时-空数学理论

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Abstract: 本文是建立<时-空数学理论>, 是宇宙学和物理学的基础.每位研究者从中可找到他们要研究方向和目标.牛顿引力公式是猜想.等效原理不存在, 广义相对论是错的.

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Keywords:时-空数学理论; 宇宙学; 物理学; 牛顿引力; 等效原理; 广义相对论

宇宙中有两种物质: (1)可观测的亚光速物质(定域); (2)不可观测的超光速物质(非定域).

本文是研究亚光速和超光共存理论.引力子是超光速粒子,爱因斯坦认为引力子是光速粒子是错误的.

Cosmologist Pedro Ferreira said: "If general relativity were ever proved wrong that would be a true revolution" (General relativity at 100, Einstein unfinished masterpiece, 10 October 2015, New Scientist, 33).

Gravity remains unsolved mysteries.

Gravity is very difficult for Newton, Einstein and all scientists.

Gravity is very easy for Jiang

Future Cosmology is new gravitational formula $F=-mc^2/R$.

We establish mathematical theory of space-time with SASC for a rewrite of physics

Einstein reaction to his discovery of equivalence principle: the happiest thought of my life (1907).

Einstein said: "If a person falls freely, he will not feel his own weight".

Einstein equivalence principle is

(Inert mass). (Acceleration)=(Intensity of the gravitational field). (gravitational mass).

Gravitational mass m (the m in $F=GMm/r^2$, where F is the gravitational attraction between two masses a distance r apart and G is Newton gravitational constant) is the same as inertial mass m (the m in F=ma, where a is the acceleration caused by a force F) (1907).

Einstein field equations (EFE) are the core of general relativity theory. The EFE describe how mass and energy (as represented in the stress-energy tensor) are related to the curvature of space-time (as represented in the Einstein tensor). The solutions of the EFE are metric tensors without gravitational mass and gravitational formula.

gravity is a product of warped space-time, space tells matter how to move and matter tells space how to curve.

Einstein did not know that what is gravitational mass? what is inertia mass?

H. Poincare said (1904):

Mass has two aspects: there are both inertia and the gravitational mass, which is involved in Newtonian gravity as a multiplication factor. If the coefficient of inertia is constant, can the gravitational mass also be constant? That is the question.

The keystone of general relativity is equivalence principle.

Kip S. Thorne (Gravitation, p1060,1973) said:

Of all the principle at work in gravitation, none is more central than the equivalence principle.

At the heart of the general theory of relativity is the equivalence principle.

The equivalence principle states that gravity and acceleration are equivalent.

In all gravitational theories there are no aspects of gravitational mass. No one researches the gravitational mass.

In Newtonian gravitational formula F=-GMm/ R^2 , where M and m are inertial mass. In it there are no gravitational mass. It is only a conjecture. In Einstein field equations there are no gravitational mass. Therefore general relativity is not gravitational theory.

Only gravitational mass produces gravity. In this paper we study gravitational mass and deduce the new gravitational formula.

Gravitational mass and new gravitational formula changed all that. All matter has tachyons and gravitational mass. We rewrite particle physics theory.

We prove that equivalence principle is nonexistent.

Therefore we prove that general relativity is the biggest wrong theory.

In the Universe there are no Higgs particles and no quarks. The standard model of particle physics is wrong.

space-time can only become science when it rises to the height of mathematics.

Theory of everything: (1) the subluminal force (electromagnetism and weak force) and (2) superluminal force (gravitation and strong force). It is a simple, elegant, unifying theory.

The quantum entanglements and non-locality are unobservable. Only the gravitational and tachyonic entanglements, but no electron and photon entanglements. All entangled photon experiments are wrong.

The Greatest New Gravity Discovery That Was Ever Made.

Newtonian gravity formula is based on empirical

evidence. He did not explain what is gravity? How it works? The equivalence principle is not exist, The gravitation must not be described by a "metric theory". The Einstein field equations are wrong. Therefore we prove that general relativity is the biggest wrong theory. No black holes, gravitational waves are unobservable. No dark matter, no dark energy. There cannot be really gravity theory without gravitational mass.

China does not allow to publish my work at home and abroad. I can only advertise my work at home and abroad using email.

If China had supported new gravitational formula (1976), scientists would not have studied black holes, dark matter, dark energy and gravitational waves.

