The Cosmic Age of Dark Matter can be about 100 million years, based on the special theory of relativity, the ternary space-times and so on.

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Abstract Published studies have stated that the mass ratio of ordinary substances such as atoms, dark matter and dark energy are approximately five percent, twenty seven percent and sixty eight percent, respectively. 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. I estimated here in this article the universal space-time by using the special theory of relativity i.e. the combined velocity, the increasing mass, the duration time and the chemical reaction 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 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

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].

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. There have been previous attempts to prove the existence of dark matter by using the thesis of unknown elementary particles, modified Newtonian dynamics and other methods.

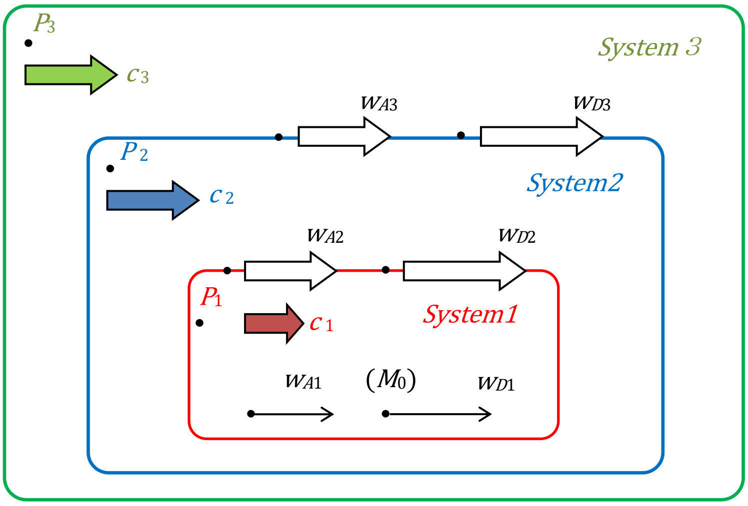
The existence of dark energy is more mysterious than that of dark matter. Baryons and dark matter pull against each other in accordance with the law of universal gravitation. In contrast, dark energy has a repulsive force, i.e., it affects negative pressure and thus accelerates the expansion of the universe. 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.

However, addressing the unresolved issues of dark matter and dark energy remains a priority for many astronomical projects.

In this work, I applied the special theory of relativity to three different space-times in which each of these systems has its own light velocity. I calculated and estimated baryons, dark matter and dark energy by using the chemical reaction rate and three formulae of the special theory of relativity for the combined velocity, the increasing mass and the duration time. The results suggest that each of "the ternary space-times" has its own specific light velocity and was created in the inflationary epoch during the very early universe and that the cosmic age of dark matter can be about 100 million years in our age of the universe 13.8 billion years. The cosmic age about 100 million years locates in the dark age of universe without any lights.

2. Methods

2.1. The combined velocity and the increasing mass



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

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

. 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.

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

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.

$$w_{AD1} = \frac{w_{D1} - w_{A1}}{1 - w_{A1} w_{D1}/{c_1}^2}$$

(2) $$w_{AD2} = \frac{w_{D2} - w_{A2}}{1 - w_{A2}w_{D2}/{c_2}^2} = \frac{(w_{D1} - w_{A1})\, {c_2}^2}{{c_2}^2 - w_{A1}w_{D1}}$$

$$w_{AD3} = \frac{w_{D3} - w_{A3}}{1 - w_{A3}w_{D3}/{c_3}^2} = \frac{(w_{D1} - w_{A1})\, {c_2}^2\, {c_3}^2\, ({c_2}^2 - {c_1}^2)}{w_{A1}w_{D1}({c_1}^2{c_3}^2 - {c_2}^4) + (w_{D1} + w_{A1})\, c_1\, {c_2}^2({c_3}^2 - {c_2}^2) + {c_2}^4({c_3}^2 - {c_1}^2)}$$

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. 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.

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

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

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

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

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

Also,

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

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

where $\delta_1 = \pm 1$, $\delta_2 = \pm 1$, $\delta_3 = \pm 1$ and $\delta_4 = \pm 1$.

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

2.2. Mass ratio

Next, I introduce the new variables $\varepsilon_1, \varepsilon_2$ 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 $\varepsilon_1, \varepsilon_2$ and ε_3, respectively.

There are $2^4 \times 3! = 96$ possible combinations for the ratios c_2/c_1 and c_3/c_1. The adoption conditions to determine the appropriate solution are described as follows.

① 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.

② The light velocity is faster than any other movement speed of galaxy in any space-time.

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

Apply two conditions of the light velocities to 96 combinations. Then six appropriate solutions remain as shown in Table1 according to the combinations of $\varepsilon_1, \varepsilon_2$ and ε_3.

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

Baryons, dark energy and dark matter appear all together in the System 3 space-time which has the light velocity c_3 $(300{,}000\ \mathrm{km/s} = c_0)$ in our real world. This is a boundary condition.

The rest mass-energy E_1 in the System 1 space-time is as follows.

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

The rest mass-energy E_2 in the System 2 space-time is as follows.

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

The rest mass-energy E_3 in the System 3 space-time is as follows.

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

The calculated rest mass-energy in the System 1,2 and 3 space-times for 6 appropriate solutions is shown in Table 2 to adopt the minimum rest mass-energy.

The most appropriate solution of the minimum rest mass-energy is shown in Table 3 to compare the light velocity ratio in the real world (i.e. the System 3 space-time) with that in the System 1 and 2 space-times.

Table 1 Selection of the appropriate solution by the condition of light velocity (in case of $\alpha=0.3$ $\beta=-0.9$)

not appropriate (shaded)

ε1 DE ➡ ε2 DM ➡ ε3 Ba

δ4	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1
δ3	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1
δ2	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1
δ1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1
c1/c1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Wa1/c1	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90
Wd1/c1	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Wad1/c1	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
c2/c1	-0.28	-0.28	-0.28	-0.28	0.28	0.28	0.28	0.28	-0.95	-0.95	-0.95	-0.95	0.95	0.95	0.95	0.95
Wa2/c1	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	25.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07
Wd2/c1	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Wad2/c1	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
c3/c1	-0.01	0.01	-0.28	0.28	-0.01	0.01	-0.28	0.28	-0.95	0.95	-25.67	25.67	-0.95	0.95	-25.67	25.67
Wa3/c1	-0.01	-0.01	-0.28	-0.28	-0.01	-0.01	0.28	0.28	-0.96	-0.96	25.02	25.02	0.96	0.96	25.11	25.11
Wd3/c1	0.00	0.00	-0.35	-0.35	0.00	0.00	0.28	0.28	-1.19	-1.19	0.03	0.03	0.95	0.95	1.92	1.92
Wad3/c1	0.01	0.01	0.28	0.28	0.01	0.01	0.28	0.28	0.93	0.93	-25.02	-25.02	0.93	0.93	-25.02	-25.02

