Fine Structure Constant| and Variable Speed of Light

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The fine structure constant has been proved to be no change even if the speed of light varies in gravitation field or in the history of cosmos. Lorentz transformation has also been proved to be a transformation of physical units between two different frames. This transformation implies a variable speed of light in gravitational field. Base on this variable speed of light, a new VSL cosmology model was established so as to solve the flatness problem and horizon problem in Standard Cosmology.

Keywords: Fine structure constant, Lorentz Transformation, Variable Speed of Light, Flatness Problem, Horizon

1. Introduction

The thinking of natural constants change with time was first made by Paul Dirac in 1937 [1] known as the Dirac Large Numbers Hypothesis, in which the gravitational constant was proposed to be inversely proportional to the age of universe in order to explain the relative weakness of the gravitational force compared to electrical forces. A group studying distant quasars claimed to have detected a variation in the fine structure constant [2], other groups claimed no detectable variation at much higher sensitivities [3][4][5][6]. Variable Speed of Light (VSL) cosmology has also been proposed by several authors [7][8][9][10] as an alternative choice for the well developed Inflationary Theory to explain the horizon problem and other puzzles in Standard Cosmology. Actually, there's still no known way can really solve these problems until today. No one really knows how speed of light and other natural constants vary if they're variable. An actual VSL theory needs to be realized to support the VSL cosmology so as to solve the problems arisen from the standard cosmology.

In the other hand, the four-dimensional space-time presented in the theory of relativity seems strange and goes against to our experience in perception of Euclidean space, in which the universe is three-dimensional in space and one-dimensional in time. In fact, space-time is only a kind of mathematical model to combine space and time into a single manifold called space-time continuum so as to simplify physical theories. What makes difference in a space-time system is the definition of physical units. A series of transformations are required for physical quantities in different unit systems to reach a common standard. Newtonian dynamics treats time as universal and constant. It uses the three-dimensional Euclidean space and one-dimensional time to describe physical events. But unfortunately, no one can find an unchanged prototype second as a universal standard for the definition of time as we do for the definition of mass and length. Actually, we have to use a variable time unit. This results in variation in other units based on it. By applying a frequency dependent definition of time, the Euclidean space-time becomes covariant to Lorentz transformation. The space-time in relativity also comes back to our experience in Euclidean space by taking the definition of physical units into account. The space-time transformations based on definition of physical units implies a variable speed of light. Based on this variable speed of light, a Newtonian cosmology model can be established without encountering problems arisen in the standard Big Bang cosmology. The theory of relativity comes back to Newtonian dynamics in cosmology with variable speed of light.

2. Fine Structure Constant and Variable Speed of Light

As we know, the fine structure constant has been confirmed as unchanged in very high accuracy in studying early quasars [3] [4] and certain isotopic abundances in the Oklo Natural Nuclear Fission Reactor [5] [6], we need first to make it clear whether variable speed of light is consistent with this experimental fact.

According to the Standard Model, interaction are caused from exchanging of some kind of integral spin bosons between half integral spin fermions, photon for electromagnetic interaction, $W^{\pm}$and Z boson for weak interaction, gluon for strong interaction and graviton for gravitation. How exchanging integral spin bosons can cause a force? The decay-spin model (DSM)[11] had given some answers: absorbing integral spin bosons breaks the equilibrium of the Decay-counter decay Reaction inside particles, and results in an inertial force from unsymmetrical radiation of graviton. Thus, interaction force is proportional to the speed of radiation which is proportional to the speed of light. The gravitational constant and the Coulomb force constant are proportional to the speed of light.

The gravitational constant can be denoted as

$$G = ZC \tag{2.1}$$

Z is a constant defined by the gravitational constant G and speed of light C to be $Z = 2.224 \times 10^{-19} m^2 s^{-1} kg^{-1}$.

The Coulomb force constant can be denoted as

$$\frac{1}{4\pi\varepsilon_0} = K = Z_e C \tag{2.2}$$

Z_e is a constant defined by Coulomb force constant K and C to be $29.9792458 C^{-2} Nms$.

