New problems of the standard model of the universe

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In this paper we will make further theoretical analysis for the validity of the accelerating universe based on General Relativity and three new problems of the standard model of the universe are presented from different perspectives. The first part, analyzed the explosion mechanism of the cosmic initial singularity and put forward a different view from the rest. It's virtually impossible to start with a giant explosion, the big bang by now cosmologists had refined the idea. The second part devised a new model of the twin paradox. It's one in which people have been consider to include both special and general relativity in the calculations to expose the counterintuitive weirdness of relativity theory. It seems to has a curious coincidence with the cat-a feline in a locked box that is both dead and alive until the box is opened-was a thought experiment devised by physicist Schr ö dinger. In part three the author makes determination on the cosmological deceleration parameter q_0 by using mathematical derivation, and based on which to construct a thought experiment on cosmological redshift. It is needed to make a static model of the universe that both conforms to the Copernican principle and satisfies Hubble's law and it's possible to make us a fresh perspective and thought process.

I. INTRODUCTION

From the earliest times to the present day, men have been trying to explain the origin of the universe and the phenomena it exhibits. The Big-Bang theory based on general relativity permits us to solve the deepest questions of our origins with a moderate degree of certainty, acts as the dominant explanation of the cosmos and the hot point problem, and caused the expert with the scholar's extensive concern, even to this day, research of its realm, and have already obtained the plenteous fruitful results in the theories field. It is hard to imagine any other theory that can have such satisfaction. In the circumstances, some of us may find this question rather superfluous, but the development of a subject is that of the research fields, and the renewing of methods and concept. Furthermore, it is an urgent problem for us how to make innovation on the basis of the previous experiences. In view of this, there have already been abundance of studies, so this article probes into the questions that are not entirely resolved and brings out new questions to be further studied and discussed. Maybe through the research and thinking it can be guided us to have a new acquaintanceship and deep understanding about theory of general relativity.

II. THE EXPLOSION MECHANISM OF THE COSMIC INITIAL SINGULARITY

There are reasons to believe that a sufficiently large spherical star, which is predicted to occur when they have exhausted their nuclear fuel. In this situation, we expect the star to collapse inevitably to a singularity which is not visible to outside observers. One can express the dragging back of light by a massive body more precisely using Penrose's idea of a closed trapped surface. If one goes to a larger scale, one can view the expansion of the universe as the time reverse of a collapse. Thus one might expect that the conditions of the microwave background radiation in the universe would be satisfied in the reverse direction of time on a cosmological scale, providing that the universe is in some sense sufficiently symmetrical, and contains a sufficient amount of matter to give rise to closed trapped surfaces. This implies the existence of a singularity in the past, at the beginning of the present epoch of expansion of the universe. This singularity is in principle visible to us. It might be interpreted as the beginning of the universe. At that moment, one has

$$|R| \equiv |R^{\mu}_{\mu}| = \left|6R^{-1}[\ddot{R} + R^{-1}(\dot{R}^2 + k)]\right| \to \infty, \tag{1}$$

$$\rho = \frac{3[\dot{R}^2(t) + k]}{8\pi G R^2(t)} \to \infty, \tag{2}$$

$$M \to \infty. \tag{3}$$

where R is the curvature scalar, M is the total mass of the universe. The most striking feature of spherically symmetric collapse is that it will eventually collapse within their Schwarzschild radius, and so give rise to a closed trapped surface. As before, since the expansion of the universe is in many ways similar to the collapse of a star, except that the sense of time is reversed and the universe contains enough matter to cause a time-reversed closed trapped surface, it is reasonable to think that the initial singularity of the universe can form as the result of many black holes merging together. In the case, one

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does expect that the initial singularity of the universe can be very accurately described by the Schwarzschild solution of Einstein's equations, except that this mass is increased. The Schwarzschild metric can be given in the form

$$ds^2 = \left(1 - \frac{2GM}{r}\right) dt^2 - \left(1 - \frac{2GM}{r}\right)^{-1} dr^2 - r^2(d\theta^2 + sin^2\theta d\varphi^2). \quad (4)$$

where $r > 2M$, To obtain the maximally extended manifold, the Kruskal metric is obtained in the form by introducing suitable coordinates

$$ds^2 = \left(\frac{32M^3}{r}\right) e^{-\frac{r}{2M}} (d\tau^2 - dR^2) - r^2(d\theta^2 + sin^2\theta d\varphi^2). \quad (5)$$

