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The Formula to Calculate the Red Shift-Distance Relation of Ia Supernova in Cosmology Has Essential Mistakes

—The Calculation of Cosmological Red Shift Should Use the Doppler Formula Directly

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ABSTRACT

There are three main mechanisms to cause the red shift of spectrum in physics. The first is gravity which is related to mass. The second is the Compton scattering which is related to the energy transformation of photon. The third is the Doppler's effect which is related to velocity. The basic formula used to calculate the relation of red shift and distance of Ia supernova in cosmology is $z+1=R_0/R(t)$ which is related to the scalar factor (t) of the R-W metric. It is completely different from the Doppler formula of red shift which is related to velocity factor $\dot{R}(t)$. This kind of inconsistency is not allowed in physics. Because of $R(t)<R_0$, when $R(t)$ became larger and larger with time increase, z became smaller and smaller, means that space expansion leads to red shift becoming smaller. At present time, we have $R(t_0)=R_0$ and $z=0$, means that there is no red shift for the light emitted from distance celestial bodies at present. The results obviously violate the Hubble law! It is proved strictly in mathematics that the formula $z+1=R_0/R(t)$ is untenable unless $R(t)=R_0=$ constant and $z=0$. The further study reveals that the essential reason of the mistake is that the R-W metric violates the principle of light's speed invariable. The time delay caused by relativity velocity between light's source and observer is neglected. Besides, there exists the problem of time misalignment between theoretical calculation and practical observations in the original documents of Ia supernova projects. So the formula used to calculate the relation between red shift and distance of Ia supernova is wrong and the deduced conclusion about dark energy and the accelerating expansion of the universe are incredible. It is proved in this paper that based on the Doppler's formula and the method of numerical calculation, the relation of red shift and distance of Ia supernova can be explained well. The hypotheses of dark energy and the accelerating expansion of the universe are completely unnecessary in cosmology.

Keywords: Cosmology; Doppler Formula; Hubble Law; Supernova; Dark Energy; R-W Metric

1. Introduction

As we know that there are three main mechanisms to cause the red shift of spectrum. One is gravity which is related to mass and another is the Doppler's effect which is related to velocity. According to the Hubble law, the spectrum red shift of extragalactic nebula was proportional to the distance between observer and luminous celestial body. The red shift of cosmology is considered to be the Doppler's effect. In 1998, cosmic observations found that the high red shift of Ia supernova deviated from the linear relation of Hubble law. By fitting the observation values with standard theory of cosmology, cosmologists concluded that more than 70% of the universe material was dark energy. The universe seems be doing accelerating expansion [1,2].

Now that the red shift of cosmology is considered as the Doppler's effect, we should use the Doppler's formula to do calculation. However, it is strange that the basic formula used to calculate the relation of red shift and distance of Ia supernova is completely different from the Doppler formula. The formula is

$$z+1=\frac{R(t_0)}{R(t)}=\frac{R_0}{R(t)} \tag{1}$$

Here $R(t)$ is the scalar factor of R-W metric. At present moment t_0, we take $R(t_0)=R_0=1$. It is well known that the Doppler's formula is related to the velocity factor $\dot{R}(t)$ of spatial expansion. But (1) is only relative to $R(t)$, which has nothing to do with $\dot{R}(t)$. The difference is so big that they are completely incompatible. This inconsistence is not allowed in physics.

More serious is that according to (1), at initial moment when the distance between observer and light's source is zero with $R(t) \to 0$, we have $z \to \infty$. Such initial red shift is strange. Meanwhile, at past time, we had $R(t) < R_0$. With time increased, $R(t)$ became greater and greater, z became smaller and smaller, means that space expansion leads to red shift becoming smaller. At present time, we have $R(t_0) = R_0$ and $z = 0$, means that there is no red shift for the light emitted from distance celestial bodies at present. The result obviously violates the Hubble law!

The further analysis indicates that the problem originnates from the R-W metric. It is proved that the R-W metric violates the principle of light's speed invariable so it is not the metric of relativity. The time contraction between observer and moving light's source is neglected when we us the R-W metric to describe the spatial expansion. So the R-W metric is unsuitable to be used as the basic space-time frame. Especially, it is unsuitable to be used to describe the high red shift of supernova in which the high speed expansion of the universe is involved.

Besides, there exist a problem of time misalignment between the result of theoretical calculation and practical observation. Because light's speed is finite, it needs time for light to propagate from luminous celestial bodies to observers on the earth. The light observed by the observers on the earth was emitted by Ia supernova billions of years ago. The positions and the red shift values of Ia supernovas observed by observers on the earth were that were emitted billions of years ago. At present moment, the real positions and red shift values of these supernovas are completely different from that we observe now.

However, in the original documents [1] and [2] of Ia supernova observations, the problem of time alignment was neglected. The observed values which presented the situations of past time were fitted directly with the calculating values of theory which presents the situations of present time. Then the dark energy and the accelerating expansion of the universe were deduced. The error is very great so that the result can not be tenable.

In sum, the formula used to calculate the relation of red and distance of supernova has essential mistake. Based on this formula, the concepts of dark energy and the accelerating expansion of the universe are incredible. It is proved that if the Doppler's formula is used directly to calculate the relation of red shift and distance of Ia supernova, we do not need the hypothesis of dark energy and the accelerating expansion of the universe again.

2. Inconsistency of Two Formulas to Calculate the Relation of Red Shift and Distance

In order to use (1) to describe the red shift of cosmology, we should fix $R(t)$ and let $R(t_0)$ change with time. When the universe expands, z increases with $R(t_0)$ increasing. However, in this case, (1) also lead irrational result. For simplicity, we assume that space expands linearly with time increasing and let $R(t) = a + bt$. The distance between observer and light's source is $r(t) = R(t)\bar{r} = (a+bt)\bar{r}$. The speed of spatial expansion $V(t) = b\bar{r}$ is a constant. Suppose initial time $t_1 = 0$, we have $r(t_1) = a\bar{r}$, $r(t_0) = (a + bt_0)\bar{r}$. Take present time $t_0 = 10^{10}$, let $a = b = 10^{-10}$ and $\bar{r} = 1$. According to (1), we have

$$z = \frac{a + bt_0}{a + bt_1} - 1 = \frac{a + bt_0}{a} - 1 = t_0 = 10^{10} \qquad (2)$$

If (2) is used to describe the special expansion between two luminous atoms, it means that distance between them is $r(t_1) = 10^{-10}\,\text{m}$ at beginning. Then they separated with each other in a uniform speed $V = 10^{-10}\,\text{m/s}$. After $t_0 = 10^{10}\,\text{s}$ (about 317 years), their distance becomes 1 m but the red shift reaches 10^{10}. The bigger problem is that the red shift increases with time's increasing, though atoms move in uniform speeds. The result is very absurd. If using Doppler's formula, when $V/c \ll 1$, we have

$$z = \frac{V}{c} = \frac{b\bar{r}}{c} = \frac{10^{-10}}{3\times 10^{8}} = 3.3\times 10^{-19} \qquad (3)$$

The difference between (2) and (3) is 3×10^{28} times! Because the Doppler's formula is verified by many experiments, (3) should be correct and (2) is certainly wrong. The origin of mistake is that in the deduction of (1), following relation is used

$$\frac{\tau_0}{R(t_0)} = \frac{\tau_1}{R(t_1)} \qquad (4)$$

In which τ_1 is the period of emitted light and τ_0 is the period of received light. We will prove strictly below that (4) is untenable unless $R(t_0) = R(t_1) = \text{constant}$ or $z = 0$.

