Dark Matter is uncatchable and its Cosmic Age can be about 100 million years, based on the special theory of relativity and the ternary space-times

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Abstract The ESA (European Space Agency)'s Planck space telescope revealed in 2013 that the total mass-energy of the universe had a composition of 68.3% dark energy, 26.8% dark matter and 4.9% normal matter that makes up stars and galaxies (baryons) [1]. However, it has not been successfully realized until today to detect and thus to prove the existence of dark matter and dark energy. There should be some fundamental problems to be addressed and the universal space-time itself must have its own hidden characteristics. If there is a universe consisting of three space-times, and each space-time touches at one point at the same time, then the general theory of relativity comes down to the special theory of relativity. It estimates here the universal space-time by using the special theory of relativity i.e. the combined velocity, the increasing mass, the duration time and the quantum rate. The results suggest that each of "the ternary space-times" has its own specific light velocity and that the cosmic age of dark matter uncatchable can be about 100 million years in our age of the universe 13.8 billion years.
Keywords dark matter, dark energy, ternary space-times, cosmic age

1. Introduction

Baryons are ordinary substances such as atoms and elementary particles that exist in the real world.

Dark matter is the substance with the mass and influences gravitation. The existence of dark matter is perceived in terms of the rotation curve of a disk galaxy [2], visible light observations of strong effects by gravitational lens and X-ray observations of bullet clusters.

Baryons and dark matter pull against each other in accordance with the law of universal gravitation. In contrast, dark energy has a repulsive force, i.e., it affects negative pressure and thus accelerates the expansion of the universe. The phenomena regarding the accelerated expansion of the universe are based on results that were obtained from the astronomical observations of the Hubble telescope [3].

Some scientists have associated these phenomena with the cosmological constant of Einstein's general theory of relativity rather than with dark energy.

2. Positioning of the special theory of relativity

The result of the general theory of relativity is that for every person, he can believe that space-time is flat at only one point where he is located, and he can choose coordinates that will make it so. In other words, as long as he adopts coordinates that match his point of view, he has a "flat space-time under his feet"

If the stationary coordinates are at one's feet and the movement of objects A and D is occurring at one's feet, "the special theory of relativity" is established at one's feet and satisfied with the general theory of relativity. An event occurred in which the space-time of the system 1~ system 3 space-time came into touch at one point that overlapped in an extremely rare moment, and dark energy and dark matter occurred.

3. Objects moving at the light velocity

The special theory of relativity is a rule for a constant-velocity inertial frame and is invalid if the observer moves in an accelerated motion. However, even when the measured person's system is in accelerated motion, the special theory of relativity is valid from the viewpoint of continuous micro-stepped velocity changes in a momentary stationary system, which is the local tangent vector space of the general theory of relativity. In this paper, it is possible to apply the special theory of relativity if it uses the rest frame in the space-time as a benchmark and checks the relative velocity between two points.

In the relativity theory, since the kinetic mass m of a fast-moving object increases $m = M_0 / \sqrt{1 - v^2/c^2}$ with velocity, the velocity of matter v cannot exceed the light velocity c. However, the relativity theory does not deny that the space-time field itself exceeds the light velocity.

4. Methods

4.1. The combined velocity and the increasing mass

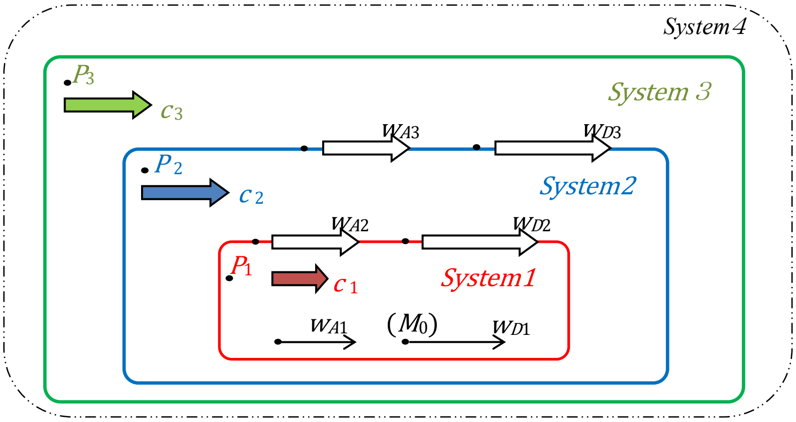


Fig.1 A model of the space-times and the symbols

First, consider applying the special theory of relativity to three different space-times. A model of the space-times is shown in Fig.1.

P_1, P_2 and P_3 are the rest frames of the System 1, 2 and 3, respectively. The System 1 space-time moves at the light velocity c_1 in the System 2 space-time, which is the same as the superstring theory. c_2 and c_3 are the same in the System 2 and the System 3 space-times. Galaxy A is the Milky Way galaxy, while galaxy D is a virtual galaxy, the aggregate of all the galaxies in the universe.

