A No-Shape-Substance is the foundation all Physics laws depend on

—— The Second Part of New Physics

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Abstract: People used to establish physical laws on the mathematical frame directly, without considering the existence of the No-Shape-Substance. Such physical laws are separated from nature.

By analyzing the interaction between the body and the No-Shape-Substance, we will have a newer and better understanding of physical laws or concepts as inertial mass, Newton's Second Law, kinetic energy equation, mass-energy equation and momentum. And now we are going to uncover the essence of the physical laws.

Keywords: Inertial Mass, Newton's Second Law, Kinetic Energy, Mass-Energy Equation, Momentum

People used to establish physical laws on the mathematical frame directly, without considering the existence of the No-Shape-Substance. Such physical laws are separated from nature.

All laws of motion of bodies depend on the No-Shape-Substance Space instead of the absolute Mathematical Space.

Again we need the previous example about the fish swimming in water flowing with reference to the bank. Well then, to what are the forces on the fish and its laws of motion related?

The forces acting on the fish and its laws of motion are closely related to the flow of the water, but not to the mathematical reference system based on the bank.

Here the bodies are analogous to the fish while the No-Shape-Substance is analogous to the water. Therefore the laws of motion of bodies depend on the No-Shape-Substance Space, but not directly on the Mathematical Space. [1, 2]

Before learning the physical laws, we must have a clear idea about the most basic physical concepts. Physics would not be firm unless these physical concepts were clarified.

1 Gravitational Mass and Inertial Mass

People usually don't distinguish the gravitational mass from the inertial mass. Therefore, the two kinds of masses are often called the "mass" uniformly. However, in fact the two kinds of masses are essentially different. [3, 4, 5]

[Gravitational Mass]

The gravitational mass, which is still denoted by *m*, reflects the quantity of substances contained in a body and is a constant.

[Inertial Mass]

While the inertial mass reflects the characteristics of motion of a body and its ability to accelerate when there is an external force acting on the body. It is a variable.

The inertial mass of a body associates not only with its gravitational mass but also with the density of the No-Shape-Substance of the space where the body is. Moreover, the inertial mass of a body also connects with its moving speed relative to the No-Shape-Substance Space where it exists.

If we denote the inertial mass of a body by *Q*, we will get

$$Q = mf(S)g(\upsilon) \tag{1}$$

Where $f(S)$ is the function of the density of the No-Shape-Substance in the space where the body exists. $g(\upsilon)$ is the function of the velocity of movement of the body in the No-Shape-Substance Space.

In the space near the earth's surface, the density of the No-Shape-Substance, which is denoted by S_0, is uniform. If $f(S_0) = 1$, then $Q = mg(\upsilon)$.

From the experiment of the relation between mass and speed conducted by Kaufmann and some other people we can learn

$$g(\upsilon)=\frac{1}{\sqrt{1-\upsilon^2/c^2}} \tag{2}$$

Please note that the light speed in equation (2) is that of the No-Shape-Substance Space where the body exists.

Where $g(\upsilon)$ approximately equals 1 when speed is a low value, therefore with the case of low velocity on the earth's surface, $Q=m$.

Obviously, on the earth's surface, when a body moves at a low speed, its inertial mass is numerically equivalent to its gravitational mass. But this is just the equivalence on the numerical value; they are completely different in nature.

[Eötvös Experiment]

In 1906, Eötvös, a Hungarian physicist, conducted a famous experiment to verify that the gravitational mass is equal to the inertial mass. As shown in figure 1.The suspended mass point will eventually reach a position of equilibrium. There are three forces acting on it:

1) The gravitation G of the earth, which directs the center of the earth;

2) The centrifugal force F of inertia , generated by the rotation of the earth;

3) The tension T , acted by the hanging thread.

What is important is that G is proportional to the gravitational mass, while F is proportional to the inertial mass. Eötvös found no difference in the position of equilibrium with a variety of substance, such as wood, platinum, copper, asbestos, water and copper sulfide. [6, 7, 8]

The 'zero' result signifies that the gravitational mass is equal to the inertial mass.

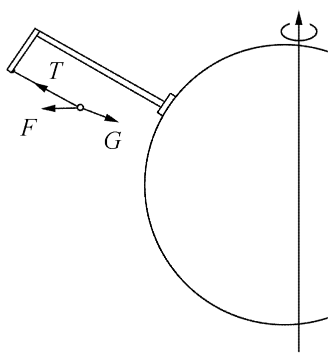

Fig. 1 Eötvös Experiment

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How should we explain the experiment? First, we need to note that the experiment was conducted at the same spot on the earth's surface and the velocity of the object was zero.