At first, we discuss how to use the Doppler's formula to calculate the red shift in cosmology. Suppose that observer is rest at the original point of reference frame. The light's source moves in velocity V relative to observer. The proper frequency and period of light observed by observer who is at rest with light's source are ν_1 and τ_1. The frequency and period which observer receives at the original point of reference frame are ν_0 and τ_0. According to the Doppler's formula, we have relations

$$\nu_1 = \frac{\nu_0\left(1 - V\cos\phi/c\right)}{\sqrt{1 - V^2/c^2}}, \tau_0 = \frac{\tau_1\left(1 - V\cos\phi/c\right)}{\sqrt{1 - V^2/c^2}} \qquad (5)$$

If light's source leaves observer, we have $\cos\phi=-1$. According to the definition of red shift, we have

$$z=\frac{\nu_1}{\nu_0}-1=\sqrt{\frac{1+V/c}{1-V/c}}-1$$

or

$$\frac{V}{c}=\frac{z^2+2z}{z^2+2z+2} \tag{6}$$

The co-moving coordinate $r=R(t)\bar{r}$ is used in cosmology. The Friedmann equation of cosmology is

$$\left(\frac{\dot{R}}{R}\right)^2+\frac{\kappa}{R^2}=\frac{8\pi G}{3}(\rho_m+\rho_\lambda) \tag{7}$$

Here ρ_m is the density of normal material and ρ_λ is the density that cosmic constant λ corresponds to. Let $\rho=\rho_m+\rho_\lambda$ be the total density of the universe material, suppose that the universe expands along the direction of radius, according to (7), we have

$$V=\dot{R}\bar{r}=\bar{r}\sqrt{\frac{8\pi G\rho R^2}{3}-\kappa} \tag{8}$$

We define

$$H(t)=\frac{\dot{R}(t)}{R(t)} \tag{9}$$

The observation of WMAP shows that our universe is approximately flat with curvature factor $\kappa=0$, so at present moment t_0, the Hubble formula is

$$V=\dot{R}\bar{r}=\bar{r}\sqrt{\frac{8\pi G\rho}{3}}=HR\bar{r} \tag{10}$$

(6) becomes

$$z=\sqrt{\frac{1+HR\bar{r}/c}{1-HR\bar{r}/c}}-1 \tag{11}$$

The relation between red shift and distance is not linear. If $V/c\ll 1$, we obtain the Hubble law

$$z=\frac{V}{c}=\frac{HR\bar{r}}{c} \tag{12}$$

In this case, the relation between red shift and distance becomes linear.

However, the problem is that in the current cosmology, we do not use (6) to calculate the red shift of Ia supernova. In stead of, we use following formula [3]

$$H_0 \mathrm{d}_L=\frac{1+z}{\sqrt{|\Omega_{k0}|}}\sin n\sqrt{|\Omega_{k0}|}\times\int_0^z\frac{\mathrm{d}z'}{\sqrt{(1+z')^2(1+\Omega_{m0}z')-z'(2+z')\Omega_\lambda}} \tag{13}$$

In which d_L is the luminosity distance

$$d_L=(1+z)r=(1+z)R_0\bar{r} \tag{14}$$

For flat space, d_L is common distance, *i.e.*, $d_L=r$. By introducing so-called effective energy density of curvature [3]

$$\rho_k=-\frac{3\kappa}{8\pi GR^2} \tag{15}$$

we define

$$\Omega_k=\frac{\rho_k}{\rho_c} \tag{16}$$

Here ρ_c is critical density. At present time t_0, we have $\Omega_{m0}=\rho_{m0}/\rho_c$, $\Omega_{k0}=\rho_{k0}/\rho_c$, $\Omega_\lambda=\rho_\lambda/\rho_c$. Cosmologists use (13) to calculate the red shift of Ia supernova and deduces that about 70% of the universe material is dark energy, about 25% is dark material. Based on these, the conclusion is that our universe is doing accelerating expansion now. However, (13) is completely different from the Doppler's formula (6). Which one is correct? We prove blow that (13) is certainly incorrect. We should directly use the Doppler's formula (6) to calculate the red shift of Ia supernova.

3. The Mistake in the Deduction of Ia Supernova's Red Shift-Distance Formula

3.1. The Relation $\tau_0/R(t_0)=\tau_1/R(t_1)$ is Untenable

The formula (13) is based on the R-W metric

$$\mathrm{d}s^2=c^2\mathrm{d}t^2-R^2(t)\times\left(\frac{\mathrm{d}\bar{r}^2}{1-\kappa\bar{r}^2}+\bar{r}^2\mathrm{d}\theta^2+\bar{r}^2\sin^2\theta\mathrm{d}\phi^2\right) \tag{17}$$

For light's motion, we have $\mathrm{d}s=0$ and get from (17)

$$c^2\mathrm{d}t^2=R^2(t)\frac{\mathrm{d}\bar{r}^2}{1-\kappa\bar{r}^2} \tag{18}$$

Because light's source is fixed at point $\bar{r}$, $\bar{r}$ does not change with time for light's source, but for light's motion, $\bar{r}$ changes with time. Suppose that photon's coordinate is $\bar{r}_1$ at moment t_1 and photon arrives at the original point $\bar{r}_0=0$ at moment t_0. The integral of (18) is [4]

$$\int_{t_1}^{t_0}\frac{c\mathrm{d}t}{R(t)}=-\int_{\bar{r}_1}^{0}\frac{\mathrm{d}\bar{r}}{\sqrt{1-\kappa\bar{r}^2}}=\sin n\bar{r}_1=\begin{cases}\sin\bar{r}_1 & k=1\\ \bar{r}_1 & k=0\\ \sinh\bar{r}_1 & k=-1\end{cases} \tag{19}$$

The negative sign indicates that light moves along the direction of decreasing $\bar{r}$. Suppose that a light wave is emitted during the period of time from t_1 to $t_1+\tau_1$ with period $\tau_1 = c/\nu_1$. Observer receives the light during the period of time from t_0 to $t_0+\tau_0$ with period $\tau_0 = c/\nu_0$. According to the current understanding on (19), because $t_0+\tau_0$ and $t_1+\tau_1$ are decided by the same $\overline{r_1}$, we have

$$\int_{t_1}^{t_0} \frac{\mathrm{d}t}{R(t)} = \int_{t_1+\tau_1}^{t_0+\tau_0} \frac{\mathrm{d}t}{R(t)} \tag{20}$$

