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DARK MATTER AND DARK ENERGY CAN BE HELD IN THE 3-COSMIC FRAMEWORK THROUGH ORIGINAL STRING THEORY

Hsien-Jung Ho

New idea Research Center

Email: *newidea.ho@gmail.com*

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Abstract: Scientific development has reached a very high level today, but in the natural sciences, research still encounter bottlenecks. The problems posing the greatest headache for scientists lay with dark matter and dark energy. Dark matter of the Universe is a hypothetical form of matter, which puzzles scientists more than 80 years and no solution yet. Most experts think dark matter is abundant in the Universe and has had a strong influence on its structure and evolution. In the observable Universe, there is no indication that the Universe is expanding at an accelerating rate, and cosmologists have hypothesized the existence of some unknown "dark energy" to explain this phenomenon.

In 2018, Plank Satellite detects tiny temperature fluctuations in the radiation of the Universe. These distributions of fluctuation reflect the baryon density of the Universe before galaxies have yet to form. Normal matter from galaxies and stars accounts for only 4.94 % of the Universe's composition, with the rest missing substance, including dark matter, which accounts for 26.64 %, and mysterious dark energy, which accounts for 68.42%, so, the invisible composition of Universe is 95.06 %. Scientists believe that dark energy is the force that tears the Universe apart, but dark matter condenses all things, and that the interaction of these two forces forms the structure of the Universe, as we know it today.

As long as we can understand the assembling speed of the galaxy, we can understand dark matter, also understand the power of dark energy tearing the Universe at the same time. Therefore, dark matter may be the best tool to study dark energy in the end. To understand dark matter now, we will probably get an answer from the most famous "String Theory".

Keywords: Dark matter, Dark Energy, Accelerating expansion, Multiverse

Introduction: The original String Theory is based on nine-dimensional space and one-dimensional time, i.e., a ten-dimensional spacetime, which is considered to universally exist. According to "Causality", an effect cannot occur before its cause, which means time has one direction and cannot be divided into some different parts. So one-dimensional time is taken as a common standard in order of events in the Universe. Following the "Anthropic

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Principle", which is the simple fact that we live in a Universe set up to allow our existence, three-dimensional space and one-dimensional time are taken as one cosmos as our living world. Therefore, the nine-dimensional space can be divided into three portions, and each portion has a common time standard, which means that there is a 3-cosmic framework in the Universe, called the triple cosmoses, i.e., multiverse.

In the triple cosmoses, according to String Theory among any cosmoses, there are no basic interactive forces of nature except gravity, i.e., the graviton in the field of gravity can penetrate all the cosmoses; however, the electromagnetic wave (light) cannot. So dark matter may be situated in the cosmoses other than ours; in other words, the triple cosmoses can contain dark matter. The best method of exploring dark matter is to start from the Earth where we live.

In the current Earth model utilized in seismological investigations, such as body-wave travel times, surface-wave dispersion, and free oscillation periods for researching the chemical composition and the density distribution of the Earth, one can analyze some data of the Earth. We use the Preliminary Reference Earth Model (PREM) as the standard Earth model. According to the characteristics of Earth's interior, equitably examining its constitution, composition, density, and pressure from a different view of the core, the special arguments are put forward.

There are some arguments in the topic of the CMB as in the following: 1. In 1948, Ramsey and in 1973, Lyttleton have challenged the concept of an iron core that the CMB is the boundary of Ramsey's phase-change not silicates and iron core interface. 2. In 1965, Knopoff showed that bulk modulus keeps constant that density distribution should be continuous at the CMB. 3. In 1968, Buchbinder studied the variation in reflection amplitudes of seismic wave and found that show a phase-change at the CMB. 4. In 1987, Morelli and Dziewonski found the topography of CMB more than 10 km that shows the relief is dynamically supported and provides coupling between the solid mantle and the fluid core.

It is inferred that solid rock and molten rock, or the magma change states interactively and the density distribution is continuous at the CMB, therefore, we figure out a new Earth model as figure 1.

