New problems of the standard model of the universe

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The paper discusses, for the most part, the expansive problem of the universe, the explosive problem of the cosmic initial singularity and two kinds of paradox of kinetic stars. The research discovers that some our previous conclusions based on General Relativity would appear to be called in question.

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The evidence today tends to favor the theory that the modern civilization of mankind is closely linked to once severe explosion in the distant past. The discovery of the cosmic microwave background radiation and redshifts of distant galaxies as well as the survey of cosmic abundance of helium gave strong support to the big-bang theory. It cannot conceive of any other theory that can have such satisfaction. However, it is to be admitted that the theory shows many complicated problems. As yet, we cannot examine the expansion of the universe directly and have done no more than scratch the surface of some subjects. Unless scientists and technologists constantly questioned and re-examined established concepts and procedures, scientific progress would slow down or stop. In this paper we will pose some new problems to the validity of the big-bang theory. It undertakes these approachs in the hope of providing evidence cast doubt on our earlier conclusions.

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. We call the Hubble condition this requirement that these galaxies move away from each other and their receding velocities are directly proportional to the proper distance between oneself and another galaxy in the universe. It is this condition which causes the expansive problem of the universe. To help us gain further insight into its essence, let us imagine the following experiment: some galaxies are distributed randomly in a great deal of space and the distribution conforms to the requirements of the cosmological principle (Fig 1). Each galaxy has an observer and suppose that they observe the same galaxy at the same time, say A, that observer B will discover that it recedes and goes in the direction of BA, that observer C will discover that it recedes and goes in the direction of CA, that observer D will discover that it recedes and goes in the direction of DA, that observer E will discover that it recedes and goes in the direction of EA, and that observer F will discover that it recedes and goes in the direction of FA. The more galaxy A is observed, the incompatibler direction it moves. A reasonable interpretation of this contradictory problem is to explain it as implying that, galaxy A 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

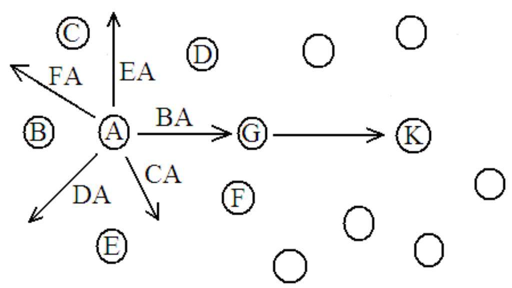

FIG.1. The analysis on galaxy expanding.

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

$$V = HD_{AK} \tag{1}$$

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

$$V = HD_{EK} \tag{2}$$

and

$$V = HD_{DK} \tag{3}$$

obviously

$$D_{AK} \neq D_{EK} \neq D_{DK} \quad (4)$$

Thus, the fact that we are uncertain about kinetic details of g-alaxies makes it impossible for us to describe clear the beha-viour of the huge number of galaxies in the universe. Contra-ry to common belief, one discovers that it seems the only rea-sonable explanation that the detected galaxy is at rest in spa-ce. If this observation is repeated over and over again for dif-ferent galaxies, it must be required the supposition that all t-he galaxies in the universe are closely static. Thus, if Hubbl-e's law is universal significance, one may certainly infer that our universe is at rest in space.

We have expected a sufficiently large spherical star to coll-apse inevitably to a singularity which is not visible to outside observers at a late stage in its evolution, and one can express this process precisely using Penrose's idea of a closed trapp-ed surface. The expansion of the universe is in many ways si-milar to the time reverse of a collapse. Thus one might expe-ct that the conditions of theorem about singularities would be satisfied in the reverse direction of time on a cosmological s-cale, providing that the universe is in some sense sufficiently symmetrical, and contains a sufficient amount of matter to g-ive rise to closed trapped surfaces. This implies the existence of a spacelike singularity in the past, at the beginning of the present epoch of expansion of the universe. At that moment, one has[1]