Here, c_1 is the light velocity, w_{A1} is the movement speed of galaxy A and w_{D1} is the movement speed of galaxy D in the rest frame P_1 in the System 1 space-time, respectively. c_2, w_{A2}, w_{D2} and c_3, w_{A3}, w_{D3} are the corresponding parameters for the System 2 and the System 3 space-times, respectively. Formulae for the combined velocities of w_{A2}, w_{D2}, w_{A3} and w_{D3} for galaxies A and D in the rest frames P_2 and P_3 are provided as shown below, since the combined velocity law is completed in the accelerated motion and the special theory of relativity is also completed at the flat space-time point where the Systems 1, 2, and 3 come into touch.

$$w_{A2} = \frac{w_{A1} + c_1}{1 + w_{A1}\, c_1/c_2^2} \qquad w_{D2} = \frac{w_{D1} + c_1}{1 + w_{D1}\, c_1/c_2^2} \qquad w_{A3} = \frac{w_{A2} + c_2}{1 + w_{A2}\, c_2/c_3^2} \qquad w_{D3} = \frac{w_{D2} + c_2}{1 + w_{D2}\, c_2/c_3^2}$$

The relative speed w_{AD1} between w_{D1} and w_{A1} is presented as shown below when (w_{D1}) and $(-w_{A1})$ are substituted into the combined velocity. The corresponding relative speeds are also shown for the System 2 and the System 3 space-times.

$$w_{AD1} = \frac{w_{D1} - w_{A1}}{1 - w_{A1} w_{D1}/{c_1}^2} \qquad w_{AD2} = \frac{w_{D2} - w_{A2}}{1 - w_{A2} w_{D2}/{c_2}^2} \qquad w_{AD3} = \frac{w_{D3} - w_{A3}}{1 - w_{A3} w_{D3}/{c_3}^2}$$

The rest mass M_0 is common to all three systems and can be described by using the mass of motion m_{D2} at the relative speed w_{AD2} between w_{D2} and w_{A2} in the System 2 space-time. The corresponding descriptions are also provided for both the System 1 and the System 3 space-times.

$$M_0 = m_{D1} \sqrt{1 - \left(\frac{w_{AD1}}{c_1}\right)^2} = m_{D2} \sqrt{1 - \left(\frac{w_{AD2}}{c_2}\right)^2} = m_{D3} \sqrt{1 - \left(\frac{w_{AD3}}{c_3}\right)^2}$$

Substitute w_{AD1} , w_{AD2} and w_{AD3} into the equations.

$$M_0 = m_{D1}\sqrt{1-\left[\frac{(w_{D1}-w_{A1})\,c_1}{{c_1}^2-w_{A1}w_{D1}}\right]^2} \quad = m_{D2}\sqrt{1-\left[\frac{(w_{D1}-w_{A1})\,c_2}{{c_2}^2-w_{A1}w_{D1}}\right]^2}$$

$$= m_{D3}\sqrt{1-\left[\frac{(w_{D1}-w_{A1})\,{c_2}^2\,c_3\,({c_2}^2-{c_1}^2)}{w_{A1}w_{D1}({c_1}^2{c_3}^2-{c_2}^4)+(w_{D1}+w_{A1})\,c_1{c_2}^2\,({c_3}^2-{c_2}^2)+{c_2}^4({c_3}^2-{c_1}^2)}\right]^2}$$

It then becomes necessary to solve c_2/c_1 and c_3/c_1 , where $w_{A1} = \alpha \cdot c_1$ and $w_{D1} = \beta \cdot c_1$.

$$\left(\frac{c_2}{c_1}\right)^4 (1-K) - \left(\frac{c_2}{c_1}\right)^2 [\alpha^2+\beta^2-2\alpha\beta K\,] + (1-K\,)\alpha^2\beta^2 = 0$$

$$\left(\frac{c_2}{c_1}\right) = \delta_2\sqrt{\frac{1}{2(1-K)}\left[\alpha^2+\beta^2-2\alpha\beta K+|\alpha-\beta|\delta_1\sqrt{(\alpha+\beta)^2-4\alpha\beta K}\right]}$$

$$\left(\frac{c_3}{c_1}\right)^4 (1-L)(A^2+\alpha)^2(A^2+\beta)^2 \quad -\left(\frac{c_3}{c_1}\right)^2 A^4[(A^2-1)^2(\alpha-\beta)^2+2(1-L)(A^2+\alpha)(A^2+\beta)(1+\alpha)(1+\beta)]$$
$$+\ (1-L)A^8(1+\alpha)^2(1+\beta)^2 = 0$$