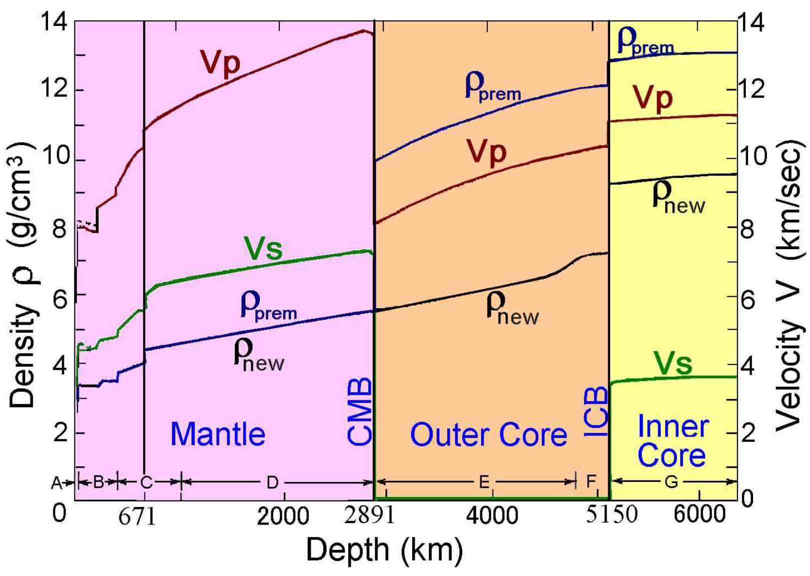

figure 1. Seismic velocity and density in the Earth's interior of PREM and the new earth model.

1. In 1995, Hecht discovered under the frozen wastes of Siberia that platinum has come all the way from the core

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to ground shows a single convection cell. 2. In 2018, Perrin discovered the intact remains of a natural nuclear fission reactor in a uranium mine at Oklo of Gabon and demonstrated from the radioactive elements can generate nuclear energy in the core. 3. In 2023, Horton *et al.* argue that the extremely high-$^3He/^4He$ helium measured in terrestrial igneous rocks, in olivine's from Baffin Island lavas, whose primordial helium may be leaking from Earth's core. 4. In August 2002, Oak Ridge Lab of United States report a new achievement in scientific research that 6371 km below the surface of the Earth's center has a diameter of 8 km, consisting of uranium and plutonium fast breed natural fission reactors, which can generate the fission heat.

From above statements we can figure out in the interior of Earth a great convection cell that the flow of the magma and the solid or molten rock migrating up to the crust and down across the CMB to the lowermost F-layer of the outer core as figure 2. In the low viscosity F-layer of the outer core, the high temperature causes some elements and oxides of magma to undergo oxidation-reduction reactions and separate due to its gravity. The great amount of heat is produced from chemical reactions in the F-layer and radioactive element generated nuclear energy in the Earth's interior which serves as the main power source for the geo-dynamo of the great convection cell [1].

Based on the new conception and applying a simplified method calculates the data of the Earth that the density distribution follows the divisions of PREM divided into 94 levels, including 82 thin shells. The thickness of each shell is not greater than 100 km and so small compared with the Earth's radius of 6371 km that the density is regarded as linear variation within it. Then, a simplified method is applied to calculate the information of the Earth in order to simplify the calculating work. The formula for the mass M of a uniform sphere can be derived through $M = (4/3) \pi \rho R^3$. The mass ΔM of each shell in the Earth's interior can be calculated through