$$|R| \equiv |R^{\mu}_{\mu}| = \left| 6R^{-1}\left[\ddot{R} + R^{-1}(\dot{R}^2 + k) \right] \right| \to \infty \quad (5)$$

$$\rho = \frac{3\left[\dot{R}^2(t) + k \right]}{8\pi G R^2(t)} \to \infty \quad (6)$$

$$M \to \infty \quad (7)$$

where R is the curvature scalar, M is the total mass of the uni-verse. As before, since the expansion of the universe is simil-ar to the collapse of a star and the universe contains enough matter to cause a time-reversed closed trapped surface, it is r-easonable to think that the initial singularity of the universe can form as the result of many black holes mergering togeth-er. In the case, one does expect that the initial singularity of t-he universe can be very accurately described by any attainab-le exact solution of the field equations, except that this mass is increased. In order not to bring in too many complicating factors, we shall consider only the Schwarzschild metric. The metric can be given in the form

$$ds^2 = (1 - \frac{2GM}{r})dt^2 - (1 - \frac{2GM}{r})^{-1} dr^2$$
$$-r^2(d\theta^2 + \sin^2\theta d\varphi^2) \quad (8)$$

where $r > 2m$. To obtain the maximally extended manifold, the Kruskal metric is obtained in the form by introducing sui-table coordinates[2]

$$ds^2 = (\frac{32M^3}{r})e^{-\frac{r}{2M}}(d\tau^2 - dR^2)$$
$$-r^2(d\theta^2 + \sin^2\theta d\varphi^2) \quad (9)$$

The space-time diagram of the metric is shown in figure 2. [3]

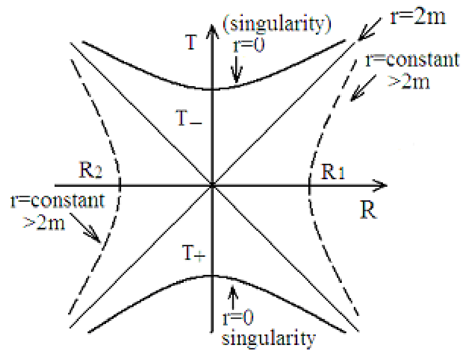

FIG. 2. The kruskal diagram.

In the figure, T_- is the Schwarzschild black hole, T_+ is the Schwarzschild white hole. One sees that any future-direct-ed 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 t-imelike 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 p-rocess during which a material particle expands from the singularity *r=0* to region T_- and then outward diffuses to r-egion R_1 and R_2. This direction is just the reverse of that a-lready described. It must resort to the theory of white hol-es to describe this course, but since its spurting course is i-rrelevant to time, it will lead to more knotty problem. In t-he model of white holes, as particles move apart due to the explosion of the initial singularity, new matter is continua-lly being created until infinity. Although there is theoretic-al feasibility associated with such a process, this seems to be in conflict with observations of facts and one cannot d-escribe anything definite about the matter coming out of a singularity, as physical theory which occurs at the singula-rity possibly loses one's ability to predict the future. Besi-des, in a spherical collapse, the existence of the event hori-zon also keeps naked singularities from arising. Thus, to k-eep 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[4]. As a black hole radiates, the potential barrier will thin sufficiently thin to start explosion due to t-he evaporation. The Hawking radiation can be given in the form[1] b-

$$\langle N_{\omega lm} \rangle = \frac{1}{e^{\omega/k_B T} - 1} \tag{10}$$

where $T = \dfrac{\kappa}{2\pi k_B}$. In consequence of the Hawking formula is analogous to the Plack formula, one can uses the Stefen—Boltzmann law to reckon this process.
According to the Stefen—Boltzmann 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

$$\frac{dE}{dt} \approx 10^{46}(M^{-2}) \cdot \Gamma erg/s \tag{11}$$

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

$$\tau \approx 10^{-27} M^3 s \approx 10^{67} \left[\frac{M}{M_{\odot}}\right]^3 \tag{12}$$

where $M_{\odot}$ is the solar mass. By (7) and for $M \gg M_{\odot}$, therefore

$$\frac{dE}{dt} \approx 10^{46}(M^{-2}) \cdot \Gamma erg/s \xrightarrow{M \to \infty} 0 \tag{13}$$

$$\tau \approx 10^{67} \left[\frac{M}{M_{\odot}}\right]^3 \xrightarrow{M \gg M_{\odot}} \infty \tag{14}$$