Because τ_0 and τ_1 are small, we obtain from (20)

$$\frac{\tau_0}{R(t_0)} = \frac{\tau_1}{R(t_1)} \tag{21}$$

Based on (21) and the definition of red shift, we have

$$1+z = \frac{\nu_1}{\nu_0} = \frac{\tau_0}{\tau_1} = \frac{R(t_0)}{R(t_1)} \tag{22}$$

By considering (22) and the Freidamann equation of cosmology, as described in Section 3, we can obtain (13). We now prove that (21) is untenable unless $R(t_0) = R(t_1)$ and $\tau_0 = \tau_1$. Let $f'(t) = 1/R(t)$ and take the integral of (20), we have

$$f(t_1) - f(t_0) = f(t_1+\tau_1) - f(t_0+\tau_0) \tag{23}$$

By developing (23) into the Taylor series, we obtain

$$\begin{aligned} f(t_0) - f(t_1) &= f(t_0) + f'(t_0)\tau_0 + \frac{1}{2!} f''(t_0)\tau_0^2 \\ &+ \frac{1}{3!} f'''(t_0)\tau_0^3 + \cdots - f(t_1) - f'(t_1)\Delta\tau_1 \\ &- \frac{1}{2!} f''(t_1)\tau_1^2 - \frac{1}{3!} f'''(t_1)\tau_1^2 - \cdots \end{aligned} \tag{24}$$

Because τ_0 and τ_1 are very small, the items with same orders should be equal to each other, so we have

$$f'(t_0)\tau_0 = f'(t_1)\tau_1 \tag{25}$$

$$f''(t_0)\tau_0^2 = f''(t_1)\tau_1^2 \tag{26}$$

$$f'''(t_0)\tau_0^3 = f'''(t_1)\tau_1^3 \tag{27}$$

$$f''''(t_0)\tau_0^4 = f''''(t_1)\tau_1^4 \tag{28}$$

Because of $f'(t) = 1/R(t)$, (25) is actually the same with (21). (26) can be written as

$$\frac{\dot{R}(t_0)}{R^2(t_0)}\tau_0^2 = \frac{\dot{R}(t_1)}{R^2(t_1)}\tau_1^2 \tag{29}$$

Substituting (21) in (29), we obtain

$$\dot{R}(t_0) = \dot{R}(t_1) \tag{30}$$

Because t_0 and t_1 are arbitrary, (30) indicates $\dot{R}(t) =$ constant, so we have $\ddot{R}(t) = 0$. From (27), we have

$$\left[-\frac{\ddot{R}(t_0)}{R^2(t_0)} + \frac{2\dot{R}^2(t_0)}{R^3(t_0)}\right]\tau_0^3 = \left[-\frac{\ddot{R}(t_1)}{R^2(t_1)} + \frac{2\dot{R}^2(t_1)}{R^3(t_1)}\right]\tau_1^3 \tag{31}$$

Substituting (21) and (30) in (31), we get

$$\ddot{R}(t_0)\tau_0 = \ddot{R}(t_1)\tau_1 \tag{32}$$

From (28), we get

$$\begin{aligned} &\left[-\frac{\ddot{R}(t_0)}{R^2(t_0)} + \frac{6\ddot{R}(t_0)\dot{R}(t_0)}{R^3(t_0)} - \frac{6\dot{R}^3(t_0)}{R^4(t_0)}\right]\tau_0^4 \\ &= \left[-\frac{\ddot{R}(t_1)}{R^2(t_1)} + \frac{6\ddot{R}(t_1)\dot{R}(t_1)}{R^3(t_1)} - \frac{6\dot{R}^3(t_1)}{R^4(t_1)}\right]\tau_1^4 \end{aligned} \tag{33}$$

We have $\ddot{R}(t) = 0$ too. So (33) becomes

$$\dot{R}(t_0)\tau_0 = \dot{R}(t_1)\tau_1 \tag{34}$$

By considering (30), we have $\tau_0 = \tau_1$. Substituting it in (21), we have at last

$$R(t_0) = R(t_1) \tag{35}$$

It means that $R(t)$ = constant. So only for stationary space, (21) can be tenable. According to (22), we have $z = 0$. No red shift can be observed.

We take two simple examples. Suppose space expands with time increase, let $R(t) = at^2$ and take the integral of (20), we have

$$\frac{1}{a}\left(\frac{1}{t_1} - \frac{1}{t_0}\right) = \frac{1}{a}\left[\frac{1}{t_1+\tau_1} - \frac{1}{t_0+\tau_0}\right] \tag{36}$$

Because time coordinates t_0 and t_1 are arbitrary, if $t_0 \gg \tau_0$ and $t_1 \gg \tau_1$, we obtain

$$\frac{\tau_1}{t_1^2} - \frac{\tau_1^2}{t_1^3} - \cdots = \frac{\tau_0}{t_0^2} - \frac{\tau_0^2}{t_0^3} + \cdots \tag{37}$$

Substitute $R(t_0) = at_0^2$ and $R(t_1) = at_1^2$ in (37), we get

$$\frac{a\tau_1}{R(t_1)} - \frac{a^{3/2}\tau_1^2}{R^{3/2}(t_1)} + \cdots = \frac{a\tau_0}{R(t_0)} - \frac{a^{3/2}\tau_0^2}{R^{3/2}(t_0)} + \cdots \tag{38}$$

Let the items with same orders are equal to each other, we obtain

$$\frac{\tau_1}{R(t_1)} = \frac{\tau_0}{R(t_0)} \tag{39}$$

$$\frac{\tau_1^2}{R^{3/2}(t_1)} = \frac{\tau_0^2}{R^{3/2}(t_0)} \tag{40}$$

(39) is just (21). Substitute (39) in (40), we get $R^{1/2}(t_1) = R^{1/2}(t_0)$ or $R(t_1) = R(t_0)$. So we get $\tau_1 = \tau_0$ and $z = 0$. Therefore, (39) can not be used to describe red shift. We should solve (36) directly and obtain

$$\tau_0 = \frac{t_0^2 \tau_1}{t_1^2 - (t_0 - t_1)\tau_1} = \frac{R(t_0)\tau_1/a}{R(t_1)/a - \left(\sqrt{R(t_0)/a} - \sqrt{R(t_1)/a}\right)\tau_1} \quad (41)$$

$$z = \frac{\tau_0}{\tau_1} - 1 = \frac{R(t_0)/a}{R(t_1)/a - \left(\sqrt{R(t_0)/a} - \sqrt{R(t_1)/a}\right)\tau_1} - 1 \quad (42)$$

The result is completely different from (22). If space contracts with time, we take $R(t) = a/t$. By taking the integral of (20), we obtain

$$2t_0\tau_0 + \tau_0^2 = 2t_1\tau_1 + \tau_1^2 \quad (43)$$

or

$$\frac{2a\tau_0}{R(t_0)} + \tau_0^2 = \frac{2a\tau_1}{R(t_1)} + \tau_1^2 \quad (44)$$

It (21) holds, we get $\tau_0 = \tau_1$ and $R(t_0) = R(t_1)$ from (44). We can not observe reds shift too. In order to reach useful result, we consider (43) directly and obtain

$$\tau_0 = -t_0 + \sqrt{t_0^2 + 2t_1\tau_1 + \tau_1^2} = -\frac{a}{R(t_0)} + \sqrt{\frac{a^2}{R^2(t_0)} + \frac{2a\tau_1}{R(t_1)} + \tau_1^2} \quad (45)$$

$$z = \frac{\tau_0}{\tau_1} - 1 = -\frac{a}{\tau_1 R(t_0)} + \sqrt{\frac{a^2}{\tau_1^2 R^2(t_0)} + \frac{2a}{\tau_1 R(t_1)} + 1} - 1 \quad (46)$$

So (21) and (22) can not hold in general situation. It should be emphasized that red shift is only related to ratio τ_0/τ_1. Very small changes would cause great change of red shift, so we should do strict calculation.