ε1 DE ➡ ε2 Ba ➡ ε3 DM

δ4	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1
δ3	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1
δ2	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1
δ1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1
c1/c1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Wa1/c1	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90
Wd1/c1	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Wad1/c1	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
c2/c1	-0.27	-0.27	-0.27	-0.27	0.27	0.27	0.27	0.27	-0.99	-0.99	-0.99	-0.99	0.99	0.99	0.99	0.99
Wa2/c1	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33
Wd2/c1	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Wad2/c1	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
c3/c1	-0.01	0.01	-0.27	0.27	-0.01	0.01	-0.27	0.27	-0.99	0.99	-1.33	1.33	-0.99	0.99	-1.33	1.33
Wa3/c1	-0.01	-0.01	-0.27	-0.27	-0.01	-0.01	0.27	0.27	-1.01	-1.01	1.30	1.30	0.99	0.99	1.33	1.33
Wd3/c1	0.00	0.00	-5.45	-5.45	0.00	0.00	0.27	0.27	-28.07	-28.07	0.02	0.02	0.99	0.99	1.28	1.28
Wad3/c1	0.01	0.01	0.26	0.26	0.01	0.01	0.26	0.26	0.96	0.96	-1.30	-1.30	0.96	0.96	-1.30	-1.30

ε1 DM ➡ ε2 DE ➡ ε3 Ba

δ4	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1
δ3	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1
δ2	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1
δ1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1
c1/c1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Wa1/c1	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90
Wd1/c1	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Wad1/c1	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
c2/c1	-0.30	-0.30	-0.30	-0.30	0.30	0.30	0.30	0.30	-0.91	-0.91	-0.91	-0.91	0.91	0.91	0.91	0.91
Wa2/c1	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08
Wd2/c1	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Wad2/c1	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
c3/c1	-0.01	0.01	-0.30	0.30	-0.01	0.01	-0.30	0.30	-0.91	0.91	-1.13	1.13	-0.91	0.91	-1.13	1.13
Wa3/c1	-0.01	-0.01	-0.30	-0.30	-0.01	-0.01	0.30	0.30	-0.91	-0.91	-1.13	-1.13	0.95	0.95	-0.75	-0.75
Wd3/c1	0.00	0.00	-0.37	-0.37	0.00	0.00	0.30	0.30	-1.08	-1.08	0.14	0.14	0.91	0.91	1.11	1.11
Wad3/c1	0.01	0.01	0.30	0.30	0.01	0.01	0.30	0.30	0.91	0.91	1.13	1.13	0.91	0.91	1.13	1.13

ε1 Ba ➡ ε2 DE ➡ ε3 DM

δ4	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1
δ3	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1
δ2	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1
δ1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1
c1/c1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Wa1/c1	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90
Wd1/c1	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Wad1/c1	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
c2/c1	-0.30	-0.30	-0.30	-0.30	0.30	0.30	0.30	0.30	-0.90	-0.90	-0.90	-0.90	0.90	0.90	0.90	0.90
Wa2/c1	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.91	-0.91	-0.91	-0.91	-0.91	-0.91	-0.91	-0.91
Wd2/c1	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Wad2/c1	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
c3/c1	-0.01	0.01	-0.30	0.30	-0.01	0.01	-0.30	0.30	-0.90	0.90	-0.95	0.95	-0.90	0.90	-0.95	0.95
Wa3/c1	-0.01	-0.01	-0.30	-0.30	-0.01	-0.01	0.30	0.30	-0.90	-0.90	-0.95	-0.95	5.77	5.77	-0.08	-0.08
Wd3/c1	0.00	0.00	-4.19	-4.19	0.00	0.00	0.30	0.30	-1.06	-1.06	0.79	0.79	0.90	0.90	0.95	0.95
Wad3/c1	0.01	0.01	0.30	0.30	0.01	0.01	0.30	0.30	0.90	0.90	0.95	0.95	0.90	0.90	0.95	0.95

ε1 DM ➡ ε2 Ba ➡ ε3 DE

δ4	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1
δ3	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1
δ2	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1
δ1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1
c1/c1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Wa1/c1	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90
Wd1/c1	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Wad1/c1	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
c2/c1	-0.28	-0.28	-0.28	-0.28	0.28	0.28	0.28	0.28	-0.97	-0.97	-0.97	-0.97	0.97	0.97	0.97	0.97
Wa2/c1	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	2.24	2.24	2.24	2.24	2.24	2.24	2.24	2.24
Wd2/c1	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Wad2/c1	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
c3/c1	-0.01	0.01	-0.27	0.27	-0.01	0.01	-0.27	0.27	-0.98	0.98	-2.24	2.24	-0.98	0.98	-2.24	2.24
Wa3/c1	-0.01	-0.01	-0.28	-0.28	-0.01	-0.01	0.28	0.28	-1.02	-1.02	2.23	2.23	0.99	0.99	2.24	2.24
Wd3/c1	0.00	0.00	0.33	0.33	0.00	0.00	0.27	0.27	1.22	1.22	0.02	0.02	0.98	0.98	1.64	1.64
Wad3/c1	0.01	0.01	0.27	0.27	0.01	0.01	0.27	0.27	0.98	0.98	-2.23	-2.23	0.98	0.98	-2.23	-2.23

ε1 Ba ➡ ε2 DM ➡ ε3 DE

δ4	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1
δ3	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1
δ2	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1	1	1
δ1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1	1	1	1	1
c1/c1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Wa1/c1	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90
Wd1/c1	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Wad1/c1	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
c2/c1	-0.30	-0.30	-0.30	-0.30	0.30	0.30	0.30	0.30	-0.90	-0.90	-0.90	-0.90	0.90	0.90	0.90	0.90
Wa2/c1	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.95	-0.95	-0.95	-0.95	-0.95	-0.95	-0.95	-0.95
Wd2/c1	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Wad2/c1	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
c3/c1	-0.01	0.01	-0.30	0.30	-0.01	0.01	-0.30	0.30	-0.93	0.93	-0.96	0.96	-0.93	0.93	-0.96	0.96
Wa3/c1	-0.01	-0.01	-0.30	-0.30	-0.01	-0.01	0.30	0.30	-0.93	-0.93	-0.96	-0.96	-2.41	-2.41	-0.58	-0.58
Wd3/c1	0.00	0.00	0.37	0.37	0.00	0.00	0.30	0.30	2.71	2.71	0.61	0.61	0.93	0.93	0.96	0.96
Wad3/c1	0.01	0.01	0.30	0.30	0.01	0.01	0.30	0.30	0.93	0.93	0.96	0.96	0.93	0.93	0.96	0.96

Table 2 Selection of the appropriate solution satisfied with the condition of light velocity and minimum rest mass energy