From the above analyses we have derived that the inertial mass and the gravitational mass satisfy the following relation $Q = mf(S)g(\upsilon)$.

Well, on the earth's surface, $f(S_0) = 1$ and $g(\upsilon) = 1$, when $\upsilon = 0$, thus we get $Q = m$.

As discussed above, in Eötvös experiment the equivalence between the inertial mass of every single body and its gravitational mass is inevitable.

Either the density of the No-Shape-Substance in the space where the body exists, or the speed the body moves, is different, the gravitational mass will not equal to the inertial mass.

2 Newton's Second Law

When a body is acted on by a resultant force of zero, its acceleration relative to the total No-Shape-Substance Space where it exists is zero.

When a body is acted on by a certain external force that is not zero, the product of its acceleration relative to the total No-Shape-Substance Space where it exists and its inertial mass is equal to the resultant force the body is acted on.

$$\vec{F} = Q\vec{a} \tag{3}$$

The above is the more exact presentation of Newton's second law.

[Illustration]

Newton describes his second law in the book of The Mathematical Principles of Natural Philosophy like this: the change of momentum of a body is proportional to the motive force acting on it.

$$\vec{F} = \frac{\mathrm{d}\vec{p}}{\mathrm{d}t} = \frac{\mathrm{d}(m\vec{\upsilon})}{\mathrm{d}t} \tag{4}$$

This is the initial expression of Newton's second law.

Notice that the mass *m* is submitted for the consideration that it doesn't change with speed. When the inertial mass varies with speed, the momentum will not be the form of $\vec{P} = m\vec{\upsilon}$.

You will find out the form of momentum in the following part.

The reason for my redescription of the inertial mass and Newton's second law or even redefine it is to make physical concepts more explicit and distinct.

3 Kinetic Energy Equation

The kinetic energy of a body is the energy it possesses when it moves with reference to the total No-Shape-Substance Space where it exists.

We then deduce the kinetic energy E of a body. We assume that at first the particle is immobile relative to the total No-Shape-Substance Space $\upsilon = 0$, which indicates that its original kinetic energy is zero. And then we exert an external force on the body to make it move along a straight-line path. When the speed of the particle increases to υ, its kinetic energy equals the work done by the external force acting on it. That can be expressed as

$$E = \int F \mathrm{d}x$$

If substituting Qa for F in the above equation, we get

$$E = \int Qa \mathrm{d}x$$

Again replacing $\frac{\mathrm{d}\upsilon}{\mathrm{d}t}$ for a and then $\frac{\mathrm{d}x}{\mathrm{d}t}$ for υ in above equation, it follows that

$$E = \int_0^{\upsilon} Q\upsilon \mathrm{d}\upsilon \tag{5}$$

In the No-Shape-Substance Space near the earth's surface, when the body moves at a low speed Q=m. Then the kinetic energy of the body is

$$E = m\int_0^{\upsilon} \upsilon \mathrm{d}\upsilon = \frac{1}{2}m\upsilon^2 \tag{6}$$

This is the kinetic energy equation we are familiar with.

In general, $Q = mf(S)g(\upsilon)$. So the kinetic energy is as follows

$$E = \int_0^{\upsilon} Q\upsilon \mathrm{d}\upsilon = mf(S)\int_0^{\upsilon} g(\upsilon)\upsilon \mathrm{d}\upsilon = mf(S)\int_0^{\upsilon} \frac{\upsilon}{\sqrt{1-\upsilon^2/c^2}}\mathrm{d}\upsilon$$

As a result,

$$E = m\,f\left(S\right)c^2\left(1-\sqrt{1-\frac{\upsilon^2}{c^2}}\right) \tag{7}$$

This is the kinetic energy equation for the general condition.

Here let's look at the following particular case.

On the earth's surface, what will the kinetic energy be if the speed of a moving body approaches the light speed? Its kinetic energy is

$$E = m\,f\left(S_0\right)c^2\left(1-\sqrt{1-\frac{\upsilon^2}{c^2}}\right) = mc^2 \tag{8}$$

Unexpectedly, this is the mass-energy equation we are familiar with.

4 Mass-Energy Equation

Mass is conservative and energy is also conservative. Mass and energy can not be converted to each other while they are in essence two completely different kinds of things.

