

The geometric characteristics of the universe

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Abstract

A new kinematics cosmological model that base on cosmological principle has been given. The basic frame of cosmic entire space and time is: in four-dimensional Euclidean space, the cosmic time is a continuously growing four-dimensional spherical object and the cosmic space is its three-dimensional hypersphere. We argue that the cosmic radius $R(t)$ can't be determined by any dynamics. For special case, we give $R(t)=kt$, here k is equivalent constant. It means that the expanding of the universe is determined by the immanency of cosmic entire space and time. By analysis of this case, we have deduced: The redshift formula: $V/c=\ln(1+Z)$; The formula for modification of the lifetime or period of an astronomical phenomenon; The periodic formula of redshift (Karlsson's statistical formula), farther, we got the integral periodic parameter of redshift $\Omega=2k\pi/c$, $\Delta\ln(1+Z)=\Omega\approx 0.206$. We also can give the natural deduction of this model: There are the lens effect of cosmic entire space: There must be some periodicity for the distant observations; All of the quasars observed in all directions in the sky are the early multiple images of both the stars in milky way or milky way itself and stars or galaxies located within the area near by the opposite pole that relatives to milky way...

Key words: cosmology, kinematics model, large scale structure of universe, quasars, redshift, redshift periodicity, galaxies, space time.

1. Introduction

The "confirmation" of the acceleration of the expansion of the universe at beginning has brought huge confusion in concept. The cause of acceleration is attributed to a mysterious power to drive cosmic space expanding, and later, the noun -- "dark energy" becomes hotter and hotter. This confusion may impute that the mainstream cosmologist obstinately cling to standard cosmological model based on General relativity.

Any kind dynamics involve with more factors (hypothesizes) in local space-time, if we compelled it to adapt for the whole universe, its systemic error must be magnified. For instance, General relativity based on the principle of equivalence requires that gravitation constant G is a universal constant. As we know that gravitational radiation from a point source represents spherical symmetry, so the character of G must lie on the character of space. If the space is not a Euclidean and the spatial curvature is the function of time, the universal constant G has to be oppugned. Comparing with cosmic entire space, the space of solar system almost is a Euclidean. Although the constancy of G has been testified by Cavendish in the local space-time (on the earth or in solar system), we have no reason to extend it into cosmic large-scale space-time. Other tests for General relativity is also limited in solar system, in the sense of this, it is seen that General relativity as same as Newton's theory, is a theory fitting for the local space-time.

For attaching importance to this topic, we will give the imagery as follows:

As we know, the different cosmic spatial scales are: The diameter of earth: 1.2742×10^9 cm; the scale of solar system: 10^{18} cm; the scale of Milky Way galaxy: 10^{22} cm; the scale of universe: 10^{28} cm. If we use General relativity which was testified in solar system to paraphrase entire universes, it means that we use the physical law got from a very small space, smaller than a seed of gingili, to define the physics of the earth, and even if General relativity was testified in Milky Way galaxy, according to the same ratio to the earth, the test area is only about 160 square meter as same as an apartment. The other representative example is quantum mechanics. Its adaptable scale is about 10^{-8} cm. It is obvious that different scale of space adapt to different physics law. It is defective that we haven't strictly defined the different between cosmic larger-scale space-time and local space-time, however, in this paper, we might as well cursorily prescribe that the space-time scale less than a galaxy size called local space-time.

For General relativity obtain great achievement in local space-time, we might as well consider that General relativity is one kind of approximate theory of unbeknown cosmic entire dynamics system, of course, some important factors must be neglected in Einstein's equation when we put it to use for cosmology. So we must avow that man hasn't gotten ready a mature dynamic theory to fit in with entire universe at the present time. General relativity is just the local space-time theory, and according to Cosmological Principle, it also fit in with another "local space-time" anywhere in the universe.

Comparing with the dynamics cosmology model, the kinematics cosmology model is easier to set up and its "precision" is better, because the hypothesis is not only fewer but also simpler. In fact, so far all the results or records of observation for cosmology are in the category of cosmic kinematics or particle physics, the dynamic effect in cosmic large-scale space-time merely is hypotheses. Since cosmology has come into provable era, why not to open mind and give more choices to be checked up with the observational evidence? First to set up a working kinematics model, and then to test it by observation, after the kinematics cosmology is established, to set up a dynamics model base on the kinematics cosmology, it is the nature way to develop cosmology.

Birth of observational cosmology was in 20th century and during the 1910s to 1940s, many cosmology models were discussed, these famous authors are Einstein and de Sitter (1917)[1]; Friedmann (1922); LeMaître (1931); Milne (1933) [2]etc. Almost all regarded model are based on Relativity and by dint of Cosmological Principle as additional hypothesis. Apparently, the Friedmann model is advantaged and called standard model, the reason is that the model fit in with the observations well. However, it is suspenseful that there isn't any evidence in dynamic factors to validate the model, and so far, all the favourable observations are in the category of cosmic kinematics or particle physics. In addition, there is intrinsic antinomy within this model. According to Einstein's philosophy, the characteristic of space-time must be determined by matter, however, additional Cosmological Principle imply that the characteristic of the cosmic entire space is regulated beforehand and then the Einstein's matter be encased in the "rigid box" homogeneously. This has brought much difficulties, such as spatial "open" or "close" problem, about which omnipotent matter can't determine the distribution of themselves but the form of cosmic entire space; though the cosmic absolute reference frame (microwave background radiation has implied this) is engaged by Friedmann model, it is not unisonous with General relativity in concept, and seems that there is a scientific religion in cosmology, in order to taboo the absolute concept to disguise displacement, such as the definition of proper time and comoving coordinate etc.; what is the geometrical meaning of the cosmic scale factor $R(t)$ (can't be defined) and horizon difficulty etc.

2. The proposed cosmological model (Deng Xiaoming 1992)[3]

Human cognition from the Geocentrism and Heliocentrism to the Cosmological Principle is a great philosophical advancement. The Cosmological Principle is described as: ignoring local irregularities, the universe looks pretty much the same to every observer within it; in other words, there is no special cosmic vantage point. In brief word, The Universe is homogeneous and isotropic. Although this word is simple, it includes profound meaning. We may identify that the homogeneity and isotropy of cosmic large-scale space are not only relative to the matter in the universe but also to the time. Therefore, the relation between cosmic large-scale space and time at every point shows no difference (ignore the local effect of General relativity). We can give ratiocinates here, the matter at every point in large-scale space has the same history, this means that not only the age is same but also has been experiencing the same historical course of matter evolvement, and another is that cosmic entire space and time remain orthogonal relation with each other everywhere in the universe. According to these two points, every observer on different planet in the Universe can set eyes on the same cosmic historical course.