$$\left(\frac{c_3}{c_1}\right) = \frac{A^2\,\delta_4\sqrt{\begin{array}{c}(A^2-1)^2(\alpha-\beta)^2+2(1-L)(A^2+\alpha)(A^2+\beta)(1+\alpha)(1+\beta)\\ +|A^2-1||\alpha-\beta|\delta_3\sqrt{(A^2-1)^2(\alpha-\beta)^2+4(1-L)(A^2+\alpha)(A^2+\beta)(1+\alpha)(1+\beta)}\end{array}}}{(A^2+\alpha)(A^2+\beta)\ \sqrt{2(1-L)}}$$

where $\delta_1 = \pm 1$, $\delta_2 = \pm 1$, $\delta_3 = \pm 1$ and $\delta_4 = \pm 1$. There are $2^4 \times 3! = 96$ possible combinations for the ratios c_2/c_1 and c_3/c_1 .

Here, it inserts $K = \left(\frac{m_{D1}}{m_{D2}}\right)^2 \frac{(1-\alpha^2)(1-\beta^2)}{(1-\alpha\beta)^2}$ $\quad L = \left(\frac{m_{D1}}{m_{D3}}\right)^2 \frac{(1-\alpha^2)\,(1-\beta^2)}{(1-\alpha\beta)^2}$ $\quad A = \frac{c_2}{c_1}$

4.2. Mass ratio

It introduce the new variables ε_1, ε_2 and ε_3 in the forms of $m_{D1} = m\varepsilon_1$, $m_{D2} = m(\varepsilon_1+\varepsilon_2)$ and $m_{D3} = m(\varepsilon_1+\varepsilon_2+\varepsilon_3)$ rather than the variables m_{D1}, m_{D2} and m_{D3}. The mass densities of dark energy, dark matter and baryons are given based on the mass ratio of the galaxy D motion when observed at the Milky Way galaxy A. Therefore, the corresponding mass densities are ε_1, ε_2 and ε_3, respectively.

5. Analysis and denying the presence of the System 4 space-time

Since the System 1, 2 and 3 space-times exist, it is highly likely that the System 4 space-time also similarly exists. This calls for investigating the possibility of the System 4 space-time existence.

It applies the formula of "4.1. the combined velocity and the increasing mass" to the System 4 space-time.

5.1. Mathematical analysis by theoretical calculation

① Consider the System 4 space-time and organize the formula § 4 above.

$$M_0 = m_{D1}\sqrt{1-\left(\frac{w_{AD1}}{c_1}\right)^2} = m_{D2}\sqrt{1-\left(\frac{w_{AD2}}{c_2}\right)^2} = m_{D3}\sqrt{1-\left(\frac{w_{AD3}}{c_3}\right)^2} = m_{D4}\sqrt{1-\left(\frac{w_{AD4}}{c_4}\right)^2}$$

$$K = \left(\frac{m_{D1}}{m_{D2}}\right)^2 \frac{(1-\alpha^2)(1-\beta^2)}{(1-\alpha\beta)^2}\ ,\quad L = \left(\frac{m_{D1}}{m_{D3}}\right)^2 \frac{(1-\alpha^2)\,(1-\beta^2)}{(1-\alpha\beta)^2}\quad ,\quad J = \left(\frac{m_{D1}}{m_{D4}}\right)^2 \frac{(1-\alpha^2)(1-\beta^2)}{(1-\alpha\beta)^2}$$

Since the relative velocity w_{AD1} ,w_{AD2} ,w_{AD3} ,w_{AD4} are derived, as a solution

$$\left(\frac{w_{AD2}}{c_2}\right)^2 = 1-K = \left[\frac{(\beta-\alpha)c_1\boldsymbol{c_2}}{\boldsymbol{c_2}^2-\alpha\beta\,{c_1}^2}\right]^2\ ,\quad \left(\frac{w_{AD3}}{c_3}\right)^2 = 1-L = \left[\frac{(\beta-\alpha)c_1{c_2}^2\boldsymbol{c_3}(\,{c_2}^2-{c_1}^2)}{\boldsymbol{c_3}^2(\alpha{c_1}^2+{c_2}^2)(\beta{c_1}^2+{c_2}^2)-(1+\alpha\,)(1+\beta\,){c_1}^2\,{c_2}^4}\right]^2$$

$$\left(\frac{w_{AD4}}{c_4}\right)^2 = 1 - J = \left[\frac{(\beta-\alpha)c_1{c_2}^2{c_3}^2\boldsymbol{c_4}({c_2}^2 - {c_1}^2)({c_3}^2 - {c_2}^2)}{\boldsymbol{c_4}^{\boldsymbol{2}}[{c_2}^2({c_3}^2 + c_1c_2) + \alpha c_1(c_1{c_3}^2 + {c_2}^3)].[{c_2}^2({c_3}^2 + c_1c_2) + \beta c_1(c_1{c_3}^2 + {c_2}^3)] \\ -{c_2}^2{c_3}^4(c_1+c_2)^2(\alpha c_1 + c_2)(\beta c_1 + c_2)}\right]^2$$