When a nuclear fission happens, an atomic nucleus will release a great number of particles with high energy and their speed is approaching the light speed. The mass taken away by these particles is the mass the atomic nucleus loses. And the kinetic energy acquired by these particles is converted from the inner energy of the atomic nucleus. Both mass and energy are conservative.

From the above equation (8), we can get the following equation between the mass and energy taken away by these particles

$$E = \Delta mc^2 \tag{9}$$

Now it is natural for us to understand the existence of the mass-energy equation.

Photons are No-Shape-Substance in nature. So a photon's mass is not zero. It is $m_0 = \frac{h\nu}{c^2}$.

The theory of relativity considers the rest mass of a photon to be zero. Well then, from the viewpoint of mass-speed and mass-energy relations in the theory of relativity, the energy and momentum of a photon in a medium must be zero too. It's completely contradictory to the objective physical facts.

[The Change of Phases of Matter]

We all know that the heat of fusion for solid and that of evaporation for liquid. Taking ice for example .The fusing heat of ice is the heat input required to fuse ice of unit mass to water at the same temperature of 0℃, which is the fusing point of ice. The transformation between No-Shape-Substance and Shape-Substance is a more essential change in the state of matter. Then, is it accompanied with a process of heat absorbing or releasing?

Can we say that No-Shape-Substance is the basic component of the universe, while Shape-Substance is the spray in the No-Shape-Substance?

No-Shape-Substance is corresponding to a state of energy. It’s a state with low energy, which is an implicit state. But the Shape-Substance is corresponding to another state of energy. It is a state with high energy, which is an explicit state.

We demonstrate the state with low energy by 0, which is corresponded with No-Shape-Substance, while 1 demonstrating the state with high energy of Shape-Substance.

When transforming No-Shape-Substance to Shape-Substance, the matter is changed from an implicit state to an explicit one. This is a process of heat absorbing. The energy absorbed and the mass transformed satisfy mass-energy equation $E = \Delta mc^2$.

Oppositely, energy is released when Shape-Substance is changed into No-Shape-Substance. The matter is changed from an explicit state to an implicit one. Then the energy released and the mass transformed also satisfy mass-energy equation as above.

Energy is conservational and mass is too. But the process of the transformation of matter’s state is accompanied with energy absorbing or releasing.

Let’s now review the laws reflected by Bose-Einstein condensation state. When the temperature of Shape-Substance is absolute zero, there is little energy in it. So it’s about to change into No-Shape-Substance completely.

[The Annihilation of an Electron-Positron Pair]

Experiments show that an electron-positron pair can annihilate into photons. The *energy of photons and the mass of electrons are linked by mass-energy equation.* [9]

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This is a transformation from Shape-Substance to No-Shape-Substance. Energy is released in this process. So the energy released and the mass satisfy mass-energy equation.

$$E = \Delta mc^2$$

On the contrary, the energy absorbed in the transformation from no-Shape-Substance to Shape-Substance and the mass also satisfy mass-energy equation.

—— Many phenomena, such as photons producing phenomenon from an electron-positron pair, is such one kind of the reactions of transformation.

We will inquire into the annihilation of an electron-positron pair briefly from the viewpoint of basic physics as follows.

Does an electron have a radius?

Certainly it does since it is a particle. We assume its radius to be R_e and its electric charge to be distributed uniformly on its surface. Thus we are in an ideal position to probe the annihilation and we consider stationary electric force uniquely.

At the beginning, the electron and positron are far away from each other, so the electrical potential energy is zero.

In general case, the electrical potential energy is expressed as

$$E_p = -\frac{e^2}{4\pi\varepsilon_0 R} \tag{10}$$

When the electron and positron syncretize completely, the electrical potential energy is

$$E_p = -\frac{e^2}{4\pi\varepsilon_0 R_e}$$

In this situation, the Shape-Substance is transformed into the No-Shape-Substance. It's perceived that the No-Shape-Substance is in a state with lower energy.

The energy released is equal to the electrical potential energy reduced

$$2m_e c^2 = -\frac{e^2}{4\pi\varepsilon_0 R_e}$$

From this we can calculate the radius of an electron as follows:

$$R_e = \frac{e^2}{8\pi\varepsilon_0 m_e c^2} \approx 1.41\times10^{-15} m \tag{11}$$

What to emphasize is that it is a very ideal calculation. The action of annihilation of an electron-positron pair is not so simple. We know that the distribution of No-Shape-Substance has different levels. The density of No-Shape-Substance near the electron is greater than that in a vacuum near the earth's surface. In this case, the specific inductive capacity ε is greater than ε_0, so the radius of the electron is much likely to be less than the calculation.

