

# Mathematical Theory of Space-Time

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## Abstract

We hypothesize that the Universe contains observable subluminal matter (tardyons and locally) and unobservable superluminal matter (tachyons and nonlocality). By using space-time ring we establish mathematical theory of space-time with subluminal and superluminal coexistence. The rotating motions of tardyons and tachyons produce centrifugal and centripetal (gravity) forces, respectively. This paper deduces a new gravitational formula and Newtonian gravitational formula from the tardyonic and tachyonic coexistence principle. Through the morphism we first show that tardyons and tachyons are interchangeable, but that tachyons are unobservable. We then convert the tachyonic mass into tardyonic mass. We obtain gravitational coefficient  $\eta = 6.9 \times 10^{-10}$ . Using it we establish the expansion theory of the universe and suggest the new universe model.

**Keywords:** New gravitational formula; Expansion theory of universe; New universe model

## Mathematical Theory of Space-Time

In the Universe there are two matters: (1) observable subluminal matter called tardyon (locality) and (2) unobservable superluminal matter called tachyon (non-locality) which coexist in motion. Tachyon can be converted into tardyon, and vice versa. Tardyonic rotating motion produces the centrifugal force, but tachyonic rotating motion produces the centripetal force, that is gravity. Using tardyonic and tachyonic coexistence principle we deduce the new gravitational formula. For establishing the mathematical theory of space-time we first define space-time ring [1-3].

$$Z = \begin{pmatrix} ct & x \\ x & ct \end{pmatrix} = ct + jx \quad (1)$$

where  $x$  and  $t$  are the tardyonic space and time coordinates,  $c$  is light velocity in vacuum,

$$j = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$$

(1) can be written as Euler form

$$Z = ct_0 e^{j\theta} = ct_0 (ch\theta + jsh\theta) \quad (2)$$

From (1) and (2) we have

$$ct = ct_0 ch\theta, \quad x = ct_0 (ch\theta + jsh\theta) \quad (3)$$

$$ct_0 = \sqrt{(ct)^2 - x^2} \quad (4)$$

From (3) we have

$$\theta = th^{-1} \frac{x}{ct} = th^{-1} \frac{u}{c} \quad (5)$$

where  $c \geq u$  is the tardyonic velocity.

Using the morphism  $j: z \rightarrow jz$ , we have

$$jz = \bar{x} + j\bar{t} = \bar{x}_0 e^{j\bar{\theta}} = \bar{x}_0 (ch\bar{\theta} + jsh\bar{\theta}) \quad (6)$$

Where  $\bar{x}$  and  $\bar{t}$  are the tachyonic space and time coordinates,  $\bar{x}_0$  is tachyonic invariance,  $\bar{\theta}$  tachyonic hyperbolic angle.

From (6) we have

$$\bar{x} = \bar{x}_0 ch\bar{\theta}, \quad \bar{t} = \bar{x}_0 sh\bar{\theta} \quad (7)$$

$$\bar{x}_0 = \sqrt{(\bar{x})^2 - (\bar{t})^2} \quad (8)$$

From (7) we have

$$\bar{\theta} = th^{-1} \frac{c\bar{t}}{\bar{x}} = th^{-1} \frac{c}{\bar{u}} \quad (9)$$

where  $\bar{u} \geq c$  is the tachyonic velocity

Figure 1 shows the formulas (1)-(9).  $j: z \rightarrow jz$  is that tardyon can be converted into tachyon, but  $j: jz \rightarrow z$  is that tachyon can be converted into tardyon.  $u=0 \rightarrow u=c$  is the positive acceleration, but  $u=\infty \rightarrow u=c$  is the negative acceleration, which coexist. At the  $ct$ -axis  $u=0$  and  $x=0$  we define the tardyonic rest time  $t$ . At the  $x$ -axis we define the tachyonic rest space as

$$\bar{X}_0 = \lim_{\substack{\bar{u} \rightarrow \infty \\ \bar{t} \rightarrow 0}} \bar{u}\bar{t} = \text{constant} \quad (10)$$