Mode-1 solution ; Expanding $(w_{AD}/c)^2 = [\ \cdot\ \cdot\ \cdot\ ]^2$

$$A(c^2)^2 + B(c^2) + C = 0 \qquad c = \delta_2\sqrt{[-B + \delta_1\sqrt{B^2 - 4AC}\ ]/2A}$$

Mode-2 solution ; Taking square root $(w_{AD}/c)^2 = [\ \cdot\ \cdot\ \cdot\ ]^2$

$$A\delta'_1\sqrt{1-L}\,c^2 + Bc + C\delta'_1\sqrt{1-L} = 0 \qquad c = \frac{-B + \delta'_2\sqrt{B^2 - 4AC(1-L)}}{2A\delta'_1\sqrt{1-L}}$$

② With the Mode -1 solution, determine the sign ± 1 of (δ_1, δ_2), (δ_3, δ_4), (δ_5, δ_6).

Since the System 1 moves at the light velocity in the System 2 space-time, there is a part where the System 1 space-time and the System 2 space-time are in contact. Consider the momentum tensor when an object (photon) exists at the boundary between the System 1 space-time and the System 2 space-time and apply "the principle of least action" to this photon momentum tensor.

Photon momentum in the System 1 space-time $p_1 = h_1\nu_1/c_1$,

Photon momentum in the System 2 space-time $p_2 = h_2\nu_2/c_2$

" the principle of Photon momentum least action" Min 〔 $p_1 + p_2$ 〕

$$\text{Min}\ [h_1\nu_1/c_1 + h_2\nu_2/c_2\ ] = \text{Min}\ h_1\nu_1/c_1\,[\ 1 + h_2\nu_2/h_1\nu_1 \cdot c_1/c_2\ ]$$

$$= \text{Min}\ \frac{h_1\nu_1}{c_1}\left[\ 1 + \frac{h_2\nu_2}{h_1\nu_1}\ \delta_2\Big/\sqrt{\frac{1}{2(1-K)}\left[\alpha^2+\beta^2-2\alpha\beta K + |\alpha-\beta|\delta_1\sqrt{(\alpha+\beta)^2-4\alpha\beta K}\right]}\ \right]$$

⇒ for minimum, $\boldsymbol{\delta_2 = -1}$

Also, Min $[h_2\nu_2/c_2 + h_3\nu_3/c_3]$

⇒ for minimum, $\boldsymbol{\delta_4 = +1}$, because of $\delta_2 = -1$, c_2 and c_3 are opposite sign.

Also, Min $[h_3\nu_3/c_3 + h_4\nu_4/c_4]$

⇒ for minimum, $\boldsymbol{\delta_6 = -1}$, because of $\delta_4 = +1$, c_3 and c_4 are opposite sign.

Furthermore, in order to determine δ_1, δ_3, δ_5, the condition that the speed of the object does not exceed the light velocity is applied. For the System 2 space-time

$$\left(\frac{w_{D2}}{c_2}\right)^2 = \left(\frac{1}{c_2}\cdot\frac{w_{D1}+c_1}{1+w_{D1}c_1/c_2^2}\right)^2 = \frac{2(1-K)(1+\beta)^2(\alpha^2+\beta^2-2\alpha\beta K + |\alpha-\beta|\delta_1\sqrt{(\alpha+\beta)^2-4\alpha\beta K}\ )}{[\,2(1-K)\beta + \alpha^2+\beta^2-2\alpha\beta K + |\alpha-\beta|\delta_1\sqrt{(\alpha+\beta)^2-4\alpha\beta K}\ \,]^2} < 1$$

If so $\frac{\partial}{\partial\delta_1}\left(\frac{w_{D2}}{c_2}\right)^2 = 0$, $\delta_1 = \frac{-\sqrt{(\alpha+\beta)^2-4\alpha\beta K}}{|\alpha-\beta|} < 0$, therefore $\boldsymbol{\delta_1 = -1}$

Also, for the System 3 space-time $\left(\frac{w_{D3}}{c_3}\right)^2 < 1$, If so $\frac{\partial}{\partial\delta_3}\left(\frac{w_{D3}}{c_3}\right)^2 = 0$, therefore $\boldsymbol{\delta_3 = -1}$