ε1	0.68 dark energy				0.68 dark energy				0.27 dark matter				0.05 baryon				0.27 dark matter				0.05 baryon			
ε2	0.27 dark matter				0.05 baryon				0.68 dark energy				0.68 dark energy				0.05 baryon				0.27 dark matter			
ε3	0.05 baryon				0.27 dark matter				0.05 baryon				0.27 dark matter				0.68 dark energy				0.68 dark energy			
c1/c1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
α =Wa1/c1	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90
β =Wd1/c1	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90
Wad1/c1	0.00	-0.82	-0.94	-0.99	0.00	-0.82	-0.94	-0.99	0.00	-0.82	-0.94	-0.99	0.00	-0.82	-0.94	-0.99	0.00	-0.82	-0.94	-0.99	0.00	-0.82	-0.94	-0.99
E1/m c_0^2	0.84	4527	2437	0.62	0.84	5414	2867	0.90	0.33	1301	744	0.09	0.06	227	130	0.01	0.33	1715	1000	0.30	0.06	228	131	0.01
c2/c1	-0.90	-0.29	-0.28	-0.83	-0.90	-0.27	-0.27	-0.82	-0.90	-0.30	-0.30	-0.87	-0.90	-0.30	-0.30	-0.89	0.90	0.28	0.28	0.82	0.90	0.30	0.30	0.89
Wa2/c1	-0.90	-0.26	0.28	0.83	-0.90	-0.24	0.26	0.81	-0.90	-0.29	0.30	0.87	-0.90	-0.30	0.30	0.89	-0.90	-0.25	0.27	0.82	-0.90	-0.30	0.30	0.88
Wd2/c1	-0.90	-0.01	-0.01	-0.34	-0.90	-0.01	-0.01	-0.28	-0.90	-0.01	-0.01	-0.56	-0.90	-0.01	-0.01	-0.79	-0.90	-0.01	-0.01	-0.31	-0.90	-0.01	-0.01	-0.68
Wad2/c1	0/0	0.26	-0.28	-0.83	0/0	0.23	-0.26	-0.81	0/0	0.29	-0.30	-0.87	0/0	0.30	-0.30	-0.89	0/0	0.25	-0.27	-0.82	0/0	0.30	-0.30	-0.89
E2/m c_0^2	#VALUE!	371	197	0.43	#VALUE!	408	215	0.60	#VALUE!	116	65.85	0.07	#VALUE!	20.38	11.71	0.01	#VALUE!	134	77.38	0.20	#VALUE!	20.46	11.77	0.01
c3/c1	-0.90	-0.01	-0.01	-0.34	-0.90	-0.01	-0.01	-0.28	0.90	0.01	0.01	0.56	0.90	0.01	0.01	0.79	-0.90	-0.01	-0.01	-0.31	-0.90	-0.01	-0.01	-0.68
Wa3/c1	-0.90	0.00	0.00	0.00	-0.90	0.00	0.00	0.00	-0.90	0.00	0.00	0.00	-0.90	0.00	0.00	0.00	-0.90	0.00	0.00	0.20	-0.90	0.00	0.00	0.65
Wd3/c1	-0.90	-0.01	-0.01	-0.34	-0.90	-0.01	-0.01	-0.28	-0.90	-0.01	-0.01	-0.56	-0.90	-0.01	-0.01	-0.79	-0.90	-0.01	-0.01	-0.30	-0.90	-0.01	-0.01	-0.68
Wad3/c1	0/0	-0.01	-0.01	-0.34	0/0	-0.01	-0.01	-0.28	0/0	-0.01	-0.01	-0.56	0/0	-0.01	-0.01	-0.79	0/0	-0.01	-0.01	-0.30	0/0	-0.01	-0.01	-0.68
E3/m c_0^2	#VALUE!	0.39	0.22	0.07	#VALUE!	0.39	0.22	0.07	#VALUE!	0.15	0.09	0.03	#VALUE!	0.03	0.02	0.01	#VALUE!	0.15	0.09	0.03	#VALUE!	0.03	0.02	0.01
c1/c1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
α =Wa1/c1	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90
β =Wd1/c1	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30
Wad1/c1	0.82	0.00	-0.55	-0.94	0.82	0.00	-0.55	-0.94	0.82	0.00	-0.55	-0.94	0.82	0.00	-0.55	-0.94	0.82	0.00	-0.55	-0.94	0.82	0.00	-0.55	-0.94
E1/m c_0^2	4527	7.59	443	10.95	5414	7.59	1863	12.66	1301	2.98	11.54	3.12	227	0.54	0.65	0.54	1715	2.98	183	4.00	228	0.54	0.94	0.54
c2/c1	-0.29	-0.30	-0.15	-0.28	-0.27	-0.30	-0.11	-0.27	-0.30	-0.30	-0.24	-0.30	-0.30	-0.30	-0.28	-0.30	0.28	0.30	0.12	0.28	0.30	0.30	0.26	0.30
Wa2/c1	-0.01	-0.30	0.09	0.16	-0.01	-0.30	0.05	0.15	-0.01	-0.30	0.20	0.17	-0.01	-0.30	0.27	0.17	-0.01	-0.30	0.06	0.15	-0.01	-0.30	0.24	0.17
Wd2/c1	-0.26	-0.30	-0.06	-0.26	-0.24	-0.30	-0.03	-0.23	-0.29	-0.30	-0.16	-0.29	-0.30	-0.30	-0.26	-0.30	-0.25	-0.30	-0.04	-0.24	-0.30	-0.30	-0.21	-0.30
Wad2/c1	-0.26	0/0	-0.12	-0.28	-0.23	0/0	-0.07	-0.26	-0.29	0/0	-0.23	-0.30	-0.30	0/0	-0.28	-0.30	-0.25	0/0	-0.09	-0.27	-0.30	0/0	-0.26	-0.30
E2/m c_0^2	371	#VALUE!	9.98	0.88	408	#VALUE!	20.83	0.95	116	#VALUE!	0.64	0.28	20.38	#VALUE!	0.05	0.05	134	#VALUE!	2.84	0.31	20.46	#VALUE!	0.07	0.05
c3/c1	-0.01	-0.30	-0.04	-0.14	-0.01	-0.30	-0.02	-0.13	0.01	0.30	0.14	0.17	0.01	0.30	0.25	0.17	-0.01	-0.30	-0.03	-0.15	-0.01	-0.30	-0.21	-0.17
Wa3/c1	-0.01	-0.30	0.01	0.11	-0.01	-0.30	0.00	0.10	-0.01	-0.30	0.02	0.16	-0.01	-0.30	0.04	0.17	-0.01	-0.30	0.03	0.15	-0.01	-0.30	0.20	0.17
Wd3/c1	0.00	-0.30	-0.03	-0.12	0.00	-0.30	-0.01	-0.11	0.00	-0.30	-0.13	-0.14	0.00	-0.30	-0.25	-0.15	0.00	-0.30	-0.03	-0.02	0.00	-0.30	-0.19	0.00
