

# “Dark Energy” May Not Exist -- Is the Rest Mass Immutable? -- “Empty Voids”

**Zhong Guan**

Jiangxi Provincial Water Conservancy Planning Design and Research Institute,  
Nanchang, 330029, China  
Email: 908844275@qq.com

**Abstract.** "God particle" is the source of the mass of substance, and due to its uneven distribution in space, when the extragalactic galaxies move backwards to the edge of the universe, the same in different position of interstellar galaxy will have different inertial mass, then because of the momentum conservation principle there must be the accelerated motion, and no need to assume the repulsive forces (called dark energy) between the galaxies. The related astronomical phenomena of dark matter (the mechanical mass greater than photometric mass) can also be explained by the uneven distribution of "god particles" in the universe. Exploring the details of the distribution of "god particles" in cosmic space, and whether the existence of a local region of space that does not contain "god particles"---called "Empty Void" ,and its conditions for formation, may be one of the most cutting-edge questions in future physics.

**Keywords:** Dark Energy, Dark Matter, God Particles, Uneven Distribution, Momentum conservation principle, Empty Voids

## 1. Introduction

It took humans more than half a century and billions of dollars to make a leap in our understanding of the physical world: it turns out that the inertial mass of matter is derived from the "God Particles" in the surrounding space, overturning the traditional idea of the past. Then, so what happens if the theoretical concept of the "God Particles" applies to the entire universe? How to use this new concept to explain the astronomical phenomena associated with "dark matter and dark energy"? Is the inertial mass of the same substance at any point in cosmic space constant? How is the "God Particles" distributed in astrospace? These are the questions that need to be answered next.

## 2. What's Inertial Mass---Definition of Inertial Mass

### 2.1. According to Newton's Second Law

The force  $F$  acting on a body (or particle), is proportional to the acceleration  $a$  of the body (or particle) [1]:

$$F = ma \quad (1)$$

the coefficient of proportionality  $m = F/a$  above is called the inertial mass of the object (or particle); in Newtonian mechanics, the inertial mass is a fixed constant.



## 2.2. According to Special Relativity

The inertial mass  $m$  of an object (or particle), which increases with the speed  $v$  of motion, is a variable; at some point  $t$ , the external force  $F$  acting on the object(or particle) is equal to the rate of change of momentum of the object(or particle) at that time [1]:

$$F = d(mv) / dt \quad (2)$$

the relationship between the inertial mass  $m$  and the velocity  $v$  above is as follows :

$$m = m_0 / \sqrt{1 - v^2 / c^2} \quad (3)$$

in the equation,  $m_0$ = the rest mass, is consistent with the inertial mass defined by Newton's law, which is also equivalent to the mass measured by the balance scale.

Above, inertial mass, as defined by Newtonian mechanics and special relativity, tends to be the same when it is moving much slower than the speed of light.

In addition, according to formula (3), although the inertia mass  $m$  changes with the speed  $v$  of motion, but its lower limit is the rest mass  $m_0$ , and the inertia mass is no smaller than the rest mass. In relativistic mechanics, the rest mass of an object (or particle) is an immutable constant.

## 2.3. According to General Relativity

Inertial Mass is Equivalent to Gravitational Mass [1]. In Newtonian mechanics, it is tacitly approved that the above two masses are equal, from which: the equation of rotational motion of the star (or interstellar matter) around the center of gravity can be calculated, in addition, the observed motion data can also be used to inversely compute the mass of material to verify whether there existed the dark matter with unknown mass in interstellar space, etc.

## 3. The Source of Inertial Mass

At the beginning of this century, the most important achievement in physics attributed to the discovery and confirmation of the existence of the so-called God Particle. This discovery and confirmation had overturned the traditional concept of inertial mass: which was previously believed to be an inherent fundamental property of matter itself and to be not assigned to it by the outside of matter. The new theory, however, holds that the "Higgs Boson", or called "God Particle", is the source of matter's inertial mass [2-4]. Its central idea is that space is not empty, but permeated with a kind of "Higgs Field", whose ripples take the form of new particles (the "God Particles"), and when particles of matter travel through space, they interact with the "God Particles" and get "stickiness", there the resistance acting on them are just the inertial force (Note: at low speed situation, according to Newtonian mechanics, inertial force  $F' = -ma$ ), then obtained the mass of them. That is, the inertial mass of the particle of matter is given from the outside by the "God Particles" distributed around it, and .not inherent in itself.