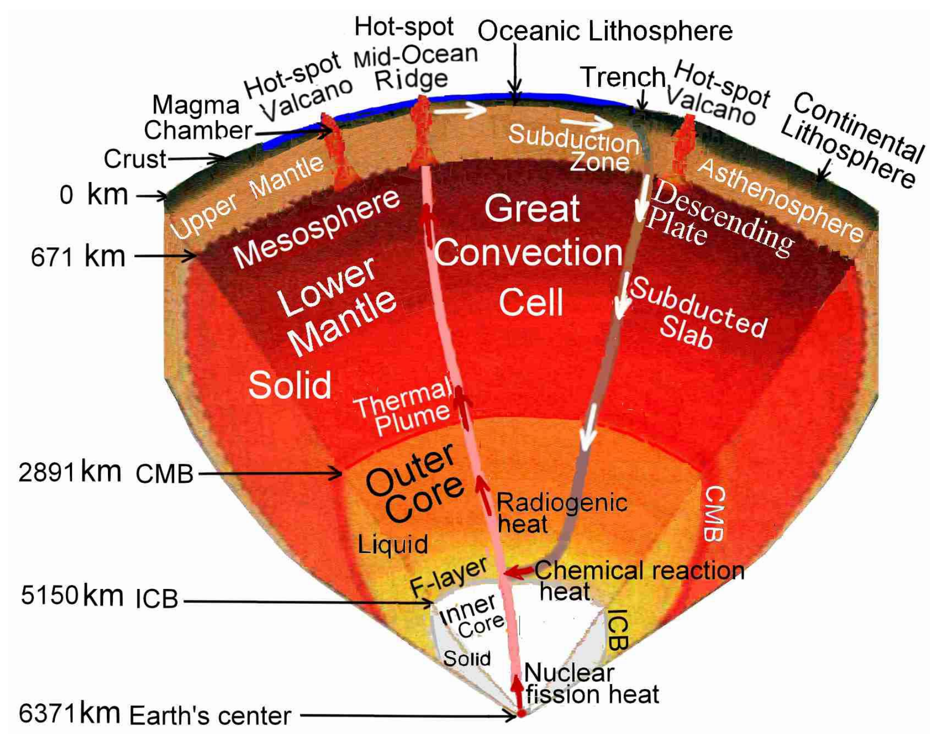

Figure 2. A schematic diagram of a great convection cell and heat flow, and the composition of Earth's interior.

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$\Delta M = (4/3)\pi\rho_t R_t^3 - (4/3)\pi\rho_b R_b^3$ (1)

Where: ρ_t, ρ_b are the densities at the top and the bottom, respectively, of one shell, and R_t, R_b are the radii of the top and the bottom in a shell. Because the difference between R_t and R_b is so small and the density is regarded as linear variation in the shell, the mean value $\bar{\rho}$ of both ρ_t and ρ_b is substituted for ρ_t and ρ_b in order to simplify the calculation. Then equation (1) becomes

$\Delta M = (4/3)\pi\bar{\rho}(R_t^3 - R_b^3)$ (2)

The moment of inertia ΔI of each shell in the Earth's interior can be calculated through

$\Delta I = (8/15)\pi\bar{\rho}(R_t^5 - R_b^5)$ (3)

From fluid mechanics, in a region of uniform composition, which is in a state of hydrostatic stress, the gradient of hydrostatic pressure is expressed by

$dP/dR = -g\rho$ (4)

Where: P, R are the pressure and the radius, respectively, at the region; ρ is the density at that depth; g is the acceleration due to gravity at the same depth. If the effect of the Earth's rotation is negligible, the potential theory shows that g is resulted only from the attraction of the mass M within the sphere of radius R through

$g = GM/R^2$ (5)

Where: G is the gravitational constant ($6.6726\times10^{-11} m^3/kg.s^2$). Equation (5) substitutes into equation (4) and integrate it. In order to simplify the calculation, ρ and M are substituted by $\bar{\rho}$ and $\bar{m}$, which are considered the constants in the thin shell and irrelative to the P and R. The result becomes

$\Delta P = (1/R_b - 1/R_t)G\bar{\rho}\,\bar{m}$ (6)

