A new light estimation of Dark Matter, Dark Energy and Ternary Space-Times, based on the special theory of relativity

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Abstract Published studies in the literature have stated that the mass of dark matter and the mass of dark energy are approximately five times and 14 times greater in mass, respectively, than ordinary substances such as atoms. However, the detection and thus proof of the existence of dark matter and dark energy have not been successfully realized to date. I believe that there are some fundamental problems that must be addressed and that universal space-time itself has its own hidden characteristics. In this work, I have estimated universal space-time based on the special theory of relativity i.e. the combined velocity and the increasing mass. Based on this estimate, it can be concluded that "ternary space-times" exist in the universe and that each of these space-times has its own specific light velocity.

Keywords Dark matter, dark energy, ternary space-time, negative light velocity, relativity theory

1. Introduction

In 2013, the European Space Agency calculated 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 of the type that makes up the stars and galaxies (baryons), based on the observations of the Planck satellite [1]. Baryons are the ordinary substances such as the atoms and elementary particles that exist in the real world.

Dark matter is a substance that has the mass and influences gravitation. The existence of dark matter is recognized in terms of the rotation curve of a disk galaxy [2], visible light observations of strong effects using a gravitational lens and X-ray observations of bullet clusters. There have been previous attempts to prove the existence of dark matter using the thesis of unknown elementary particles, modified Newtonian dynamics and other methods.

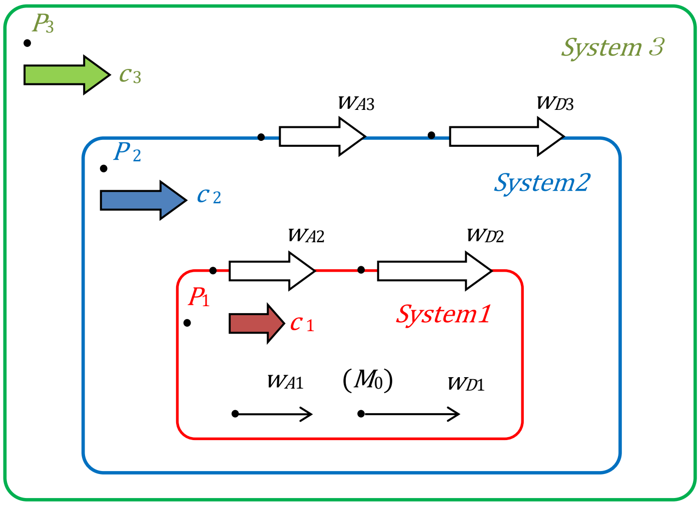
The existence of dark energy is more mysterious than that of dark matter. Baryons and dark matter pull against each other according to the law of universal gravitation. In contrast, dark energy has a repulsive force, i.e., it affects negative pressure and thus accelerates the expansion of the universe. The phenomena with regard to 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 have applied the special theory of relativity, which is the first approximation of the general theory of relativity, to three different space-times (where each of these systems has its own light velocity). Using the formulas for both the combined velocity and the increasing mass from the special theory of relativity, I have calculated and estimated baryons, dark matter and dark energy. On the basis of these results, I then propose the ternary space-times universe as a new light.

2. Methods

2.1. The combined velocity and the increasing mass



First, consider application of the special theory of relativity to three different space-times.

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

A model of space-times that are to be considered is shown in Fig.1. P_1, P_2 and P_3 are the rest frames of 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.

In the case that is considered here, galaxy A is the Milky Way galaxy, while galaxy D is a virtual galaxy that collects all the galaxies in the universe.

Here, c_1, w_{A1} and w_{D1} are the light velocity, the movement speed of galaxy A and the movement speed of galaxy D in the rest frame P_1 in the System 1 space-time, respectively. The parameter sets 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.

Because the combined velocity law is completed in accelerated motion, 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.

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

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.

(2)
$$w_{AD1} = \frac{w_{D2} - w_{A2}}{1 - w_{A2}w_{D2}/{c_2}^2}$$

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

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

The rest mass M_0 is common to all three systems and can be described 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.

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

w_{AD1} , w_{AD2} and w_{AD3} are substituted.