On July 31, 2012, two particle detector teams, at CERN's ATLAS [5] and CMS [6], announced the existence of the Higgs boson (the God Particle) in separate papers. The discovery was confirmed by Fermi National Accelerator Laboratory, USA, on February 4, 2013.

If this statement is correct, one will see: that for the same object in the space environment, if there distributed densities of the "God Particles" are equal everywhere, the inertial mass of the object will be the same everywhere, if the "God Particles" in space becomes more dense, the object's inertial mass will also increase; if the "God Particles" in space becomes thinner, the object's inertial mass will also decrease; if the distribution density of the "God Particles" decreases to zero, the object's inertial mass will also decrease to zero (Note: The above refers to the low speed situation); however during that time, the various particles or the number of atoms of various elements contained in the object did not change.

This result does not violate the "Law of Conservation of Mass and Energy", because the "God Particle" is itself an energy quantum, and their quantities are also conserved, unchanged by the passage of matter through it.

In addition, the concept of "God Particle" can also be combined with Special Relativity. In high-speed environment, according to formula (3):

The resistance of an object traveling through a swarm of "God Particles" is nonlinear, depending not only on the distribution density of "God Particles", but also on its velocity of movement, and when the movement speed approaches the speed  $c$  of light, the resistance (or inertial mass) tends to infinity  $\infty$ .

Since the "God Particle" is the source of matter's inertial mass, what about "dark matter" and "dark energy" in this view?

#### 4. How to Explain "Dark Energy" and "Dark Matter"

Theories of dark energy and dark matter stem from explanations for astronomical phenomena.

##### 4.1. The Dark Energy

According to observations of Hubble telescope, distant galaxies are moving away from us (the Earth or the Sun) in an accelerated manner. The radial velocity  $v_R$  of their backward movement is proportional to the distance  $R$  away from us. The proportional coefficient  $H_0$  is called the Hubble coefficient, and the relationship is as follows:

$$v_R = H_0 R \quad (4)$$

In the formula  $H_0 = 72 \pm 8 \text{ km}/(\text{s} \cdot \text{Mpc})$  (data in 2003), all directions are the same,  $v_R =$  backward speed ( $\text{km}/\text{s}$ ),  $R =$  distance ( $\text{s} \cdot \text{Mpc}$ ),  $1 \text{ Mpc} = 3.26163 \times 10^6$  (light year); this is "Hubble's Law" in astronomy [7].

What explains Hubble's Law? Why is the motion of galaxies leaving us an accelerated motion? The current physical explanation is: that there are repulsive forces between galaxies, known as dark energy [7], which is greater than gravity and causes galaxies moving backward away into accelerated motion; the dark energy in cosmic space, if converted into mass according to  $E = mc^2$ , would have to be 18 times the mass of ordinary matter to be able explaining the question (Note: Physicists now reckon [7] that dark energy accounts for 73 percent of the total mass of the visible universe, dark matter for 23 percent, and ordinary matter (including black holes) for only 4 percent).

But we can also change the mode of thinking about it, as follows: there is no need to assume the existence of the repulsive forces, in addition to gravitational forces, between galaxies, and need only to consider the "God Particles" unevenly distributed along the motion path of galaxy, and the inertial mass of the galaxy also changed with it along the path.

Hubble Space Telescope observations across the whole sky show [7] that: the spatial distribution of fixed stars with magnitude above 25 and galaxies, within a distance of  $1000 \text{ Mpc}$  or 3.2 billion light years, is fairly uniform. This indicates that the distribution of matter in large-scale space is fairly uniform (Note: According to current data, there are about  $10^{11}$  galaxies [8] in the visible universe, and our Milk Way galaxy is just one of them). So the external forces acting on a particular galaxy should be isotropic, that the external forces should be (or are basically) a set of equilibrium forces, in this case, the net force of the external forces should be:  $F \approx 0$ , Please note: what do these external forces contain (?), in addition to the universal gravitation, whether there are mutually repulsive forces, we do not make any assumptions, and then substitute into formula (2) :