Where: ΔP is the difference in pressure between the top and the bottom in a layer of the Earth, and $\bar{m}$ is the mass of a sphere as the mean value of the masses of the sphere within the top radius R_t and the bottom radius R_b, respectively, of a shell. Equation (6) cannot be applied to the center of the Earth where is a discontinuous point. To integrate the portion of the center, the other form is applied as R_c

$\Delta P_c = (2/3)\pi G\bar{\rho}^2 R_c^2$ (7)

Where: ΔP_c is the difference in pressure between the radius Rc and the center of the Earth at the center portion. The acceleration due to gravity g of each layer can be derived from equation (5). According to the observation data, the moment of inertia about the polar axis of the earth is $0.3309 M_e R_e^2$ and about an equatorial axis is $0.3298 M_e R_e^2$. The earth is regarded as a sphere, of which the moment of inertia is determined to be 80286.4×10^{40} $g.cm^2$ by taking the mean value of both figures, where Me is the earth's mass of 5974.2×10^{24} g and Re is the equatorial radius of 6378.14 km.

To examine the accuracy of applied equations, we apply the density distribution of the PREM to calculate the Earth's mass, moment of inertia, pressure and acceleration due to gravity. The calculated values of the earth's data

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using simplified method from the density distribution of the PREM as compared with the values of the current data in Table 1 (http://newidea.org.tw/pdf/S60.pdf). The calculated data of the PREM are listed in compared with that of the current data and the PREM are listed and Table 2.

Table 2. The calculated values of simple method from the density distribution of the Earth as compared with the data and the PREM and the current Earth.

Data of the Earth	Mass	Moment of inertia	Pressure at CMB	Pressure at Earth center	Gravity at CMB	Gravity at Earth surface
Unit	10^{24} g	10^{40}g.cm^2	K bar	K bar	cm/sec^2	cm/sec^2
PREM & Current	5974.200	80286.400	1357.509	3638.524	1068.230	981.560
Calculated values	5973.289	80205.664	1358.335	3655.973	1068.680	981.959
Difference %	-0.0152	-0.1006	+0.0608	+0.4796	+0.0421	+0.0406

From Table 2 the deviations of the calculated Earth's values from the data of the PREM and the current Earth are nearly within 0.1**%**, except the pressure at the Earth center. It indicates that the calculated values are very close to the current data and the simplified method is acceptable and useful; however, the calculated pressure of 3655.973 kbar at the Earth's center is higher than the data of the PREM of 3638.524 kbar by 0.4796 %, about 8 times of deviation at the CMB. We compare all the calculated pressures of the simplified method with that of the PREM by the curve of deviation E in the pressure P of the PREM in Figure 3.

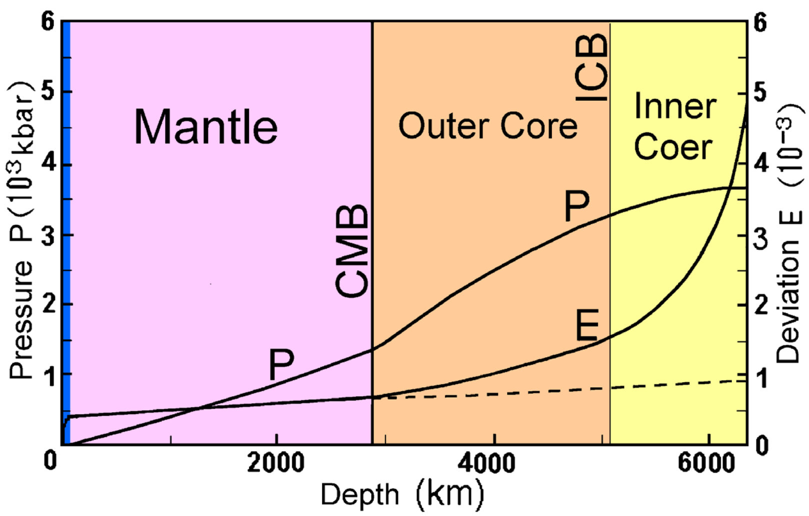

Figure 3: The pressure P of the PREM and the deviation E of the calculated pressure of simplified method from the value of P.