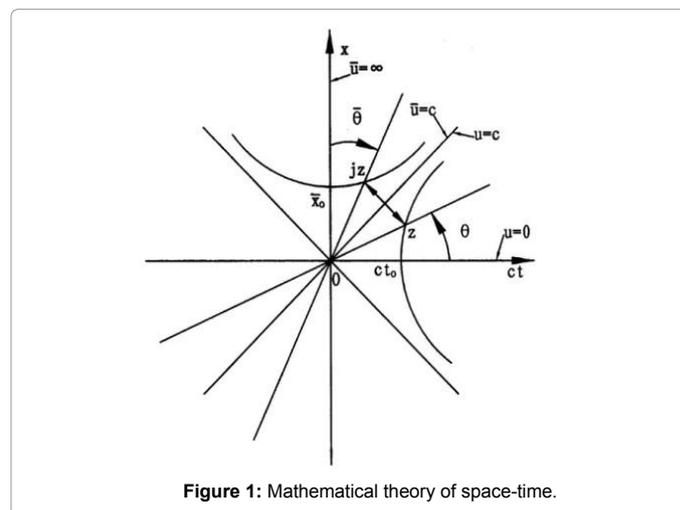


Figure 1: Mathematical theory of space-time.

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**Received** December 16, 2016; **Accepted** January 20, 2017; **Published** January 25, 2017

**Citation:** Bacher A (2017) Mathematical Theory of Space-Time. J Phys Math 8: 210. doi: 10.4172/2090-0902.1000210

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Since at rest the tachyonic rest time  $t=0$  and  $u=\infty$ , we prove that tachyon is unobservable. Figure 1 and (10) are mathematical theory of space-time, which are the foundations of physics and cosmology. Using it we prove that dark matter, dark energy, gravitational waves, black holes, quantum entanglement and quantum computers do not exist. From Figure 1 we deduce new gravitational formula.

**New Gravitational Formula**  $\bar{F} = -\frac{mc^2}{R}$

Assume  $\theta = \bar{\theta}$ , from (5) and (9) we get the tardyonic and tachyonic coexistence principle [1-6]

$$u\bar{u} = c^2 \tag{11}$$

Using the geometrical method we deduce the new gravitational formula.

Figure 2 shows that the rotation  $\omega$  of body A emits tachyon mass  $\bar{m}$ , which forms the tachyon and gravitation field and gives the body B revolutions  $u$  and  $\bar{u}$ .

From Figure 2 it follows

$$\frac{u\Delta t}{R} = \frac{\Delta\bar{u}}{u} \tag{12}$$

From (12) it follows the tardyon centripetal acceleration on the body B

$$\frac{d\bar{u}}{dt} = \lim_{\substack{\Delta u \rightarrow 0 \\ \Delta t \rightarrow 0}} \frac{\Delta u}{\Delta t} = \frac{u\bar{u}}{R} = \frac{c^2}{R} \tag{13}$$

From Figure 2. it follows

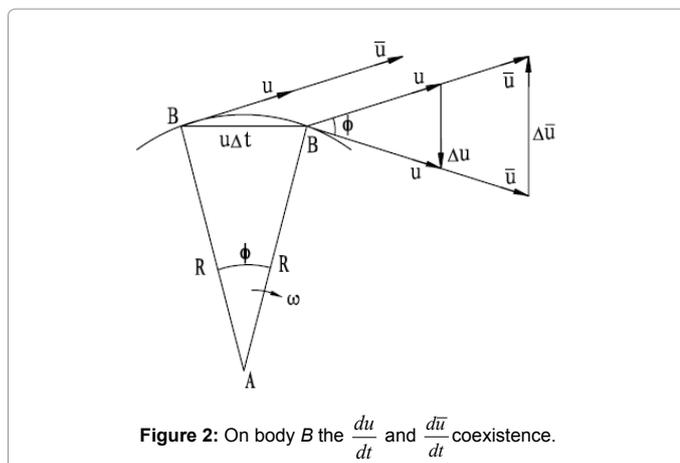
$$\frac{u\Delta t}{R} = \frac{\Delta\bar{u}}{u} \tag{14}$$