However, though (21) can not hold in general, if (20) is tenable, we can obtain the strict relation between τ_0 and τ_1 from (23). Based on definition $1+z=\tau_0/\tau_1$ and (42) or (46), the red shift is still related to $R(t)$ and unrelated to $\dot{R}(t)$. The result is still inconsistent with the Doppler's formula. Where is the trouble? We discuss this problem below.

3.2. The Problem of the R-W Metric

In the R-W metric, we have $g_{00} = 1$. It means that we have universal time in whole space. However, due to the expansion of the universe, there is a relative speed between observer who is rest at the original point of coordinate system and the luminous celestial body which is fixed at a certain point with $\bar{r} \neq 0$. According to special relativity, there is time delay between them. The R-W metric can not describe this relation, so it can not be the metric of relativity. In fact, by using common coordinate system, the four dimensional metric of flat space-time is

$$ds^2 = c^2 dt^2 - \left(dr^2 + r^2 d\theta^2 + r^2 \sin^2\theta d\phi^2\right) \quad (47)$$

By using co-moving coordinate $r = R(t)\bar{r}$ in (47), we obtain

$$ds^2 = c^2\left[1 - \frac{\dot{R}^2(t)\bar{r}^2}{c^2}\right]dt^2 - 2R(t)\dot{R}(t)\bar{r}d\bar{r}dt - R^2(t)\left(d\bar{r}^2 + \bar{r}^2 d\theta^2 + \bar{r}^2\sin^2\theta d\phi^2\right) \quad (48)$$

It is completely different from the R-W metric (17) when $\kappa = 0$. The metric (48) seems to be curved but is flat essentially. According to the principle of the Riemannian geometry, if we can find a transformation to turn a curved metric into flat, the original one is flat essentially. If we can not find such a transformation, the original metric is a curved one in essence. It is obvious that we can not find a transformation to turn (17) into (47) when $\dot{R}(t) \neq 0$, so the spatial part of (17) can not be flat! According to (48), the time delay of special relativity is

$$d\tau = dt\sqrt{1 - \frac{\dot{R}^2(t)\bar{r}^2}{c^2}} = dt\sqrt{1 - \frac{V^2}{c^2}} \quad (49)$$

So (48) is the metric of relativity in flat space-time.

Conversely, we can prove that the R-W metric violates the principle of invariance of light's velocity. For the light's source fixed on the reference fame, coordinate $\bar{r}$ does not change with time. But for the light's motion, coordinate $\bar{r}$ changes with time. Suppose that light moves along the direction of radius with $ds = d\theta = d\phi = 0$, according to (17), when $\kappa = 0$, we have

$$\frac{d\bar{r}}{dt} = \pm\frac{c}{R(t)} \quad (50)$$

The velocity of light relative is

$$V_c(t) = \frac{dr(t)}{dt} = \bar{r}\frac{d}{dt}R(t) + R(t)\frac{d\bar{r}}{dt} = \dot{R}(t)\bar{r} \pm c = V(t) \pm c \quad (51)$$

(51) indicates that light's velocity is related to the velocity of special expansion. At the moment when light is emitted out, (51) is just the Galileo's addition rule of light's velocity. When light moves towards observer, minus sign is taken in (48) so light's speed is less than its speed in vacuum. When the light moves apart from observer, plus sign is taken so the light's speed is great than its speed in vacuum. Especially, because $\bar{r}$ increases with time, enough long time later, light's speed may greatly exceed its speed in vacuum.

So the R-W metric violates the principle of invariance of light's velocity. This is not allowed in physics. As we know that the watershed between classical physics and modern physics is just on the invariance principle of light's speed. Because the R-W metric violates this principle, it can not be used as the space-time frame for modern cosmology which is considered as the theory of relativity. Especially when the expansion speed of the universe is very high, huge error will be caused.

Therefore, we should use (48) to describe light's motion in flat space-time. Suppose that light moves along the direction of radius, we have $\mathrm{d}s = \mathrm{d}\theta = \mathrm{d}\phi = 0$ and obtain

$$\begin{aligned} &c^2\left[1-\frac{\dot{R}^2(t)\bar{r}^2}{c^2}\right]\mathrm{d}t^2 \\ &-2R(t)\dot{R}(t)\bar{r}\mathrm{d}\bar{r}\mathrm{d}t - R^2(t)\mathrm{d}\bar{r}^2 = 0 \end{aligned} \quad (52)$$

$$\frac{\mathrm{d}\bar{r}}{\mathrm{d}t} = -\frac{\dot{R}(t)\bar{r}}{R(t)} \pm \frac{c}{R(t)} \quad (53)$$

By considering (53), light's velocity is

$$V_c = \frac{\mathrm{d}r}{\mathrm{d}t} = \frac{\mathrm{d}R(t)\bar{r}}{\mathrm{d}t} = \dot{R}(t)\bar{r} + R(t)\frac{\mathrm{d}\bar{r}}{\mathrm{d}t} = \pm c \quad (54)$$

The result indicates that light's speed is invariable. Similarly, the four dimensional metric in which three dimensional space has constant curvature κ is

$$\mathrm{d}s^2 = c^2\mathrm{d}t^2 - \left(\frac{\mathrm{d}r^2}{1-\kappa r^2} + r^2\mathrm{d}\theta^2 + r^2\sin^2\theta\mathrm{d}\phi^2\right) \quad (55)$$

By using co-moving coordinate in (55), we obtain

$$\begin{aligned} \mathrm{d}s^2 &= \left[c^2 - \frac{\dot{R}^2(t)}{1-\kappa R^2(t)\bar{r}^2}\right]\mathrm{d}t^2 - \frac{2\dot{R}(t)R(t)\mathrm{d}t\mathrm{d}\bar{r}}{1-\kappa R^2(t)\bar{r}^2} \\ &-R^2(t)\left(\frac{\mathrm{d}\bar{r}^2}{1-\kappa R^2(t)\bar{r}^2} + \bar{r}^2\mathrm{d}\theta^2 + \bar{r}^2\sin^2\theta\mathrm{d}\phi^2\right) \end{aligned} \quad (56)$$

When light moves along the direction of radius, we have

$$\begin{aligned} &\left[c^2 - \frac{\dot{R}^2(t)\bar{r}^2}{1-\kappa R^2(t)\bar{r}^2}\right]\mathrm{d}t^2 \\ &-\frac{2\dot{R}(t)R(t)\mathrm{d}t\mathrm{d}\bar{r}}{1-\kappa R^2(t)\bar{r}^2} - \frac{R^2(t)\mathrm{d}\bar{r}^2}{1-\kappa R^2(t)\bar{r}^2} = 0 \end{aligned} \quad (57)$$

$$\frac{\mathrm{d}\bar{r}}{\mathrm{d}t} = -\frac{\dot{R}(t)\bar{r}}{R(t)} \pm \frac{c\sqrt{1-\kappa\dot{R}^2(t)\bar{r}^2}}{R(t)} \quad (58)$$

If we use (53) and (58) to calculate the red shift of cosmology, the results are related to velocity. However, we can not separate variables in (53) and (58), so we can not write them in the simple form of (19). It is more convenient for us to use the Doppler's formula directly to calculate the red shift of supernova in cosmology.