Wad3/c1	0.01	0/0	-0.03	-0.14	0.01	0/0	-0.01	-0.13	0.01	0/0	-0.14	-0.17	0.01	0/0	-0.25	-0.17	0.01	0/0	-0.03	-0.15	0.01	0/0	-0.21	-0.17
E3/m c_0^2	0.39	#VALUE!	0.57	0.22	0.39	#VALUE!	0.57	0.22	0.15	#VALUE!	0.22	0.09	0.03	#VALUE!	0.04	0.02	0.15	#VALUE!	0.22	0.09	0.03	#VALUE!	0.04	0.02
c1/c1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
α =Wa1/c1	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90
β =Wd1/c1	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Wad1/c1	0.94	0.55	0.00	-0.82	0.94	0.55	0.00	-0.82	0.94	0.55	0.00	-0.82	0.94	0.55	0.00	-0.82	0.94	0.55	0.00	-0.82	0.94	0.55	0.00	-0.82
E1/m c_0^2	2437	443	7.59	16.25	2867	1863	7.59	18.90	744	11.54	2.98	5.27	130	0.65	0.54	0.94	1000	183	2.98	6.64	131	0.94	0.54	0.94
c2/c1	-0.28	-0.15	-0.30	-0.29	-0.27	-0.11	-0.30	-0.27	-0.30	-0.24	-0.30	-0.30	-0.30	-0.28	-0.30	-0.30	0.28	0.12	0.30	0.28	0.30	0.26	0.30	0.30
Wa2/c1	-0.01	-0.06	0.30	0.16	-0.01	-0.03	0.30	0.15	-0.01	-0.16	0.30	0.17	-0.01	-0.26	0.30	0.17	-0.01	-0.04	0.30	0.15	-0.01	-0.21	0.30	0.17
Wd2/c1	0.28	0.09	0.30	0.28	0.26	0.05	0.30	0.26	0.30	0.20	0.30	0.30	0.30	0.27	0.30	0.30	0.27	0.06	0.30	0.27	0.30	0.24	0.30	0.30
Wad2/c1	0.28	0.12	0/0	0.26	0.26	0.07	0/0	0.23	0.30	0.23	0/0	0.29	0.30	0.28	0/0	0.30	0.27	0.09	0/0	0.25	0.30	0.26	0/0	0.30
E2/m c_0^2	197	9.98	#VALUE!	1.33	215	20.83	#VALUE!	1.43	65.85	0.64	#VALUE!	0.47	11.71	0.05	#VALUE!	0.08	77.38	2.84	#VALUE!	0.52	11.77	0.07	#VALUE!	0.08
c3/c1	-0.01	-0.04	-0.30	-0.15	-0.01	-0.02	-0.30	-0.14	0.01	0.14	0.30	0.17	0.01	0.25	0.30	0.17	-0.01	-0.03	-0.30	-0.15	-0.01	-0.21	-0.30	-0.17
Wa3/c1	-0.01	-0.03	0.30	0.14	-0.01	-0.01	0.30	0.13	-0.01	-0.13	0.30	0.17	-0.01	-0.25	0.30	0.17	-0.01	-0.03	0.30	0.15	-0.01	-0.19	0.30	0.17
Wd3/c1	0.00	0.01	0.30	0.00	0.00	0.00	0.30	0.01	0.00	0.02	0.30	0.00	0.00	0.04	0.30	0.00	0.00	0.03	0.30	0.13	0.00	0.20	0.30	0.15
Wad3/c1	0.01	0.03	0/0	-0.14	0.01	0.01	0/0	-0.13	0.01	0.14	0/0	-0.17	0.01	0.25	0/0	-0.17	0.01	0.03	0/0	-0.15	0.01	0.21	0/0	-0.17
E3/m c_0^2	0.22	0.57	#VALUE!	0.39	0.22	0.57	#VALUE!	0.39	0.09	0.22	#VALUE!	0.15	0.02	0.04	#VALUE!	0.03	0.09	0.22	#VALUE!	0.15	0.02	0.04	#VALUE!	0.03
c1/c1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
α =Wa1/c1	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90	-0.90	-0.30	0.30	0.90
β =Wd1/c1	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Wad1/c1	0.99	0.94	0.82	0.00	0.99	0.94	0.82	0.00	0.99	0.94	0.82	0.00	0.99	0.94	0.82	0.00	0.99	0.94	0.82	0.00	0.99	0.94	0.82	0.00
E1/m c_0^2	0.62	10.95	16.25	0.84	0.90	12.66	18.90	0.84	0.09	3.12	5.27	0.33	0.01	0.54	0.94	0.06	0.30	4.00	6.64	0.33	0.01	0.54	0.94	0.06
c2/c1	-0.83	-0.28	-0.29	-0.90	-0.82	-0.27	-0.27	-0.90	-0.87	-0.30	-0.30	-0.90	-0.89	-0.30	-0.30	-0.90	0.82	0.28	0.28	0.90	0.89	0.30	0.30	0.90
Wa2/c1	-0.34	-0.26	0.28	0.90	-0.28	-0.23	0.26	0.90	-0.56	-0.29	0.30	0.90	-0.79	-0.30	0.30	0.90	-0.31	-0.24	0.27	0.90	-0.68	-0.30	0.30	0.90
Wd2/c1	0.83	0.16	0.16	0.90	0.81	0.15	0.15	0.90	0.87	0.17	0.17	0.90	0.89	0.17	0.17	0.90	0.82	0.15	0.15	0.90	0.88	0.17	0.17	0.90
Wad2/c1	0.83	0.28	-0.26	0/0	0.81	0.26	-0.23	0/0	0.87	0.30	-0.29	0/0	0.89	0.30	-0.30	0/0	0.82	0.27	-0.25	0/0	0.89	0.30	-0.30	0/0
E2/m c_0^2	0.43	0.88	1.33	#VALUE!	0.60	0.95	1.43	#VALUE!	0.07	0.28	0.47	#VALUE!	0.01	0.05	0.08	#VALUE!	0.20	0.31	0.52	#VALUE!	0.01	0.05	0.08	#VALUE!
c3/c1	-0.34	-0.14	-0.15	-0.90	-0.28	-0.13	-0.14	-0.90	0.56	0.17	0.17	0.90	0.79	0.17	0.17	0.90	-0.31	-0.15	-0.15	-0.90	-0.68	-0.17	-0.17	-0.90
Wa3/c1	-0.34	-0.12	0.00	0.90	-0.28	-0.11	0.01	0.90	-0.56	-0.14	0.00	0.90	-0.79	-0.15	0.00	0.90	-0.30	-0.02	0.13	0.90	-0.68	0.00	0.15	0.90
Wd3/c1	0.00	0.11	0.14	0.90	0.00	0.10	0.13	0.90	0.00	0.16	0.17	0.90	0.00	0.17	0.17	0.90	0.20	0.15	0.15	0.90	0.65	0.17	0.17	0.90
Wad3/c1	0.34	0.14	0.14	0/0	0.28	0.13	0.13	0/0	0.56	0.17	0.17	0/0	0.79	0.17	0.17	0/0	0.30	0.15	0.15	0/0	0.68	0.17	0.17	0/0
E3/m c_0^2	0.07	0.22	0.39	#VALUE!	0.07	0.22	0.39	#VALUE!	0.03	0.09	0.15	#VALUE!	0.01	0.02	0.03	#VALUE!	0.03	0.09	0.15	#VALUE!	0.01	0.02	0.03	#VALUE!