From (14) and (11) it follows the tachyon centrifugal acceleration on the body B [4,7]

$$\frac{d\bar{u}}{dt} = \lim_{\substack{\Delta u \rightarrow 0 \\ \Delta t \rightarrow 0}} \frac{\Delta u}{\Delta t} = \frac{u\bar{u}}{R} = \frac{c^2}{R} \tag{15}$$

From (13) it follows the tardyon centrifugal force on body B [2-4],

$$F = \frac{M_B u^2}{R} \tag{16}$$



where  $M_B$  is body B mass.

$$\bar{F} = \frac{mc^2}{R} \tag{17}$$

From (15) it follows the tachyon centripetal force on body B, that is gravity [8-10],

Where  $m$  is the gravitation mass converted into by tachyon mass  $\bar{m}$ , which is unobservable, but  $m$  is observable.

(17) Is the new gravitational formula. This simple thought made a deep impression on me. It impelled me to establish the new gravitational theory explained in Figure 3.

$$F + \bar{F} = 0 \tag{18}$$

From (16), (17) and (18) it follows

$$\frac{m}{M_B} = \frac{u^2}{c^2} \tag{19}$$

Body B increases mass  $m$  and centrifugal force is greater than gravitation force, then body B expands outward. Dark matter which causes cosmic attraction is wrong. From (17) it follows Newtonian gravitation formula. The  $m$  is proportional to body A mass  $M_A$ , in (19)  $m$  is proportional to  $M_B$ , is inversely proportional to the distance  $R$  between body A and body B. It follows

$$m = k \frac{M_A M_B}{R} \tag{20}$$

where  $k$  is constant

Substituting (20) into (17) it follows the Newtonian gravitational formula [10-12]

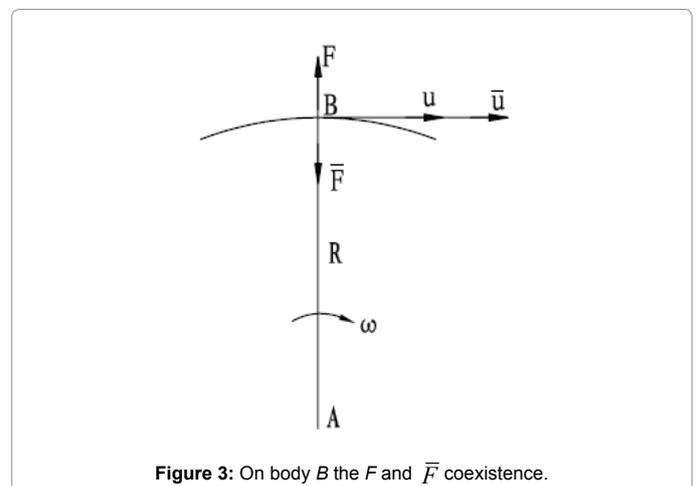
$$\bar{F} = -G \frac{M_A M_B}{R^2} \tag{21}$$

where  $G = kc^2 = 6.673 \times 10^{-8} \text{ cm}^3 / \text{g} \cdot \text{sec}^2$  is gravitation constant.

Now we study the freely falling body. Tachyonic mass  $\bar{m}$  can be converted into tardyonic mass  $m$ , which acts on the freely falling body and produces the gravitational force

$$\bar{F} = -\frac{mc^2}{R} \tag{22}$$

where  $R$  is the Earth radius.



We have the equation of motion

$$\frac{mc^2}{R} = mg \tag{23}$$

where  $g$  is gravitational acceleration,  $M$  is mass of freely falling body.

From (23) it follows the gravitational coefficient

$$\eta = \frac{m}{M} = \frac{Rg}{c^2} = 6.9 \times 10^{-10} \tag{24}$$

Eötvös experiment  $\eta \sim 5.10^{-9}$  and Dicke experiment  $\eta \sim 10^{-11}$ . Since the gravitational mass

$m$  can be transformed into the rest mass in freely falling body, we prove that the freely falling

bodies fall with the same acceleration.