According to DSM, Coulomb force is the space-time rate of angular momentum change caused by absorbing integral spin bosons, similar to the gravitational force which is the time rate of linear momentum change caused by absorbing gravitons [11]. Take two electrons as an example, according to Bohr's rule, the absorbed angular momentum of spin boson has to be $n\hbar$, across a space distance *r* and a time of *t*=*br*/*C* (*b* is a proportional constant and *C* is the speed of light), the Coulomb force will be

$$F = \frac{dL}{rdt} = \frac{n\hbar C}{br^2} \tag{2.3}$$

Compare (2.3) with the Coulomb's law

$$F = \frac{Z_e C e^2}{r^2} \tag{2.4}$$

The charge can be denoted as

$$e = \sqrt{\frac{n\hbar}{bZ_e}} \tag{2.5}$$

The charge of a particle is proportional to the square root of its angular momentum which in turn is proportional to the Dirac constant (reduced Planck constant) $\hbar$ ($e \propto \sqrt{\hbar}$). This is a very important conclusion. As we have known, charge is independent to the mass of charge particles as shown in (2.5). Charge is a property of matter related to angular momentum; this implies an equivalence principle of magnetism and spin, and also implies a universal magnetism in galaxy and the whole cosmos. [11][17]

Thus, the fine structure constant can be denoted as

$$a = \frac{Ke^2}{\hbar C} = \frac{n}{b} = const. \tag{2.6}$$

The fine structure constant remains unchanged even if the speed of light varies all the time in gravitation field or in the history of cosmos.

3. Transformation of space-time and Variable Speed of Light

In the Newtonian space-time system, the unit of length was defined as the length of a prototype bar, the unit of time can also be regarded as a kind of prototype interval supposed to be the same anywhere, anytime and at any speed. In Einstein's space-time system, the only unchanged parameter is the speed of light defined as 299792458m/s. In this context, the unit of length was defined as the path light travels in a time interval of 1/299792458 of a second in vacuum. Unfortunately, neither Einstein nor Newton could find a prototype second as a standard for the unit of time as we do for the units of mass and length, so the unit of time is just "something" related to a certain physical phenomenon. As an international standard, a second was defined as the duration of 9192631770 periods of the radiation corresponding to the transition between two hyperfine levels of the ground state of cesium-133 atom. Since the unit of time was so defined, the change in the frequency of this spectrum in physical events has been interpreted as a change in the unit of a second and other physical units based on it.

Frequency change of light happens in two important circumstances: motion and gravitation field. According to the definition of second, the interval of a second will change correspondingly with the change of the frequency of light.

As an experimental fact, frequency change of light in a motional frame is described with the Doppler Effect as

$$v' = v\sqrt{\frac{C+V}{C-V}} \tag{3.1}$$

Relative to observers in a rest frame, the definition of a second in a motional frame is different from that in his frame. The above definition gives the relation between them as $t'/t = T'/T = v/v'$, so

$$t' = t\sqrt{\frac{C-V}{C+V}} \tag{3.2}$$

The change of a second also results in a change in length of a meter, for the path light travels in 1/299792458 of a second is different correspondingly. For $x = Ct$ and $x' = Ct'$, so $x'/x = t'/t$,

$$x' = x\sqrt{\frac{C-V}{C+V}} \tag{3.3}$$

The change in length of a meter is also equivalent to a change in magnitude of the speed of light as the distance light travels in a second is different corresponding to the change in definition of a second.

$$C' = C\sqrt{\frac{C-V}{C+V}} \tag{3.4}$$

Combine them as a whole to be the transformation of physical units as the followings

$$\left.\begin{aligned} x' &= x\sqrt{\frac{C-V}{C+V}} \\ y' &= y \\ z' &= z \\ t' &= t\sqrt{\frac{C-V}{C+V}} \\ C' &= C\sqrt{\frac{C-V}{C+V}} \end{aligned}\right\} \tag{3.5}$$

Except the transformation of the speed of light, the transformation of space-time base on definition of physical units is the same as Lorentz's transformations, for $x = Ct$, $x' = Ct'$ we have

$$x' = x\sqrt{\frac{C-V}{C+V}} = \frac{x - Vt}{\sqrt{1-\left(\frac{V}{C}\right)^2}} \tag{3.6}$$

$$t' = t\sqrt{\frac{C-V}{C+V}} = \frac{t - \frac{Vx}{C^2}}{\sqrt{1-\left(\frac{V}{C}\right)^2}} \tag{3.7}$$