Also, for the System 4 space-time $\left(\frac{w_{D4}}{c_4}\right)^2 < 1$, if so $\frac{\partial}{\partial\delta_5}\left(\frac{w_{D4}}{c_4}\right)^2 = 0$

$$\delta_5\sqrt{\begin{array}{c}\{\ 2[(c_2^2(c_3^2+c_1c_2)+\alpha c_1(c_1c_3^2+c_2^3)][c_2^2(c_3^2+c_1c_2)+\beta c_1(c_1c_3^2+c_2^3)]\,c_2^2c_3^4(c_1+c_2)^2(\alpha c_1+c_2)(\beta c_1+c_2)(1-J) \\ +[(\beta-\alpha)c_1c_2^2c_3^2(c_2^2-c_1^2)\,(c_3^2-c_2^2)]^2\ \}^2 \\ -4(1-J)^2[(c_2^2(c_3^2+c_1c_2)+\alpha c_1(c_1c_3^2+c_2^3)]^2\,[c_2^2(c_3^2+c_1c_2)+\beta c_1(c_1c_3^2+c_2^3)]^2\,[c_2^2c_3^4(c_1+c_2)^2(\alpha c_1+c_2)(\beta c_1+c_2)\,]^2\end{array}}$$

$$\begin{aligned} = \ & 2(1-J)\,[(c_2^2(c_3^2+c_1c_2)+\alpha c_1(c_1c_3^2+c_2^3)]^2\,[c_2^2(c_3^2+c_1c_2)+\beta c_1(c_1c_3^2+c_2^3)]^2\ [(1+\beta)c_1c_2^2/(c_2^2+\beta c_1^2) \\ & + c_2]\,c_1c_3^3/[\beta c_1c_3^2+(1+\beta)c_2^3]\ -\ 2[(c_2^2(c_3^2+c_1c_2)+\alpha c_1(c_1c_3^2+c_2^3)][c_2^2(c_3^2+c_1c_2) \\ & + \beta c_1(c_1c_3^2+c_2^3)]\,c_2^2c_3^4(c_1+c_2)^2(\alpha c_1+c_2)(\beta c_1+c_2)(1-J) - [(\beta-\alpha)c_1c_2^2c_3^2(c_2^2-c_1^2)\,(c_3^2-c_2^2)]^2 \end{aligned}$$

Since it is $c_2 < 0$, δ_5 fluctuates positively and negatively. That is, in the System 4 space-time, it transits to

δ_5=+1 and δ_5=−1. As a result, the existence of the System 4 space-time is denied.

Mode -2 solution validating the System 4 space-time c_4

$$c_4{}^2\ \delta'_5\sqrt{1-J}\ [c_1c_2{}^3\ (1+\alpha)+c_3{}^2(c_2{}^2+\alpha\, c_1{}^2)\,]\,[c_1c_2{}^3\,(1+\beta\,)+c_3{}^2(c_2{}^2+\beta\, c_1{}^2)\,]$$
$$+\,c_4(\alpha-\beta\,)c_1\,c_2{}^2c_3{}^2(c_2{}^2-c_1{}^2\,)(c_3{}^2-c_2{}^2\,)\ -\delta'_5\sqrt{1-J}\,c_2{}^2c_3{}^4\,(c_1+c_2)^2\ (\alpha\, c_1+c_2)(\beta c_1+c_2)=0$$

In the above c_4 quadratic equation, since coefficients $(\alpha-\beta\,)c_1\,c_2{}^2c_3{}^2(c_2{}^2-c_1{}^2\,)(c_3{}^2-c_2{}^2\,)$ of c_4 term is greatly affected by the positive and minus signs of $(\alpha-\beta\,)$, the root changes positively and negatively. As a result, the existence of the System 4 space-time is denied.

Next, consider the rest mass energy of each space-time. For the System 1 space-time to be the least energy in space-time, ε_1: Baryon. For the System 2, since space-time is $c_2 < 0$, ε_2: Dark Energy. For the System 3 space-time, the rest is ε_3: Dark Matter.

5.2. Numerical analysis by computer

Since the absolute value of the galaxy movement speed is unknown, it calculated the light velocities in both the System 2 space-time and the System 3 space-time by changing the galaxy movement speed α, β from −0.999 to +0.999 times faster than the light velocity in the System 1 space-time.

The adoption conditions to determine the appropriate solution are described as follows.

① The light velocity is faster than any other movement speed of galaxy in any space-time.

Then, $|c_3| > |w_{A3}|\,,|w_{D3}|$ $\quad |c_2| > |w_{A2}|\,,|w_{D2}|$ $\quad |c_1| > |w_{A1}|\,,|w_{D1}|$.

② The time-space in which dark energy first appears as a result of the system transition has a light velocity with the opposite sign to that of the other two velocities.

③ it applies the principle of energy minimum in the rest mass-energy E to the System 1, 2 and 3 space-times.

$$E_1 = M_0\,c_1{}^2 = m_{D1}\,c_1{}^2\sqrt{1-\left(\frac{w_{AD1}}{c_1}\right)^2} = m\varepsilon_1\,(c_1/c_3\,)^2\ c_0{}^2\sqrt{1-\left(\frac{w_{AD1}}{c_1}\right)^2}$$

$$E_2 = m(\varepsilon_1+\varepsilon_2)\,(c_2/\,c_3)^2\ c_0{}^2\sqrt{1-\left(\frac{w_{AD2}}{c_2}\right)^2} \qquad E_3 = m(\varepsilon_1+\varepsilon_2+\varepsilon_3)\,c_0{}^2\sqrt{1-\left(\frac{w_{AD3}}{c_3}\right)^2}$$

The trial calculations are performed, and the results are as follow. [4].