$$F = d(mv)/dt = 0 \quad (5)$$

Add the initial conditions:  $R_1 =$  at the initial position of the observed galaxy, the distance from us;  $m_{R_1} =$  the inertial mass of the galaxy at its initial position;  $v_{R_1} =$  the galaxy's backward speed at its initial position; all as known numbers. By integrating the above equation, it is easy to get:

$$m_R v_R = m_{R_1} v_{R_1}, \text{ or } v_R = m_{R_1} v_{R_1} / m_R \quad (6)$$

where  $m_R, v_R =$  the inertial mass and backward speed of the galaxy as it recedes to distance  $R$ . That's just the principle of momentum conservation, but the difference is that the mass of inertia is a variable quantity; and let's see how does it change?

By substituting Hubble's Law (formula (4) into the above equation), we can get:

$$m_R = m_{R_1} v_{R_1} / v_R = m_{R_1} R_1 / R, (R \geq R_1) \quad (7)$$

According to the above equation, the inertial mass  $m_R$  is inversely proportional to the distance  $R$ , and the larger  $R$  is, the smaller  $m_R$  is; indicating that the galaxy is constantly reducing and losing its inertial mass in the backward movement, due to the Momentum Conservation Principle (Formula (6)), its backward speed  $v_R$  will also be faster and faster accordingly; this causes the extragalactic galaxies' movement retreat away from us an accelerated motion, rather than to resort to the repulsive forces between galaxies.

Since the inertial mass of matter is given by the "God Particles", we should continue to investigate how the "God Particles" are distributed along the path of moving backwards of galaxy(?), to explain why do galaxies have less and less inertial mass along the way(?).

In order to extend the application of formula (3) of Special Relativity, from the space of near earth (or inner solar system) to the whole universe, the formula is rewritten: as follows:

$$m_R = m_{R_0} / \sqrt{1 - v_R^2 / c^2} \quad (8)$$

Where,  $m_R =$  the inertia mass at distance  $R$ ,  $m_{R_0} =$  the static inertia mass at distance  $R$ , and the above  $R$  refers to the distance from the solar system; the other symbols are the same as before.  $m_{R_0}$  only depends on the density of the "God Particles" distributed in the environment; therefore, from the changes of  $m_{R_0}$  along the path of moving backwards of the galaxy, the distributed situation of "God Particles" can be inferred on the same path. By comparing the two formulas (7) and (8), we can get:

$$m_{R_0} = \sqrt{1 - v_R^2 / c^2} \cdot m_{R_1} R_1 / R \quad (9)$$

From the above equation, when the observed galaxy is at the initial position  $R = R_1$ , assuming that the initial backward speed  $v_R (= v_{R_1})$  is much lower than the speed  $c$  of light, it can be obtained  $m_{R_0} \approx m_{R_1}$ , and that is, the  $m_{R_0}$  (or the distribution density of "God Particles") is at the maximum; thereafter, along the path of moving backwards (the direction of increasing  $R$ ), the  $m_{R_0}$  will gradually become smaller; when reach the exit boundary of the visible universe:  $R = 41625 Mpc$  (i.e. 13.6 billion light years), the backward speed arrived at  $v_R = H_0 R = c$  (the speed of light), and because  $\sqrt{1 - v_R^2 / c^2} = 0$ , substitute into formula (9):  $m_{R_0} = 0$ , this means that near the boundary of the visible universe, the distribution density of the "God Particles" decays to zero and no longer existed.

In conclusion, Hubble's Law means: that the distribution density of the "God Particles" around the observed galaxy, from its starting position (to be the maximum) decreases gradually along its path of moving backwards, and attenuates to zero when arrived at the exit boundary of the visible universe; as a result, the galaxy's inertial mass is also reduced from its initial value (the maximum value), as it

moves backwards, and its “static inertial mass” drops to zero when reaching the edge of the visible universe; according to the “Momentum Conservation Principle”, the backward speed of the galaxy will gradually increase from its initial position (minimum), to the exit edge of the visible universe arrived at the speed of light  $c$ .

From the above, if the dark energy refers to the mutually repulsive forces between galaxies, then it may not be existed, because the astronomical phenomenon can be explained by the uneven distribution of "God Particles" in space.