Therefore, the saying that the transformation of the state of the matter is accompanied with energy absorbing or releasing in the annihilation of an electron-positron pair, is equivalent with the description that electrical potential energy is transformed into light energy.

The theory of relativity teaches that the energy released is transformed from mass in the annihilation of an electron-positron pair. Well, where does the electrical potential energy go?

Furthermore, the kinetic energy is increasing when the two electrons are approaching each other. The theory of relativity believes that their moving mass is becoming greater, so the total energy is greater. Then, why isn't the whole moving mass being transformed into energy?

Since mass and energy are two kinds of things that are different in nature. Isn't it too farfetched to make them equal to each other?

[Calorimetry Measurements of Energy]

Mr. Hao Ji, who works in Shanghai Oriental Institute of electromagnetic waves in china, bombards lead target by use of high-speed electrons wich is obtained by the beam current 1.26A with energys of 1.6MeV, 6MeV, 8MeV, 10MeV, 12MeV and 15MeV respectively, based on Bettozzi experiment in 1964. [10] He measures directly electron energy by Calorimetry measurements. Obtained experimental values are highly different from that is obtained by relativity theory. [11]

Compare the experimental datas with various theoretical values

Energy / Temperature	1.6MeV	6MeV	8MeV	10MeV	12MeV	15MeV
Relativistic value	0.67	2.52	3.36	4.20	5.03	6.29
Experimental value	0.26	0.29	0.32	0.32	0.32	0.32
New physical values	0.30	0.30	0.30	0.30	0.30	0.30

In the relativistic point of view, when speed of electron approach to the speed of light, the electron energy will tend to infinity. The new physics holds that when speed of electron approach to the speed of light, the energy will tend to a constant value. As shown in listed table, the theoretical values obtained by "new physics" are very close to the experimental value.

5 The Objectivity of Time

What is time?

Time is just as an immensely long river flowing from the antiquity to the future.

The Analects of Confucius says: It was a stream that the Master said --Thus do things flow away!

Time is just like a rushing river ceaselessly on the move. It's like the water of the Yellow River from the sky, which flushes into the sea without ever returning.

But how can the Yellow River, whose flow is always in a broken state, compare with time?

Time is like the sun and stars in the sky, rising in the east and setting down in the west day after day. Time is like the immense Milky Way, going round and round ceaselessly forever.

But the Milky Way cannot compare with the huge time either.

Lei yuanxing said that, the gear wheel of time joggles the whole universe and drives all galaxies to rotate towards the everlasting future. [12]

And Newton has ever said that 'The absolute, real or mathematical time, itself and to the extent of its nature, always lapses uniformly, having nothing to do with any outside body.'

Time is the most essential objective being in the universe, or time is the reflection of the total existence and changes in the whole universe. Time is the most essential foundation stone of physics. The movements of a trivial object, a star or even a galaxy, absolutely cannot change the objective state of time.

Time is our sole measurement tool for the process of universal existence and changes. Of course, this kind of measurement is regulated by a time system on the earth's surface that is familiar to us.

[The Prolongation of the Life-span of A Moving Particle]

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There are a number of high-speed μ^- *mesons within the cosmic rays from outer space. In an experiment conducted at the top of a mountain with 1910 meters high in 1963, the number of the* μ^- *mesons whose vertically downward velocities vary from 0.9950c to 0.9954c is measured. And it turned out that there was* 563 ± 10 μ^- *mesons per hour on an average. Also the number of the* μ^- *mesons with the same range of velocity is measured at the altitude of 3 meters above the sea. As a result, it was found that the average result is* 408 ± 9*. The time it takes for a* μ^- *meson to fall from the top of the mountain to the sea level should be*

$$t=\frac{(1910-3)m}{0.9952\times 3\times 10^{8}\,{}^{m}\!/\!{}_{s}}=6.4\times 10^{-6}(s)$$

This time is four times as long as the half- life $\left(T_{1/2}\right)$ *of an immobile* μ^- *meson. If the half- life of a* μ^- *meson moving at a high speed is equal to that of an immobile one, it is expected that the number of the* μ^- *mesons near the sea level should be less than* $\frac{563}{2^4}(\approx 35)$ *after their flying through a distance of 1907 meters. However, the practical* *number acquired from the experiment is 408. This clearly indicates that the half-life of a moving μ^- meson extends or in other words its process of decay becomes slow.*

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How should we explain the problem in this experiment?