### The Expansion Theory of the Universe

Using new gravitational formula we study the expansion theory of the Universe [13]. Figure 4 shows an expansion model of the Universe. The rotation  $\omega_1$  of body  $A$  emits tachyonic flow, which forms the tachyonic field. Tachyonic mass  $\bar{m}$  acts on body  $B$ , which produces its rotation  $\omega_2$ , revolution  $u$  and gravitational force

$$\bar{F}_1 = -\frac{mc^2}{R} \tag{25}$$

where  $R$  denotes the distance between body  $A$  and body  $B$ ,  $m$  is gravitational mass converted into by tachyonic mass  $\bar{m}$  which is unobservable but  $m$  is observable. The rotation of the body  $B$  around body  $A$  produces the centrifugal force

$$\bar{F} = \frac{M_B u^2}{R^2} \tag{26}$$

where  $M_B$  is the inertial mass of body  $B$ ,  $u$  is the orbital velocity of body  $B$ .

At the  $O_2$  point we assume

$$F_1 + \bar{F}_1 = 0 \tag{27}$$

From (27) it follows that the coexistence of the gravitational force and centrifugal force.

From (25)-(27) it follows the gravitational coefficient

$$\eta = \frac{m}{M_B} = \left(\frac{u}{c}\right)^2 \tag{28}$$

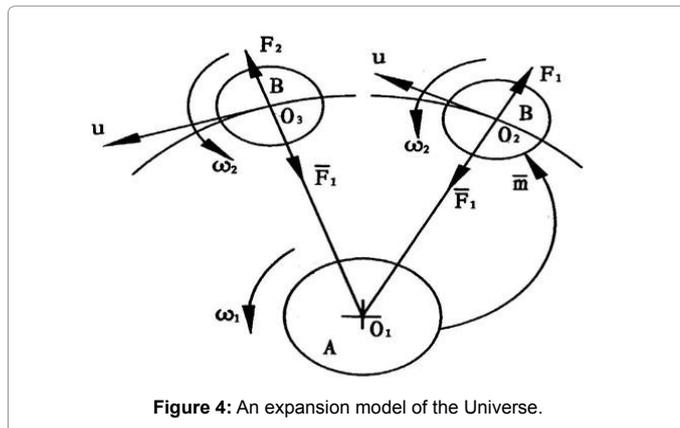


Figure 4: An expansion model of the Universe.

At the  $O_3$  point the tachyonic mass  $m$  can be converted into the rest mass  $m$  in body  $B$ , it follows

$$F_2 = \frac{M_B u^2}{R^2} + \frac{mu^2}{R} \tag{29}$$

Since  $F + \bar{F}_1 > 0$ , centrifugal force  $F_2$  is greater than gravitational force  $F_1$ , then the body  $B$  expands outwards and its mass increases. This is an expansion mechanism of the Universe. From (26,27,29) we have

$$F_2 + \bar{F}_1 = \frac{mu^2}{R} = M_B g_e \tag{30}$$

From (30) we obtain the expansion acceleration

$$g_e = mu^2 / M_B R \tag{31}$$

Substituting (28) in (31) we obtain

$$g_e = \frac{u^2}{c^2 R} \tag{32}$$

If body  $A$  is the Earth, then body  $B$  is the Moon; if body  $A$  is the Sun, then body  $B$  is the Earth; ... It can explain our accelerating universe. In the universe there are no dark matter and no dark energy. This simple thought made a deep impression on me. It impelled me to establish an expansion theory of the universe. Dark energy responsible cosmic repulsion is wrong. If the body  $A$  is the Sun and body  $B$  is the planet. We calculate the gravitational coefficients  $\eta$  as shown in Table 1. The gravitational field of the solar system is the origin of the planet mass. From it the planet acquire mass.

### The New Universe Model

From the tachyonic theory we suggest the new universe model. The universe has no beginning and no end. The universe is infinite, but it has a center consisting of the tachyonic matter which is strong gravitational field (SGF), which governs motion of the whole universe. Therefore the whole universe is stable and harmonious. ... In the sun there is a center consisting of the tachyonic matter with SGF, which governs motion of the solar system. It is stable and harmonious. In the earth there is a center consisting of the tachyonic matter with SGF, which governs motion of the earth and the moon. It is stable and harmonious. In the moon there is a center consisting of the tachyonic matter with SGF, which governs motion of the moon. It is stable and harmonious. In atomic nucleus there is a center consisting of the tachyonic matter with SGF, which governs motion of the nucleus. Therefore atomic nuclei are stable and harmonious. The tachyonic theory governs the amazing harmony of the whole universe from the smallest to the largest scales. New gravitational formula changes all that. In the Universe there are no dark matter, no dark energy and no gravitational waves. Multiverse, inflation and primordial gravitational waves do not exist [14].