Note that in the above derivation, a galaxy "flies" from its original position to the exit of the visible universe, with its chemical mass (that is, the number of the various matter particles it contains) remaining the same, while its inertial mass continually to decline, and its “static inertial mass” decreasing to zero at its exit position.

#### 4.2. The Dark Matter

In 1933 Fritz Zwicky, a Swiss astronomer, observed and studied [9] the "Coma Cluster of Galaxies", which consists of more than 3,000 galaxies and 320 million light-years from Earth, and found that the rotational velocity of galaxies moving around the centre of the cluster much faster than the results calculated from "photometric mass", by Newton's Laws; and then reversely calculated the “mechanical mass” by using observed data of motion velocities, found that the “mechanical mass” was about 400 times higher than the “photometric mass”. He speculated there must existed a large amount of invisible, non-luminous matter in the "mechanical mass", which had provided the gravitational contribution to hold back these galaxies from flying out of current orbits, and first named the invisible matter "dark matter".

By the 1960s, American astronomer Vera Rubin, in collaboration with Kent Ford, made observations of the Andromeda Nebula [10], which was also a spiral galaxy adjacent to our own Milky Way Galaxy; by using Ford's sophisticated spectrograph, the observation points could be pushed far away from the galaxy's center, and she found that at the farthest edge of the whirlpool, the rotational velocities of matter around the galaxy's center were much faster than the prediction of the Law of Gravitation; on the resulting "rotation curve of galaxy" (the rotational velocity at different distances from the center), the rotational velocity was almost constant everywhere, from the highest velocity point not far from the vortex's center to the farthest edge of the vortex, bringing the rotation curve close to the horizon. In the 1970s, with more sophisticated spectrometers, she made observations of eight spiral galaxies in the vicinity of the Milky Way, producing similar galaxy rotation curves. She speculates that these spiral galaxies should contain at least six times more dark matter than the luminous material to explain their rotation curves.

But so far, what astronomers call evidence for dark matter is only evidence for the existence of "dark mass", and no new matter (new particles or mediators) has been found to make up these "dark masses".

The detection results of Fritz Zwicky and Vera Rubin, was a milestone of significance in the long history of human understanding of matter mass. The two scientists' definition of dark matter can be expressed as follows:

measured mass (also known as mechanical mass) - "photometric" mass = mass of dark matter.

It is an indisputable fact that there is a large amount of "dark mass" (refers to: the difference value that the measured mass or mechanical mass bigger than the "photometric" mass), inside elliptical galaxies and spiral galaxies; until the "God Particle" theory was proven, equating this "dark mass" with "dark matter" was the only possible explanation. However, after the confirmation of the “God Particles” in this century, since the mass of matter is derived from the “God Particles”, the large amount of “dark mass” should also be derived from the “God Particles”, and it is not necessary to assume that “there must be another large amount of non-luminous, invisible matter existed in these galaxies”.

The existence of "dark mass" indicates that the rest mass  $m_0$  (or inertial mass in low-speed situation) of matter is variable. the rest mass of the same substance has different values in different

space environments, depending on the distribution density of the "God Particles" : in the space of the solar system, its rest mass is the "weighed" mass on earth, equivalent to the "photometric" mass, and its motion conforms to Newton's Law; however if put it in the Andromeda nebula, then its rest mass is of at least 6 times increased (note: according to Vera Rubin terms), adapted to the measured rotation curve, because if its "photometric" mass increased by more than six times, then put into Newton's Law of Gravitation and Newton's Second Law, the calculated results accord with the measured rotation curve (where Newton's Laws do not change, and the rest mass  $m_0$  increased of more than 6 times).

For instance, in the solar system, we know that the molecular weight of  $H_2$  is equal to 2; However, if by placing  $H_2$  in the Andromeda Nebula and using the rotation curve measured by Vera Rubin to back-calculate the "mechanical mass" (inertial mass, gravitational mass) by Newton's Law, then the molecular weight of hydrogen has increased by more than 6 times, to more than  $(6+1) \times 2$ ; therefore the molecular weight of  $H_2$  has changed from 2 on Earth to more than 14 in the Andromeda Nebula, a steep increase of more than 12.