The space-time diagram of the metric is shown see Fig.1 In the figure, T_- is the Schwarzschild black hole, T_+ is

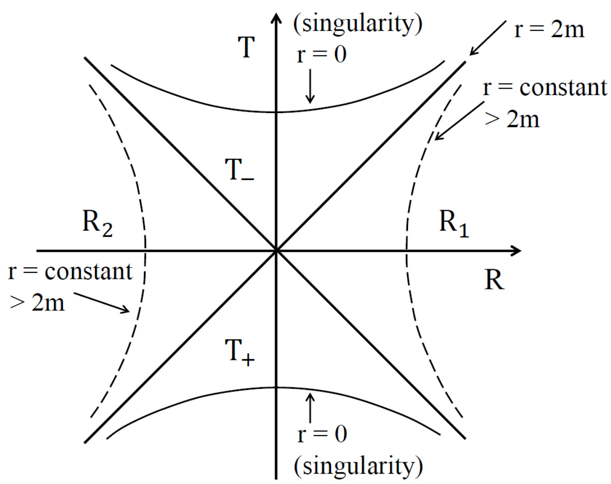

FIG. 1: The kruskal diagram.

the Schwarzschild white hole. One sees that any future-directed timelike or null curve which crosses the surface $r = 2M$ approaches $r = 0$ within a finite affine distance. As $r \to 0$, the scalar $R^{\mu\nu\lambda\sigma}R_{\mu\nu\lambda\sigma}$ diverges as M^2/r^6 . There are no timelike or null curves which go from the initial singularity $r = 0$ to region R_1 and R_2. However, one discovers that the occurrence in which the initial singularity is exploded is process during which a material particle expands from the singularity $r = 0$ to region T_- and then outward diffuses to region R_1 and R_2. This direction is just the reverse of that already described. It must resort to the theory of white holes to describe this course, but since its spurting course is irrelevant to time, it will lead to more knotty problem. In the model of white holes, as particles move apart due to the explosion of the initial singularity, new matter is continually being created until infinity. Although there is theoretical feasibility associated with such a process, this seems to be in conflict with observations of facts and one cannot describe anything definite about the matter coming out of a singularity, as physical theory which occurs at the singularity possibly loses one's ability to predict the future. Besides, in a spherical collapse, the existence of the event horizon also keeps naked singularities from arising. Thus, to keep theory from becoming too involved, one still uses the theory of black holes to solve this problem. A reasonable way to solve this will be to consider the Hawking radiation. In theory, one has shown that any space-time, being static or stationary, which has future horizon have the Hawking thermal radiation [1]. As a black hole radiates, the potential barrier will thin sufficiently thin to start explosion due to the evaporation. The Hawking radiation can be given in the form [2].

$$\langle N_{\omega lm} \rangle = \frac{1}{e^{\omega/k_B T} - 1}. \quad (6)$$

where $T = \frac{k}{2\pi k_B}$, In consequence of the Hawking formula is analogous to the Plack formula, one can uses the StefenBoltzmann law to reckon this process.
According to the StefenBoltzmann law, one has

$$\frac{dE}{dtdA} = \sigma T^4, \qquad \sigma = \frac{2\pi^5 k_B^4}{15\hbar^3 c^2}, \qquad A = 16\pi G^2 c^{-4} M^2.$$

The rate of the releasing energy can be calculated at

$$\frac{dE}{dt} \approx 10^{46}(M^{-2}) \cdot \Gamma erg/s. \quad (7)$$

where Γ is the permeability rate of the potential barrier. The life-span is

$$\tau \approx 10^{-27} M^3 s \approx 10^{67} \left[\frac{M}{M_\odot}\right]^3. \quad (8)$$

where $M_\odot$ is the solar mass. By Eq. (3) and for $M >> M_\odot$, therefore.

$$\frac{dE}{dt} \approx 10^{46}(M^{-2}) \cdot \Gamma erg/s \xrightarrow{M\to\infty} 0. \tag{9}$$

$$\tau \approx 10^{67}\left[\frac{M}{M_\odot}\right]^3 \xrightarrow{M>>M_\odot} \infty. \tag{10}$$

To make possible the subsequent expansion of the universe, the temperature must be at the moment of explosion

$$T > 10^{12}K. \tag{11}$$

One thereby reckons the mass of the universe at after explosion

$$M < 10^{15}g. \tag{12}$$

This mass is not nearly so much as cosmic mass now.