The deviations E of Pressure curve from the crust to the CMB is showed nearly as a straight line, indicating that the calculated pressures have the systematic errors in view of the error theory. But from the CMB to the Earth's center, the slope of curve E sharply increases above the dashed line, which is the straight line extended from the CMB. It indicates that there is a considerable discrepancy within the core. We may suppose that the structure of the core in the PREM, which greatly affects its core pressure, is something wrong.

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The insufficiencies of the Earth's mass and moment of inertia, called the missing mass and moment of inertia, both are relative to the gravity that belong to the dark matter in astrophysics. It can only be obtained by comparing the observed data of the Earth but cannot be detected directly and answered clearly through the ordinary Earth sciences. In order to solve the problems of the insufficiencies, a new study of the Earth is attempted by utilizing the contemporary physics. If we can successfully explain that the insufficiencies exist in a suitable condition, a new Earth model will be established.

Proceeding with the assumption, the missing mass and moment of inertia of the Earth are taken as the cold dark matter, which may constitute a normal planet. In order to find some solution in this article, the dark matter is compared to Mars. The average radius of Mars is 3397 km, and the mass 642.40×10^{24} g. In 1989, Kaula *et al* studied the moment of inertia of Mars and got the maximum allowable mean value is 0.3650 MR^2, i.e., 2689.8×10^{40} $g.cm^2$. The insufficient data of new Earth models roughly approach to the Mars', so the dark matter is considered as a planet, called a dark planet, of which the form is similar to Mars and its characteristics are based on the inner planets of the solar system. In order to cut a figure of the dark planet, it is considered as a sphere, whose radius and density can be calculated from the insufficiencies of the Earth's mass and moment of inertia through the simplified method. The data of the dark planet can be calculated as following.

Considering the density of rock on the surface of the Earth and the Moon, the surface density 2.70 $g/cm^3$of the dark planet is proposed. Under the condition that the density of a layer is proportional to its depth, a trial value of density at the center of the dark planet is selected and applying the equations (2) and (3) to calculate the mass and the moment of inertia of each shell, the total mass and moment of inertia of it should be gotten. Because the radius and the center density of the dark planet are the hypothetical values, but the total mass and moment of inertia are necessary to correspond to the insufficiencies of the Earth's; therefore, it is necessary to use a trial-and-error approach to determine the proper radius and the center density. Since the Earth's orbit around the Sun may be affected by the gravity of the dark planet, but no abnormal effect on the Earth has been observed. An assumption is suggested that the gravity centers of the Earth and the dark planet coincide with each other at the same point. It is inferred from the phenomenon in which the same side of the Moon always faces the Earth that means the Earth and the dark planet may rotate synchronously.

Assuming that the gravity centers of the Earth and the dark planet coincide at a single point, and both rotate synchronously, the total values of mass and moment of inertia may be obtained from the sum of them. Based on mechanics, the gravity at each shell inside the Earth is affected by the mass of the Earth and the dark planet within its radius. The pressure difference $\Delta P'$ between the top and the bottom of a shell within the Earth is calculated through:

$$\Delta P' = (1/R_b - 1/R_t) G \overline{M}' \overline{\rho} \qquad (8)$$

Where: $\overline{M}'$ is the mean value of the total mass of the Earth and the dark planet within the radius R_t and R_b. Equation (8) cannot be applied to the Earth's center. The average density $\overline{\rho}'$ of the central portion combined

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with the Earth and the dark planet within the radius Rc can be calculated through

$$\bar{\rho}' = (Mc + Md) / [(4/3)\pi Rc^3] \quad (9)$$

Where: Mc and Md are the masses of central portion in the Earth and in the dark planet, respectively. The difference of pressure $\Delta P_c'$ between the top and the center of the central portion in the Earth can be obtained through

$$\Delta P_c' = (2/3)\pi G \bar{\rho} \bar{\rho}' Rc^2 \quad (10)$$

Based on the characteristics of the inner planets of the solar system except Mercury, the bigger the radius of a planet, the higher the average density is, so the radius and the average density of a suitable dark planet must be compatible with the characteristics of inner planet in solar system. The data of the new Earth models and dark planet are compared with the data of the current Earth and the PREM in the Table 3.

