

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

Chun-Xuan. Jiang

P. O. Box 3924, Beijing 100854, P. R. China

Jiangchunxuan@sohu.com and

Institute for Basic Research

Palm Harbor, FL 34682, U. S. A.

## **Abstract**

We find a new gravitational formula, establish the expansion theory of the Universe, and prove that the principle of equivalence is nonexistent, therefore the general theory of relativity, superstrings, black holes and Calabi-Yau conjecture could all be wrong. In the universe there are no dark matter and no dark energy. Due to the importance of a new gravitational formula, comments by interested colleagues are here solicited.

PACS numbers: 04. 90. +e, 95. 30. Sf, 96. 10. +i, 98. 35. Ce

In the Universe there are two matters: (1) observable subluminal matter called tardyon and (2) unobservable superluminal matter called tachyon 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. In this paper using tardyonic and tachyonic coexistence principle we find a new gravitational formula, establish the expansion theory of the Universe, prove that Einstein's principle of equivalence is nonexistent. Therefore the general theory of relativity could be wrong.

We first define two-dimensional space and time ring [1]

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

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

$$z = ct_0 e^{j\theta} = ct_0 (\text{ch } \theta + j \text{sh } \theta), \quad (2)$$

where  $ct_0$  is the tardyonic invariance,  $\theta$  tardyonic hyperbolical angle.

From (1) and (2) we have

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

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

From (3) we have

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

where  $c \geq u$  is the tardyonic velocity,  $\text{ch } \theta = 1/\sqrt{1-(u/c)^2}$  and  $\text{sh } \theta = u/c/\sqrt{1-(u/c)^2}$ .

The  $z$  denotes mathematics of the special relativity and quantum theory.

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

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

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

From (6) we have

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

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

From (7) we have

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

where  $\bar{u} \geq c$  is the tachyonic velocity,  $\operatorname{ch} \bar{\theta} = \frac{1}{\sqrt{1-(c/\bar{u})^2}}$  and

$$\operatorname{sh} \bar{\theta} = \frac{c/\bar{u}}{\sqrt{1-(c/\bar{u})^2}}.$$

The  $jz$  denotes mathematics of the gravitational theory and cosmology.

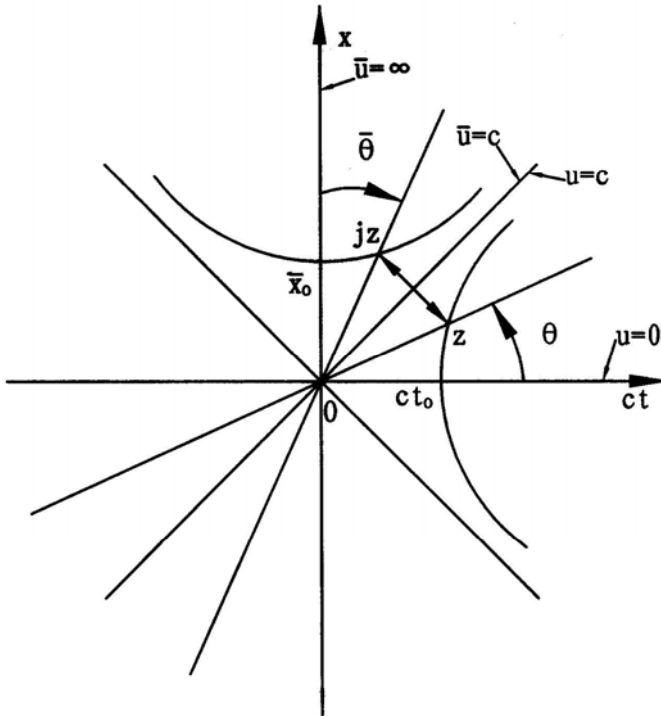


Fig. 1. Tardyonic and tachyonic coexistence principle

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  $\bar{u} = \infty \rightarrow \bar{u} = c$  is the negative acceleration, which coexist. At the  $x$ -axis we define the tachyonic unit length

$$L_0 = \lim_{\substack{\bar{u} \rightarrow \infty \\ t \rightarrow 0}} \bar{u}t = \text{constant}. \quad (10)$$

Since at rest the tachyonic time  $t = 0$  and  $\bar{u} = \infty$ , we prove that tachyon is unobservable. Assume  $\theta = \bar{\theta}$ , from (5) and (9) we get the tardyonic and tachyonic coexistence principle [2-3]

$$u\bar{u} = c^2 \quad (11)$$

Differentiating (11) by the time, we get

$$\frac{d\bar{u}}{dt} = -\left(\frac{c}{u}\right)^2 \frac{du}{dt}. \quad (12)$$

$\frac{du}{dt}$  and  $\frac{d\bar{u}}{dt}$  can coexist in motion, but their directions are opposite.

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

$$\frac{du}{dt} = \frac{u^2}{R}, \quad (13)$$

where  $R$  is rotating radius.