The units of length and the distance of space are two different concepts. The unit of length tells us how long a meter is, and the distance tells us how many meters there are between two points of space. So as for the time, the unit of time tells us how long a second is, the interval of time tells us how many seconds there are between two moments. These differences are also shown in their dependency on the direction of speed. Units of space and time depend on the direction of speed as shown in (3.5), while distance and interval don't as shown in the followings.

$$T = T'\sqrt{1-\left(\frac{V}{C}\right)^2}$$
$$L = \frac{L'}{\sqrt{1-\left(\frac{V}{C}\right)^2}} \qquad (3.8)$$

The variable speed of light between two relative motional frames doesn't violate the covariance of Lorentz transformation. The speed of light is always the same under the physical unit system in every frame, but not the same relative to observers in other frames who have a different physical unit system. It follows the transformation shown in (3.5). Einstein's special relativity comes back to our experience of sense in Euclidean space when the variable time definition is taken into account. In facts, the above space-time system based on definition of physical units is Newton's space-time system with variable unit of time or Einstein's space-time system with variable speed of light. It's a bridge to joint Newtonian dynamics with relativity.

4. Variable Speed of Light in Cosmic System

The frequency change of light in gravitation field has been verified first by Pound and Snider [12] in an accuracy of 1% and then by Vessot, et al, in an accuracy about 10^{-4} [13] to be

$$v = v_0\left(1-\frac{2GM}{RC^2}\right)^{\frac{1}{2}} = v_0\left(1-\frac{2ZM}{RC}\right)^{\frac{1}{2}} \tag{4.1}$$

In this context, the period of the spectrum will be

$$T = T_0\left(1-\frac{2ZM}{RC}\right)^{-\frac{1}{2}} \tag{4.2}$$

The speed of light in a gravitation field will be

$$C = C_0\left(1-\frac{2ZM}{RC}\right)^{-\frac{1}{2}} \tag{4.3}$$

The only physical solution of (4.3) is

$$C = \sqrt{C_0^2+\left(\frac{ZM}{R}\right)^2}+\frac{ZM}{R} \tag{4.4}$$

This is the speed of light in a local gravitational system. C_0 is the speed of light inside cosmos without gravitation from local system. For a cosmos system without outer "environment" where C_0 is zero, the speed of light inside is

$$C = \frac{2ZM}{R} \tag{4.5}$$

Thus, the speed of light in a cosmic system is variable. It depends on the matter states of the system.

5. Space-time of Cosmos with Variable Speed of Light

The variable speed of light in cosmic system has been successfully derived from the definition of fundamental units in physics. In the followings sections, we will discuss the cosmology model based on this variable speed of light.

An expanding cosmos can be regarded as an idea gas system, it's reasonable to think that the cosmos expands with the speed of light.

$$dR = Cdt \tag{5.1}$$

From (4.5) and (5.1), the space-time equation can be deduced as.

$$R = 2Z^{\frac{1}{2}}M^{\frac{1}{2}}t^{\frac{1}{2}} \tag{5.2}$$

From (4.5) and (5.2), the variable speed of light in a cosmos system can be deduced as

$$C = Z^{\frac{1}{2}}M^{\frac{1}{2}}t^{-\frac{1}{2}} \tag{5.3}$$

So the variable gravitational constant deduced as

$$G = Z^{\frac{3}{2}}M^{\frac{1}{2}}t^{-\frac{1}{2}} \tag{5.4}$$

The Hubble constant can be defined as

$$H = \frac{C}{R} \tag{5.5}$$

From (5.2), (5.3) and (5.5), the Hubble constant relation can be deduced as

$$H = \frac{1}{2} t^{-1} \tag{5.6}$$

6. Mass and Radius of Cosmos with Variable Speed of Light

More surprisingly, if the speed of light depends on the state of cosmic system, the mass, radius and Hubble constant can be accurately calculated with the speed of light and the density or the age of cosmos.

