described by t'_2 is the time of coordinate system K' at the moment.

In the same way, the event that the clock A' encounters the clocks resting in the frame K such as the clock C can also be referred to as the second event. It is self-evident that the similar result can be obtained. That is to say that both the time t of the coordinate system K and the time t' of the coordinate system K' meet the following equation:

$$t = t' \Big/ \sqrt{1 - \upsilon^2 / c^2} \tag{4}$$

If $\upsilon = c\sqrt{99/100}$, then

$$t = 10\, t' \quad . \tag{5}$$

What is the meaning of that?

It can be shown from the viewpoint of relativity theory, if a year were past in the frame K', ten years would have been past in the frame K. This is not believable.

Secondly, the clock A is supposed to be the starting point inversely. The event that the clock A encounters the clock A' is referred to as the first event. The event that the clock A encounters the clock B' (or the clocks that are resting in the frame K' such as the clock C') is referred to as the second event. It is obvious that the two events occur at the same point (the point of O) in the frame K, where the time interval of the two events is intrinsic time.

According to SRT, $t' = t \Big/ \sqrt{1 - \upsilon^2 / c^2}$. It can be obtained that if $\upsilon = c\sqrt{99/100}$, then $t' = 10\, t$. So in SRT it can can be shown that if one year passed in the frame K, ten years would have passed in the frame K'. So it is said in relativity theory that $t = 10\, t'$ *and* that $t' = 10\, t$. That is, that if it took Earth one year to move around the sun seen from the frame K', it would take

Earth ten years to move around the sun seen from the frame K. But also, if it took Earth one year to move around the sun seen from the frame K, it would take Earth ten years to move around the sun seen from the frame K'. Not only are the objective facts ignored, but also there is an obvious self-contradiction.

7. One Event, Three Responses

In terms of the above problem, a supporter of relativity theory named Mr. I. Ching equivocates that the time of the two coordinate systems cannot be compared; it is the times of the same event that should be compared. Below we carefully compare the different times of the same event. What's more, let us analyze a physical event!

Take Mr. I. Ching for example, he is running and jumping. Suddenly he sneezes. We analyze this event in the frame K, in which it occurred at $x = 50$ light years, $t = 10$ years. When does the event occur in the frame K'?

1) According to the basic equations of relativity theory, we can obtain the rule that the two time systems can meet all the time from Eq. (5). That is $t = 10t'$. It is obvious that $t' = 1$ year.

2) According to the basic equations of relativity theory, we can obtain the rule that the two time systems can meet all the time from Eq. (7). That is $t' = 10\ t$. It is obvious that $t' = 100$ year.

3) This is just a physical event, which can be solved by using Lorentz Transformation $t' = (t - x\upsilon / c^2)\Big/\sqrt{1-\upsilon^2/c^2} = -397.5$ year! How novel this conclusion is! When the two origins of coordinate coincide with each other, is the fortune teller born? We can conclude that it is as early as 397.5 years before he is born, he hit a sneeze. **Is that reasonable?**

It is shown in relativity theory that the sneeze of Mr. I. Ching (it is actually an 'event') occurs not only at $t' = 1$ year, but also at $t' = 100$ years. What is amazing is that it occurs at $t' = -397.5$ years! **Isn't that absurd?**

8. Conclusion

In our earlier paper [9], we showed that, no matter what, Lorentz transformation is not derived. The present paper shows that Lorentz transformation and its precondition are contradictory. Lorentz transformation leads to contradictory results everywhere! We conclude that Lorentz transformation is a distortion of space-time.

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CBR – Evidence of a 'Liquid' Phase of Aether?
Continued from page 36

We can find entropy increment on the interval [T_1, T_0] from the relationship $S(T_0) - S(T_1) = S_1 \ln(T_0 / T_1)$. The background radiation temperature $T_1 = 2.728\ \text{K} = 5.29 \times 10^{-14}\,\text{m}^2/\text{s}$. So $S_1 = 1.03 \times 10^{24}\,\text{rad}/\text{m}^2$. Knowing T_1 and S_1, we can obtain the transition calorie $\omega_1 = T_1 S_1 = 5.45 \times 10^{10}$ rad/sec. ω_1, T_1, S_1 characterizes separate aether-1 particle when it comes from the gas-like to the liquid-like phase. Its energy is $\hbar\omega_1 = 5.72 \times 10^{-24}\,\text{J}$. One can consider ω_1 obtained for background radiation in experiments: from 3.77×10^9 rad/s to 6.28×10^{10} rad/s. This value is rather close to the upper end of the interval. This means that the interval beginning already corresponds to liquid-like aether. The phase transition temperature remains constant. Thus we can find the entropy corresponding the calorie $\omega_2 = 3.77 \times 10^9\,\text{rad}/\text{sec}$. This entropy is $S_2 = \omega_2 / T_2 = 7.3 \times 10^{22}\,\text{rad}/\text{m}^2$ and the temperature is $T_2 = \omega_2 / S_2 = 5.16 \times 10^{-14}\,\text{m}^2/s = 2.65\ \text{K}$ We see that the liquid-like fraction temperature is below the frontier temperature 2.728 K.

3 Conclusions

1) The closes to aether-1 among habitual substances is Helium. It comes to liquid-like phase approximately under the same temperature. It is possible that superfluid Helium is just aether-1.

2) In order to explain superconductivity we are compelled to adopt some very artificial assumptions. In particular it is connected with Cooper's pairs. There is a basis to believe that aether-1 particles are electrons deprived of their ring rotation and "magnetic winding" [1, §1.5]. Can we suppose that transition to superconductivity just means that ring rotation is suppressed but magnetic winding is conserved in electrons? Such particle without electric charge will move in media without resistance.

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Dr. J. G. Klyushin
Budapest Str., 5-3-241, 192242 St Petersburg, RUSSIA
e-mail klyushin7748848@live.ru