The Big-Bang theory has explained at considerable length the cosmic evolution after explosion $t = 10^{-2}s(T \sim 10^{11}K)$ to now $t = 3\times 10^{17}s(T \sim 2.7K)$, and it can be solved by inflationary model again to approach more the moment of explosion that everything seems fair and reasonable, it cannot conceive of any other theory that can have such satisfaction. However, it is to be admitted that one seems not to have arrived at a very satisfactory explanation of the explosion mechanism. To perfect the theory, people fudged and prevaricate the answer at the most important link in the chain of evolution. But a scientific theory and above all a basic theory must be logically correct. Any flaw will furnish a high-sounding excuse to which God interfere in the cosmic events, thus although one steers clear of the absurd view of "first driving force", yet one will face more preposterous problem of "first explosive force".

III. THE CONTRADICTORY EFFECT OF MOVING STAR

The space-time of Special Relativity is the simplest empty space-time in General Relativity. Mathematically, it is the manifold R^4 with a flat Lorentz metric η. In terms of the natural coordinates (x^1, x^2, x^3, x^4) on R^4, the metric η can be expressed in the form

$$ds^2 = (dx^1)^2 + (dx^2)^2 + (dx^3)^2 - (dx^4)^2. \tag{13}$$

the geodesics have the form

$$x^a(\nu) = b^a\nu + c^a. \tag{14}$$

where b^a and c^a are constants. However, in General Relativity, one sees that the distinctive geometrical character of the metric tensor caused this simple physical explanation to become not significant. It is generally believed that an exact line of demarcation existed between Special Relativity and General Relativity, for if a sufficiently large amount of matter were concentrated in some region, one described that the mathematical equation for this space-time must be uniquely determined by the functions of the fields and their derivatives up to some finite order. It seems that need not be thought about effects of Special Relativity, but in fact it may not be possible to know strictly flat space-time from curved space-time. It is because the Schwarzschild, Reissner-Nordström and Kerr metrics approach that of Minkowski space at large distances from the system, the conformal structure of null infinity in these spaces is similar to that of Minkowski space, what is more, all the spaces mentioned above are covered in this definition which be known as weakly asymptotically simple and empty [3]. Thus we can succeed in setting the special and the general theories within the framework of the same mathematical equation in theory if only it rejects this innate hypothesis with the inertial frame to be infinitesimal. We shall now suppose that the inertial frame extends out very into space to contain those bounded matter fields such as stars. We have to accept that the measurement and the time have an immediate physical significance in the huge inertial frame, and the time dilation will happen if it moves uniform motion in a straight line relatively to a static frame of reference. There is good reason to believe that this effect is the case with the gravitational fields is that one can divide the explanation of this statement into two parts. First, because of gravitation of the matter fields are occurred against the background of the asymptotically flat space-time, their object's motion must be influenced by the law of Special Relativity. Secondly, if the time dilation is already occurring, it is unable to speed the passage of time up, even if gravitate, it will not returned to its original condition. Thus it is reasonable to think that it may be a general effect in a moving inertial frame

$$d\tau = \frac{dt}{\sqrt{1-\frac{V^2}{C^2}}} = \gamma dt. \tag{15}$$

The theoretical analysis of twin paradox and a series of experiments on μ-particle have convinced us of the absolute truth of this effect. In the region of the gravitational fields where dt is an interval of time which a freely falling particle go from $r = R$ to $r = r_0$. This interval can be expressed as

$$dt = \left(\frac{R^3}{8GM}\right)^{\frac{1}{2}}\left\{2\left(\frac{r}{R}-\frac{r^2}{R^2}\right)^{\frac{1}{2}} + cos^{-1}\left(\frac{2r}{R}-1\right)\right\}. \tag{16}$$

where M is tthe stellar mass. By formula Eq. (15) and let $r = 0$, one has

$$d\tau = \frac{dt}{\sqrt{1-\frac{V^2}{C^2}}} = \frac{\pi}{\sqrt{1-\frac{V^2}{C^2}}}\sqrt{\frac{R^3}{8GM}} \xrightarrow{v\to c} \infty. \quad (17)$$