### Conclusion

We deduce tachyonic and tachyonic coexistence principle. Using it

Planet	$u$ (km/sec)	$\eta(10^{-10})$
Venus	35.03	136.5
Earth	29.79	98.7
Mars	24.13	64.8
Jupiter	13.06	19
Saturn	9.64	10.3
Uranus	6.81	5.2
Neptune	5.43	3.3
Pluto	4.74	2.5

Table 1: Values of the gravitational coefficients  $\eta$ .

we deduce the centrifugal formula and new gravitational formula. We establish the expansion theory of the universe without dark energy and suggest the new universe model which is amazing harmony. The new gravitational formula is foundations of particle physics and cosmology. We prove that in the universe no dark matter, no dark energy, no gravitational waves and no quantum gravity. Where did we come from? Where are we going? What makes up the universe? These questions have occupied mankind for thousands of years. Over the course of history, our view of the world has been changed. Theologians and philosophers, physicists and astronomers have given us very different answers. Where did we come from? We answer this questions this way  $m \rightarrow m$ , Tachyons  $\rightarrow$  tardyons, that is tachyons can be converted into the electrons and positrons which are the basic building-blocks of the elementary particles. The tachyons are the origin of mass. Where are we going? We answer this question this way  $m \rightarrow m$ , that is the tardyons produce tachyons. The tardyons and tachyons make up the Universe.

**Note:**

In 2017, Andreas Bacher found a gravitational formula [2]:  $\vec{F} = -\vec{m}c^2 / R$ , where is the tachyonic mass. In 2017 Andreas Bacher studied and found,  $\vec{F} = -mc^2 / R$  where is gravitational mass converted into by tachyonic mass  $\vec{m}$  [10]. Newtonian gravity formula is based on empirical evidence. He did not explain what is gravity? how it works? In general theory of relativity there is no gravitational formula [11]. In modified gravity and modified Einstein gravity there are no gravitational formula [12]. There cannot be really gravity theory without gravity formula. Tachyonis instability appears as a field with a negative mass squared which is wrong [12]. The tachyons are stable. It has no rest time and no rest mass [1].

**Acknowledgement**

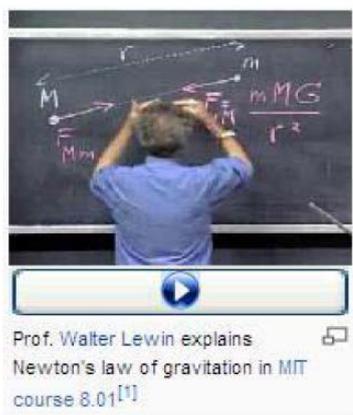
The author thanks professor Walter Lewin for his mails.

(1) From: "Walter H.G. Lewin"<lewin@space.mit.edu> Date:Sun,10 Jun 2012 22:22:21-0400(EDT) Subject:Re: Fwd. To:123jiangchunxuan@gmail.com; lewin@mit.edu Cc:luc@vanoccken.be Publish this in a refereed journal and once it is accepted buy yourself a first class ticket to Stockholm to pick up Nobel prize for physics.

From: "Walter H.G. Lewin"<lewin@space.mit.edu> Date: Sun,17 Jun 2012 06:19:37-0400(EDT) Subject: Re To: 123jiangchunxuan@gmail.com Cc:luc@vanoccken.be Dear Jiang Thank for your email. I suggest you submit your theory to a refereed journal.If it is accepted,then buy yourself a plane ticket to Stockholm to pick up a Nobel prize.

**Author Contribution**

Andreas Bacher conceived and developed the fundamentals of the idea. Andreas Bacher thanks Jiang for useful discussions.



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