ε_1: baryons, 0.049; ε_2: dark energy, 0.683; ε_3: dark matter, 0.268 , $\delta_1=\delta_2=\delta_3=-1,\ \ \delta_4=+1.$

As a matter of course, this§5.2 results coincide with that §5.1 results.

6. The cosmic age of dark matter

6.1. The duration time

By the special theory of relativity, when the physical phenomena are observed during time $\Delta t'$ in the rest coodinate, they are observed during time $\Delta t\ (=\Delta t'\,/\sqrt{1-v^2/c^2}\,)$ in the moving coordinate. Therefore, it is possible to express as follow at each of the System 1, 2 and 3 space-times of the ternary space-times.

$$\Delta t_1 = \frac{\Delta t_1{}'}{\sqrt{1-w_{AD1}{}^2/c_1^2}} \qquad \Delta t_2 = \frac{\Delta t_2{}'}{\sqrt{1-w_{AD2}{}^2/c_2^2}} \qquad \Delta t_3 = \frac{\Delta t_3{}'}{\sqrt{1-w_{AD3}{}^2/c_3^2}}$$

The observation durations of the physical phenomena are common to each of the rest coordinates.

$$\Delta t_1' = \Delta t_2' = \Delta t_3'\ (=\Delta t_0)$$

$$\Delta t_0 = \Delta t_1\sqrt{1-w_{AD1}{}^2/c_1^2}\ = \Delta t_2\sqrt{1-w_{AD2}{}^2/c_2^2}\ = \Delta t_3\sqrt{1-w_{AD3}{}^2/c_3^2}$$

Upper equations Δt_0 are the same that the rest mass equations shown below.

$$M_0 = m_{D1}\sqrt{1 - {w_{AD1}}^2/c_1^2} = m_{D2}\sqrt{1 - {w_{AD2}}^2/c_2^2} = m_{D3}\sqrt{1 - {w_{AD3}}^2/c_3^2}$$

So that, it is $\Delta t_1 < \Delta t_2 < \Delta t_3$ in the moving coordinate, because it is $m_{D1} < m_{D2} < m_{D3}$.

The moving duration time Δt_1 of the physical phenomena is the shortest in the System 1 space-time. It means that the physical phenomena have finished and the next step proceeds in the System 1 space-time, while the physical phenomena are being observed in the System 3 space-time. That is, the evolution speed in the System 1 space-time is the fastest in the three Systems. Henceforth, the moving duration time of the physical phenomena is shortly called the duration time.

6.2. The net duration time

There is Plank time as the minimum time-unit. The duration time Δt_1 , Δt_2 and Δt_3 are divided finely by Plank time and they are integrated each Plank time.

$\Delta t_1 = \Delta t_{11}$ $\Delta t_2 = \Delta t_{21} + \Delta t_{22}$ $\Delta t_3 = \Delta t_{31} + \Delta t_{32} + \Delta t_{33}$

Δt_{11} : the net duration time of baryons in the System 1 space-time

Δt_{21} , Δt_{22} : the net duration times of baryons and dark energy in the System 2 space-time

$\Delta t_{31}, \Delta t_{32}, \Delta t_{33}$: the net duration times of baryons, dark energy and dark matter in the System 3 space-time

In the System 2 space-time, the duration time of baryons and dark energy is Δt_2 because they appear together. Likewise, in the System 3 space-time, the duration time of baryons, dark energy and dark matter is Δt_3 because they appear all together,

The net duration time of baryons is common in the System 1,2 and 3 space-times, $\Delta t_{11} = \Delta t_{21} = \Delta t_{31}$

The net duration time of dark energy is common in the System 2 and 3 space-times, $\Delta t_{22} = \Delta t_{32}$

The net duration time of dark matter in the System 3 space-time is Δt_{33}

Consequently, $\Delta t_1 = \Delta t_{11}$ $\Delta t_2 = \Delta t_{11} + \Delta t_{22}$ $\Delta t_3 = \Delta t_{11} + \Delta t_{22} + \Delta t_{33}$

Because their relations equal to that of the mass of motion, it follows

$\Delta t_{11} = \varepsilon_1 T$ $\Delta t_{22} = \varepsilon_2 T$ $\Delta t_{33} = \varepsilon_3 T$

$\Delta t_1 = \varepsilon_1 T$ $\Delta t_2 = (\varepsilon_1 + \varepsilon_2)\, T$ $\Delta t_3 = (\varepsilon_1 + \varepsilon_2 + \varepsilon_3)\, T$