It is the high-speed motion of a μ^- meson in the No-Shape-Substance Space that extends the life-span of the μ^- meson.

As shown in figure 2, similarly, μ^- meson is also made up of smaller mass units and the mutual collisions among these mass units cause the decay of the μ^- meson. When a μ^- meson moves at a high speed in the No-Shape-Substance near the earth's surface, the inertial mass of every mass unit composing the μ^- meson increases, and at the same time the relative speed of every mass unit decreases due to the unchanged vibration momentum. As a result, the time interval of collisions among these mass units of the μ^- meson increases, and thus the lifespan of the μ^- meson extends.

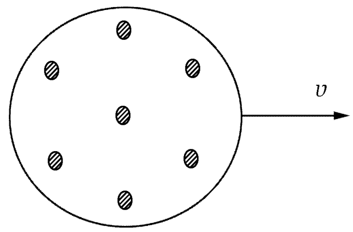

Fig. 2 the configuration of μ^- meson

We will estimate the lifespan of a μ^- meson by means of the following method.

When a μ^- meson moves at a high speed in the No-Shape-Substance Space, the inertial mass of each mass unit composing the μ^- meson increases by $g(\upsilon)$ times as much as the inertial mass of each mass unit of an immobile μ^- meson. Because the vibration momentum of each mass unit doesn't change, the relative velocity of each mass unit decreases by $g(\upsilon)$ times as little as the relative speed of each mass unit of an immobile μ^- meson. Therefore the time interval of collisions among the mass units of a μ^- meson extends by $g(\upsilon)$ times of the original value, and accordingly the lifespan of the μ^- meson extends by $g(\upsilon)$ times of its original value. We can express it by the following equation:

$$\tau = g(\upsilon)\tau_0 = \frac{\tau_0}{\sqrt{1-\upsilon^2/c^2}} \tag{12}$$

Where, τ is the lifespan of a moving μ^- meson and τ_0 is that of an immobile μ^- meson.

When the υ is substituted by the data in the experiment, we obtain

$$\tau = \tau_0 \Big/ \sqrt{1-(0.9952)^2} = 10.2\tau_0$$

But the lifespan of a μ^- meson acquired from the above experiment is $\tau = 9.1\tau_0$.

What we can see from the above is that although the theoretical value to some extent approached the experimental value, there exists larger error between them.

Well, why the theoretical value is larger than the experimental value? Let us look at the following analysis. Because the μ^- mesons are sent out from the high altitude, their collisions with the atmospheric molecules will cause the result that the number of the μ^- mesons measured on the earth's surface is smaller than the number of the μ^- mesons flying in the vacuum. Therefore the practical lifespan of a μ^- meson based on the measurement is smaller than the theoretical value.

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In 1966, on the earth's surface people made the μ^- *mesons move at a high speed circling a round orbit and made sure that the value of their speed satisfied the following equation,*

$$\frac{1}{\sqrt{1-\upsilon^2/c^2}} = 12$$

As a result, they measured the lifespan of the μ^- *mesons is*

$$\tau = (26.15 \pm 0.03) \times 10^{-6} s$$

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Now we theoretically calculate the value of the lifespan of the μ^- meson again.

The result is $\tau = \frac{\tau_0}{\sqrt{1-\upsilon^2/c^2}} = 26.5\times10^{-6}s$.

We can see from this that the theoretical value agrees with the experimental value well.

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There are many experiments including an accelerating process in experiments validating the time dilation. And the range of the acceleration is very wide. For example, in the experiment of clock sailing around the earth, the centripetal acceleration acted on the atomic clock is $10^{-3}g$, *where* g *is the acceleration of gravity on the earth's surface; in the rotating-disk experiment, the centripetal acceleration of the light source extends to* $10^5 g$; *in the experiment on the temperature dependence of Mossbauer effect, the vibrating acceleration of the atomic nucleus in the crystal lattice and the centripetal acceleration of the* μ^- *meson moving in a circle are both larger than* $10^{16}g$. *Although the range of the acceleration is so wide, almost all the experimental results are consistent with the basic formula of* $\tau = \frac{\tau_0}{\sqrt{1-\upsilon^2/c^2}}$. *This fact indicates that, the acceleration has no contribution to time dilation in the experiment. Even if we admit the existence of the effect of time dilation, it can only say that the effect is caused by the speed instead of the acceleration.* [9, 13]

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We can easily understand these experimental results.