Table 3. The calculated data of the new earth models compared with the data of the current earth and the PREM.

Kind of Earth's model	The Earth planet							The dark planet					Suitability
	Radius	Average density	Mass	Moment of inertia	Center density	Center pressure	Moment of inertia	Radius	Average density	Mass	Moment of inertia	Moment of inertia	
Unit	km	g/cm^3	$10^{24}g$	10^{40} $g.cm^2$	g/cm^3	kbar	C	km	g/cm^3	$10^{24}g$	10^{40} $g.cm^2$	C	
PREM	6371	5.5150	5974.200	80286.400	13.08848	3638.524	0.3309						
New Model	6371	4.7284	5121.820	76126.841	9.49821	2805.297	0.3662	3700.375	4.0161	852.380	4159.559	0.3564	good

The precise data of the Earth and the dark planet are calculated from the density distribution of the new Earth model, the data of the Earth planet is listed in Tables 4 (http://newidea.org.tw/pdf/S91.pdf), the dark planet is listed in Table 5 (http://newidea.org.tw/pdf/S92.pdf) and the global data of the new Earth model in Table 6 (http://newidea.org.tw/pdf/S93.pdf).

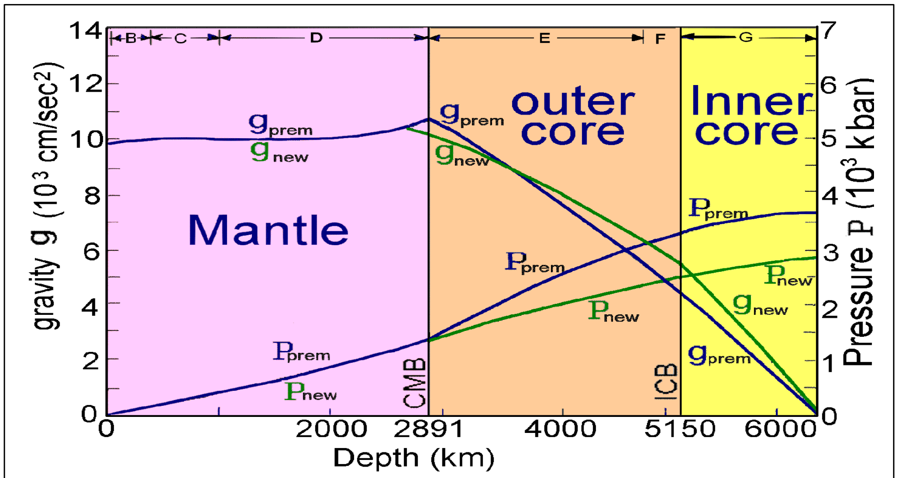

Figure 4. The Diagram of the gravity g and the pressure P compares between the new Earth model and the PREM.

The pressure P and the acceleration due to gravity g of the new Earth model

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compared with the PREM are shown in Figure 4. In this suitable model the slope of density curve from a depth of about 400 km of the upper mantle through zones C, D and E to the upper boundary of F-layer is nearly a straight line, which means the density increase in proportion to its depth in accord with general physical phenomenon, so the new Earth model is acceptable as the proper new one.

The average radius of Mars is 3397 km, the mass 642.40×10^{24} g, and the average density 3.912 g/cm^3. Both values of the radius and the average density of the dark planet in the new Earth model are bigger than those of Mars, therefore, this model is found to be the more suitable one.