As we know, merely according to The Cosmological Principle, we can give R-W metric (Robertson and Walker, 1935)[4][5], and virtually, by the observational evidence that our physical universe is finite now (based on Hubble's observations – the redshift of distant star system in 1930), we can give ulteriorly ratiocinates: The cosmic time itself has the symmetric geometric configuration. So, we can deduce that the universe is close.

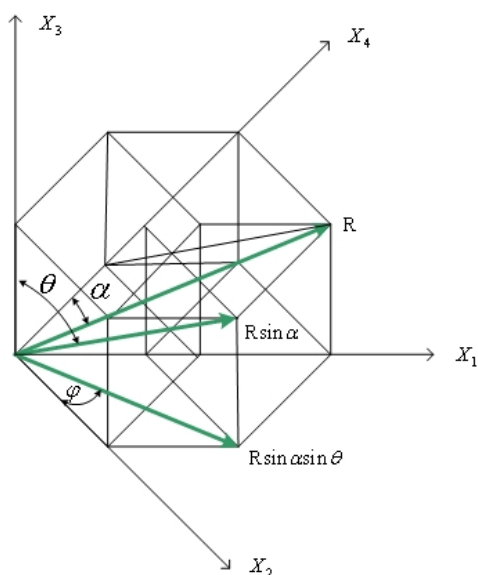


Fig 1 Vector R in four-dimensional rectangular coordinates

four-dimensional Euclidean space, and If cosmic time is expressed as t , the function $R=R(t)$ is defined as cosmic radius vector, in unit of spatial length, which growing direction is same as cosmic time, and then the surface of cosmic time [three-dimensional hypersphere determined by the end point of $R(t)$] is defined as cosmic entire space, which is given in unit of volume.

There is an origin in this model, and relative to the origin, the cosmic space and time show spherical symmetry in four-dimensional Euclidean space. Visually, inside of hypersphere (cosmic entire space) is historical space (from the origin to the surface) and outside of hypersphere is future space in four-dimensional Euclidean space. It is quite evident that cosmic entire space is expanding with the growing of cosmic time. If we accept the model as the real structure of cosmic entire space and time, then, at a certain cosmic time, the curvature of cosmic entire space is $K = 1/R^2$. It is seen that $K \rightarrow \infty$ when $R \rightarrow 0$, and this is the special state of cosmic entire space and time, which is called cosmic singularity. The length of time t from origin to now is

What are time and space? This is a question, a still puzzle question. Thousands years past, traditional Chinese philosophy and venerable Achaean genius couldn't answer. Even now the definition of time and space in different physical domain are confused. Such a confusion root in that, at the moment, there isn't any omnipotent uniform theory to solve the whole problem in the universe.

The purpose of the present paper doesn't want to clarify what is time and space and discuss much about philosophy, but give a simple cosmological kinematics model that can be proved by observations.

For convenience, we define the state of having existence of cosmic time as a continuously growing four-dimensional spherical object in

defined as cosmic age.

The cosmic time marks the evolution degree of the universe, the matter (relative rest), radial and energy permeate homogeneously in cosmic entire space. So the structure of entire space and time is absolute.

Figure 1 shows $R(t)$ in four-dimensional Euclidean rectangular coordinates, and the hypersphere equation is given as:

$$R^2 = X_1^2 + X_2^2 + X_3^2 + X_4^2 \quad (1)$$

The transformation between hyperspherical and rectangular coordinates with the same origin is:

$$\begin{aligned} X_1 &= R \sin \alpha \sin \theta \sin \varphi \\ X_2 &= R \sin \alpha \sin \theta \cos \varphi \\ X_3 &= R \sin \alpha \cos \theta \\ X_4 &= R \cos \alpha \end{aligned} \quad (2)$$

We can obtain Lamé coefficient: $H_R = 1$, $H_\theta = R \sin \alpha$, $H_\alpha = R$ and $H_\varphi = R \sin \alpha \sin \theta$.

The differential of arc: $dS_R = H_R dR = dR$, $dS_\theta = H_\theta d\theta = R \sin \alpha d\theta$, $dS_\alpha = H_\alpha d\alpha = R d\alpha$ and $dS_\varphi = H_\varphi d\varphi = R \sin \alpha \sin \theta d\varphi$. Then, the three-dimensional hypersphere space metric is:

$$dS_{\text{space}}^2 = R^2 [\alpha^2 + \sin^2 \alpha (d\theta^2 + \sin^2 \theta d\varphi^2)] \quad (3)$$

Now, although the vivid geometrical image about our physical universe has been given, the characteristic for function $R=R(t)$ still hang in doubt. Maybe it is determined by a cosmic dynamics system (not only General relativity) or the contribution of cosmic vacuum or the characteristic of the space more than four-dimensional or other unbeknown complication. Anyway, the radius $R(t)$ is a function of time, and it's character determine the mode of being or form of existence of the universe. In a general way, we can discuss any kind of function of $R(t)$ under the frame of cosmic space-time like this. On all accounts, there are two way to confirm the function of $R(t)$, one is employing the principles of statistics to analyze representative observations, another is based on some elements to give a possible function to be certified by observations. The present paper adopts the latter to give the function of $R(t)$.

Supposing that nothing can change the topology of cosmic space and time, it means that the structure of cosmic space-time is rigid. The time increasing and space expanding is determined by its inherent mechanism. If the case likes this, we can give the simplest function: $R=kt$ (Deng Xiaoming 1992), and we will show that it can be confirmed by observations. Here k is defined as equivalent constant of cosmic space and time or the increasing rate of R , which is given in unit of velocity.