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

$$T > 10^{12} K \tag{15}$$

One thereby reckons the mass of the universe at after explosion

$$M < 10^{15} g \tag{16}$$

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

In the Special Theory of Relativity, which does not include gravitational effects, the constant character of the metric tensor attached an immediate physical significance to coordinates. In a coordinate system in which the metric takes the following form

$$ds^2 = (dx^1)^2 + (dx^2)^2 + (dx^3)^2 - (dx^4)^2 \tag{17}$$

the geodesics have the form

$$x^a(v) = b^a v + c^a \tag{18}$$

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 occured 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 occuring, 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

$$d\tau = \frac{dt}{\sqrt{1 - \frac{V^2}{C^2}}} = \gamma dt \tag{19}$$

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[5]

$$dt = \left(\frac{R^3}{8GM}\right)^{\frac{1}{2}} \left[2\left(\frac{r}{R} - \frac{r^2}{R^2}\right)^{\frac{1}{2}} + \cos^{-1}\left(\frac{2r}{R} - 1\right)\right] \tag{20}$$

where *M* is the stellar mass. By formula (19) and let *r=0,* one has

$$d\tau = \frac{dt}{\sqrt{1-\frac{V^2}{C^2}}} = \frac{\pi}{\sqrt{1-\frac{V^2}{C^2}}}\sqrt{\frac{R^3}{8GM}} \xrightarrow{V\to C} \infty \qquad (21)$$

where $d\tau \propto V$, will have $d\tau \to \infty$ as $V \to C$, its three —dimensional velocity is

$$\frac{dr}{dt} = \frac{dr}{d\tau} \Big/ \frac{dt}{d\tau} \to 0 \qquad (22)$$

that the free particle is at rest in space, thus

$$\frac{d^2 r}{d\tau^2} = 0 \qquad (23)$$

Using the geodesic equation, one has

$$\Gamma^{\mu}_{\nu\lambda} = 0 \qquad (24)$$

and then is

$$R^{\mu}{}_{\nu\lambda\sigma} = 0 \qquad (25)$$

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

$$M = \frac{M_c}{\sqrt{1-\frac{V^2}{C^2}}} = \gamma M_c \qquad (26)$$

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

$$M = \frac{M_c}{\sqrt{1-\frac{V^2}{C^2}}} = \gamma M_c \qquad (27)$$

Thus a star will exceed its critical value in mass to support gravity necessarily if only it moves at a high velocity[6]

$$M = \gamma M_c > M_c = \frac{8}{9}\sqrt{\frac{2}{3kc^2\rho}} \qquad (28)$$

where $c^2 = 1.86\times10^{-27}\,cmg^{-1}$, 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

$$d\tau = \frac{\pi}{2}\sqrt{\frac{3}{8\pi GM}} \qquad (29)$$

By (26), one obtains

$$d\tau = \frac{\pi}{2}\left(\frac{3}{8\pi GM_c}\sqrt{1-\frac{V^2}{C^2}}\right)^{\frac{1}{2}} \xrightarrow{V\to C} 0 \qquad (30)$$

One sees that (21) is in disagreement with (30) 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 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. We can tell at a glance that some important links of this theory are wrong through a consideration of the above problems. To perfect the theory, it is likely that people arrive at, to a considerable extent, matter-of-factness in a well-meaning way which cater to the subjective desire of these questions. It is true that some details of science fiction may be treated in the way, but a scientific theory, especially a basic theory, must be logically correct. Any flaw will furnish a high-sounding excuse to which God interfere in the cosmic events, in this sense, we seem not to have arrived at a very satisfactory explanation to the problem of the origin of our universe.

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