The net change rate of the physical phenomena is in inverse proportion to the net duration time and the net change length is in proportion to the net change rate. So that, in the System 3 space-time.

the net change length of dark matter / the net change length of baryons

= the net duration time of baryons Δt_{31} / the net duration time of dark matter Δt_{33} $= \varepsilon_1 / \varepsilon_3$

6.3. The reaction rate of the physical phenomena

Evolution process of dark matter is much more unclear than that of baryons. Here, chemical reaction engineering is introduced. Quantum chemical reaction rate (stochastic process) is in proportion to density (i.e. mass / space volume). So that, the relations between baryons and dark matter in the System 3 space-time are as follow.

	baryons	dark matter
light velocity	c_3	c_3
mass	ε_1	ε_3
net duration time	Δt_{31}	Δt_{33}
virtual space volume	$(c_3\, \Delta t_{31})^3$	$(c_3\, \Delta t_{33})^3$
virtual density	$\varepsilon_1 /(c_3\, \Delta t_{31})^3$	$\varepsilon_3/(c_3\, \Delta t_{33})^3$
ratio of virtual density	1.0	$\varepsilon_3/ \varepsilon_1 \cdot (\Delta t_{31} / \Delta t_{33})^3 = (\varepsilon_1 / \varepsilon_3)^2$

6.4. The cosmic age of dark matter

The net evolution length (cosmic age) of dark matter is with relation to the net duration time of Plank time and the reaction rate of the physical phenomena.

$$\frac{\text{the net evolution length (cosmic age) of dark matter}}{\text{the net evolution length (cosmic age) of baryons}}$$

$$=\frac{\text{the net duration time of baryons}}{\text{the net duration time of dark matter}}\times\frac{\text{the net reaction rate of dark matter}}{\text{the net reaction rate of baryons}}$$

$$=(\varepsilon_1/\varepsilon_3)\cdot(\varepsilon_1/\varepsilon_3)^2=(\varepsilon_1/\varepsilon_3)^3$$

When the net evolution length of baryons is 13.8 billion years cosmic age in the System 3 space-time, the cosmic age of dark matter can be about 100 million years 〔0.08billion=13.8×(0.049/0.268)^3〕. The cosmic age about 100 million years locates in the dark ages of universe (cosmic age from 0.37 million to about 400 million years) without any lights i.e. electromagnetic waves but with gravitation.

Evolution process of dark energy is most difficult of three Systems. Nevertheless boldly speaking, the cosmic age of dark energy can be about 5 million years 〔13.8× $(\varepsilon_1/\varepsilon_2)^3$〕 but gravity except photon radiated from dark energy can be felt in the System 3 space-time.

7. Discussion

An event occurred in which the space-time of the system 1 ~ system 3 space-time came into touch at one point that overlapped, where the special theory of relativity is satisfied with the general theory of relativity. In summary, it estimates the ternary space-times by using the formulae for both combined velocities and the increasing mass which are completed in the accelerated motion from the special theory of relativity.

In the first place, the capture of elementary particles (including photons, gravitons and other elementary particles with the light velocity) between Ba, DE and DM is not suitable because it causes fluctuations in the ε of the Systems 1, 2 and 3. However, gravities and electro-magnetic forces which are distortions of the space-time field, exist and act. (They are characteristics of origin space-time.)

Dark matter is a product in the System 3 space-time, and the System 3 is the present “real world” with a positive light velocity (300,000 km/s). So that, dark matter gathers around baryons in the System 3 space-time because of the positive light velocity c_3.

Dark energy is a product in the System 2 space-time, and in the case of varying α and β from −0.9 to +0.9 respectively as numerical analyses, the System 2 is the “illusive world” with a negative light velocity that is ten times faster $(c_2/c_3 : -1.0\sim-90)$ than that in the real world. The System 2 also has negative pressure since this is a negative light velocity world, i.e., it represents the expansion of the universe itself. So that, dark energy disperses in the System 2 because of the negative light velocity c_2.

Baryons is a product in the System 1 space-time and the System 1 is the “core world” with a positive light velocity c_1 that is hundred times faster $(c_1/c_3$: 1.1～900) than that in the real world. So that, baryons gather each other because of the positive light velocity c_1.

Dark matter and dark energy are the magics of the ternary space-times and generated from baryons of the core world. It is impossible to directly catch substances proper i.e. elementary particles of dark matter in the System 3 space-time, because this real world is separated from the System 1 where the core world exists due to the space-time light velocity energy gaps. Substances of dark energy in the System 2 space-time are the same as above. So that, baryons never collide with dark matter.