On the other hand, as proved in document [5], when scalar factor $R(t)$ is related to time, the R-W metric has no constant curvature. By using the formula of the Riemannian geometry to do strict calculation, the space-time curvatures of the R-W metric actually are [5]

$$\begin{aligned} K_{01} &= K_{02} = K_{03} = -\frac{\ddot{R}}{R} \\ K_{12} &= K_{13} = K_{23} = \frac{\kappa - \dot{R}^2}{R^2} \end{aligned} \quad (59)$$

Here K_{0j} is the curvature of space-time crossing parts and K_{ij} is the curvature of pure spatial parts. This result is completely different from the current understanding. Therefore, constant κ is not the factor of spatial curvature. It is a certain adjustable parameter. The R-W metric does not represent flat space-time when $\kappa = 0$. It does not represent the metric of curved space with constant curvature too. It is improper for us to use the R-W metric to describe the expansion universe with zero or constant spatial curvature.

3.3. Time Misalignment Problem of Theoretical Calculation and Practical Observations

Because light's speed is finite, it needs time for light to propagate from luminous celestial bodies to observers on the earth. If the celestial body is far ways from the earth, the light may take billions of years to arrive at the observer. That is to say, light observed by observer on the earth was emitted billions of years ago. So the positions and the red shift values of Ia supernovas observed by observers at present on the earth were that of billions of years ago. At present moment, the real positions and the real red shift values of these supernovas are completely different from that we observe now.

In the formulas (13), H_0, d_L, Ω_{m0} and Ω_{k0} are the values at present moment t_0, therefore, (13) describe the relation between red shift and distance. However, **Figure 1** describe the observed relation of red shift and distance of Ia supernova at past moments. Moreover, for the different points of curves in **Figure 1**, the times are different. In order to match times, we should transform all observation values at past moments to the value at present moment. Then fit them with the result of theory. Only in this way, the discussion can be meaningful.

However, in the original documents of supernova cosmology projects, we have not found this kind of transformations. In stead, the observation values which represent the red shifts and distances of supernova at past times are compared directly with theoretical values at present time. Then the conclusions of $\Omega_{m0} = 0.3$ and $\Omega_\lambda = 0.7$ are deduced out.

It is obvious that there is a problem of time match be-

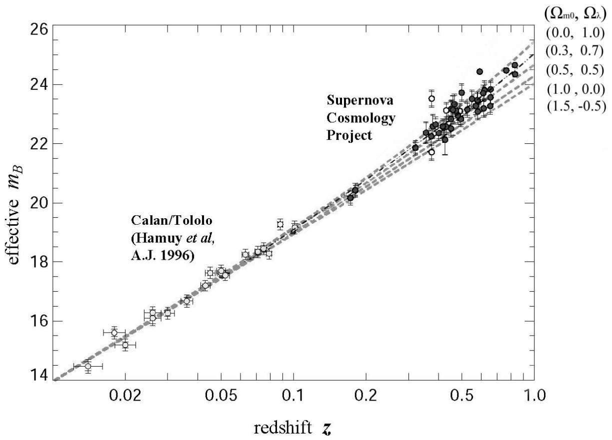

Figure 1. Hubble diagram for red shift and distance of Ia supernova.

tween theoretical calculation and practical observations. This problem exists in cosmology commonly, not only for supernova. The values of theory are present ones, but the observed values were past ones. At the early period of cosmology while Hubble deduced the Hubble law, the observed red shift were small. Because celestial bodies were near the earth, time for light to reach the earth was not very great so that the differences can be neglected. But for supernova of high red shift, great error would be caused. With this point alone, the result of $\Omega_{m0} = 0.3$ and $\Omega_\lambda = 0.7$ is unbelievable.

3.4. The Problem of Constant Ω_k

According to definition (9), at present time t_0, we have $\rho_0 = \rho(t_0)$ and $H_0 = H(t_0)$, the Friedmann equation of cosmology can be written as

$$\frac{3H_0^2}{8\pi G} - (\rho_{m0} + \rho_\lambda) = -\frac{3\kappa}{8\pi G R_0^2} \tag{60}$$

Defining critical density ρ_c as

$$\rho_c = \frac{3H_0^2}{8\pi G} \tag{61}$$

Because we define $\Omega_{m0} = \rho_{m0}/\rho_c$, $\Omega_\lambda = \rho_\lambda/\rho_c$ and $\Omega_0 = \Omega_{m0} + \Omega_\lambda$, (60) can be written as

$$1 - \Omega_0 = -\frac{\kappa}{R_0^2 H_0^2} \tag{62}$$

Let $a(t) = R(t)/R(t_0)$, we have $a(t_0) = 1$ at present time. Because κ is a constant, we can write the Friedamman equation as

$$\dot{a}^2(t) - \frac{8\pi G}{3}(\rho_m + \rho_\lambda)a^2 = -\frac{\kappa}{R_0^2} = H_0^2 - \frac{8\pi G}{3}\rho_0 \tag{63}$$

Because we have

$$\rho_m R^3 = \rho_{m0} R_0^3 \quad \text{or} \quad \rho_m a^3 = \rho_{m0} \tag{64}$$

so (63) can be written as

$$\left(\frac{\mathrm{d}a}{\mathrm{d}t}\right)^2 = H_0^2\left(1 - \Omega_{m0} + \frac{\Omega_{m0}}{a} + \Omega_\lambda a^2 - \Omega_\lambda\right) \tag{65}$$

We have $\mathrm{d}a/\mathrm{d}t = \dot{a}$ and $\mathrm{d}t = \mathrm{d}a/\dot{a}$, so (19) can be written as

$$\sin n\bar{r} = \frac{1}{R_0}\int_{1/(1+z)}^{1} \frac{\mathrm{d}a}{a\dot{a}} \tag{66}$$