We can find the pressure curve of the new Earth model is smoother than that of the PREM below the CMB. In the gravity curve of the new Earth model, there are two deflection points in the curve that the one is at 2670.625 km in depth at the radius of the dark planet, and the other is at the inner Core Boundary (ICB). The Earth has a mass of 5121.820×10^{24}g, a moment of inertia of 76126.841×10^{40} g.cm^2, an average density of 4.7284 g/cm^3. The Earth's center has a density of 9.49821 g/cm^{3}and the pressure of 2805.297 kbar. The reduced values of the Earth's data from those of the current Earth are due to the existence of the dark planet. The dark planet has a radius of 3700.375 km, a moment of inertia of 4159.559×10^{40}g.cm^2, an average density of 4.0161 g/cm^{3}and a mass of 852.380×10^{24}g about 1.33 times of Mars. The data of the new Earth model compared with those of the current Earth and the PREM are listed in Table 7.

Table 7. The data of the new earth model compared with the data of the current Earth and the PREM.

Data of planet	Radius	Mass	Inertia of moment	Average density	Center density	Center pressure	Coef-ficient
Unit	km	10^{24}g	10^{40} g.cm^2	g/cm^3	g/cm^3	kbar	C
PREM & Current Earth	6371.000	5974.200	80286.400	5.515	13.08848	3638.524	0.3309
Earth planet	6371.000	5121.820	76126.841	4.7284	9.49821	2805.297	0.3662
Dark planet	3700.375	852.380	4159.559	4.0161	7.96097	1115.272	0.3564

We apply the different density distribution curves of the model in the core to calculate the data of Earth and then compare it with the existing current data of Earth. The insufficient mass and moment of inertia are the missing matter which are taken as the parts of dark matter, and then a suitable new Earth model is developed. Apply the simplified method to evaluate the Earth's mass and moment of inertia, which are found to be only 85.73% and 94.82% respectively of the current data. By the two insufficiencies of Earth's mass and moment of inertia, formulating the reasonable assumptions, a dark planet inside the earth has been figured out, then calculate gravity and pressure in every depth within the Earth to check suitability or not. Finally, a planet of dark matter, called dark planet, with a radius of 3700.375 km, about 1.33 times of Mars, is reasonably inside the Earth in the extra dimensions of space other than ours.

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It is hard to examine the existence of the dark matter directly; however, that can be recognized from Chandler wobble. Referring to the orientation of the rotation axis of the Earth in space in addition to both precession and nutation, there is a wobble on the instantaneous axis of rotation of the Earth itself. The wobble alters the position of a point on the Earth relative to the pole of rotation. In 1891, Chandler pointed out that there are two distinct kinds of the wobble periods. One is a period of 12 months, and the other is a period of 433 days, about 14 months. The former, called annual wobble, is obviously affected by the seasonal climate. The latter, called Chandler wobble, has not been solved the problem for more than one hundred years. The Chandler wobble is a small deviation that amounts to change of about nine meters at the point in the surface of the rotation axis of the Earth. It is inferred from the phenomenon in which the same side of the Moon always faces the Earth that means the Moon and the Earth rotate synchronously. The same phenomenon will happen to the Earth and the dark planet that both rotate synchronously, but the rotation axes of both are impossible coinciding with each other; i.e., an angle between the two rotation axes produces the Chandler wobble as the precession and nutation because of the Sun and the Moon on non-parallel rotation axes with the Earth's. Therefore, the effect of Chandler wobble may confirm the existence of a dark planet inside the Earth but in the other cosmos than ours[2].

To research dark energy, we apply the eight data of cosmological parameters of Wilkinson Microwave Anisotropy Probe (WMAP) results and Planck Satellite results from 2003 to 2018 for 15 years, to form the Table 8 of cosmological parameters from them.