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

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

(13) and (14) are twin formulas, which have the same form. It is unique and perfect. From (13) we get the tardyonic centrifugal force

$$F = \frac{Mu^2}{R}, \quad (15)$$

where  $M$  is the inertial mass.

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

$$\bar{F} = -\frac{mc^2}{R}, \quad (16)$$

where  $m$  is the gravitational mass converted into by tachyonic mass  $\bar{m}$ .

(15) and (16) are twin formulas, which have the same form. (16) is a new gravitational formula. It is simplicity, elegance and mathematical beauty. It is the foundations of gravitational theory and cosmology.

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

$$\bar{F} = -\frac{mc^2}{R}, \quad (17)$$

where  $R$  is the Earth radius.

We have the equation of motion

$$\frac{mc^2}{R} = Mg, \quad (18)$$

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

From (18) we define the gravitational coefficient

$$\eta = \frac{m}{M} = \frac{Rg}{c^2} = 6.9 \times 10^{-10}. \quad (19)$$

In 1922 Eötvös experiment  $\eta \sim 5 \cdot 10^{-9}$  and in 1964 Dicke experiment  $\eta \sim 10^{-11}$  [4].

Since the gravitational mass  $m$  can be transformed into the rest mass in freely falling body, we define Einstein's gravitational mass  $M_g = M_i + m$  and inertial mass  $M_i = M$  [5]. We prove

$$M_g > M_i. \quad (20)$$

Therefore we prove that the principle of equivalence is nonexistent. At the heart of the general theory of relativity is the principle of equivalence. Therefore the general theory of relativity, superstrings, black holes and Calabi-Yau conjecture could all be wrong.

The Big Bang threw all the matter in the universe outwards. Both Newton's and Einstein's theories of gravity predict that the expansion must be slowing down to some degree: the mutual gravitational attraction of all the matter in all the galaxies should be pulling them

inwards. But measurements of distant supernovae show just the opposite [6]. All the matter in the universe appears to be accelerating outwards. Its speed is picking up. There is no agreement yet about how to explain these mysterious observations. Now we explain our accelerating universe.

Using (16) we study the expansion theory of the Universe. Figure 2 shows a 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

$$\bar{F}_1 = -\frac{mc^2}{R}, \quad (21)$$

where  $R$  denotes the distance between body  $A$  and body  $B$ ,  $m$  is gravitational mass converted into by tachyonic mass  $\bar{m}$ .

The revolution of the body  $B$  around body  $A$  produces the centrifugal force

$$F_1 = \frac{M_B u^2}{R}, \quad (22)$$

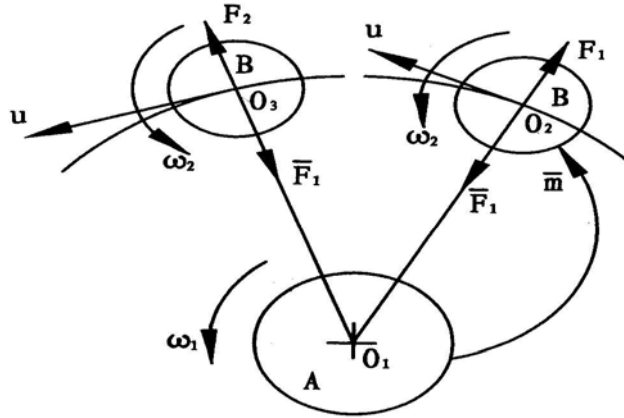


Fig. 2. A expansion model of the Universe

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

$$F_1 + \bar{F}_1 = 0. \quad (23)$$

From (21)-(23) we have the gravitational coefficient

$$\eta = \frac{m}{M_B} = \left(\frac{u}{c}\right)^2. \quad (24)$$

At the  $O_3$  point the tachyonic mass  $\bar{m}$  can be converted into the rest mass  $m$  in body  $B$ , we have

$$F_2 = \frac{M_B u^2}{R} + \frac{m u^2}{R}. \quad (25)$$

Since  $F_2 + \bar{F}_1 > 0$ , centrifugal force  $F_2$  is greater than gravitational force  $\bar{F}_1$ , then the body  $B$  expands outwards and its mass increases. This is a expansion mechanism of the Universe. If body  $A$  is the Earth, then body  $B$  is the Moon; if body  $A$  is the Sun, then body  $B$  is the Earth;  $\dots$ . It can explain our accelerating universe. In the universe there are no dark matter and no dark energy.

If the body  $A$  is the Sun and body  $B$  is the planet. We calculate the gravitational coefficient  $\eta$  as shown in table 1.

Table 1.

Planet	$u$ (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

Since gravitational mass  $m$  can be transformed into the rest mass in body  $B$ , we define

Einstein's gravitational mass  $M_g = M_i + m$  and inertial mass  $M_i = M_B$  [5].

We prove

$$M_g > M_i. \quad (26)$$

Therefore we prove that the principle of equivalence in the Solar system is nonexistent. Of all the principles at work in gravitation, none is more central than the principles of equivalence [4], which could be wrong.