Because speed will affect inertial mass, Acceleration will not affect inertial mass, nor will it affect particle life.

Time, which is objective and absolute, is the foundation on which we learn the nature.

The lifespan extension of a moving particle does not prove the time dilation but shows that the self-reaction of the particle becomes slow after its moving at a high speed relative to the corresponding No-Shape-Substance Space where it exists.

6 Momentum

Does the momentum of a body preciously satisfy the relation as follows?

$$\vec{P} = m\vec{\upsilon} \tag{13}$$

No, the above expression of the momentum of a body is not exact. Such expression doesn't uncover the essence of the momentum. Exactly speaking, what the momentum theorem reflects is the essential source of the momentum. That is, the impulse acting on a body equals the increment in momentum of the body. That can be expressed as

$$\mathrm{d}\vec{P} = \vec{F}\mathrm{d}t$$

As shown in figure 3, a system free of any external force is conservational in momentum because the internal forces of the system are actions and reactions which are equal in magnitude, opposite in direction; and the time duration of the pairs of forces is always corresponding equal. Therefore the resultant impulse acting on this system is zero, which means the momentum of this system is conservational.

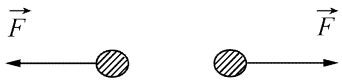

Fig. 3 actions and reactions in the system

The impulse acting on a body equals the increment in momentum of the body.

The expression can be written as

$$\Delta\vec{P} = \int \vec{F}\mathrm{d}t$$

If we make a body's initial velocity zero and let it move along a straight-line path, we will deduce the relation for momentum as follows,

$$\mathrm{d}P = F\mathrm{d}t$$

By substituting Qa for F and then substituting $\frac{\mathrm{d}\upsilon}{\mathrm{d}t}$ for a in above equation, we get

$$\mathrm{d}P = Q\mathrm{d}\upsilon$$

When the velocity of a body is zero ($\upsilon = 0$), its momentum is also zero（$P = 0$）, so the momentum of a body at any time is

$$P = \int_0^{\upsilon} Q\mathrm{d}\upsilon \tag{14}$$

On the earth's surface, when a body moves at a low speed, its value of Q, which equals m, is a constant. So

$$P = m\int_0^{\upsilon} \mathrm{d}\upsilon = m\upsilon \tag{15}$$

This is the formula for momentum we are familiar with. The direction of velocity is the direction of the momentum. Expressing it with vectors, we get

$$\vec{P} = m\vec{\upsilon}$$

In general case, $Q = m\, f(S)\, g(\upsilon)$

$$P = \int_0^{\upsilon} m\, f(S)\, g(\upsilon) d\upsilon = m\, f(S) \int_0^{\upsilon} \frac{1}{\sqrt{1-\upsilon^2/c^2}} d\upsilon$$

Solving P from the above equation,

$$P = mc\, f(S) \arcsin\frac{\upsilon}{c} \tag{16}$$

The direction of velocity is the direction of the momentum. Expressing it with vectors, we get

$$\vec{P} = mc\, f(S) \arcsin\frac{\upsilon}{c}\ \vec{e}_{\upsilon}$$

Where, $\vec{e}_{\upsilon}$ is the unit vector in the direction of velocity.

Now let us look at the particular case. On the earth's surface, when the velocity of a body υ equals the light speed c, what is the magnitude of its momentum?

We know on the earth's surface $f(S_0) = 1$, but when $\upsilon = c$, $\arcsin\frac{c}{c} = \frac{\pi}{2}$

Therefore,

$$P = mc\frac{\pi}{2} \tag{17}$$

[Is there negative mass or virtual mass in the nature?]

Some science workers calculated the rest mass of a particle by measuring its energy and momentum. They calculated the rest mass of a particle by means of the following formula between energy and momentum from the theory of relativity. The formula is

$$E^2 = E_0^2 + P^2c^2 \tag{18}$$

Wherein, E and P are respectively the energy and the momentum of a particle in motion, while E_0 is the energy of a particle at rest.

Since $E_0 = m_0 c^2$, we can get the following relation

$$m_0^2 = \frac{E^2 - P^2c^2}{c^4} \tag{19}$$

Wherein, m_0 is the rest mass of a particle.