A space environment similar to the solar system is not isolated in the universe; within about 100 light-years from the solar system, there 70 percent of the fixed stars are binary stars and multiple stars [7], with their rotational motions in completely accordance with the results of Newton's laws (by using "photometric" masses of stars); these suggest that the laws of physics on Earth should also apply to these fixed stars systems, that the rest mass  $m_0$  of a same substance placed in the environment of solar system should be the same as it is in the environments of these stars systems, so that the distribution density of "God Particles" should be the same in solar system space as in the space of these fixed stars systems.

For the projects of spaceflight, when a spaceship flies out of the solar system space, into the Milky Way \_ deep space of this spiral galaxy, where the "God Particles" density than the near-earth space (or within the solar system) several times higher, according to what is said above, the spaceship's inertial mass will spurt several times (more than 6 times), and due to the conservation of momentum, its movement speed will be greatly reduced , making the space travel becoming more difficult.

However, if natural world is symmetrical, are there also existed the space domains in the universe with the very low distributed densities of "God Particles", in which the mechanical masses of matter would be much lower than the "photometric" masses (i.e, much lower than its rest masses in the solar system environment)? Or would there also existed regional spaces or space passages completely free of the "God Particles" and the Higgs field? We haven't found it yet, but we shouldn't rule it out.

## 5. What Would Happen in Space Region without "God Particles"?

In the space region without "God Particles", the static inertial mass of matter would be zero,  $m_{R0} = 0$ .

Substituting  $m_{R0} = 0$  into equation (8), and when the motion velocity  $v_R$  of the object is less than or approaching the speed of light, we can obtain the follows: the inertial mass  $m_R = \lim_{v_R \rightarrow c} (0 / \sqrt{1 - v_R^2/c^2}) = 0 \neq \infty$ , that is, the object would be situated at "massless state" and where doesn't has created the "light barrier" [7]; and when the motion velocity is just equal to the speed of light  $v_R = c$ , we can obtain:  $m_R = 0 / \sqrt{1 - v_R^2/c^2} = 0/0 = \text{math infinitive} \neq \infty$ , where doesn't has formed the "light barrier" also.

Therefore, an object moving in the space region without "God particle", its motion speed is not limited by the "light barrier" and can move or fly at any speed (such as faster-than-light speed). Because its motion does not involve the transfer of energy.

Then, by substituting  $m = m_R = 0$  into formula (2) of special relativity, we can get:  $F = d(0 \bullet v) / dt = 0 \bullet dv / dt = 0 \bullet a$ , or  $a = F/0$ , this is a math infinitive, if the external force  $F$  is a finite value, then  $a \rightarrow \infty$ , the acceleration  $a$  can be obtained a greater than any given value ; if the

external force approaches zero (considered an infinitely small quantity), we get  $a = 0/0$ , which is also an indeterminate form, meaning any acceleration.

Therefore, the object in the space region without "God Particles", would be situated in "massless state" with its inertial mass to be zero, and it can be able to move and fly with arbitrary acceleration (magnitude and direction), including with the trajectory of broken line (turning radius to be zero, and centripetal acceleration tending to infinity).

What are the details of the distribution of "God Particles" within the visible universe? Whether there existed a local space of cosmic without the "God Particles" and the Higgs field, called "empty void"? Would one able to artificially create this "empty void"? These could be one of the frontiers of physics in the future.

## 6. Several Suggestions

The basic idea above is to distinguish the chemical mass of a substance from its inertial mass; for the same object, the number of atoms of various elements it contains doesn't change, however, if it is located in different places in the universe, and where the distribution density of "God Particles" is different, then it will have different inertial masses.

### 6.1. To Express Mass by Complex Number

In the "A Briefer History of Time" [11], S.W. Hawking advocated using two measures of "imaginary time" and "real time" to represent time, so as to fully reflect the relativity theory of time. Like that, how do we represent the concept of mass in its entirety?