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

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

It then becomes necessary to solve for 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) $$\left(\frac{c_3}{c_1}\right) = \frac{A^2\,\delta_4\sqrt{\begin{array}{l}(A^2-1)^2(\alpha-\beta)^2+2(1-L)(A^2+\alpha)(A^2+\beta)(1+\alpha)(1+\beta)\\ +(A^2-1)(\alpha-\beta)\delta_3\sqrt{(A^2-1)^2(\alpha-\beta)^2+4(1-L)(A^2+\alpha)(A^2+\beta)(1+\alpha)(1+\beta)}\end{array}}}{(A^2+\alpha)(A^2+\beta)\ \sqrt{2(1-L)}}$$

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 ε_1, ε_2 and ε_3 which are used 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 motion of galaxy D when observed at the Milky Way galaxy. Therefore, the corresponding mass densities are ε_1, ε_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 conditions that were adopted to determine the appropriate solution are described as follows.

① 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 the movement speed of galaxy in any space-time

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

Two conditions of the light velocities are applied to 96 combinations, then 6 appropriate solutions appear such as Table1, depending on combinations of $\varepsilon_1, \varepsilon_2$ and ε_3.

③ Furthermore, the principle of energy minimum in the rest mass-energy E is applied 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 in the System 1 space-time,

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

The rest mass-energy in the System 2 space-time,

(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 in the System 3 space-time,

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

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 α=0.3 β=-0.9) — not appropriate

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 of these calculations are discussed below.

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

Then, because the light velocity related to the negative pressure based on dark energy is negative and the light velocity is faster than the speed of galaxy and the rest mass-energy is minimum, only one combination from the 96 possible combinations is left to serve as a most appropriate solution that satisfies the physical condition requirements. 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 sampled for the 96 solutions.

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.

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

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

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

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. $c_1 > |c_2| \geqq c_3$

4. Discussion

In summary, I have estimated ternary space-times, using the formulas for both the combined velocities and the increasing mass which are completed in accelerated motion from the special theory of relativity.

The System 1 space-time has baryons and the positive light velocity c_1. It moves at the light velocity c_1 in the System 2 space-time and produces dark energy by the increasing mass. (See Fig.2)

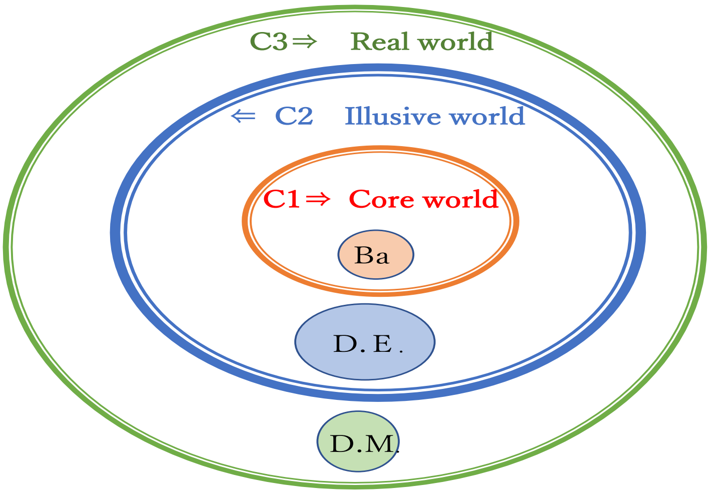


Fig.2 Image of ternary space-times

The System 2 space-time has baryons, dark energy and the negative light velocity c_2. It moves at the light velocity c_2 in the System 3 space-time and produces dark matter by the increasing mass.

The System 3 space-time has baryons, dark energy, dark matter and the positive light velocity c_3.

Dark matter is a product in the System 3 space-time and System 3 is the present "real world" with a positive light velocity (300,000 km/s) in this case.

Dark energy is a product in the System 2 space-time and System 2 is the "illusive world" with a negative light velocity that is ten times degree faster (c_2/c_3 : $-1.0 \sim -89$) than the light velocity in the real world. Because this is a negative light velocity world, it also has negative pressure, i.e., it represents the expansion of the universe itself.

Baryons is a product in the System 1 space-time and System 1 is the "core world" with a positive light velocity that is hundred times degree faster (c_1/c_3 : $1.1 \sim 890$) than the light velocity in the real world.

Dark matter and dark energy are the magics of ternary space-times and generated from baryons of the core world.

It seems that 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 space-time, in which the core world exists, by a space-time curtain.

Substances of dark energy in the System 2 space-time are the same above.

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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.