3. R-W metric (Robertson and Walker, 1935)[4]

R-W metric in general format is: $d\tau^2 = c^2 dt^2 - R^2(t) [dr^2 / (1 - kr^2) + r^2 (d\theta^2 + \sin^2 \theta d\varphi^2)]$. Since r is a periodic coordinate, it is convenient to introduce a new angular coordinate α (Figure 1) in

the case of positive curvature, and let $r = \sin\alpha$, $k=1$. Then, R-W metric in hypersphere space is:

$$d\tau^2 = c^2 dt^2 - R^2(t)[d\alpha^2 + \sin^2\alpha(d\theta^2 + \sin^2\theta d\phi^2)]. \quad (4)$$

It is seen that, considering photon moving in space, Eq. (3) can be translated into R-W metric. Note that R-W metric itself is not only independent of relativity but also absolute!

4. Redshift formula (Deng Xiaoming 1992)[3]

Since photon moves along geodesic - great circle, we let $\theta=0$ (see Figure 1), and discuss about the track on the plan determined by X_3 and X_4 axes.

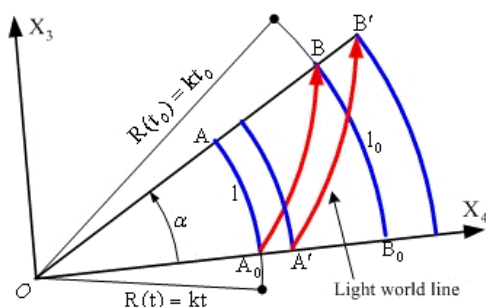


Fig 2 The spatial linear arc AA_0 at time t , its length is l and spatial linear arc BB_0 at time t_0 , its length is l_0

See Figure 2, We place ourselves at point B ($\alpha = \alpha$, $t = t_0$) and receive electromagnetic wave signal from a typical galaxy, located at point A_0 ($\alpha=0$, $t=t$). From Eq. (4), the equation of motion of a given wave crest is then

$$d\tau^2 = c^2 dt^2 - R^2(t)d\alpha^2 = 0$$

(We also can get the same equation directly from Eq. (3), $dS_{\text{space}} = Rd\alpha$ when $\theta=0$, and then $c = Rd\alpha/dt$). Its integral equation is: $\int_t^{t_0} \frac{cdt}{R(t)} = \int_0^\alpha d\alpha$, If $R=kt$, $\int_t^{t_0} \frac{cdt}{kt} = \int_0^\alpha d\alpha$, after integration, we have:

$$\frac{k\alpha}{c} = \ln \frac{t_0}{t}, \text{ or } t_0 = te^{k\alpha/c} \quad (5)$$

From Figure 2, we know that spatial linear arc AA_0 at time t expands to BB_0 at time t_0 with the growing of R . So we define $\bar{V} = k\alpha$ as the spatial expanding rate, or in another word, it is the recession velocity of a light source. Then Eq. (5) is translated into

$$\frac{\bar{V}}{c} = \ln \frac{t_0}{t}, \text{ or } t_0 = te^{\bar{V}/c} \quad (6)$$

If the next wave crest leaves from point A' ($\alpha=0$, $t=t+\Delta t$), and arrive us at point B' ($\alpha = \alpha$,

$t = t_0 + \Delta t_0$), then $\int_{t+\Delta t}^{t_0+\Delta t_0} \frac{cdt}{kt} = \int_0^\alpha d\alpha$, after integration, $\frac{k\alpha}{c} = \ln \frac{t_0 + \Delta t_0}{t + \Delta t}$. Comparing with Eq. (5), we have $\frac{t_0}{t} = \frac{t_0 + \Delta t_0}{t + \Delta t} = \frac{\Delta t_0}{\Delta t}$. Here Δt and Δt_0 are the period of the wave at different time, correspondingly, if the wavelength are λ and λ_0 , then $\frac{t_0}{t} = \frac{\Delta t_0}{\Delta t} = \frac{\lambda_0}{\lambda}$. Since redshift $Z = \frac{\lambda_0 - \lambda}{\lambda}$, and substitute it into Eq. (6),

$$\frac{\bar{V}}{c} = \ln(1 + Z), \text{ or } \frac{k\alpha}{c} = \ln(1 + Z). \tag{7}$$

This expression is very important and called redshift formula. If Z is small value, the approximation of 1st degree of this formula is $\bar{V} \approx Zc$.

5. The geometric significance of three different distances (Deng Xiaoming 1992)[3]

It is necessary to distinguish the three different distances between arbitrary two points in the universe. Referring to Figure 2, l_0 is the proper distance between B and B₀ at time t_0 ; l is proper distance between these two points (A, A₀) at time t . As we know the traveling distance of an electromagnetic wave from A₀ to B is: $D = (t_0 - t) c$.

Here D is defined as the observation distance. The relations of l , l_0 and D is: $l < D < l_0$.

6. The geometric significance of Hubble's Law (Deng Xiaoming 1992)[3]

The famous Hubble's expression is: $\bar{V} = HD$, here H is Hubble constant and its geometrical meaning is $H=1/t$. Referring to Figure 2, supposing that the wave from A₀ to B take time $\Delta t' = t_0 - t$, then $t_0 = t + \Delta t'$, substituting it into Eq. (6), then $\frac{\bar{V}}{c} = \ln(1 + \frac{\Delta t'}{t})$ and its series form is:

$$\frac{\bar{V}}{c} = \frac{\Delta t'}{t} - \frac{\Delta t'^2}{2t^2} + \frac{\Delta t'^3}{3t^3} - \dots + (-1)^{(n-1)} \frac{\Delta t'^n}{nt^n} + \dots, n=1, 2, \dots$$

Because $\frac{\Delta t'}{t}$ is a very small value when the observation distance D is near range. So the approximation of 1st degree is: $\frac{\bar{V}}{c} \approx \frac{\Delta t'}{t}$. For $D = c\Delta t'$, $H=1/t$, then $\bar{V} \approx HD$.

7. The modification of the lifetime or the period of an astronomical phenomenon (Deng Xiaoming 1992)[3]

In spatial curving universe, we must modify the lifetime or period of an astronomical phenomenon observed from a distance event (such as the duration of supernovae explosion or the period of light variation of celestial bodies etc.). Figure 2 shows that there is a difference between the real value and the observed. Here assuming that $\Delta \tau_0$ expresses our observed value of the lifetime or the period of an astronomical phenomenon at place B, B' from time t_0 to $t_0 + \Delta \tau_0$, $\Delta \tau$ is the real value emitted at place A₀, A' from time t to $t + \Delta \tau$ (Noting that the putative process is same as

the change of a period of the electromagnetic wave from one point to another), then $\frac{\lambda_0}{\lambda} = \frac{\Delta\tau_0}{\Delta\tau}$,

since $Z = \frac{\lambda_0 - \lambda}{\lambda}$, then

$$\Delta\tau = \frac{\Delta\tau_0}{1+Z} \tag{8}$$

Formula (8) shows that there is a modification factor $1/(1+Z)$ for the observed value of the lifetime or the period of an astronomical phenomenon.