Before the 1950s, chemistry textbooks used to mention "the Lavoisier's (Antoine--Laurent DE Lavoisier) Theorem of Material Immutability: the quantity of substances before and after chemical reactions does not change, and chemical reactions cannot eliminate substances.", where "quantity of substances" is defined as mass and can be measured by a balance scale; however, the physics textbook defines inertial mass as mass. These two definitions of a substance's mass are both correct, but they are two different things. Each of them reflects two aspects of the property of a substance, which can be called chemical mass and physical mass, and should be distinguished according to what is said above. Therefore, it is suggested to use complex numbers to express the mass of substance:

$$M = M_{ch} + i \cdot M_{ph} \quad (10)$$

In the formula,  $M_{ch}$  = chemical mass of a substance, representing the intrinsic quantity of a substance, which is determined by the number of atoms of various elements or the number of various particles contained in the substance; it does not vary with the location and speed of matter, and its value is equal to the inertial mass at rest in near-earth (or in solar system)space;  $M_{ph}$  = the inertial mass, or called physical mass of a substance, which varies with its place and speed;  $i = \sqrt{-1}$  imaginary number. In near-earth (or in solar system) space and low speed situation,  $M_{ch}$  and  $M_{ph}$  are basically the same.

In contrast to astronomical phenomena, chemical mass  $M_{ch}$  corresponds to "photometric mass" [7, 9], and inertial mass (gravitational mass) or physical mass  $M_{ph}$  to "mechanical mass" [9]. For a galaxy or each star (or matter) in it, there objectively existed a pair of  $M_{ch}$  and  $M_{ph}$  values for itself, and its dark mass should be:

$$M_{dm} = M_{ph} - M_{ch} \quad (11)$$

In above formula,  $M_{dm}$  corresponds to the difference value that "mechanical mass" bigger than "photometric mass" in reference [9]. But according to the above, dark mass should be the contribution

of the "God Particles", the existence of dark mass does not necessarily equate to the presence of new matter or particles.

People are now interested in black holes, but should also be interested in exploring the "empty void", which is the other extreme. If there existed the "empty void", even without the "God Particles" or Higgs field, when there is a matter entered and moving in it, then the matter will be situated in "massless state" and will no longer be affected by inertial forces; its action and behavior should be as described above.

## 7. Brief Summaries

Based on the uneven distribution of "God Particles" in cosmic space, the above explanation for astronomical phenomena related to "dark energy" and "dark matter", does not require to introduce the existence of "unknown energy" which makes the mutual repulsion between galaxies, nor to assume there existed a new kind of nonluminous matter or particle within galaxies or clusters of galaxies. In addition to continuing to probe for possible new rays, particles or unknown energies in space, the academic community should also further explore the details of the distribution of "God Particles" in cosmic space, to facilitate the development of space engineering into deep space beyond the solar system.

## References

- [1] Zhang S H and Wang H Z 1999 *Tsinghua University Textbooks (in Chinese): University Physics (First Book), Mechanics, First Edition* Beijing: Tsinghua University Press 38-42 50-52 62-63 217-246 268
- [2] Endler F and Brout R 1964 Broken symmetry and the mass of the gauge vector mesons *Physical Review Letters* **13**: 321-323.
- [3] Higgs P W 1964 Broken symmetries, massless particles and gauge fields *Physics Letters* **12**: 132.
- [4] Wang H Y, Chen X, Huang F J and Lu W M 2013 The mystery of the source of mass: the BEH mechanism and Higgs Bosen - A brief introduction to the Noble Prize in Physics *Chinese Journal of Nature* **35**(6).
- [5] ATLAS collaboraton 2012 Observation of a new particle in the search for the standard model Higgs boson with the ATLAS detector at the LHC *Physics Letters B* **716**: 1-29.
- [6] The CMS collaboration 2012 Observation of a new boson at a mass of 125GeV with the CMS experiment of the LHC *Physics Letters B* **716**: 30-61.
- [7] Song J 2007 *Space Flight* (in Chinese) Beijing Higher Education Press **225** 237-238 261-271 **282**: 285-292.
- [8] Xu G X 2007 Chemical molecular information quantities computing and estimate of the information contents in the visible universe (in Chinese) *Science in China (Series B: Chemistry)* **37**(4) 313-317.
- [9] Zwicky F 1933 Spectral displacement of extra galactic nebulae *Helv. Phys. Acta* **6**: 110.
- [10] Rubin V C and Ford W K 1970 Rotation of the andromeda nebula from a spectroscopic survey of emission regions *Astrophys. J.* **159**: 379.
- [11] Hawking S W 2009 *A Briefer Histry of Time* (in Chinese Translated by Wu Z C) Yanji City: Yanbian People's Publishing House 162