Using the same analysis with "twin paradox", the increase in mass is discovered to have the same absolute authenticity as time dilation

$$M = \frac{M_c}{\sqrt{1-\frac{V^2}{C^2}}} = \gamma M_c. \quad (18)$$

Thus, the twin paradox includes mass paradox as well as time paradox, and this two type of paradox give us to believe that when an inertial frame moves uniform motion in a straight line relatively to large numbers of galaxies in the universe, the increase in mass and the time dilation are two true type of physics in the inertial frame. There can be no the problem of twin paradox and one will also produce an obscure understanding with some of the most basic concepts on Special Relativity if one not considers the authenticity of these effects. Now one considers the increase in mass

$$M = \frac{M_c}{\sqrt{1-\frac{V^2}{C^2}}} = \gamma M_c. \quad (19)$$

Thus a star will exceed its critical value in mass to support gravity necessarily if only it moves at a high velocity

$$M = \gamma M_c > M_c = \frac{8}{9}\sqrt{\frac{2}{3kc^2\rho}}. \quad (20)$$

where $c^2 = 1.86 \times 10^{-27} cmg^{-1}$, the last term is the critical mass of stars to support gravity, thus in such a situation, the gravitational collapse must occur if only that stars have a sufficient velocity. This time can be expressed as which it collapse to the central singularity [4].

$$d\tau = \frac{\pi}{2}\sqrt{\frac{3}{8\pi GM}}. \quad (21)$$

By Eq. (19), one obtains

$$d\tau = \frac{\pi}{2}\left(\frac{3}{8\pi GM_c}\sqrt{1-\frac{V^2}{C^2}}\right)^{\frac{1}{2}} \xrightarrow{V\to C} 0. \quad (22)$$

One sees that is in disagreement with and they will tend to two extreme states as $V \to C$. Because of they belong to the same system, it is unable to steer a middle course between these views. The great success is obtained with Special Relativity by the infinitesimal treatment of an inertial frame in fields of the microcosm and the macrocosm. By contrast, it seldom takes account of effects of Special Relativity to involve the material motion about the large scale structure of space-time because of a difference of the background of space-time. However, in fact it is difficult to draw an exact line of demarcation between two type of space-time, for a true gravitational field. In consequence of an asymptotic flatness in space-time, one must consider that effects of Special Relativity. In theory, one thus faces not a very cheerful divergence that shows up as form of "twin paradox" which takes into account the "time paradox" and the "mass paradox". It seems to be not inherent in an object to accompany two phenomena. Thus one discovers that there is also a similar phenomenon in the Special Theory of Relativity with fundamental problem of quantum mechanicswave-particle duality.

IV. THE EXPANSION ANALYSIS OF THE COSMOLOGICAL REDSHIFT

These observational investigations of redshifts which have been carried out so far support the conclusion that other galaxies are moving away from us, and so indicate that the matter in the universe is expanding at the present time. It means that Hubble's law is universal significance if we firmly believe the assumption of the Copernican principle, that we do not occupy a privileged position in space-time. The future evolution of the universe needs to depend heavily on the observational data of the Hubble constant and the cosmological deceleration parameter. Although one can build mathematical models fulfilling this requirement of expansion, it is difficult to test expansion directly by observation, as there is no simple way of measuring the separation between us and distant objects. Now in theory one could make constraints on the cosmological deceleration parameter based on rigorous mathematical derivation and hence questioned the ultimate fate of our universe.