8. The lens effect of cosmic entire space

Supposing that electromagnetic wave (or gravitational wave if it is existent) emitted from a point O take on spherical symmetry relative to a point O_r in four-dimensional Euclidian space, reference Figure 3, the wave front is given as $4\pi r^2$ in three-dimensional cosmic hyperspherical space. Since $r = kt_0 \sin \alpha$, if the radiant energy is expressed as E, and radiant intensity is expressed as I, then

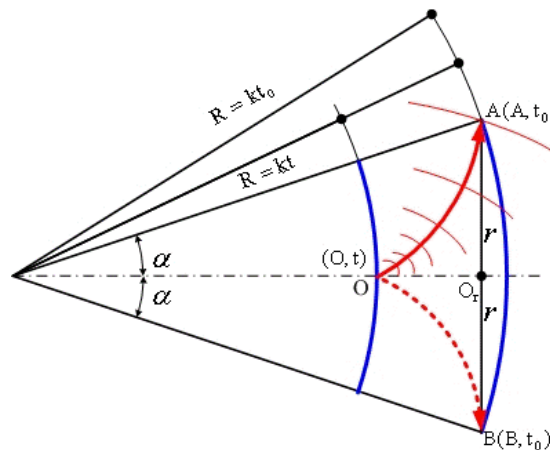


Fig 3 Electromagnetic radiation from point O take on spherical symmetry relative to O_r in four-dimensional Euclidian space

$$I = \frac{E}{4\pi r^2} = \frac{E}{4\pi k^2 t_0^2 \sin^2 \alpha} \tag{9}$$

From Eq. (5), we have $t_0 = te^{k\alpha/c}$, then

$$I(t, \alpha) = \frac{E}{4\pi k^2 t^2 e^{2k\alpha/c} \sin^2 \alpha} \tag{10}$$

Eq. (10) is called as radiant intensity formula. For convenience, if we only consider the radiant intensity of a wave front or supposing that the radiant energy E is invariableness within a short duration, the emitting time t would be fixed and let $\mu = \frac{E}{4\pi k^2 t^2}$ (μ is a constant), then

$$I(\alpha) = \frac{\mu}{e^{2k\alpha/c} \sin^2 \alpha} \tag{11}$$

Here, $\frac{1}{e^{2k\alpha/c}}$ is degressive factor and $\frac{1}{\sin^2 \alpha}$ is period factor.

We can give the Figure 4 to show the variation of I with α . It is seen that near by $\alpha=0, \pi, 2\pi, 3\pi, \dots, n\pi, \dots$, $I \rightarrow \infty$. Of course, it is not verity, it merely is mathematical infinite, because energy E emitted from a celestial body is limited, in nature, it should be the value measured nearby the position of a celestial body. Without regard to others wastage during propagation process, as a whole, Eq. (11) is a slow decreasing function. Clearly, it is the character of cosmic entire space-time that cause the huge value of radiant intensity at $\alpha=\pi, 2\pi, 3\pi, \dots, n\pi, \dots$, in other word, the wave can be repeatedly focalized in the universe during its long journey. We might as well call this phenomenon as the lens effect of cosmic entire space.

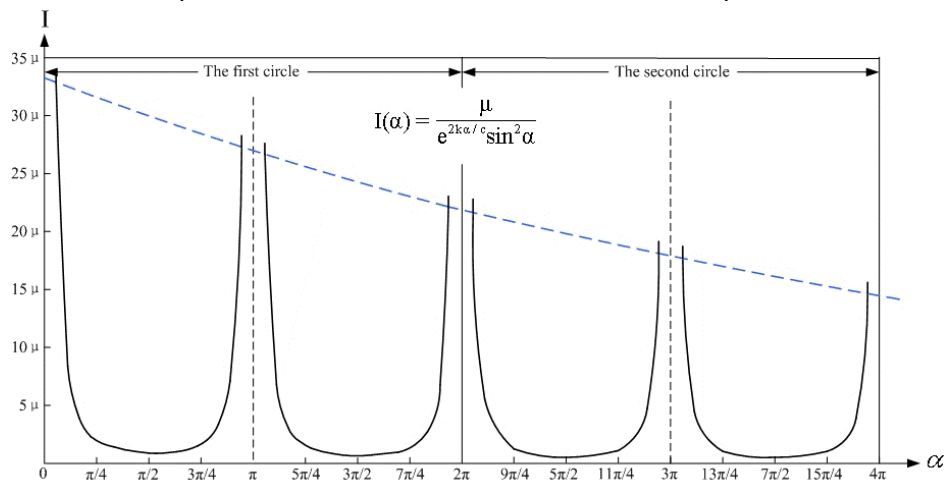


Fig 4 the change of radiant intensity I with α

We might as well transpose the position from which the lens effect can be observed. For visual aid, we give Figure 5.

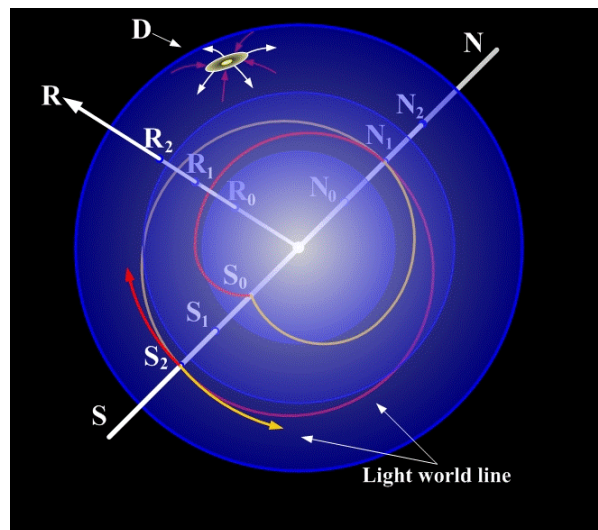


Fig 5 Light circulating through the expanding two-dimension sphere

With the help of two-dimensional sphere, we can partially understand the case happened on three-dimensional hypersphere. Imagining that a light beam move along geodesic on the great circle, and hank of light also move along each geodesic on the great sphere. In other word, the electromagnetic wave emitted by a source radiate in all directions in three-dimensional hypersphere space, and all radial are placed on innumerable great circle and innumerable great sphere. If we study the case on one great circle or great sphere, the factually outcome must be gained. Figure 5 shows the case on a great sphere.