The mass M, radius R and average density of cosmos have the following relation

$$M = \frac{4}{3} \pi R^3 \rho \tag{6.1}$$

From (5.2), (5.4), (5.6) and (6.1), we get the density relation as

$$\rho = \frac{3H^2}{8\pi G} \tag{6.2}$$

We know this is the critical density in standard cosmology. From (5.6) and (6.2), we obtain the density equation as

$$\rho = \frac{3}{32\pi G} t^{-2} \tag{6.3}$$

From (4.5) and (6.1), we get the following relations.

$$R = \left(\frac{3C}{8\pi Z\rho}\right)^{\frac{1}{2}} \tag{6.4}$$

$$M = \left(\frac{3C^3}{32\pi Z^3 \rho}\right)^{\frac{1}{2}} \tag{6.5}$$

With the speed of light and the density or age of the cosmos, the mass and radius of cosmos can be calculated accurately. The age of cosmos has been confirmed with the five-year data of Wilkinson Microwave Anisotropy Probe (WMAP) released by NASA on February 28, 2008 to be about 13.7Gyr or $4.3\times10^{17}s$ [12]. (Table 1).

Table 1. Some Cosmological Parameters from WMAP[14]

Description	Symbol	WMAP-only	WMAP+BAO+SN
Age of universe	t_0	13.69± 0.13 Gyr	13.73± 0.12 Gyr
Hubble constant	H_0	$71.9^{+2.6}_{-2.7}$ km/s/Mpc	70.1± 1.3 km/s/Mpc
Total density	Ω	$1.099^{+0.100}_{-0.085}$	1.0052± 0.0064

So the average density of cosmos calculated with (6.3) is

$$\rho = 2.42\times10^{-27}\,kgm^{-3} \tag{6.6}$$

The mass of the cosmos can be calculated with the (6.5) as

$$M = 1.74\times10^{53}\,kg \tag{6.7}$$

The radius of the cosmos can be calculated with (6.4) as

$$R = 2.58 \times 10^{26}\, m \tag{6.8}$$

The Hubble constant can be calculated with (5.6) as

$$H = 1.16 \times 10^{-18}\, s^{-1} \tag{6.9}$$

All these data are consistent with the observation data except the Hubble constant, but, similar to the horizon puzzle, the Hubble constant obtained by observations was proved to be twice of its actual value because the speed of light is variable in the history of cosmos [15]. If this is true, the Hubble constant is still consistent with the observation value 71.9km/s/Mpc, of which half is $1.16 \times 10^{-18}\, s^{-1}$, exactly the same as that shown in (6.9). Also, the WMAP five year data of total density $\Omega = \rho/\rho_c = 1.0052 \pm 0.0064$ strongly supports (6.2) in which $\Omega = \rho/\rho_c \equiv 1$.

As the radius, mass of a cosmos are confirmed to be a definite value, one may argue about what's going on outside our 25.8 billion light-year cosmos. That's surely a good and more exciting philosophic question, but the VSL system model has actually been able to give us an implication of numerous cosmoses co-exist in the vast empty space to infinite. Every cosmos develops independently as they don't have any relation to others due to the horizon of cosmos $R = 2(ZMt)^{1/2}$. The nature can be infinite, but our cosmos is limited, we happen to be in a cosmic system with the mass of about $1.74 \times 10^{53}\, kg$ and a speed of light is now 299792458m/s.

7. Temperature of Cosmos with Variable Speed of Light

Usually, the temperature of cosmos and its radiation energy density can be obtained from the Stefan-Boltzmann law as

$$\rho_r C^2 = aT^4 \tag{7.1}$$

$a = 7.57\times10^{-16} Jm^{-3}K^{-4}$, it's the radiation constant. In early cosmos when all mass can be regarded to be in radiation state, the temperature of cosmos can be deduced from (6.3) and (7.1) as

$$T = \left(\frac{3C^2}{32\pi Ga}\right)^{\frac{1}{4}} t^{-\frac{1}{2}} = \left(\frac{3C}{32\pi Za}\right)^{\frac{1}{4}} t^{-\frac{1}{2}} \tag{7.2}$$

(7.2) is similar to the temperature equation Gamow approached in 1946[16] except C and G are constants in his cosmology model.