Table 8. The cosmological parameters from WMAP and Planck Satellite

Source / Symbol	WMAP 1st year.	WMAP 3rd year	WMAP 5th year	WMAP 7th year	WMAP 9th year	Planck Satellite 2013	Planck Satellite 2015	Planck Satellite 2018
$\boldsymbol{H_0}$	71.0	70.4	70.5	70.2	70.0	68.14	67.31	67.32
$\boldsymbol{\Omega_\Lambda}$	73.0%	73.2%	72.6%	72.5%	72.1%	69.64%	68.5%	68.42%
$\boldsymbol{\Omega_m}$	27.0%	26.8%	27.3%	27.44%	27.9%	30.36%	31.5%	31.58
$\boldsymbol{\Omega_b}$	4.4 %	4.41%	4.56%	4.58%	4.63%	4.79%	4.9%	4.94%
$\boldsymbol{\Omega_c}$	22.34%	22.39%	22.8%	22.9%	23.3%	25.43%	26.42%	26.64%
$\boldsymbol{t_0}$	13.7Gyr	13.73 Gyr	13.72 Gyr	13.76 Gyr	13.74 Gyr	13.784 Gyr	13.80 Gyr	13.80 Gyr

From the table, the dark energy density Ω_Λ from 1-year WMAP results to Planck 2018 results VI for 15 years, the value from 73.22% decreases gradually down to 68.42%, decreasing 4.8%, but the total matter density Ω_m from 1-year WMAP results to Planck 2018 results VI, the value from 26.78% increases gradually up to 31.58%,

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increasing 4.8%. The dark energy loss is equal to the increase of total matter that is consistent with "The Big Bang Theory".

The cosmological parameters of Planck 2018 results VI are taken as the current situation of the Universe, we may imagine that at the firstly time of the Big Bang, the full energy (100% energy density) of the Universe gradually loses, after 13.8 billion years later, remains 68.42% energy density, which is called dark energy density Ω_Λ, and creates 31.58% total matter density Ω_m, so, we should take the current dark energy as the residual energy of the Universe after the Big Bang. Due to the current composition of the Universe, dark energy accounts for 68.42%, which is much larger than the 31.58% of matter. It can be seen that the Universe is still expanding rapidly.

After the Big Bang, 68.42% dark energy density Ω_Λ is remainder today, but the lost 31.58% dark energy density transforms into total matter density Ω_m, which contains 4.94 % baryon density Ω_b (normal matter) in our cosmos and 26.64 % cold dark matter density Ω_c in other cosmoses than ours. According to the table 8, Ω_c from the value 22.34% increases gradually up to 26.64%, increasing 4.3%, and Ω_b in our cosmos from the value 4.44% increases gradually up to 4.94%, only increasing 0.54%, and the ratio of both is 8:1. Because matter transforms from energy after Big Bang, the baryon density Ω_b increasing value is very small, which indicates energy in our cosmos is so poor that we can label our cosmos as the low-energy-density. On the contrary, the matter in other cosmoses, i.e., the dark matter for our world, has an increase value of 8 times, indicating that dark matter density Ω_c in the other cosmoses has increased greatly, so we can label the other cosmoses as the high-energy-density cosmoses. After WMAP and Planck Satellite detected, the current actual temperature of cosmic microwave background radiation (CMBR) is only 2.725 °K, which is awfully close to the absolute zero (0°K = −273.15°C), therefore, our cosmos of low-energy-density cannot contribute to expand at an accelerating expansion.

Under the 3-cosmic framework of the Universe, the rate of expansion in the high-energy-density cosmoses will be much higher than that of a low-energy-density cosmos as ours. The cosmoses of high- energy-density cannot directly contribute to the expansion of our low-energy-density cosmos, but when the high-energy-density cosmoses rapidly expand, their matter (i.e., dark matter) will expand at high pace that will use gravitational force to drag on the stars of our cosmos away at the same pace. Due to gravity, the dragging effect causes the effect of pulling the stars of our cosmos accelerating expansion [3].

Based on the applications of ten-dimensional space-time of String theory, a 3-cosmic framework of the Universe is developed that the problems of dark matter and dark energy in astrophysics may be solved as above [4], but still needs to be proved by the fine outcomes of physicists' new research.

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