Table 3 Light velocity ratio between in Real World and in the System 1 and 2 of the appropriate solusion (-0.9< α <0.9 , -0.9< β <0.9)

c1/c1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
α =Wa1/c1	-0.90	-0.60	-0.30	-0.10	0.10	0.30	0.60	0.90	-0.90	-0.60	-0.30	-0.10	0.10	0.30	0.60	0.90
β =Wd1/c1	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.60	-0.60	-0.60	-0.60	-0.60	-0.60	-0.60	-0.60
Wad1/c1	0.00	-0.65	-0.82	-0.88	-0.92	-0.94	-0.97	-0.99	0.65	0.00	-0.37	-0.53	-0.66	-0.76	-0.88	-0.97
c1/c3	**1.1**	**15.0**	**90.1**	**891**	**891**	**90.1**	**15.0**	**1.3**	**15.0**	**1.7**	**14.2**	**148**	**148**	**14.3**	**1.9**	**1.8**
c2/c1	-0.90	-0.60	-0.30	-0.10	-0.10	-0.30	-0.60	-0.89	-0.60	-0.60	-0.30	-0.10	-0.10	-0.30	-0.58	-0.60
Wa2/c1	-0.90	-0.60	-0.30	-0.10	0.10	0.30	0.60	0.89	-0.07	-0.60	-0.30	-0.10	0.10	0.30	0.58	0.54
Wd2/c1	-0.90	-0.07	-0.01	0.00	0.00	-0.01	-0.07	-0.79	-0.60	-0.60	-0.07	-0.01	-0.01	-0.07	-0.52	-0.60
Wad2/c1	0/0	0.60	0.30	0.10	-0.10	-0.30	-0.60	-0.89	-0.60	0/0	0.30	0.10	-0.10	-0.30	-0.58	-0.60
c2/c3	**-1.0**	**-9.0**	**-27.0**	**-89.1**	**-89.1**	**-27.0**	**-9.0**	**-1.1**	**-9.0**	**-1.0**	**-4.3**	**-14.8**	**-14.8**	**-4.3**	**-1.1**	**-1.1**
c3/c1	0.90	0.07	0.01	0.00	0.00	0.01	0.07	0.79	0.07	0.60	0.07	0.01	0.01	0.07	0.51	0.54
Wa3/c1	-0.90	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	-0.07	-0.60	-0.03	0.00	0.00	0.00	0.02	0.53
Wd3/c1	-0.90	-0.07	-0.01	0.00	0.00	-0.01	-0.07	-0.79	-0.01	-0.60	-0.07	-0.01	-0.01	-0.07	-0.51	-0.54
Wad3/c1	0/0	-0.07	-0.01	0.00	0.00	-0.01	-0.07	-0.79	0.07	0/0	-0.07	-0.01	-0.01	-0.07	-0.51	-0.54
c3/c3	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
c1/c1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
α =Wa1/c1	-0.90	-0.60	-0.30	-0.10	0.10	0.30	0.60	0.90	-0.90	-0.60	-0.30	-0.10	0.10	0.30	0.60	0.90
β =Wd1/c1	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.30	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10
Wad1/c1	0.82	0.37	0.00	-0.21	-0.39	-0.55	-0.76	-0.94	0.88	0.53	0.21	0.00	-0.20	-0.39	-0.66	-0.92
c1/c3	**90.1**	**14.2**	**3.3**	**41.6**	**41.8**	**4.0**	**4.8**	**5.8**	**891**	**148**	**41.6**	**10.0**	**12.0**	**24.1**	**38.3**	**48.0**
c2/c1	-0.30	-0.30	-0.30	-0.10	-0.10	-0.28	-0.30	-0.30	-0.10	-0.10	-0.10	-0.10	-0.09	-0.10	-0.10	-0.10
Wa2/c1	-0.01	-0.07	-0.30	-0.10	0.10	0.27	0.21	0.17	0.00	-0.01	-0.02	-0.10	0.09	0.04	0.03	0.02
Wd2/c1	-0.30	-0.30	-0.30	-0.02	-0.02	-0.26	-0.30	-0.30	-0.10	-0.10	-0.10	-0.10	-0.09	-0.10	-0.10	-0.10
Wad2/c1	-0.30	-0.30	0/0	0.10	-0.10	-0.28	-0.30	-0.30	-0.10	-0.10	-0.10	0/0	-0.09	-0.10	-0.10	-0.10
c2/c3	**-27.0**	**-4.3**	**-1.0**	**-4.2**	**-4.2**	**-1.1**	**-1.4**	**-1.7**	**-89.1**	**-14.8**	**-4.2**	**-1.0**	**-1.1**	**-2.4**	**-3.8**	**-4.8**
c3/c1	0.01	0.07	0.30	0.02	0.02	0.25	0.21	0.17	0.00	0.01	0.02	0.10	0.08	0.04	0.03	0.02
Wa3/c1	-0.01	-0.07	-0.30	-0.01	0.00	0.04	0.20	0.17	0.00	-0.01	-0.02	-0.10	0.03	0.04	0.03	0.02
Wd3/c1	0.00	-0.03	-0.30	-0.02	-0.02	-0.25	-0.19	-0.15	0.00	0.00	-0.01	-0.10	-0.08	-0.03	-0.01	-0.01
Wad3/c1	0.01	0.07	0/0	-0.02	-0.02	-0.25	-0.21	-0.17	0.00	0.01	0.02	0/0	-0.08	-0.04	-0.03	-0.02
c3/c3	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
c1/c1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
α =Wa1/c1	-0.90	-0.60	-0.30	-0.10	0.10	0.30	0.60	0.90	-0.90	-0.60	-0.30	-0.10	0.10	0.30	0.60	0.90
β =Wd1/c1	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Wad1/c1	0.92	0.66	0.39	0.20	0.00	-0.21	-0.53	-0.88	0.94	0.76	0.55	0.39	0.21	0.00	-0.37	-0.82
c1/c3	**891**	**148**	**41.8**	**12.0**	**10.0**	**23.9**	**38.2**	**47.9**	**90.1**	**14.3**	**4.0**	**24.1**	**23.9**	**3.3**	**4.8**	**5.8**
c2/c1	-0.10	-0.10	-0.10	-0.09	-0.10	-0.10	-0.10	-0.10	-0.30	-0.30	-0.28	-0.10	-0.10	-0.30	-0.30	-0.30
Wa2/c1	0.00	-0.01	-0.02	-0.09	0.10	0.04	0.03	0.02	-0.01	-0.07	-0.26	-0.10	0.10	0.30	0.21	0.17
Wd2/c1	0.10	0.10	0.10	0.09	0.10	0.10	0.10	0.10	0.30	0.30	0.27	0.04	0.04	0.30	0.30	0.30
Wad2/c1	0.10	0.10	0.10	0.09	0/0	0.10	0.10	0.10	0.30	0.30	0.28	0.10	-0.10	0/0	0.30	0.30
c2/c3	**-89.1**	**-14.8**	**-4.2**	**-1.1**	**-1.0**	**-2.4**	**-3.8**	**-4.8**	**-27.0**	**-4.3**	**-1.1**	**-2.4**	**-2.4**	**-1.0**	**-1.4**	**-1.7**
c3/c1	0.00	0.01	0.02	0.08	0.10	0.04	0.03	0.02	0.01	0.07	0.25	0.04	0.04	0.30	0.21	0.17
Wa3/c1	0.00	-0.01	-0.02	-0.08	0.10	0.04	0.03	0.02	-0.01	-0.07	-0.25	-0.03	0.00	0.30	0.21	0.17
Wd3/c1	0.00	0.00	0.00	0.03	0.10	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.04	0.30	0.00	0.00
Wad3/c1	0.00	0.01	0.02	0.08	0/0	-0.04	-0.03	-0.02	0.01	0.07	0.25	0.04	0.04	0/0	-0.21	-0.17
c3/c3	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
c1/c1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
α =Wa1/c1	-0.90	-0.60	-0.30	-0.10	0.10	0.30	0.60	0.90	-0.90	-0.60	-0.30	-0.10	0.10	0.30	0.60	0.90
β =Wd1/c1	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Wad1/c1	0.97	0.88	0.76	0.66	0.53	0.37	0.00	-0.65	0.99	0.97	0.94	0.92	0.88	0.82	0.65	0.00
c1/c3	**15.0**	**1.9**	**4.8**	**38.3**	**38.2**	**4.8**	**1.7**	**1.8**	**1.3**	**1.8**	**5.8**	**48.0**	**47.9**	**5.8**	**1.8**	**1.1**
c2/c1	-0.60	-0.58	-0.30	-0.10	-0.10	-0.30	-0.60	-0.60	-0.89	-0.60	-0.30	-0.10	-0.10	-0.30	-0.60	-0.90
Wa2/c1	-0.07	-0.52	-0.30	-0.10	0.10	0.30	0.60	0.54	-0.79	-0.60	-0.30	-0.10	0.10	0.30	0.60	0.90
Wd2/c1	0.60	0.58	0.21	0.03	0.03	0.21	0.60	0.60	0.89	0.54	0.17	0.02	0.02	0.17	0.54	0.90
Wad2/c1	0.60	0.58	0.30	0.10	-0.10	-0.30	0/0	0.60	0.89	0.60	0.30	0.10	-0.10	-0.30	-0.60	0/0
c2/c3	**-9.0**	**-1.1**	**-1.4**	**-3.8**	**-3.8**	**-1.4**	**-1.0**	**-1.1**	**-1.1**	**-1.1**	**-1.7**	**-4.8**	**-4.8**	**-1.7**	**-1.1**	**-1.0**
c3/c1	0.07	0.51	0.21	0.03	0.03	0.21	0.60	0.54	0.79	0.54	0.17	0.02	0.02	0.17	0.54	0.90
Wa3/c1	-0.07	-0.51	-0.19	-0.01	0.00	0.00	0.60	0.54	-0.79	-0.54	-0.15	-0.01	0.00	0.00	0.00	0.90
Wd3/c1	0.00	0.02	0.20	0.03	0.03	0.21	0.60	0.00	0.00	0.53	0.17	0.02	0.02	0.17	0.54	0.90
Wad3/c1	0.07	0.51	0.21	0.03	0.03	0.21	0/0	-0.54	0.79	0.54	0.17	0.02	0.02	0.17	0.54	0/0
c3/c3	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