It's not wise to think all substances in cosmos are in radiation state. As well known, the temperature of microwave background radiation is 2.73k, (7.1) gives the corresponding photon density as $4.66\times10^{-31} kg/m^3$, only 1.93×10^{-4} of the total mass in cosmos. If the temperature follows the relation shown in (7.2) after the radiation era, it can be estimated as

$$T = \left(\frac{3\Omega_r C}{32\pi Za}\right)^{\frac{1}{4}} t^{-\frac{1}{2}} \tag{7.3}$$

$\Omega_r = \rho_r / \rho_{tot} = 1.93\times10^{-4}$

The temperature of cosmos also can be estimated with the Planck formula for an idea gas system (in the natural unit system).

$$\rho = \frac{\pi^2}{30} N T^4 \tag{7.4}$$

In the standard cosmology under general relativity, the temperature equation can be deduced from Friedman equation.

$$\left(\frac{\dot{R}}{R}\right)^2 + \frac{k}{R_2} = \frac{8\pi G}{3}\rho \tag{7.5}$$

By neglecting the curvature term k/R^2 and regarding the fact of TR=constant (shown in (5.2) and (7.2) with a constant G), (7.4) and (7.5) offers a temperature equation as

$$\frac{dT}{dt} = -\left(\frac{4\pi^3 NG}{45}\right)^{\frac{1}{2}} T^3 \tag{7.6}$$

$$T(t) = \left(\frac{45}{16\pi^3 NG}\right)^{\frac{1}{4}} t^{-\frac{1}{2}} \tag{7.7}$$

This temperature equation can be obtained more directly within Newtonian dynamics context from (6.3) and (7.4). It implies once again a connection between Newtonian dynamics and relativity.

8. Curvature of Space with Variable Speed of Light

In fact, the general relativity is not necessary for a VSL cosmology model. All cosmology problems can be solved within Newtonian dynamics contexts. There's no such a problem as the flatness problem and the horizon problem arisen in the standard Big Bang cosmology. If the speed of light is variable, the GR has to be modified to a VSL form which in fact makes no difference to the Newtonian model.

But for a systematically and synchronously change of G and C, in a definite local place and a definite period of time, the standard model can be sufficient. Also, properly choose coordinate system may keep the field equation unchanged in form. This action, as we see before, is actually to redefine a new physical unit system corresponding to a definite system state. Here, I shall not make any attempt to develop such a GR VSL model, but just briefly discuss a possible solution to the cosmological problems in Big Bang cosmology.

The flatness problem can be simply described with another form of the Friedman equation (7.5)

$$\rho = \rho_c + \frac{3}{8\pi G}\frac{k}{R^2} \tag{8.1}$$

$$\rho_c \equiv \frac{3H^2}{8\pi G} \tag{8.2}$$

$$H = \frac{\dot{R}}{R} \tag{8.3}$$

H is the Hubble's constant, ρ_c and ρ are the critical density and average density of cosmos respectively. The flatness problem arise from the ratio of ρ/ρ_c, in the standard Big Bang cosmology, $(\rho/\rho_c -1)$ grew 32 orders of magnitude since the Planck epoch, but the observational fact shows that ρ and ρ_c are exactly in the same order of magnitude ($\Omega=\rho/\rho_c =1.0052 \pm 0.0064$), the critical density has to be strictly the same as the average density of cosmos to make the space strictly flat.

The VSL model can solve this puzzle, as we see

$$H = \frac{\dot{R}}{R} = \frac{C}{R} = \frac{2ZM}{R^2} \tag{8.4}$$

From (8.2) and (8.4), we have

$$\rho_c = \frac{3H^2}{8\pi G} = \frac{3M}{4\pi R^3} \equiv \rho \tag{8.5}$$

(8.1) immediately gives

$$k \equiv 0 \tag{8.6}$$

The space is strictly flat in any period in history of cosmos with $\rho/\rho_c \equiv 1$.

9. Horizon of Cosmos with Variable Speed of light

The farthest distance we see into the sky is larger than 20 billion light-years, one may wonder how light or other information can come across such a great distance at its present speed in no more than 140 billion year history of cosmos. The same problem arises in the standard cosmology known as the Horizon Problem, in which the horizon of cosmos is not that big, different regions of cosmos haven't been able to contact with each other due to the great distances between them.