The upper limit of the integral is $a(t_0) = 1$ and lower limit is $a(t_1) = 1/(1+z)$. Meanwhile, according to (16), we can write (62) as

$$1 - \Omega_0 = -\frac{\kappa}{R_0^2 H_0^2} = \Omega_{k0} \tag{67}$$

According to reference [4], from (67) we can get

$$R_0 = \frac{1}{H_0\sqrt{|\Omega_{k0}|}} \tag{68}$$

By introducing transformations $a = 1/(1+z)$ in (66) and considering (14) and (68), the formula (13) is obtained. However, (68) is obviously wrong. (67) contains constant κ, but (68) does not. According to (67), when $\kappa = 0$ we have $\Omega_{k0} = 0$, R_0 is limited. But according to (68), when $\Omega_{k0} = 0$ we have $R_0 = \infty$. That is to say, R_0 is infinite in flat space. This is completely impossible. According to (67), correct result should be

$$R_0 = \frac{\sqrt{|-\kappa/\Omega_k|}}{H_0} \tag{69}$$

In fact, it is unnecessary to introduce relation $\rho_k = -\kappa/(a^2R^2)$. Whether or not space is flat depends on $\sin n\bar{r} = \bar{r}$, $\sin n\bar{r} = \sin\bar{r}$ or $\sin n\bar{r} = \sinh\bar{r}$. For flat space, to take $\kappa = 0$ in (63) and substitute it in (66), by considering $\Omega_{m0} + \Omega_\lambda = 1$, $\sin\bar{r} = \bar{r}$ and $d_L = r$, we get

$$H_0 R_0 \bar{r} = \int_0^z \frac{\mathrm{d}z'}{\sqrt{(1+z')^2(1+\Omega_{m0}z')}} \tag{70}$$

Because (68) can not hold, (13) can only be written as

$$d_L = R_0(1+z)\sin n\frac{1}{R_0 H_0} \times \int_0^z \frac{\mathrm{d}z'}{\sqrt{(1+z')^2(1+z'\Omega_{m0}) - z'(2+z')\Omega_\lambda}} \tag{71}$$

When space is flat, we have $\kappa = 0$, $\Omega_{m0} + \Omega_\lambda = 1$, $\sin\bar{r} = \bar{r}$ and $d_L = r$. So (71) becomes

$$H_0 R_0 \bar{r} = \int_0^z \frac{\mathrm{d}z'}{\sqrt{(1+z')^2(1+\Omega_{m0}z') - z'(2+z')\Omega_\lambda}} \quad (72)$$

The reason is that when $\kappa = 0$, the right side of (65) has only two items with

$$\left(\frac{\mathrm{d}a}{\mathrm{d}t}\right)^2 = H_0^2\left(\frac{\Omega_{m0}}{a} + \Omega_\lambda a^2\right) \quad (73)$$

But we still use (65) to deduce (13). If space curved, for $\kappa = 1$, we still have $\Omega_{m0} + \Omega_\lambda = 1$ and obtain

$$d_L = R_0(1+z)\sin\left[\frac{1}{R_0 H_0}\int_0^z \frac{\mathrm{d}z'}{\sqrt{(1+z')^3\Omega_{m0} + \Omega_\lambda}}\right] \quad (74)$$

Similarly, for $\kappa = -1$, we also have $\Omega_{m0} + \Omega_\lambda = 1$ and

$$d_L = R_0(1+z)\sinh\left[\frac{1}{R_0 H_0}\int_0^z \frac{\mathrm{d}z'}{\sqrt{(1+z')^3\Omega_{m0} + \Omega_\lambda}}\right] \quad (75)$$

(74) and (75) are also different from (13). It means that (13) is wrong. This is a mistake of mathematics, having nothing to do with physics.

Therefore, the formula used to calculate the relation of red shift and distance of Ia supernova in current cosmology is wrong. We should use the Doppler formula directly. The result shows that we do not need the hypotheses of dark energy and the accelerating expansion of the universe in cosmology.

4. Using the Doppler's Formula to Calculate the Red Shift of Ia Supernova

4.1. The Friedmaann Equation Needs Relativity Revision

Standard cosmology uses the Friedmann equation as basic equation. However, British physicist E. A. Milne proved in 1943 that the Friedmann equation could be deduced simply based on the Newtonian theory of gravity. Although the Friedmann equation is described in curved space-time, the Newtonian theory of gravity is described in flat space-time, the results are actually the same when they are used to calculate practical problems, especially when we take curvature constant $\kappa = 0$. However, as we know, Newtonian theory is only suitable for the motions of low speeds. For the high speed expansion of the universe, it is unsuitable. The Friedmann equation needs relativity revision due to this fact.

The reason leading to this result is that two simplifications and improper conditions are used in the deduction process of the Friedmann equation. One is the R-W metric and another is static energy momentum tensor. The problem of the R-W metric has been discussed above. If we use static energy momentum tensor in the equation of cosmology, it means that the velocity and momentum of material are neglected in the expansion process of the universe. So the Friedmann equation is the one to be improperly simplified and needs relativity revision [5]. However, if dynamic energy momentum tensor is used in the Einstein's equation of gravity, the equation of cosmology would become very complex to be solved [5]. We have to looking for other more proper method to study cosmology.

We have proved that by transforming the geodesic equation of the Schwarzschild solution of the Einstein's equation of gravity field to flat space-time for description, the revised Newtonian formula of gravity is obtained [6]

$$m_0 \frac{\mathrm{d}^2 \boldsymbol{r}}{\mathrm{d}\tau^2} = -GM_0 m_0\left(1 + \frac{3L^2}{c^2 r^2}\right)\frac{\boldsymbol{r}}{r^3} \quad (77)$$

In (76) all quantities are defined in flat space. We have

$$\mathrm{d}\tau = \sqrt{1 - \frac{V^2}{c^2}}\mathrm{d}t \quad (78)$$

This is just the time delay formula of special relativity, so (77) can be considered as the revised formula of relativity of the Newtonian' gravity. The space-time singularity in the Einstein's theory of gravity becomes the original point $r = 0$ in the Newtonian formula of gravity. The singularity problem of gravity theory in curved space-time is eliminated thoroughly. The theory of gravity returns to the traditional form of dynamic description.

When the formula is used to describe the universe expansion, the revised Friedmann equation can be obtained. Based on the revised theory of gravity, the high red-shift of Ia supernova can be explained well. We do not need the hypotheses of the accelerating expansion of the universe and dark energy. It is also unnecessary for us to assume that non-baryon dark material is 5 ~ 6 times more than normal baryon material in the universe if they really exist. The problem of the universal age can also be solved well.

We prove below that by using the method of numerical calculation and the Doppler's formula proposed in [6], even based on the Newtonian theory of gravity, we can also explain the relation of red shift and distance of Ia supernova well. The hypotheses of dark energy and the accelerating expansion of the universe become unnecessary.

4.2. Using the Doppler's Formula to Calculate the Red Shift of Ia Supernova

As we know that the solution of differential equation is determined by initial condition. However, according to the big bang cosmology, the universe blew up from a singularity with infinite density. That is to say, all material in the universe has a same initial position. However, infinite density is imaginable and singularity can not exist in the real world. The practical situation should be that at initial time, strong, weak and electromagnetic interacttion can not be neglected. Meanwhile, unknown interaction may exist, so that material can be compressed into infinite density by gravity.