Let us now consider that a signal of light travels between two points in the Robertson-Walker metric. Suppose that the signal is sent out from the distant galaxy at moment t_e and it is received by the earth at moment t_0, soon after, another signal is sent out at moment $t_e + \Delta t_e$ and it is received at moment $t_0 + \Delta t_0$ (see Fig.2). For the sake of simplicity, one can assume the galaxy to has same value θ and φ with the earth, and one can choose the radial coordinate to the zero [5]. The galaxy is located at r_e. The equation of rays is

$$dt^2 - R^2(t)\frac{dr^2}{1-kr^2} = 0. \quad (23)$$

For ray I, one has

$$\int_{t_e}^{t_0} \frac{dt}{R(t)} = \int_0^{r_e} \frac{dr}{\sqrt{1-kr^2}}. \quad (24)$$

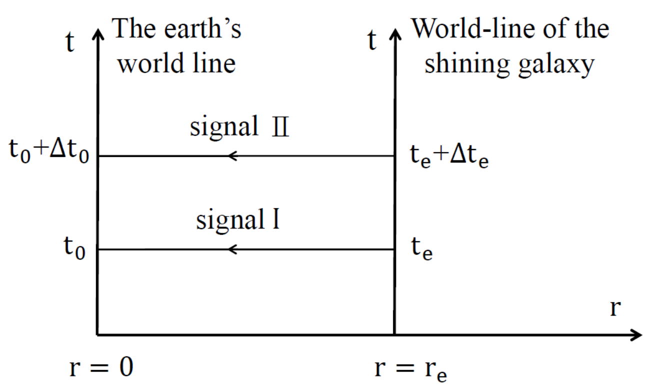

FIG. 2: A signal of light travels between galaxy and earth.

For ray II, one has

$$\int_{t_e+\Delta t_e}^{t_0+\Delta t_0} \frac{dt}{R(t)} = \int_0^{r_e} \frac{dr}{\sqrt{1-kr^2}}. \tag{25}$$

By Eq. (24) and Eq. (25), one obtains

$$\int_{t_e+\Delta t_e}^{t_0+\Delta t_0} \frac{dt}{R(t)} = \int_{t_e}^{t_0} \frac{dt}{R(t)}. \tag{26}$$

The detail derivation can consult the general cosmology textbook

$$\begin{aligned} \frac{dV_{LB}}{dt_0} &= V_{LB}H_0 + V_{LB}q_0H_0^2(t_e-t_0) - d_{LB}H_0^2 - d_{LB}H_0^2q_0 - d_{LB}H_0^2q_0 \\ &+\frac{d(d_{LB}q_0H_0^2)}{dt_0}(t_e-t_0) - \frac{d}{dt_0}d_{LB}q_0H_0^2(t_e-t_0) \approx -2d_{LB}H_0^2q_0. \end{aligned} \tag{27}$$

Using the same reasoning, it can be obtained that the galaxy at C is

$$\frac{dV_{LC}}{dt_0} \approx -2d_{LC}H_0^2q_0, \tag{28}$$

Let us now assume that the galaxy moves from B to C. by Eq. (28) - Eq. (27), one obtains

$$\frac{dV_{LC}}{dt_0} - \frac{dV_{LB}}{dt_0} = -2d_{LC}H_0^2q_0 - (-2d_{LB}H_0^2q_0), \tag{29}$$

$$\frac{d^2(d_{LC})}{dt_0^2} - \frac{d^2(d_{LB})}{dt_0^2} = -2(d_{LC}-d_{LB})H_0^2q_0, \tag{30}$$

whether

$$d_{LC} > d_{LB},$$

or

$$d_{LC} < d_{LB},$$

one obtains

$$q_0 < 0. \tag{31}$$

This shows that these galaxies in the universe are accelerating expansion at the present time [6–9]. However, more than other scientific problem the cosmic-expansion conundrum presents scientists with an existential quandary. To help us gain further insight into its essence, let us imagine the following experiment: some galaxies are distributed randomly in the large scale structure of space and the distribution conforms to the requirements of the cosmological principle (see Fig.3). Each galaxy has an