The motion of photon follows the relation $ds = 0$, it can be described with the Robertson-Walker metric as

$$\frac{dr}{\sqrt{1-kr^2}} = -\frac{dt}{R(t)} \tag{9.1}$$

The horizon radius of the cosmos is defined as

$$\int_0^{r(H)} \frac{dr}{\sqrt{1-kr^2}} = \int_0^t \frac{dt}{R(t)} \tag{9.2}$$

The horizon radius is the instantaneous distance $l_{H(t)}$ from $r = 0$ to $r = R_{(H)}$

$$l_{H(t)} \equiv R(t)\int_0^{r(H)} \frac{dr}{\sqrt{1-kr^2}} = R(t)\int_0^t \frac{dt'}{R(t')} \tag{9.3}$$

(5.2) shows that R is in direct proportion to $t^{1/2}$, the solution of equation (9.3) in the SI unit system is

$$l_{H(t)} = 2Ct \tag{9.4}$$

In standard cosmology where C is a constant, the horizon of cosmos at the moment of 10^{-44} s is only 6×10^{-36} m, with a temperature of $10^{19}\,GeV$. With TR=constant, we can calculate the radius of our 25.8

billion light-year cosmos to be about 6×10^{-5} m at the same moment. It is 31 orders larger than the horizon of cosmos at that time.

The Inflationary Theory and other VSL models seem had been able to solve this problem, but actually not, the horizon problem can arise at any period of cosmos and not only confined to the early age. For example, at the moment of 10^{12}s, if C and G are constant, the horizon of cosmos is about 6×10^{20} m, with a temperature about 1eV, but the radius of our cosmos at that moment is about 4×10^{23} m, it's still 3 orders larger than the horizon of cosmos.

In this VSL model, the horizon of cosmos always equals to the radius of cosmos as shown in (9.4), (4.5) and (5.2). There is no any abnormity in the whole history of cosmos. All cosmological results and physical results are naturally reasonable.

10. Black Hole with Variable Speed of Light

As we know, the Black Hole theory has been well developed. I don't have the intention to argue against these well known theories, but just try to find out what will be going on in black hole with a variable speed of light.

The gravitational radius of our 10^{53} kg cosmos is

$$R_G = \frac{2GM}{C^2} = 2.58\times10^{26}\,m \qquad (10.1)$$

It's as large as the radius of the whole universe we observe today. As we see, the horizon of our cosmos exactly equals to its physical radius $R = 2(ZMt)^{1/2}$ or $R = 2Ct$ at any moment in the history of cosmos. That means we are living inside a large black hole as big as ours universe without encountering any abnormality.

The metric of a spherical symmetry system has a simple form in a spherical coordinates system as

$$ds^2 = -e^{\nu} dt^2 + e^{\mu} dr^2 + r^2 (d\theta^2 + \sin^2 \theta d\varphi^2) \qquad (10.2)$$

The Schwarzschild's exterior solution of this spherical system is (in the natural unit system)

$$ds^2 = -\left(1 - \frac{2GM}{r}\right) dt^2 + \left(1 - \frac{2GM}{r}\right)^{-1} dr^2 + r^2 \left(d\theta^2 + \sin^2 \theta . d\varphi^2\right) \qquad (10.3)$$

M and r are the mass and radius of the cosmos respectively.

We can see from (10.3) that the surface of cosmos where $R = R_G = 2.58 \times 10^{28} m$ is a special interface, the characteristic of the metric tensor there will be

$$\begin{aligned} g_{00} &= 0 \\ g^{00} &= \infty \\ g_{11} &= \infty \\ g^{11} &= 0 \end{aligned} \qquad (10.4)$$

Observers outside this interface can never get any information from inside. The whole cosmos system is in fact a giant black hole to the outside world. But luckily, for the substances inside, motion in any direction is possible. There're no any special space-time areas inside the cosmos. There're no special areas inside a high dense celestial body either, for a star system, with (2.1) and (4.4), $1-2GM/r$ in (10.3) will be (SI unit system)

$$1-\frac{2GM}{rC^2}=1-\frac{2ZM}{r\left(\sqrt{C_0^2+\left(\frac{ZM}{R}\right)^2}+\frac{ZM}{R}\right)}>1-\frac{2ZM}{r\left(\frac{2ZM}{r}\right)}=0 \tag{10.5}$$

1-2GM/r>0 is always true in the Schwarzschild exterior solution of the gravitational field equation. So, there's no any special area inside a high-density star, coordinates are normal in any space-time area. Variable speed of light doesn't support black hole in any local system inside the whole universe.