According to the discussion in [6], we assume that there exist a certain mechanism so that a uniform material sphere with mass M_0 can only be compress into a finite radius r_0'. The motion equation of universe expansion can be written as

$$m_0\ddot{r} = F(r) + F_n(r) \tag{79}$$

Here $F(r)$ is the Newtonian gravity and $F_n(r)$ is the sum of all non-gravities. For convenience of calculation, we suppose

$$F_n(r) = \frac{m_0}{2}A(r)\delta(r - r_0') \tag{80}$$

Here $A(r)$ is an unknown function. $F_n(r)$ corresponds to an infinite barrier at position r_0'. When a material sphere with radius r is contracted into a sphere with radius r_0', it can not be contracted again. For the sphere with different radius r, r_0' is different.

Suppose that the material distribution of the universe is uniform with $\rho = \rho(t)$. The static mass contained in the spherical surface with radius r is M_0. According to the revised Newtonian theory, gravity is related to velocity. Using it to calculate the universe expansion, under the condition $V/c \ll 1$, the speed of a particle located on the spherical surface is

$$\frac{V}{c} = \sqrt{Q_1(r) + K(r_0')} = \sqrt{\frac{2GM_0}{c^2 r}\left(1 - \frac{3}{20}\frac{\alpha}{r} + \frac{3}{56}\left(\frac{\alpha}{r}\right)^2 + \cdots\right) + K(r_0')} \tag{81}$$

Here $\alpha = 2GM_0/c^2$. $K(r_0')$ is a constant which describes initial conditions. Let $\alpha/r = 0$ in bracket, we get the result of the Newtonian theory of gravity

$$\frac{V}{c} = \sqrt{\frac{2GM}{c^2 r} + K(r_0')} = \sqrt{\frac{8G\rho\, r^2}{3c^2} + K(r_0')} \tag{82}$$

We consider an expansion sphere as expansion universe and use Doppler's formula (6) to describe red shift. Suppose that luminous bodies move along the directions of radius and observer is located at the origin point of flat reference frame. The distance between observer and celestial body is $r(t)$ at moment t. The real distance between observer and celestial body is r_0 at present moment t_0. In the expanding process of the universe, celestial body moves from r_1 to r_0 with $r_0 > r_1$, while the light travels from r_1 to observer along opposite direction. Suppose light's speed is invariable in the process, we have following relation

$$\Delta t = \frac{r_1}{c} = \int_{t_1}^{t_0} \mathrm{d}t = \int_{r_1}^{r_0} \frac{\mathrm{d}r}{V} \tag{83}$$

By astronomical observations, we know the universe material density ρ_0 at present time t_0, but do not know $\rho(t)$ at past time t. By relation $\rho_0 r_0^3 = \rho r^3$, we have

$$\sqrt{\frac{8\pi G\rho r^2}{3c^2}} = \sqrt{\frac{8\pi G\rho_0 r_0^3}{3c^2 r}} \tag{84}$$

According to (82) and (84), we can obtain from (83)

$$r_1 = \int_{r_1}^{r_0} \frac{\mathrm{d}r}{V/c} = \int_{r_1}^{r_0} \frac{\mathrm{d}r}{\sqrt{8G\rho_0 r^2/(3c^2 r) + K(r_0')}} \tag{85}$$

In principle, we can write (85) as

$$r_1 = f(r_0, K(r_0')) - f(r_1, K(r_0')) \tag{86}$$

From (86), we can get $r_0 = g(r_1, K)$ in principle. In other word, what observer see now is the light that celestial body emitted at position $r_1 < r_0$ and at time $t_1 < t_0$. But at present time t_0, the celestial body has moved to position r_0. In the formulas above, ρ_0, r_1 and z are known through observations, but r_0 and $K(r_0')$ are unknown. By connecting (6) and (86), we can determinate r_0 and $K(r_0')$. (84) can only be calculated by numerical method through computer. We take $\rho_0 = b \times 10^{-27}\ \mathrm{Kg/m^3}$, $r_0 = y_0 \times 10^{26}\ \mathrm{m}$, $r_1 = y_1 \times 10^{26}\ \mathrm{m}$ and have

$$x = \sqrt{\frac{\alpha}{r}} = 0.25\sqrt{\frac{b y_0^3}{y}} \tag{87}$$

We use x as basic variable to calculate y_0 and $K(r_0')$. In the calculation, we take b, z and y_1 as input parameters. Therefore, according to this method, we actually deduce the initial situations of the universe expansion based on the present observations of red shift and distances. In other words, as long as the initial conditions of the universe expansion are known, we can know its current situations.

4.3. The Red Shift of Ia Supernova

In **Figure 1**, the curved line with $\Omega_{0m} = 0.3$ and $\Omega_\lambda = 0.7$ represents practical relation between the red shift and distance of Ia supernova at the early period of time t. According to photometry measurement, the density of luminous material in the university is about $\rho_0 \approx 2\times10^{-28}\ \mathrm{kg/m^3}$ at present day. Because there exist a great mount of non-luminous material, we suppose that practical material is 10 times more than luminous material and let $\rho_0 \approx 2\times10^{-27}\ \mathrm{kg/m^3}$. In **Figure 1**, we take $m_B = 5.5 + 5\log d_L$ in which d_L is luminosity distance with unit length $10^6\ pc = 3.09\times10^{22}\,\text{m}$. But the concept of luminosity distance is unnecessary in this paper, because our discussion is based on flat space-time. So we need to transform d_L into practical distance r.

The curved line in **Figure 2** shows the relations between the red-shifts, distances and initial condition parameters of Ia supernova. The vertical coordinate is the values of $K(r_0')$. The bottom horizontal coordinate is the value of red-shift. On the upside, under the line of horizontal coordinate, are the values of distance *r*, above the line is the values of r_0. For $z=1$ and $m_B = 25$, we get $r_1 = 1.23\times10^{26}\,\text{m}$. By numerical calculation, we obtain $r_0 = 1.83\times10^{26}\,\text{m}$ and $K(r_0') = -2.60\times10^{-2}$. For $z = 0.5$ and $m_B = 23.1$ corresponding to $r_1 = 0.67\times10^{26}\,\text{m}$, we obtain $r_0 = 0.91\times10^{26}$ and $K(r_0') = 2.51\times10^{-2}$. For $z = 0.1$ and $m_B = 19.1$ corresponding to $r_1 = 0.15\times10^{26}\,\text{m}$, we obtain $r_0 = 0.16\times10^{26}$ and $K(r_0') = 5.30\times10^{-3}$.

We see that by directly using the Doppler's formula and the Newtonian formula of gravity, we can explain the high red shift of Ia supernova well. The hypotheses of dark energy and the accelerating expansion of the universe become unnecessary. The universe began its expansion from a finite volume, rather than a singularity. The difficulty of singularity in cosmology is eliminated.

If we use the revised Newtonian formula, according to reference [6], the result is shown in **Figure 3**. Comparing **Figures 2** and **3**, the difference is that for the Newtonian gravity, we have $K(r_0') < 0$. But for the revised Newtonian gravity, we have $K(r_0') < 0$ when $z > 0.7$, and $K(r_0') > 0$ when $z < 0.7$. When z is very small, we have $K(r_0') \to 0$ for both situations.