3. Results

Next, the trial calculations were performed and the results are discussed below.

Since the absolute value of the galaxy movement speed is unknown, I calculated the light velocities in both the System 2 space-time and the System 3 space-time by changing the galaxy movement speed from −0.9 to +0.9 times faster than the light velocity in the System 1 space-time.

There are three requirements as to the physical condition: the light velocity related to the negative pressure based on dark energy is negative, the light velocity is faster than the speed of galaxy, and the rest mass-energy is minimum. In that case, only one combination from 96 possible combinations is left as the most appropriate solution. That is,

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

The results of the trial calculations are given in Table 1 and Table 2 with 96 solution samples

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The System 2 space-time has the negative light velocity; in contrast, the System 1 space-time and the System 3 space-time both have the positive light velocities.

The light velocity in the System 1 space-time has the highest value and the absolute light velocity in the System 2 space-time is greater than that in the System 3 space-time.

As a result, equations for the sole appropriate solution are arranged as follows.

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

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

$$\text{Here, I insert}\quad K=\left(\frac{\varepsilon_1}{\varepsilon_1+\varepsilon_2}\right)^2\frac{(1-\alpha^2)(1-\beta^2)}{(1-\alpha\beta)^2}\qquad L=\left(\frac{\varepsilon_1}{\varepsilon_1+\varepsilon_2+\varepsilon_3}\right)^2\frac{(1-\alpha^2)\,(1-\beta^2)}{(1-\alpha\beta)^2}\qquad A=\frac{c_2}{c_1}$$

ε_1: baryons, 0.049 ε_2: dark energy, 0.683 ε_3: dark matter, 0.268

$\alpha = w_{A1}/c_1,\quad \beta = w_{D1}/c_1$

By changing the speed of galaxy movement *α* and *β* from −0.9 to +0.9 times faster than the light velocity c_1, c_2/c_1 changes from -0.9 to -0.1 times and c_3/c_1 changes from 0 to 0.9 times i.e., $c_1 > |c_2| \geqq c_3$.

4. 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.

Apply the formula of "2.1. The combined velocity and the increasing mass" to the System 4 space-time.

$$w_{A4} = \frac{w_{A3}+c_3}{1+w_{A3}\,c_3/c_4^2}\qquad\qquad w_{D4} = \frac{w_{D3}+c_3}{1+w_{D3}\,c_3/c_4^2}$$

The relative speed w_{AD4} between w_{A4} and w_{D4} is presented as shown below when (w_{D4}) and ($-w_{A4}$) are substituted into the combined velocity.

$$w_{AD4}=\frac{w_{D4}-w_{A4}}{1-w_{A4}w_{D4}/{c_4}^2}$$

$$=\frac{(w_{D1}-w_{A1})\,{c_2}^2\,{c_3}^2\,{c_4}^2\,({c_2}^2-{c_1}^2)({c_3}^2-{c_2}^2)}{\left[\begin{array}{l}{c_4}^2[{c_2}^2({c_3}^2+c_1c_2)+w_{A1}({c_2}^3+c_1{c_3}^2)]\;\;[{c_2}^2({c_3}^2+c_1c_2)+w_{D1}({c_2}^3+c_1{c_3}^2)]\\ \quad-{c_2}^2{c_3}^4(c_1+c_2)^2(w_{A1}+c_2)(w_{D1}+c_2)\end{array}\right]}$$

The rest mass M_0 is common to all four systems and can be described by using the mass of motion m_{D4} at the relative speed w_{AD4}.

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

Substitute w_{AD1}, w_{AD2}, w_{AD3} and w_{AD4} into the equations.