11. Conclusions

A variable speed of light doesn't contradict with the fine structure constant. With the variable time definition in motional frame and gravitational field, the basic concepts of special relativity and general relativity come back to our experience of intuition in three-dimensional Euclidean space with transformation of physical units. Most problems in standard cosmology can be solved with variable speed of light. Further works have to be done before we can assert that the speed of light is variable. Measure the absolute speed of light in the perihelion and aphelion of the earth's orbit is an important experiment need to be done to verify it. [15] If the speed of light is variable, one meter defined by the speed of light varies with time. It has decreased about 3.7 nanometers ($3.7\times10^{-9}m$) since the establishment of Einstein's relativity one hundred years ago, and will remain decrease at this rate every century from now on. This one meter also may be 100 meters or longer in some high dense stars. The definition of a meter has to be restored to its prototype bar if we want to keep the consistency of a meter in any period and any place in cosmos. Measurement of the absolute speed of light also needs to be continued if we want to know whether the speed of light is constant or not.

References

[1] P.A. DIRAC : (1937), *Nature*, 139,323

[2] J.K. Webb et al.(2001) "*Further Evidence for Cosmological Evolution of the Fine Structure Constant". Phys. Rev*.Lett. 87

[3] H. Chand et al.(2004) "*Probing the cosmological variation of the fine-structure constant: results based on VLT-UVES sample". Astron. Astrophys*. 417: 853

[4] R. Srianand et al.(2004) "*Limits on the time variation of the electromagnetic fine-structure constant in the low energy limit from absorption lines in the spectra of distant quasars". Phys. Rev. Lett*. 92: 121302

[5] A. I. Shlyakhter (1976). "*Direct test of the constancy of fundamental nuclear constants". Nature* 264: 340.

[6] T. Damour and F. Dyson (1996). "*The Oklo bound on the time variation of the fine-structure constant revisited". Nucl. Phys*. B480: 37.

[7] J.P. Petit (1988). "*An interpretation of cosmological model with variable light velocity". Mod. Phys. Lett*. A 3 (16).

[8] J. Moffat (1993). "*Superluminary Universe: A Possible Solution to the Initial Value Problem in Cosmology". Int. J. Mod. Phys*. D 2 (3)

[9] J.D. Barrow (1998). "*Cosmologies with varying light-speed".arXiv*:astro-ph/9811022

[10] A. Albrecht, J. Magueijo (1999). "*A time varying speed of light as a solution to cosmological puzzles". Phys. Rev*. D59.

[11] Guoyou Huang,(2004). *"Decay and Spin are the Foundation of Physics". Journal of Theoretics*. Volume 6-5.

[12] Pound, R. V.; Snider J. L. (1964). *"Effect of Gravity on Nuclear Resonance". Physical Review Letters* 13 (18): 539–540.

[13] Vessot, et al. (1980). *"Test of Relativistic Gravitation with a Space-Borne Hydrogen Maser". Physical Review Letters* 45 (26): 2081–2084.

[14] G. Hinshaw et al. (2008). *Five-Year Wilkinson Microwave Anisotropy Probe (WMAP) Observations: Data Processing, Sky Maps, and Basic Results, arXiv*: 0803.0732 (March 2008), page 42.

[15] Guoyou Huang, (2005). *"Experiments and Observations on Variable Speed of Light", Hadronic Journal*, Vol.28, No.1.

[16] G. Gamow, (1946). *Phys. Rev*, 70, 572.

[17] Guoyou Huang, (2004), *"Motion and Structure of Matter under Universal Magnetism" Journal of Theoretics* Volume 6-6