In 2017 China decided to crack down on the greatest scientist Chun-Xuan Jiang

Mathematical Theory Of Space-Time With SASC

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Abstract: Using space-time ring we establish the mathematical theory of space-time with subluminal and superluminal coexistence (SASC). Using two methods we deduce the new gravitational formula. Tardyonic rotating motion produces the centrifugal force, but tachyonic rotating motion produces the centripetal force, that is gravity. Using it we establish the expansion theory of the universe and suggest the new universe model. We prove that in the universe there are no dark matter and no dark energy. New gravitational formula changes all that. Multiverse and gravitational waves do not exist. Theory of everything has the two forces: (1) the subluminal force (electromagnetism and weak force) and (2) superluminal force (gravity and strong force). We prove that equivalence principle is not exist. Therefore we prove that general relativity is the biggest wrong theory.

Keywords: new gravitational formula, expansion theory of universe.

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1. Mathematical Theory of Space-Time With SASC

Throughout history, the notion of space and time has undergone a number of dramatic transformation, thanks to figures ranging from Aristotle, Leibniz and Newton to Gauss, Poincare and Einstein. In the present understanding of nature, space and time form a single entity called space-time. In 1975 Jiang has established the mathematical theory of space-time with SASC. This theory plays a key role for the entire field of physics to unlock the deepest mysteries of the universe.

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 with SASC. we first define space-time ring [1,7-8]

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

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

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

(1) can be written as Euler form

$$Z = ct_0 e^{j\theta} = ct_0 (\operatorname{ch} \theta + j \operatorname{sh} \theta), \tag{2}$$

where ct_0 is the tardyonic invariance, θ tardyonic hyperbolical angle.

From (1) and (2) we have

$$ct = ct_0 \operatorname{ch} \theta, \quad x = ct_0 \operatorname{sh} \theta$$
 (3)

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

From (3) we have

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

where $c \ge u$ is the tardyonic velocity. Using the morphism $j: z \to jz$, we have

$$jz = \overline{x} + jc\overline{t} = \overline{x}_0 e^{j\overline{\theta}} = \overline{x}_0 (\operatorname{ch} \overline{\theta} + j \operatorname{sh} \overline{\theta}),$$
(6)

where \overline{x} and \overline{t} are the tachyonic space and time coordinates, \overline{x}_0 is tachyonic invariance, $\overline{\theta}$ tachyonic hyperbolical angle.

From (6) we have

$$\overline{x} = \overline{x}_0 \operatorname{ch} \overline{\theta}, \quad c\overline{t} = \overline{x}_0 \operatorname{sh} \overline{\theta}.$$
 (7)

$$\overline{x}_0 = \sqrt{(\overline{x})^2 - (c\overline{t})^2} \tag{8}$$

From (7) we have

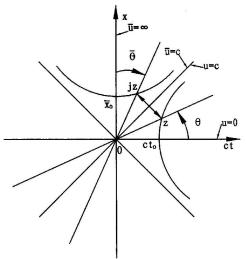


Fig. 1. Mathematical theory of space-time with SASC

说明.图 1 把亚光速和超光速联系起来,整个图

1 都有物理意义,爱因斯坦认为超光速不存在,只研究图 1 亚光速区.所有物理问题都可以从图 1 找到答案.图 1 是微观和宏观最基本的基础..它回答所有物理问题,例如无引力波,无暗物质,无暗能量,无黑洞,无量子纠缠等重大问题。

目前引力波暗物质暗能量黑洞量子纠缠支持人很多是热门,蒋认为他们可以继续研究下去,他把他的结果公布出来.让后人和实验说话.真理永存。

为什么中国花大力气研究引力波暗物质暗能量黑洞量子纠缠?为什么不允许这篇划时代论文存在呢?.最近30年花大力气实验寻找引力波暗物质暗能量毫无结果.主要现代物理理论是错的,应该集中力量提出新理论,不是搞大实验室.100年前不是这样.为什么中国跟着美国这样做?没有理论指导实验是盲目的不会得出任何结果。

$$\overline{\theta} = \tanh^{-1} \frac{c\overline{t}}{\overline{x}} = \tanh^{-1} \frac{c}{\overline{u}}.$$
(9)

where $\overline{u} \ge c$ is the tachyonic velocity.

Figure 1 shows the formulas (1)-(9). $j:z\to jz$ is that tardyon can be converted into tachyon, but $j:jz\to z$ is that tachyon can be converted into tardyon. $u=0\to u=c$ is the positive acceleration, but $\overline{u}=\infty\to \overline{u}=c$ 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-a axis we define the tachyonic rest space

$$\overline{X}_0 = \lim_{\substack{\overline{u} \to \infty \\ t \to 0}} \overline{u}t = \text{constant}.$$
(10)

Since at rest the tachyonic rest time t = 0 and $\overline{u} = \infty$, we prove that tachyon is unobservable and non-locality.