It then becomes necessary to solve the quadratic equation of c_4, where $w_{A1}=\alpha\cdot c_1$、$w_{D1}=\beta\cdot c_1$ and

$$J=\left(\frac{m_{D1}}{m_{D4}}\right)^2\frac{(1-\alpha^2)(1-\beta^2)}{(1-\alpha\beta)^2}=1-\left(\frac{w_{AD4}}{c_4}\right)^2$$

There are four solutions of c_4, which are $\delta_5=\pm1,\ \delta_6=\pm1.$

$$\begin{array}{l}{c_4}^2\ \delta_5\sqrt{1-J}\ [c_1{c_2}^3\ (1+\alpha)+{c_3}^2({c_2}^2+\alpha\,{c_1}^2)]\,[c_1{c_2}^3\ (1+\beta)+{c_3}^2({c_2}^2+\beta\,{c_1}^2)]\\ +c_4(\alpha-\beta)c_1\,{c_2}^2{c_3}^2({c_2}^2-{c_1}^2)({c_3}^2-{c_2}^2)\ -\delta_5\sqrt{1-J}\,{c_2}^2{c_3}^4\,(c_1+c_2)^2\ (\alpha\,c_1+c_2)(\beta c_1+c_2)=0\end{array}$$

Vary α and β from −0.9 to +0.9, respectively as numerical analyses. Set each parameter in the System 4 space-time as follows: baryons ε_1=0.049, dark energy ε_2= 0.683, dark matter ε_3=0.268 and the unknown energy body ε_4 from 0 to 0.1. The light velocities c_1, c_2 and c_3 are adopted according to “2. Results”. The results of numerical analyses show that the sign of c_4/c_1 of any δ_5 and δ_6 transits to ± when α and β vary from −0.9 to +0.9. A trial calculation example is shown in table 4.

This indicates that the characteristics of the System 4 space-time are uncertain and as a result, the System 4 space-time itself and the fourary space-times do not exist.

Table 4 Trial calculation example of the light velocity in the System 4 space-time

(in the case of ε4=0.01,δ5=δ6=１)

β=Wd1/c1	α=Wa1/c1	−0.9	−0.3	0.3	0.9
−0.9	c1/c1	1.000	1.000	1.000	1.000
	c2/c1	−0.900	−0.300	−0.300	−0.894
	c3/c1	0.900	0.011	0.011	0.788
	c4/c1	0.900	0.001	0.000	−0.001
−0.3	c1/c1	1.000	1.000	1.000	1.000
	c2/c1	−0.300	−0.300	−0.284	−0.300
	c3/c1	0.011	0.300	0.252	0.172
	c4/c1	0.011	0.300	−0.038	−0.149
0.3	c1/c1	1.000	1.000	1.000	1.000
	c2/c1	−0.300	−0.284	−0.300	−0.300
	c3/c1	0.011	0.252	0.300	0.173
	c4/c1	0.011	0.252	0.300	0.000
0.9	c1/c1	1.000	1.000	1.000	1.000
	c2/c1	−0.894	−0.300	−0.300	−0.900
	c3/c1	0.788	0.172	0.173	0.900
	c4/c1	0.788	0.172	0.173	0.000

Table 5 Ratio of the relative velocity and the light velocity at the ternary space-times

α=Wa1/c1	−0.9	−0.3	0.3	0.9
Wad1/c1	0.00000	−0.82192	−0.94488	−0.99448
Wad2/c2	0.00000	−0.99927	0.99976	0.99998
Wad3/c3	0.00000	−0.99961	−0.99987	−0.99999
—				
Wad1/c1	0.82192	0.00000	−0.55046	−0.94488
Wad2/c2	0.99927	0.00000	0.99844	0.99976
Wad3/c3	0.99961	0.00000	−0.99916	−0.99987
—				
Wad1/c1	0.94488	0.55046	0.00000	−0.82192
Wad2/c2	−0.99976	−0.99844	0.00000	−0.99927
Wad3/c3	0.99987	0.99916	0.00000	−0.99961
—				
Wad1/c1	0.99448	0.94488	0.82192	0.00000
Wad2/c2	−0.99998	−0.99976	0.99927	0.00000
Wad3/c3	0.99999	0.99987	0.99961	0.00000
—				

5. The cosmic age of dark matter

5.1. The duration time

By the special theory of relativity, when the physical phenomena are observed during time $\Delta t'$ in the rest coordinate, 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 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 $\Delta t_1$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.

5.2. 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 considered to be integrated each Plank time.

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

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

Δt_{31} , Δt_{32} , Δt_{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,

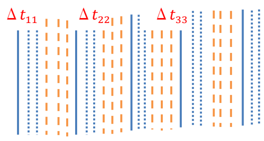
The net duration time of baryons is common in the System 1,2 and 3 space-times, $\Delta t_{11} = \Delta t_{21} = \Delta t_{31}$

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

integrated Plank time



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

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

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

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} $= \varepsilon_1 / \varepsilon_3$

5.3. 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. Chemical reaction rate is in proportion to density (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	$\varepsilon_3 / \varepsilon_1 \cdot (\Delta t_{31} / \Delta t_{33})^3 = (\varepsilon_1 / \varepsilon_3)^2$

5.4. 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.

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

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

$$= (\varepsilon_1 / \varepsilon_3) \cdot (\varepsilon_1 / \varepsilon_3)^2 = \left(\frac{\varepsilon_1}{\varepsilon_3}\right)^3$$

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 age of universe (cosmic age from 0.37 million to about 400 million years) without any lights 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 0.5 million years〔13.8×$(\varepsilon_1 / \varepsilon_2)^3$〕. But electro- magnetic force, photon and gravity radiated from dark energy cannot feel in the System 3 space-time, because the light velocity c_2 is negative in the System 2 space-time where dark energy occurred.

6. Discussion

In summary, I estimated 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.

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 the System 2 is the "illusive world" with a negative light velocity that is ten times faster (c_2/c_3 : $-1.0 \sim -89$) 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 : $1.1 \sim 890$) 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 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 curtain. Substances of dark energy in the System 2 space-time are the same as above. So that, baryons never collide with dark matter.