In expanding hyperspherical cosmic space, we define $\alpha=0, 2\pi, \dots, 2n\pi, \dots$ ($n=0, 1, 2, \dots$), as the position poles (the places of an observer at different time), and $\alpha=\pi, 3\pi, \dots, (2n+1)\pi, \dots$ ($n=0, 1, 2, \dots$) as the opposite poles (relative to the place of the observer at different time). For instance, our place in Figure 5 is S_2 at time t_2 and $\alpha=2\pi$ when a emitting area is S_0 or $\alpha=\pi$ when a emitting area is N_1 .

S-N express the position pole and the opposite pole axis. In order to explain farther, supposing that a source emit electromagnetic wave in all directions (For convenience, only two representative helical radial are drawn here) at position pole S_0 (time t_0 ; cosmic radius R_0), and all of the wave arrive in the opposite pole N_1 at time t_1 ($\alpha=\pi$) and come back at the position pole S_2 at time t_2 ($\alpha=2\pi$)To all appearances, at $\alpha=\pi, 2\pi, 3\pi, \dots, n\pi, \dots$ (the position poles and the opposite poles), the waves are continually focalized.

By the discussion in this section, we can give the conclusion:

From the point of view of an observer at each place in the universe, it is easier to see the matters that are distributed around the position poles and the opposite poles that relative to him, Because the electromagnetic wave from both poles are focalized when they pass through the place of the observer's. In observation, the lens effect of cosmic entire space should result in some periodicity, and the periodicity can be detected by means of statistic.

9. Periodicity of redshift distribution

The existence of periodic structure in the distribution of the redshifts of quasars was first pointed out by Burbidge and Burbidge (1967) [6] and confirmed by Cowan (1969) [7], Lake and Roeder (1972) [8], and Burbidge and O'Dell (1972) [9]. The mathematical solution for the periodicity was given by Karlsson (1971, 1973, 1977) [10] [11] [12] as follows:

$$\Delta \ln(1+Z) \approx 0.206, \text{ if } f(Z) = \ln(1+Z), \text{ then } (1+Z_n) = (1+Z_0)e^{0.206n}, n=1, 2, \dots$$

Later Barnothy and Barnothy (1976) [13] confirmed this periodicity to the 99.99 percent confidence level. With a larger sample of quasars Fang et al. (1982) [14] have again confirmed these results. Depaquit et al. (1985) [15] show that effectively every test to date supports karlsson's formula as the average periodicity for the quasar redshifts. H.Arp, H.G.Bi, Y.Chu and X.Zhu (1990) [16] presented a strong paper to support karlsson's formula by further investigation.

The history of quasar periodicities was reviewed by D. Scott (1991) . Possible periodic structure in the distribution of the redshifts of quasars has been the subject of controversy, which is ultimately related to the question of whether such redshifts are of cosmological origin. Some authors explained it in terms of their own cosmological model (Barnothy & Barnothy 1976a; Fang & Sato 1983; Fang 1990), and some others believed that such a large-scale "non-uniformity" is more seriously prone to selection effects (Wills 1971, 1972; Roeder & Dyer 1972a, b; Basu 1973, 1975, 1977, 1978a, b; Kjærgaard 1978; D.Scott 1991) [17-23] .

In this section, we will explain the periodicity of quasar redshifts and show that such a feature observed from the earth may expose an Important information about the hyperspherical structure of the cosmic holistic space-time, and the periodicity can naturally be fitted in with the spatial properties of this model.

9.1. The periodic formula of redshift (or Karlsson’s formula) (Deng Xiaoming 1993) [24]

By analyzing the physical properties of quasar, there is a reason for us to regard quasar as initial density matter in the universe or the predecessor of galaxy or star. For convenience, the matter within a certain space range on different evolutionary phase is defined as the same cosmic evolving-matter.

Figure 6 shows the overlapping logarithmic spiral world line of the electromagnetic waves emitted by a same cosmic evolving-matter (quasar → galaxy) at different time. Supposing that point A is the position of Earth at the present time t_0 , that points B, 1, 2, ..., n are the positions of a same cosmic evolving-matter at time $t_0, t_1, t_2, \dots, t_n$, that α ($0 \leq \alpha < 2\pi$) is the initial phase between the same cosmic evolving-matter and us, and that $l_{AB} = \alpha R(t_0)$ is the proper distance between the same cosmic evolving-matter and the earth at time t_0 . Note that perhaps there are two proper distances from a same cosmic evolving-matter to the earth when we observe it in both opposite directions, and in this case, α should be in range $0 \leq \alpha < \pi$.

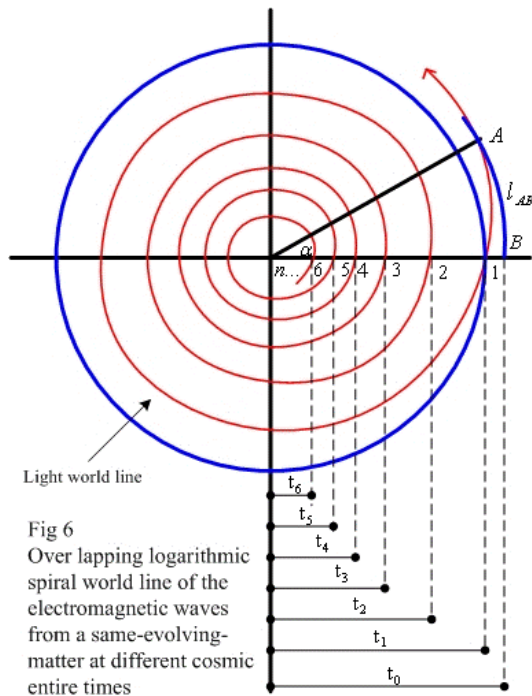


Fig 6
Overlapping logarithmic spiral world line of the electromagnetic waves from a same-evolving-matter at different cosmic entire times