5. The Age of the Universe

We consider the universe as a material sphere with radius $r_0' = 1.5\times10^{11}\,\text{m}$ at initial moment, which is about the distance between the sun and the earth. Long enough later, at time t, an observer located at the original point of reference frame receives the light emitted from a celestial body on the spherical surface with radius r = 1.23×10^{26} and red shift $z = 1$ at time t_0. Suppose that the material density of the universe is $\rho_0 = 2\times10^{-27}\ \text{kg/m}^3$ at present, the initial density inside the sphere is $\rho_0 = 5.9\times10^{17}\ \text{kg/m}^3$, to be equal to the density of neutron star. According to the calculation before, the real distance of celestial body is $r_0 = 1.83\times10^{26}\,\text{m}$ at present time. We consider it as the radius of observable universe and take $K(r_0') = -0.026$ for following formula to calculate the time during which the universe expands from radius $r_0' = 1.5\times10^{11}\,\text{m}$ to $r_0 = 1.83\times10^{26}\,\text{m}$

$$\Delta t = \int_{t_1}^{t_0} \mathrm{d}t = \int_{r_1}^{r_0} \frac{\mathrm{d}r}{V} = \int_{r_1}^{r_0} \frac{\mathrm{d}r}{c\sqrt{8G\rho_0 r_0^3 \big/ \left(3c^2 r\right) - 0.026}} \tag{88}$$

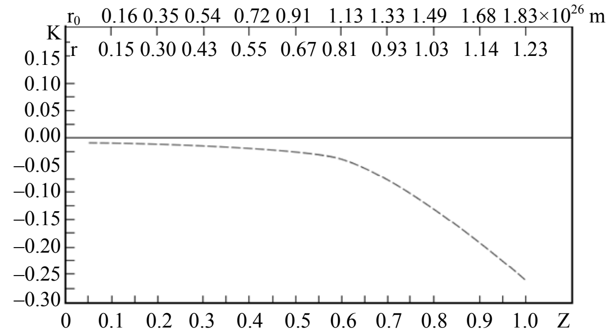

Figure 2. The relations between red-shifts, distances and initial parameters of Ia supernova by using the Doppler's formula and the Newtonian gravity.

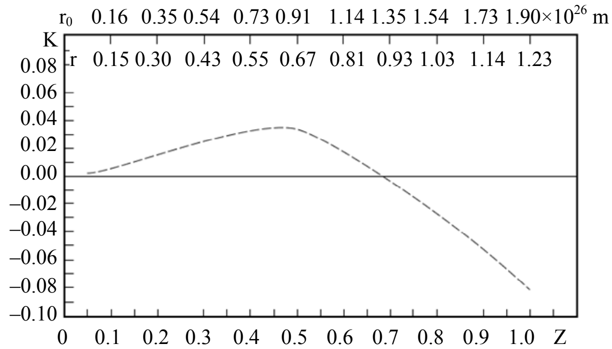

Figure 3. The relations between red-shifts, distances and initial parameters of Ia supernova by using the Doppler's formula and the revised Newtonian gravity.

The result is $\Delta t = 35$ billion years. But this value is not sensitive to r_1 when it is not very large. Taking $r_1 = 10^{20}\,\text{m}$, which is about the radius of the Milky Way galaxy, the result is almost the same with $r_0' = 1.5\times10^{11}$ m. It means that the age of the universe mainly depends on the later expansive process. Using (88) to calculates the time during which the radius of sphere expanses from $1.23\times10^{26}\,\text{m}$ to $1.83\times10^{26}\,\text{m}$, the result is 15.4 billion years, so the time during which the radius of sphere expanses from $1.23\times10^{26}\,\text{m}$ to $1.83\times10^{26}\,\text{m}$ is 19.5 billion years.

By using the revised Newtonian formula of gravity, for the same red shift $z=1$, the result is that the time is 30.8 billion years for a sphere's radius expands from r_1 = $1.5\times10^{11}\,\text{m}$ to $r_0 = 1.95\times10^{26}\,\text{m}$ and 13 billion years for radius expands $1.23\times10^{26}\,\text{m}$ to $1.95\times10^{26}\,\text{m}$. So the sphere's radius expands from $1.5\times10^{11}\,\text{m}$ to $1.23\times10^{26}\,\text{m}$ is 17.8 billion years.

Therefore, for the same red shift, by using the revised Newtonian gravity, the age of the universe is smaller then using the unrevised Newtonian gravity. The reason is that gravity becomes small after the revision of relativity. Material needs more time moving to the same position. According to the current cosmology, the universe age is estimated to be about 10 - 15 billion years, too short to the formation of galaxies. The problem does not exist by using the Doppler's formula to calculate the red shift of cosmology, no mater we use the revised Newtonian formula or the unrevised Newtonian formula of gravity.

6. Conclusions

The red shift of cosmology is considered as the Doppler's effect. However, the basic formula used to calculate the high red shift of Ia supernova in current cosmology is related to scalar factor $R(t)$ rather than velocity factor $\dot{R}(t)$. There exists inconsistency which is not allowed in physics. It is proved that the current formula used to calculates the relation of red shift and distance of Ia supernova is wrong in cosmology. We should directly use the Doppler's formula to calculate the red shift of cosmology. By the method of numerical calculation, based on the Newtonian gravity and the Doppler's formula, it is proved that the red shift of Ia supernova can be explained well. The hypotheses of dark energy and the accelerating expansion of the universe are completely unnecessary. The problem of the universe age can be solved well.

The procedure we developed and used in this paper tilled "Using Revised Newtonian Gravity and Doppler's Formula to Calculate Cosmological Red Shift" and its source code are open to researchers. Demanders please send us e-mail to obtain it.

REFERENCES

[1] S. Perlmutter, *et al.*, "Measurements of Ω and Λ from 42 High-Redshift Supernovae," *The Astrophysical Journal*, Vol. 517, No. 2, 1999, pp. 517 & 565. doi:10.1086/307221

[2] B. Leibundgut, *et al.*, "Observational Evidence from Supernovae for an Accelerating Universe and a Cosmological Constant," *The Astronomical Journal*, Vol. 116, No. 3, 1998, p. 1009. doi:10.1086/300499

[3] E. W. Kolb and M. S. Turner, "The Early Universe," Addison-Wesley Publishing Company, Boston, 1990, p. 39.

[4] S. M Carroll and W. H. Press, "The Cosmology Constant," *Annual Review of Astronomy and Astrophysics*, 1992, Vol. 30, p. 409. doi:10.1146/annurev.aa.30.090192.002435

[5] X. Mei, "The R-W Metric Has No Constant Curvature When Scalar Factor R(t) Changes with Time," *International Journal of Astronomy and Astrophysics*, Vol. 1, 2011, pp. 177-182.

[6] X. Mei and P. Yu, "Revised Newtonian Formula of Gravity and Equation of Cosmology in Flat Space-time Transformed from Schwarzschild Solution," *International Journal of Astronomy and Astrophysics*, Vol. 2, No. 1, 2012, pp. 6-18.