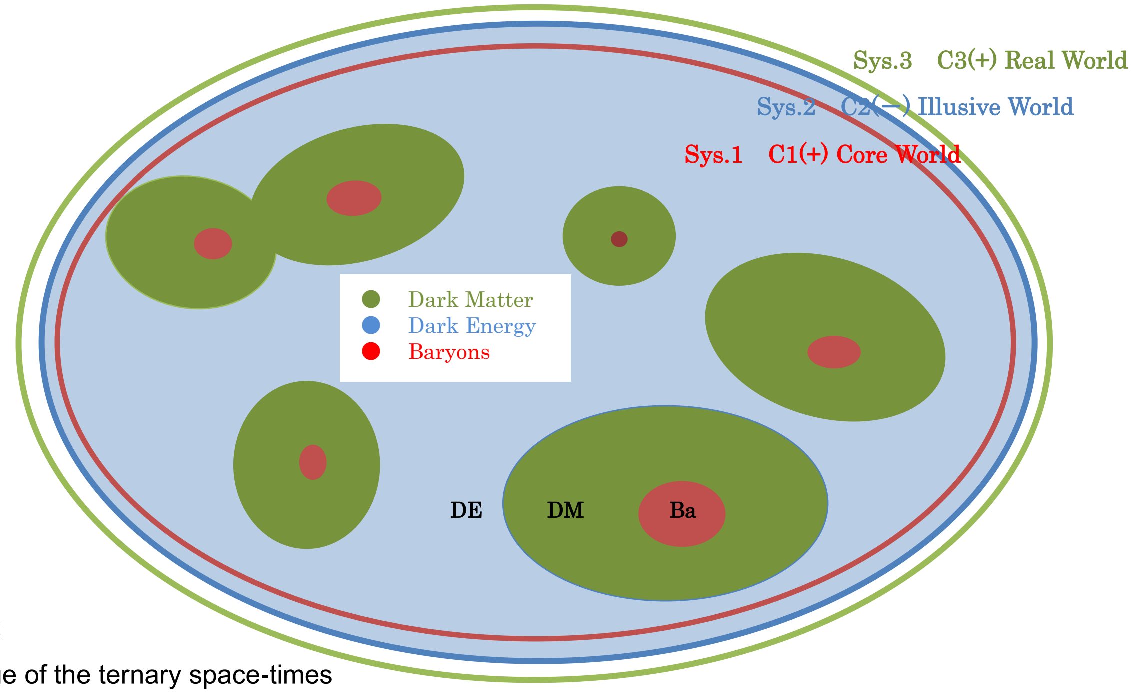
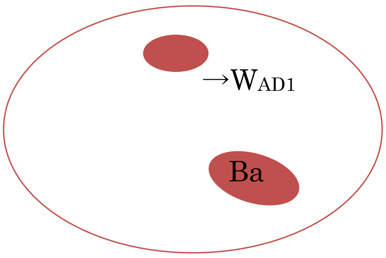
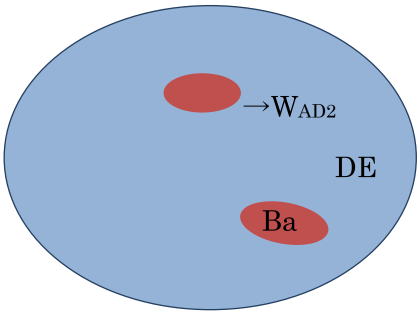
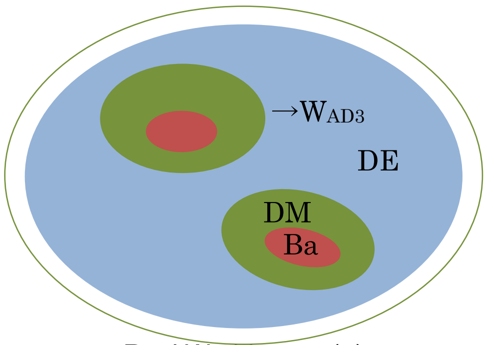


Fig.2

Image of the ternary space-times







Core World C₁(+) — Illusive World C₂(−) — Real World C₃(+)

Fig.2-1 the System 1 space-time　Fig.2-2 the System 2 space-time　Fig.2-3 the System 3 space-time

the light velocity in the system 1 space-time $c_1 > 0$

the light velocity in the system 2 space-time $c_2 < 0$ $\qquad c_1 > |c_2| \geqq c_3$

the light velocity in the system 3 space-time $c_3 > 0$

	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}	—	—	$\varepsilon_3 m$	—	—	$\Delta t_3(\varepsilon_2 T)$

It is difficult to apply the theory of relativity to the very early universe era when the sudden expansion of the universe occurred. However, it is possible to apply the theory of relativity to the era of after early universe.

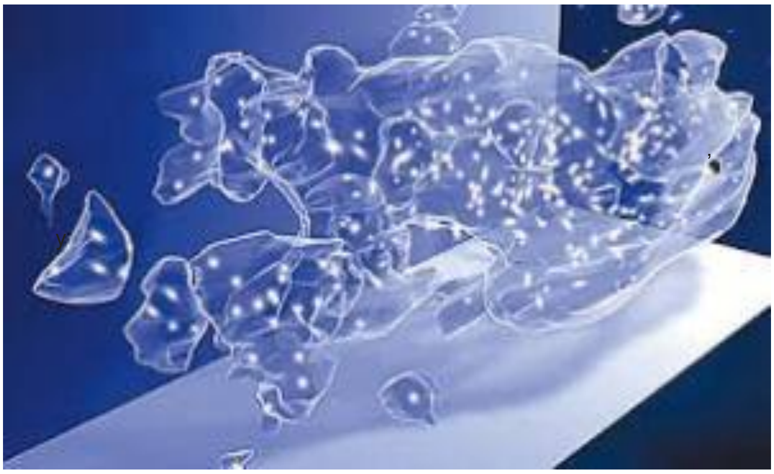
When the universe transited from the System 1 space-time to the System 2 space-time in inflationary epoch of the very early universe, the mass of motion $\varepsilon_2 m$ increased in accordance with the equation $E_2 = m(\varepsilon_1 + \varepsilon_2)\ {c_2}^2 \sqrt{1-(w_{AD2}/\ c_2)^2}$ as an enlarged copy of inflatons $\varepsilon_1 m$. Inflatons composed of elementary particles in the System 1 space-time collapsed into standard model particles (electron, photon, neutrino, proton, neutron, etc.) with the lapse of time. On the other hand, inflatons i.e. elementary particles which occurred in the System 2 and the System 3 space-times developed on their own over time.

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 because dark energy and dark matter are enlarged copies of baryons. These cosmic ages of dark energy and dark matter 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.

The movement speeds of baryons and dark energy are equal since the speed w_{AD2} is common to baryons and dark energy in the System 2 space-time. The same can be said to the System 3 space-time. As a result, it can be concluded that dark matter (halo) is located around baryons (galaxy) as shown in Fig.3.

Even if baryons assemblies with extensive innocent spaces collide each other like Bullet Galaxy (Fig. 4), baryons proper don't clash but pass through the collision space, meanwhile dark matter and dark energy belonging to baryons also don't clash. Each of some baryons or dark matter assemblies might happen to clash and be left behind incidentally, meanwhile others of baryons or dark matter pass through. Those results separate dark matte from baryons.

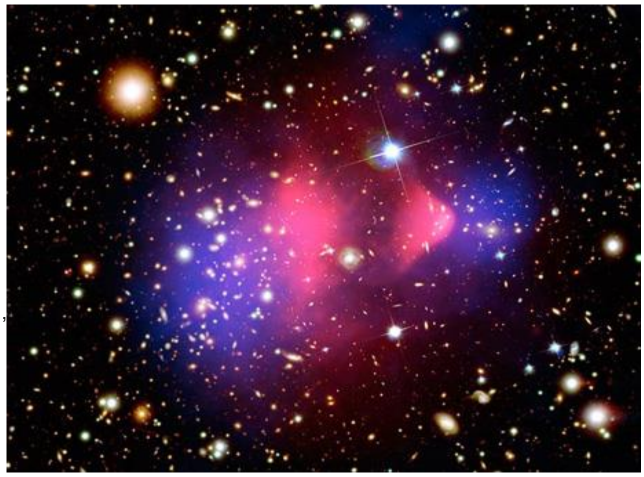
The ternary space-times universe was created in the inflationary epoch during the very early universe. Dark energy was made in the earlier inflationary epoch and dark matter was made in the big bang.



White spots are galaxies and clear jellies are dark matters.

Courtesy of NASA, ESA ,R.Massey

Fig.3 Image of dark matter and the galaxy [5]



Two blue areas are dark matters.

Courtesy of NASA, CXC, CfA

Fig.4 Bullet Galaxy

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Acknowledgements

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

I thank Dr Y.Masaki for editing an original draft of this manuscript.

Author Contributions

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

Competing Interests

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