We must emphasize that λ here means the wavelength of the light observed near the local place and time of emission and presumably take the values measured when the same atomic transition occurs in terrestrial laboratories.

while $\lambda_1, \lambda_2, \dots, \lambda_n$ in this case are the wavelengths of the electromagnetic waves detected on the earth at time t_0 , they were emitted by the same cosmic evolving-matter at time t_1, t_2, \dots, t_n . After their long journey (of course, most of them have moved round the universe for several times). The corresponding redshifts are:

$$Z_1 = \frac{\lambda_1 - \lambda}{\lambda}, Z_2 = \frac{\lambda_2 - \lambda}{\lambda}, \dots, Z_n = \frac{\lambda_n - \lambda}{\lambda}$$

According to Eq. (7) and by dint of Figure 6, we can give

$$\ln(1 + Z_n) = \frac{k\alpha_n}{c} = \frac{k[\alpha + 2(n-1)\pi]}{c}, n = 1, 2, \dots \tag{12}$$

Because $\alpha_{n+1} - \alpha_n = 2\pi$, according to Eq. (12), we find that

$$\Delta \ln(1 + Z) = \ln(1 + Z_{n+1}) - \ln(1 + Z_n) = \ln \frac{1 + Z_{n+1}}{1 + Z_n} = \frac{2\pi k}{c} \tag{13}$$

If we define

$$\Omega = \frac{2\pi k}{c} \tag{14}$$

as integral periodic parameter of redshift, it means that we just consider the case $\alpha_{n+1} - \alpha_n = 2\pi$. Yes, there are the cases like this maybe, for instance, a small area in the sky, only one group of quasars around bright galaxies (only one or few same cosmic evolving-matter in one direction) was surveyed by us, and we just can see the Integral periodic images of them. Of course, the initial phase α should be smaller enough, otherwise we can't see them according to the discussion in section 8. Commonly, for large-scale redshifts survey, most possible case is that we can see the half periodic images of mixed celestial bodies that are distributed around the position poles and the opposite poles. In this case, we suppose that the initial phase α is near zero, we have

$$\ln(1+Z_n) = \frac{k\alpha_n}{c} = \frac{kn\pi}{c}, n= 1, 2, \dots \tag{15}$$

And $\alpha_{n+1} - \alpha_n = \pi$, from Eq. (15), then

$$\Delta \ln(1+Z) = \ln(1+Z_{n+1}) - \ln(1+Z_n) = \ln \frac{1+Z_{n+1}}{1+Z_n} = \frac{\pi k}{c} \tag{16}$$

If we define

$$\Omega_h = \frac{\pi k}{c} \tag{17}$$

as half periodic parameter of redshift, and the relation with integral periodic parameter of redshift is: $\Omega = 2\Omega_h$. Corresponding to the different cases, consider Eq. (13) and (16) respectively, we have

$$\Delta \ln(1+Z) = \ln \frac{1+Z_{n+1}}{1+Z_n} = \Omega, n= 1, 2, \dots \tag{18}$$

$$\Delta \ln(1+Z) = \ln \frac{1+Z_{n+1}}{1+Z_n} = \Omega_h, n= 1, 2, \dots \tag{19}$$

From the two recurrence formula Eq. (18) and (19), we can use Z_1 to express Z_n . If we transform them,

$$\ln \frac{1+Z_n}{1+Z_1} = \Omega(n-1), \text{ or } (1+Z_n) = (1+Z_1)e^{\Omega(n-1)}, n= 1, 2, \dots \tag{20}$$

$$\ln \frac{1+Z_n}{1+Z_1} = \Omega_h(n-1), \text{ or } (1+Z_n) = (1+Z_1)e^{\Omega_h(n-1)}, n= 1, 2, \dots \tag{21}$$

Eq. (20) and (21) are very important and called the integral periodic formula and half periodic formula of redshift respectively. Here, we might as well subjectively deem that karlsson's formula is Eq. (20) -- the integral periodic formula of redshift. Note that karlsson's formula is a statistical

formula, while the periodic formula of redshift Eq. (20), obtained here, is a theoretical formula, which can be used to describe the behavior of a single same cosmic evolving-matter, observed from the earth. The integral periodic parameter of redshift Ω is also very important, it is a new provable cosmological constant. From Karlsson's work we know $\Omega \approx 0.206$.

10. The natural deduction of this model

To validate this model, we can use known observation data to check or predict undiscovered astronomical phenomenon. If this model really works, we will give conclusion or forecasts as follows:

10.1. The distance determined by stellar magnitude is not reliable in the cosmological model with curved space

See Figure 4, in hypersphere space, radiant intensity I decrease with α from 0 to $\pi/2$, and increase from $\pi/2$ to π Reference Figure 5, if we are at position pole S_2 , it is seen that, with the increase of the distance between S_2 and a celestial body, both the brightness and size observed decrease within "equator", but increase outside "equator".

10.2. The farther explanation for quasars

(1) All of the quasars observed in all directions in the sky are the early multiple images of the same cosmic evolving-matter located within the area near by both the position poles and the opposite poles. So, all of quasars take on similar characteristic.

See Figure 4, the value of radiant intensity I is much bigger in the range $(0, \pi/4)$; $(3\pi/4, 5\pi/4)$; $(7\pi/4, 9\pi/4)$... then in the range $(\pi/4, 3\pi/4)$; $(5\pi/4, 7\pi/4)$; $(9\pi/4, 11\pi/4)$ Supposing that our earth is placed at a position pole (such as S_2), all of the quasars observed in all directions in the sky only are the same cosmic evolving-matter located within the area near by both the position poles (such as S_0) and the opposite poles (such as N_1) in the range $(3\pi/4, 5\pi/4)$; $(7\pi/4, 9\pi/4)$... at different times. Because radiant intensity I is smaller in the range $(5\pi/4, 7\pi/4)$; $(9\pi/4, 11\pi/4)$..., in principle, distant celestial bodies in these area may not be observed. That is to say, all quasars observed by us, some are the early multiple images of stars or the nucleus of milky way galaxy (or local group of galaxies) and others are the early multiple images of stars or galaxies nearby the opposite poles that relative to milky way.

(2) The super radiation of quasars is a kind feint and caused by the lens effect of cosmic entire space.