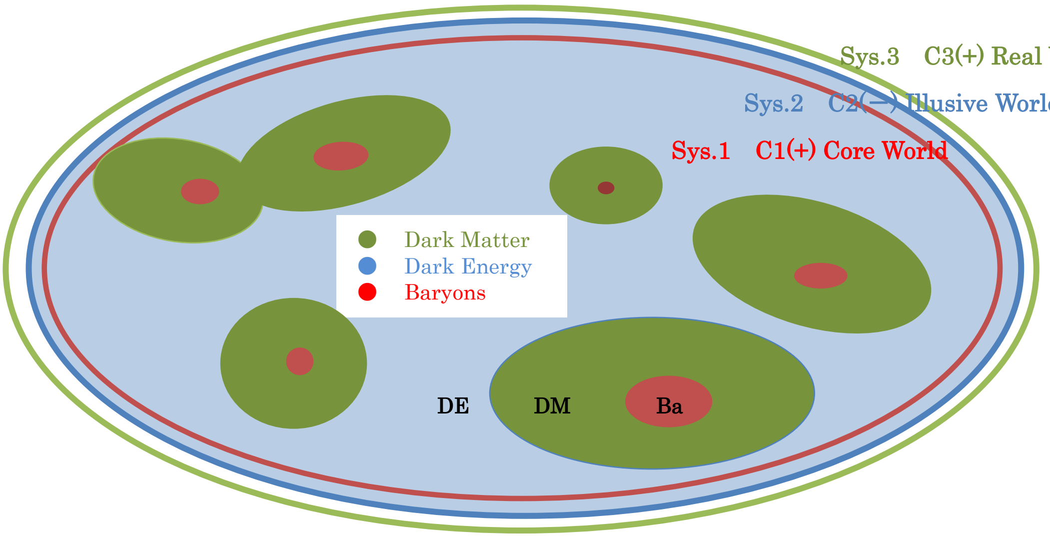
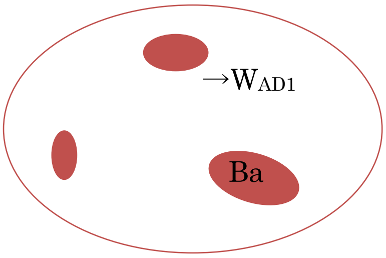
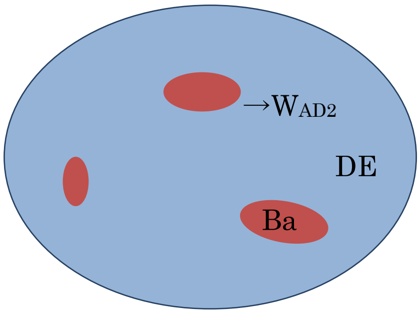


Fig.3 Image of the ternary space-times



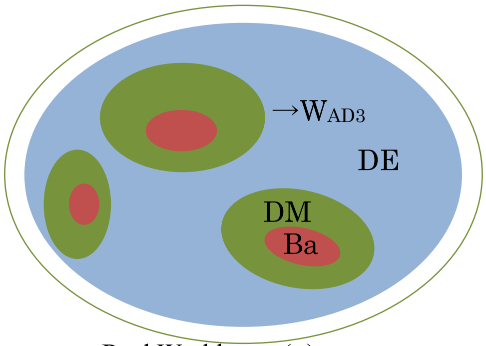
Core World $c_1(+)$

Fig.4-1 the System 1 space-time



Illusive World $c_2(-)$

Fig.4-2 the System 2 space-time



Real World $c_3(+)$

Fig.4-3 the System 3 space-time

	galaxy relative speed			mass of motion			virtual (net) duration time of motion		
	Sys.1	Sys.2	Sys.3	Sys.1	Sys.2	Sys.3	Sys.1	Sys.2	Sys.3
baryons	w_{AD1}	w_{AD2}	w_{AD3}	$\varepsilon_1 m$	$\varepsilon_1 m$	$\varepsilon_1 m$	$\Delta t_1\ (\varepsilon_1 T)$	$\Delta t_2(\varepsilon_1 T)$	$\Delta t_3(\varepsilon_1 T)$
dark energy	—	w_{AD2}	w_{AD3}	—	$\varepsilon_2 m$	$\varepsilon_2 m$	—	$\Delta t_2(\varepsilon_2 T)$	$\Delta t_3(\varepsilon_2 T)$
dark matter	—	—	w_{AD3}	—	—	$\varepsilon_3 m$	—	—	$\Delta t_3(\varepsilon_2 T)$

Baryons lapse cosmic age 13.8 billion years from the big ban. The cosmic age of dark energy can be about 5 million years and the cosmic age of dark matter can be about 100 million years, if the processes of evolution in the System 1,2 and 3 space-times are similar. These cosmic ages locate in the dark ages (from cosmic age 0.37 million to about 0.4 billion years) of universe without any light by the chronology of the universe [5].

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Declarations

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F. I. developed the theory and wrote the manuscript.

Competing Interests

The author declares no competing interests including financial and non-financial interests.