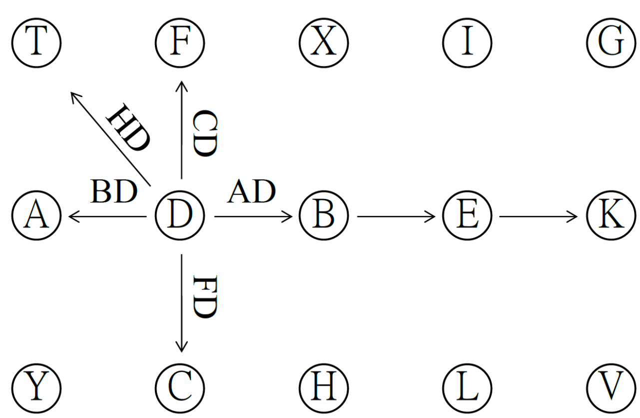

FIG. 3: The analysis on galaxy expanding.

observer and suppose that they observe the same galaxy at the same time, say D, that observer B will discover that it recedes and goes in the direction of BD, that observer C will discover that it recedes and goes in the direction of CD, that observer H will discover that it recedes and goes in the direction of HD, that observer F will discover that it recedes and goes in the direction of FD, and that observer A will discover that it recedes and goes in the direction of AD. The more galaxy D is observed, the incompatible direction it moves. A reasonable interpretation of this contradictory problem is to explain it as implying that, galaxy D is at rest there and all other galaxies recede and go in all directions relatively to it, but in this manner, those further it must move faster than those nearer away, otherwise the movement of a galaxy will be in conflict with the Hubble condition. In the model, one discovers that the expansion of the universe shows an inconceivable panorama: by means of Hubble's law one can determine the movement of all other galaxies by giving the state of a galaxy. But this galaxy is chosen arbitrarily, similarly, one may also choose another galaxy as the detected galaxy, say B. Using the same reasoning, it can be discovered that the movement of other galaxies will show another different form again, thus they will have many different states in the universe. On the other hand, one must still consider the diversification of a velocity. The velocity of galaxy K can be expressed as relative to galaxy A

$$V = HD_{AK}, \tag{32}$$

and it is respectively expressed as relative to galaxy E and D

$$V = HD_{EK}, \tag{33}$$

and

$$V = HD_{DK}, \tag{34}$$

obviously

$$D_{AK} \neq D_{EK} \neq D_{DK}. \tag{35}$$

Thus, the fact that we are uncertain about kinetic details of galaxies makes it impossible for us to describe clear the behavior of the huge number of galaxies in the universe. Contrary to common belief, if this observation is repeated over and over again for different galaxies, one discovers that the only reasonable explanation theoretically to this phenomenon is that all the galaxies in the universe are closely static. Thus, if one accepts that the Copernican assumption holds, i.e. we do not occupy a special position in the universe, and that Hubble's law is universal significance, one can conclude that this is a static model of the universe.

V. CONCLUSION

The Big-Bang theory based on General Relativity achieves great success, so that hardly ever has a scientific achievement had such profound and far-reaching consequences. However, we also see that the theory does not offer a satisfactory explanation of the some questions we can raise about it and all the observed facts. Unless scientists and technologists constantly questioned and reexamined established concepts and procedures, scientific progress would slow down or stop. Although Einstein's General Relativity has become the prevailing theory of gravity and probably the most beautiful of all existing theories, scientists should know that their job is never finished and that even the best theory can turn out to be wrong. We can tell at a glance that some important links of this theory exist in two mutually contradictory states through a consideration of the above problems. Cosmology, as a field of theoretical physics, should not only be perfect, but also logical consistency. In front of these new problems, we must have a new understanding towards Einstein's view of physical gravitation. When theory and experiments contradict each other, we will make an awful and a difficult choice. I am well aware that this paper may predictably cause considerable opposition. However, the objectivity of science, is a scientist the most basic moral requirement and principle of behavior. The job was to call on all his scientific conscience and moral courage. I hope this paper can wake up our potential sense of justice in our heart of hearts, it would lead physics to keep the theory on the right track. There is still need the legendary pioneer of upholding justice and defending truth such as Giordano Bruno type in our era. We should work unremittingly in pursuit of truth and fight for truth, never disappoint the historical mission and academic duty endued to us by the times. I sincerely hope that the paper will resonate with anyone who loves the science. Let's join hands and explore the boundless universe in quest of the never-ending truth of science!

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