See Figure 4, the radiation emitted by the same cosmic evolving-matter (or early star) in the area nearby a position pole or an opposite pole that relative to us would be focused, and in addition, see Eq. (10), the bigger is radiant intensity I , the smaller is t . Since quasars are the early phase of same cosmic evolving-matter, then t is small enough, so by both reasons, all of quasars observed would show super radiation.

(3) The random variability of a quasar's radiation is caused by its peculiar motion.

Also see Figure 4, if a same cosmic evolving-matter (or early star) nearby a position pole or an opposite pole, it is seen that the radiant intensity I is very sensitive to a small motion of quasar's about $\alpha = \pi, 2\pi, 3\pi, \dots, n\pi, \dots$. So we must say that the random variability of a quasar's radiation is caused by its peculiar motion nearby a position pole or an opposite pole.

10.3. Alleged “dark matter” is not darker, same as normal matter, the uniquely difference only is the different position at which they located.

In order to cater to Friedmann (FRW) model for “close or open”, the term dark matter was defined. There is “dark matter” indeed in this model. See Figure 4, if the matter were distributed in the area $(5\pi/4, 7\pi/4)$; $(9\pi/4, 11\pi/4)$... (or nearby “equator” $3\pi/2, 5\pi/2$...), maybe, some of them are too dark to be seen. For the range $(\pi/4, 3\pi/4)$ is nearby us, majority of the matter in it could possibly be seen.

10.4. The Main contribution for microwave background radiation were by the early matter nearby the position poles and the opposite poles

The microwave background radiation that we detected in all directions in the sky were emitted by both the matter nearby (include) our milky way galaxy and the matter nearby the opposite poles at very early era.

The detection of tiny variations in the temperature of the microwave background radiation tell us that the radiation come from the era after the universe become transparence. When the cosmic energy that was based solely on radiation become that was based solely on matter, and if the thermometric scale of this period is: $T_{r0}=3000\sim 4000\text{K}$, according to this model, (if $\Omega \approx 0.206$), the redshift of the microwave background radiation is: $Z \approx 1454\sim 1090$, and it means that every photon circle the universe about 35~36 times. It is evident that the difference of the radiation almost be blotted out.

10.5. There are full of the small area within which the electromagnetic wave (or gravitational wave if it is in existence) is focused in the universe.

Supposing that there is such a point, see Figure 5, point D on the sphere space, to which all of the radiant energy is focused, relative to the point D, the emission source (a same cosmic evolving-matter) is at a position pole or an opposite pole. If this case was true, what would be happened? On man’s view, that is disaster indeed! Imagine that if a celestial body or galaxy or intergalactic matter (include dark matter, gaseous nebula) drops into this area, it must be smashed or burned out by both enormous radiant energy and gravitational energy. We should see these astronomical phenomena distinctly in the sky, and if it is a new explanation for supernova explosion or gamma ray burst etc?

There are full of such “death focuses” (small area) in the universe. It is clear that every star, galaxy or emission source has several corresponding death focuses nearby the position poles and the opposite poles (for the peculiar motion, the focuses shift about the poles in different directions), because the radiant energy turns round the universe several times. In this case, we may infer that the probability of this kind events is more then the events of bump between galaxies or stars.

10.6. A same cosmic evolving-matter (a group of star, galaxy or quasars) can also be seen in reverse direction in the sky

Reference Figure 7, supposing our position (Earth) is at point B (α_0, t_0) , and the positions of a same cosmic evolving-matter at different time are at $A_1 (0, t_1)$ and $A_2 (0, t_2)$, electromagnetic wave emitted by it at time t_1 and t_2 move toward us in both positive and negative direction, and at time t_0 , we receive them.

Supposing the wave from A_2 to B is positive direction and from A_1 to B is negative direction.

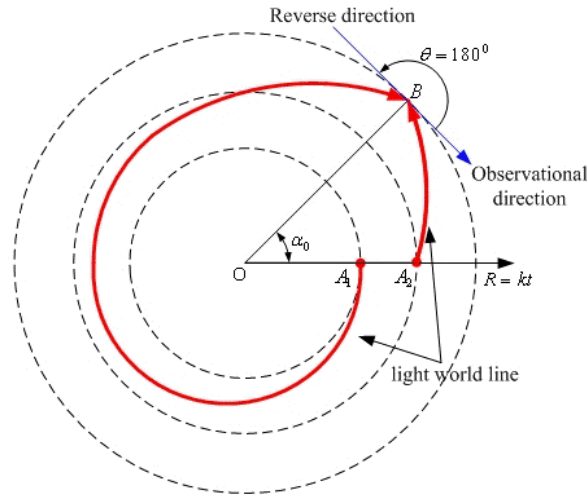


Figure 7 Supposing our position is at B (α_0, t_0) , a same cosmic evolving-matter at $A_1 (0, t_1)$ and $A_2 (0, t_2)$, respectively emitted electromagnetic wave moving toward us in both positive and negative direction, and at time t_0 , we receive them.

According to Eq. (7), we can give $\frac{k\alpha_0}{c} = \ln(1 + Z_p)$ and $\frac{k(2\pi - \alpha_0)}{c} = \ln(1 + Z_n)$. Here Z_p and Z_n respectively express the redshifts observed from positive and negative direction for a same cosmic evolving-matter. From above two equations, we have $\frac{2k\pi}{c} = \ln[(1 + Z_p)(1 + Z_n)]$, and consider Eq. (14) (the integral periodic parameter of redshift), then

$$\Omega = \ln[(1 + Z_p)(1 + Z_n)], \text{ or } Z_n = \frac{e^\Omega}{1 + Z_p} - 1. \quad (22)$$

Noting that we only discuss the case of initial phase angle $0 \leq \alpha_0 < 2\pi$, the redshifts series ($2\pi \leq \alpha$) of the same cosmic evolving-matter in both positive and negative direction can be given by Eq. (20). If the integral periodic parameter of redshift $\Omega \approx 0.206$ given by K.G. Karlsson was real, the Eq. (22) would be $Z_n \approx \frac{e^{0.206}}{1 + Z_p} - 1$. It means that if we observed a same cosmic

evolving-matter (a group of star, galaxy or quasars), and its redshift was Z_p , we would see its another side image in reverse direction (maybe a small area) on the celestial sphere and the redshift is $Z_n \approx \frac{e^{0.206}}{1 + Z_p} - 1$. If others wastage of radiant energy during propagation process is

neglected, By Eq. (10), (5) and (22), it can be proved that the radiant intensity I observed in both positive and negative direction would be same. That is to say, both brightness (or magnitude) is similar. Certainly, not only the state but also the position of the same cosmic evolving-matter must be changed from time t_1 to t_2 . Because during the period $(t_2 - t_1)$, there were the evolution and peculiar motion of the same cosmic evolving-matter.