Fig.1 and (10) are mathematical theory of space-time with SASC, which are the foundations of physics and cosmology. Using it we prove that dark matter, dark energy, gravitational waves and black holes do not exist., quantum entanglement and quantum computers are unobservable. only gravitonic and tachyonic entanglements, but no electronic and photonic entanglements. From Fig.1 we deduce new gravitational formula.

2. New Gravitational Formula:
$$\overline{F} = -\frac{mc^2}{R}$$
 without dark matter

暗物质根本不存在,国内外都找暗物质毫无结果,中国发射暗卫星是中国最大成果,这是胡说八道。

Assume $\theta = \overline{\theta}$, from (5) and (9) we get the tardyonic and tachyonic coexistence principle [1-4,7-8]

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

Using the analytical method we deduce the new gravitational formula. Differentiating (11) by the time, we get

$$\frac{d\overline{u}}{dt} = -\left(\frac{c}{u}\right)^2 \frac{du}{dt}.$$

$$\frac{du}{dt} \quad \frac{d\overline{u}}{dt} \quad \text{can coexist in motion, but their time are expected.}$$

We study the tardyonic and tachyonic rotating motions. In 1673 Huygens discovered that the tardyonic rotation produces centripetal acceleration

$$\frac{du}{dt} = \frac{u^2}{R},\tag{13}$$

where R is rotating radius.

Substituting (13) into (12) we have the tachyonic centrifugal acceleration

$$\frac{d\overline{u}}{dt} = -\frac{c^2}{R}.$$
 (14)

(13) and (14) have the same form. From (13) we get the tardyonic centrifugal force

$$F = \frac{Mu^2}{R},\tag{15}$$

where M is the inertial mass.

From (14) we get the tachyonic centripetal force, that is gravity

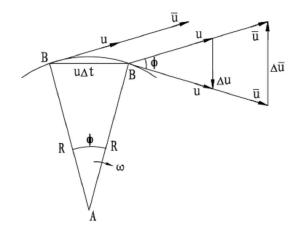
$$\overline{F} = -\frac{mc^2}{R} \tag{16}$$

where m is the gravitational mass converted into by tachyonic mass m.

(15) and (16) have the same form. (16) is the new gravitational formula.

Using the geometrical method we deduce the new gravitational formula.

Figure 2 shows that the rotation ω of body Aemits tachyon mass \overline{m} , which forms the tachyon and gravitation field and gives the body B revolutions u and \overline{u} .



 $d\overline{u}$ Fig.2. On body B coexistence [2]

From Fig. 2. it follows

$$\frac{u\Delta t}{R} = \frac{\Delta u}{u} \tag{17}$$

From (17) it follows the tardyon centripetal acceleration on the body B [2-4],

$$\frac{du}{dt} = \lim_{\stackrel{\Delta u \to 0}{\Delta t \to 0}} \frac{\Delta u}{\Delta t} = \frac{u^2}{R}$$
(18)

From Fig. 2. it follows

$$\frac{u\Delta t}{R} = -\frac{\Delta \overline{u}}{\overline{u}} \tag{19}$$

From (19) and (11) it follows the tachyon centrifugal acceleration on the body B [2-4],

$$\frac{d\overline{u}}{dt} = \lim_{\stackrel{\Delta \overline{u} \to 0}{\Delta t \to 0}} \frac{\Delta \overline{u}}{\Delta t} = -\frac{u\overline{u}}{R} = -\frac{c^2}{R}$$
On body B the $\frac{du}{dt}$ and $\frac{d\overline{u}}{dt}$ coexistence.

From (18) it follows the tardyon centrifugal force on body B [2-4],

$$F = \frac{M_B u^2}{R},\tag{21}$$

where M_B is body B inertial mass. From (20) it follows the tachyon centripetal force on body B, that is gravity [2-4,7-8],

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

where m is the gravitation mass converted into by tachyon mass \overline{m} which is unobservable, but m is observable.

(22) is the new gravitational formula. In 1976[2] this simple thought made a deep impression on me. It impelled me to establish the new gravitational theory. On body B the F and \overline{F} coexistence.