From (21) we derive Newtonian gravitational formula. The  $m$  is proportional to  $M_A$ , which denotes inertial mass of body  $A$ , in (24)  $m$  is proportional to  $M_B$ , is inversely proportional to the distance  $R$  between body  $A$  and body  $B$ . We have

$$m = k \frac{M_A M_B}{R}, \quad (27)$$

where  $k$  is a constant.

Substituting (27) into (21) we have Newtonian gravitational formula [2-3]

$$\bar{F}_1 = -G \frac{M_A M_B}{R^2}, \quad (28)$$

where  $G = kc^2$  is a gravitational constant.

We have Einstein's gravitational mass

$$M_g = M_i + m = M_i(1 + \eta). \quad (29)$$

Substituting (29) into (28) we have Newtonian generalized gravitational formula

$$\bar{F}_1 = -G \frac{M_A(1 + \eta_A)M_B(1 + \eta_B)}{R^2}, \quad (30)$$

where  $\eta_A$  and  $\eta_B$  denote gravitational coefficients of body  $A$  and body  $B$  separately.

Assume  $\rho_A$  and  $\rho_B$  denote the densities of body  $A$  and body  $B$  separately. In the same way from (21) we get a unified formula of the gravitational and strong forces[3]

$$\bar{F}_1 = -G_0 \frac{\rho_A M_A(1 + \eta_A)\rho_B M_B(1 + \eta_B)}{R^2} \quad (31)$$

where  $G_0 = 5.2 \times 10^{-10} \text{ cm}^9/\text{g}^3 \cdot \text{sec}^2$  is a new gravitational constant.

In the nucleus exists the strong interactions. We have [3]

$$\frac{\text{Strong interaction}}{\text{Gravitational interaction}} = \frac{G_s}{G_g} = 10^{38} \quad (32)$$

where  $G_g = 6.7 \times 10^{-8} \text{ cm}^3/\text{g} \cdot \text{sec}^2$  and  $G_s = 6.7 \times 10^{30} \text{ cm}^3/\text{g} \cdot \text{sec}^2$

In the nucleus we assume  $\rho_A = \rho_B = \rho$ . From (31) we have

$$G_s = G_0 \rho^2 \quad (33)$$

From [33] we have the formula of the particle radii

$$r = 1.55[m(\text{Gev})]^{1/3} \text{ jn}, \quad (34)$$

where  $1 \text{ jn} = 10^{-15} \text{ cm}$  and  $m (\text{Gev})$  is the mass of the particles.

From (34) we have that the proton and neutron radii are  $1.5 \text{ jn}$ [3].

We have the formula of the nuclear radii

$$r = 1.2(A)^{1/3} \text{ fm}, \quad (35)$$

where  $1 \text{ fm} = 10^{-13} \text{ cm}$  and  $A$  is its mass number.

It is shows that (34) and (35) have the same form. The particle radii  $r < 5 \text{ jn}$  and the nuclear radii  $r < 7 \text{ fm}$ .

Special relativity and quantum physics are the tardyonic theory. Einstein pointed out that velocities greater than that of light have –as in our previous results–no possibility of existence [7], which could be wrong. But gravitation is the tachyonic theory and the action-at-a-distance.

Einstein experience with the creation of general relativity: *But the creative principle resides in mathematics. In a certain sense, therefore, I hold it true that pure thought can grasp reality, as the ancients dreamed. (A passage in Einstein's 1933 Herbert Spencer Lecture.)*. It gave direction to later theoretical research, and its influence on fundamental physics will extend well into the 21st century. They can conjecture the physical reality in studying Riemannian geometry, curved spacetime, Calabi-Yau conjecture, superstrings, supersymmetry, black holes, dark matter, dark energy, cosmological constant, brane world,

theory of everything, Big Bang, inflation, Higgs physics and other, which could all be wrong, because they do not consider and understand the gravitational nature, the tachyonic theory and a new gravitational formula:  $\bar{F} = -\frac{mc^2}{R}$ . Practice is the sole criterion for testing truth.

Note In 1976 I found a gravitational formula [2]:  $\bar{F} = -\frac{\bar{m}c^2}{R}$ , where  $\bar{m}$  is the tachyonic mass. In 2004 I study the Universe expansion and find  $\bar{F} = -\frac{mc^2}{R}$ , where  $m$  is gravitational mass converted into by tachyonic mass  $\bar{m}$ .

### References

1. C. X. Jiang, Wuli (Physics) (Chinese), 4, 119-125 (1975).
2. C. X. Jiang, J. Beijing Observatory (Chinese), 7, 32-38 (1976).
3. C. X. Jiang, Hadronic J. 24, 629-638 (2001).
4. C. W. Misner, K. S. Thorne and J. A. Wheeler, Gravitation (Freeman, 1973), P. 1050, 1060.
5. A. Einstein, The Meaning of Relativity (6th ed., Chapman and Hall, London, 1967), p. 56.
6. S. Perlmutter, Physics Today, 53-59, April (2003).
7. A. Einstein, Ann. Phys., 17, 891-921(1905).