11. Discussion

Through above explanation, we know that there are four basic constants, the integral periodic and half periodic parameter of redshift Ω and Ω_h (since $\Omega = 2\Omega_h$, we just consider both as one

constant), equivalent constant k , velocity of light c and π in this model, and their relation is $\Omega = 2k\pi/c$ or $\Omega_h = k\pi/c$. Herein, both Ω (or Ω_h) and π are dimensionless constant. It is seen, If the model fit the observations nicely or not, it entirely depend on the mensuration of Ω (or Ω_h). Because one of the most dependable observations in astronomy is redshifts, we have gotten three ways to determine the value of Ω (or Ω_h) at the moment, one is by statistical method, like Karlsson did ($\Omega \approx 0.206$), another is according to Eq. (22) to look for typical samples in the sky, and the third is that use the results of large-scale survey for redshifts, such as SDSS redshift survey slices. We might as well borrow two Figures from Blanton et al. (2003) [25] to guesstimate the value Ω_h .

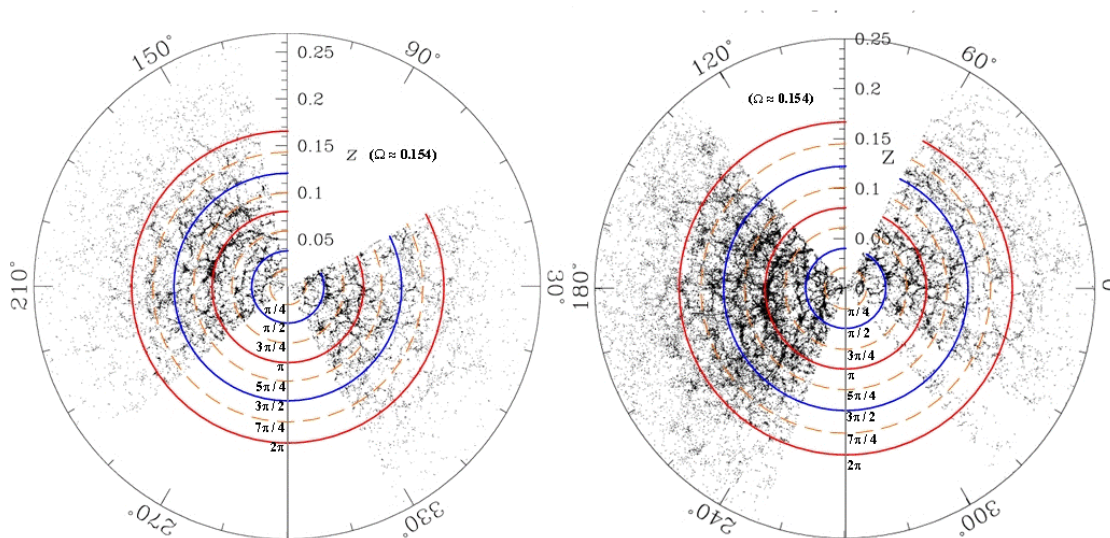


Fig 8 Blanton et al. (2003) (astro-ph/0210215), Large-Scale Structure sample. This author add concentric circles coordinate and correlative sign. $\Omega_h \approx 0.077$, the black area under the circle ($Z \approx 0.08$, $\alpha = \pi$) is “the great wall”

See Figure 8, supposing that the ridge of the great wall at redshift 0.08 are the matter that was distributed nearby the opposite pole that relative to us at first phase (reference Figure 4, the radiant intensity I is magnified at $\alpha = \pi, 2\pi, 3\pi, \dots, n\pi, \dots$ it mean that we can see more matter in these areas), then, according to Eq. (7) and (17), the coarse value of Ω_h is given as $\Omega_h \approx 0.077$. Comparing with $\Omega \approx 0.206$ (given by Karlsson), the difference of both is $\Omega - 2\Omega_h = 0.206 - 0.154 = 0.052$ (in percentage 33.7% or -25.2%). there are three likelihoods in this situation, the first, we haven't made a good use of the existing observational data or there are some error in the data (maybe, the peculiar redshift must be considered); the second, one of both must be wrong (perhaps, there are some problems about $\Omega \approx 0.206$, for the sample space is too small); and the third, if both have no statistical mistake, it indicate that the cosmic radius $R(t)$ is not a linear function, In this case, since $\Omega \approx 0.206$ is the statistical data of distant quasars and $2\Omega_h \approx 0.154$ is the galactic nearby, and even the periodic parameter 0.206 itself given by Karlsson is half periodic parameter of redshift, we can mainly say that the universe is decelerated expanding. Anyway, we can give the statistical function of $R(t)$ by more samples under the frame of this model (As we said first, $R(t)$ can't be simply determined by any dynamics at present, and another reason is that the model with horizon, such as Friedmann's, can't trace back to the early era).

In addition, we predict that not only the great wall but also “the great spherical shell” could be seen at redshift $Z \approx 0.08$ if our eyeshot haven't been enveloped by Milky Way.

Comparing with Friedmann model, this model is easier to give the age of the universe, such as, by formula $t_0 = D(1 + Z)/(cZ)$. As we know that the distance determined by stellar magnitude is not reliable in any cosmological model with curved space. The ways currently available for distance measuring contain much hypothesis too, so they are also in doubt. In fact, the age of the universe and Hubble constant are very coarse approximation in any cosmological model at present.

Philosophical universe is different from our physical universe. We would rather believe that the philosophical universe is infinite. Maybe the word “infinite” imply our nescience, certainly, the eyeshot of human beings is limited. Praiseworthy, we have already set foot on great expedition to discover the universe in which we are living – observable physical universe. Variety evidences indicate that our physical universe is finite, and just such “finite” exposit that our finite physical universe is one part structure of the philosophical universe.

This model not only is simple but also can explain more observations then Friedmann model (FRW model) does. Though the deductive metric come down to R-W metric, it is quite different from the other model, like Milne model or the empty FRW universe.

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