图 3,亚光速转动产生离心力 F 这点人们都知道,超光速转动产生向心力即引力.

这就是引力机制,人们都可以理解地球和太阳运动. A 是太阳, B 是地球.

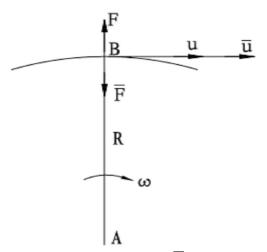


Fig.3. On body B the F and \overline{F} coexistence and the new Universe model

From Fig. 3, it follows

$$F + \overline{F} = 0. (23)$$

From (21), (22) and (23) it follows

$$\frac{m}{M_B} = \frac{u^2}{c^2} \tag{24}$$

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 above we prove that equivalence principle is not exist. Therefore we prove that general relativity is the biggest wrong theory.

Using Fig.3 we establish the new universe model.

- (1) Body A is earth center, body B is the moon;
- (2) Body A is the sun center, body B is the Earth;
- (3) Body A is Galactic center, body B is stars in the milky way;
 - (4)
- (5) Body A is the universe center; body B is the stars in the universe.

In Fig.3 on body B there is tardyonic centrifugal force and tachyonic centripetal force coexistence.

It is the universe foundations. All matter has unobservable tachyons to produce gravity. We should establish new cosmological theory and new particle physics theory.

From (22) it follows Newtonian gravitation formula. The m is proportional to body A mass M , in (24) m is proportional to M , is inversely proportional to the distance R between body A and body B . It follows

$$m = k \frac{M_A M_B}{R} \tag{25}$$

where k is constant

Substituting (25) into (22) it follows the Newtonian gravitation formula [2-4,7-8]

$$\overline{F} = -G \frac{M_A M_B}{R^2},\tag{26}$$

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

从新引力公式(22)可推导出牛顿引力公式(26),这是任何理论都不能完成的

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

$$\overline{F} = -\frac{mc^2}{R} \tag{27}$$

where R is the Earth radius.

We have the equation of motion

$$\frac{mc^2}{R} = Mg \tag{28}$$

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

From (28) it follows the gravitational coefficient

$$\eta = \frac{m}{M} = \frac{Rg}{c^2} = 6.9 \times 10^{-10} \tag{29}$$

Eötvös experiment $\eta \sim 5 \cdot 10^{-9}$ 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 and the equivalence principle is not exist. Therefore we prove that general relativity is the biggest wrong theory.

3. The expansion theory of the universe without dark energy

暗能量不存在,本章给出宇宙膨张理论和膨张加速 度公式,彻底解决这个问题。

Using new gravitational formula we study the expansion theory of the Universe [7-8]. Figure 4 shows a expansion model of the Universe. The rotation ω_1 of body A emits tachyonic flow, which forms the tachyonic field. Tachyonic mass \overline{m} acts on body

B , which produces its rotation $\,\,\omega_2^{}$, revolution u and gravitational force

$$\overline{F}_1 = -\frac{mc^2}{R} \tag{30}$$

where R denotes the distance between body A and body B, m is gravitational mass converted into by tachyonic mass \overline{m} which is unobservable but *m* is observable.

The rotation of the body B around body Aproduces the centrifugal force

$$F_{1} = \frac{M_{B}u^{2}}{R},$$

$$W_{1}$$

$$W_{2}$$

$$W_{3}$$

$$W_{4}$$

$$W_{5}$$

$$W_{7}$$

Fig. 4. A expansion model of the Universe

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

At the
$$O_2$$
 point we assume $F_1 + \overline{F_1} = 0$. (32)

From (32) it follows that the coexistence of the gravitational force and centrifugal force.

From (30)-(32) it follows the gravitational

coefficient

$$\eta = \frac{m}{M_B} = \left(\frac{u}{c}\right)^2. \tag{33}$$

At the O_3 point the tachyonic mass \overline{m} can be converted into the rest mass m in body B, it

$$F_2 = \frac{M_B u^2}{R} + \frac{m u^2}{R} \ . \tag{34}$$

Since
$$F_2 + \overline{F_1} > 0$$
, centrifugal force F_2 is

greater than gravitational force F_1 , then the body Bexpands outwards and its mass increases. This is a expansion mechanism of the Universe. From (31,32,34)

$$F_2 + \overline{F_1} = \frac{mu^2}{R} = M_B g_e$$
 (35)
From (35) we obtain the expansion acceleration

$$g_e = \frac{mu^2}{M_B R}$$
 (36)

Substituting (33) in (36) we obtain

$$g_e = \frac{u^4}{c^2 R} \tag{37}$$

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 a 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.

Table 1: Values of the gravitational coefficients η

There is a mineral of the Bray standard control of the		
Planet	$u_{\rm (km/sec)}$	$\eta(10^{-10})$
Mercury	47.89	255.2
Venus	35.03	136.5
Earth	29.79	98.7
Mars	24.13	64.8
Jupiter	13.06	19.0
Saturn	9.64	10.3
Uranus	6.81	5.2
Neptune	5.43	3.3
Pluto	4.74	2.5

The gravitational field of the solar system is the origin of the planet mass. From it the planet acquire mass. In the universe there are no Higgs particles. The equivalence principle is not exist. Therefore we prove that general relativity is the biggest wrong theory.

4. Conclusion

In summary. We deduce tardyonic and tachyonic coexistence principle. Using it we deduce the centrifugal formula and new gravitational formula We establish the expansion theory of the universe without dark energy. 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 $\overline{m} \rightarrow m$, tachyons \rightarrow tardyons [1], that is tachyons can be converted into the electrons and positrons which are the basic building-blocks of the elementary particles [5-6]. In the universe there are no Higgs particles and no quarks. The standard model of particle physics is wrong. The tachyons are the origin of mass. Where are we going? We answer this question this way $m \to \overline{m}$, that is the tardyons produce tachyons [1]. The tardyons and tachyons make up the Universe.

Note. In 1976 Jiang found a gravitational formula

$$\overline{F} = -\overline{m}c^2/R \, , \, \text{where} \, \, \overline{m} \, \, \text{is the tachyonic mass.}$$
 In 2004 Jiang studied the Universe expansion and

found a new gravitational formula $R = \frac{1}{R}$, where R is gravitational mass converted into by tachyonic mass \overline{m} [7].

Newtonian gravity formula is based on empirical evidence. He did not explain what is gravity? how it works? Equivalence principle is not exist, the gravitation must not be described by a "metric theory". The Einstein field equations are wrong, therefore we prove that general relativity is the biggest wrong theory.

Acknowledgments

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@vanocken.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.

(2) 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

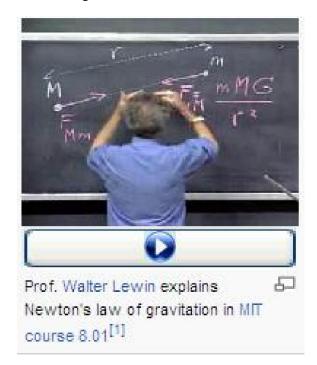
Cc: <u>luc@vanocken.be</u>

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.

Greetings.



MIT 著名引力教授 Lewin 给本文这么高评价; 只要发表就可获诺贝尔物理奖.中国没有反应.中国 不允许国外物理杂志发表本文, 国外杂志要发表由 于中国假洋鬼子反对而没发表, Google 和百度全面 报道本文所有图和公式。

现在有网络本文己在国际传播,全世界人都在 看本文,中国不支持不需要本文,这将是中国一个大 丑闻。 为获诺贝尔物理奖, 需要中国支持, 宣传组织 人员研究, 将会获得更多诺贝尔奖。

References

- 1 Chun-Xuan Jiang, A theory of morphisms between the tardyon and tachyon, physics (Chinese), 4. (1975)119-125.
- 2 Chun-Xuan Jiang, On nature for gravitation, (new gravitational formula) J. Beijing observatory (Chinese), 7(1976)32-38.
- 3 Chun-Xuan Jiang, An approach on the nature of attractive force, Potential science (Chinese), 4(1982)19-20.
- 4 Chun-Xuan Jiang, A unified theory of the gravitational and strong interactions, Hadronic J., 24(2001)629-638.

- 5 Chun-Xuan Jiang, A simple approach to the computation the total number of hadronic constituents in Santilli model, Hadronic J., 3(1979)256-292.
- 6 Chun-Xuan Jiang, A mathematical model for particle classification, Acta Math. Scien, 8(1988)133-144.
- 7 Chun-Xuan Jiang, New gravitational formula and expansion theory of the universe. In: new studies of space-time theory (Chinese), Dizi press, pp.254-259,2005.
- 8 Chun-Xuan Jiang, New gravitational formula; The expansion theory of the Universe without dark energy. In: unsolved problems in special and general relativity, Education publishing, USA, p131-140,2013.

6/25/2018