Science workers have obtained exact measurements of the energy of particle E and the momentum of the particle P. As a result, they found that the value of $E^2 - P^2c^2$, which is a negative value, is smaller than zero.

It means that the square of the rest mass of a particle is a negative value. Is it meaningful? of course not. This negative value accurately shows that Einstein's theory may be wrong in its formulation for the energy and momentum.

Science workers believed that their measurements were accurate. While they are unable to put an end to the theory of relativity, they brought forward the view that a particle has virtual mass in order to explain the negative value.

Is there any negative or virtual matter in nature? In order to illustrate the answer to this question, let's look at the following example first. If we refer to the case that every one has an apple in his or her hand, we know clearly that the case of holding an apple in everyone's hand exists objectively and even can be seen by ourselves. Any of us can understand it well. Now if we refer to the case by saying that it is a negative apple or a virtual apple in our hand, how can we be understandable?

So we should never violate the objective facts when discussing physical questions.

Well, let us return to the above problem again that why the value of $E^2 - P^2c^2$ is negative? From the previous discussion, we know that on the earth's surface, when the velocity of a particle υ equals the speed of light c, the momentum of the particle is $P = mc\frac{\pi}{2}$.

And the energy of the particle is $E = mc^2$.

Here we can readily get

$$E^2 - P^2c^2 = m^2c^4(1 - \frac{\pi^2}{4}) \tag{20}$$

Obviously, the value is negative.

Therefore from the above we can easily conclude that it is normal that the value of $E^2 - P^2c^2$ is negative when a body moves at a high speed. However, this does not indicate the existence of the virtual mass of a particle.

7 The Pattern of Function $f(S)$

In this part we will primarily discuss the functional form of $f(S)$.

The inertial mass is the result of interplay between an object and its No-Shape-Substance Space. The inertial mass is desirable to increase by times when the density of a No-Shape-Substance multiplies according to logical deduction. Then the function of $f(S)$ is

$$f(S) = \beta S \tag{21}$$

Where, β is the inertial coefficient. Since $f(S_0) = 1$, $\beta = \frac{1}{S_0}$.

In which S_0 is the density of the No-Shape-Substance on the earth's surface.

Let's examine the energy of certain photon moving in the No-Shape-Substance Space of different density. We want to know whether the energy is the same when the speed of the photon varies.

As shown in figure 4, assuming the mass of the photon is m_0, now we calculate its energy when it moves in the No-Shape-Substance Space of different density. From equation (7), we can obtain the energy (kinetic energy) of a Photon,

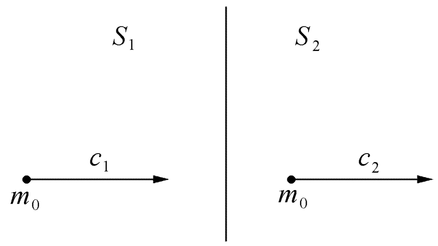

Fig. 4 the motion of photon in the No-Shape-Substance Space of different density

$$E = m_0 f(S)c^2 \tag{22}$$

In the space in which the density of No-Shape-Substance is S_1, the energy of the photon is,

$$E_1 = m_0 f(S_1) c_1^2 = m_0 \beta S_1 \left(\sqrt{\frac{W}{S_1}} \right)^2 = m_0 \beta W$$

In the space in which the density of No-Shape-Substance is S_2, the energy of the photon is,

$$E_2 = m_0 f(S_2) c_2^2 = m_0 \beta S_2 \left(\sqrt{\frac{W}{S_2}} \right)^2 = m_0 \beta W$$

Obviously, when a photon propagates in the No-Shape-Substance of different densities, although its speed varies, its energy is conservational.

Maybe this is the perfect and harmonic aspect of light.

8 Law of Reflection and Refraction

As shown in figure 5. As we all know, there is no energy lost during a perfect elastic collision happened to a ball on. The outside force acted on the ball is in the normal direction, so the tangent component of the ball's momentum is invariable.

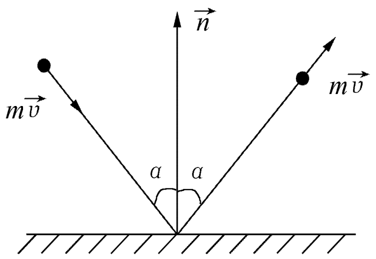

Fig. 5 the perfect elastic collision between a ball and a smooth plane

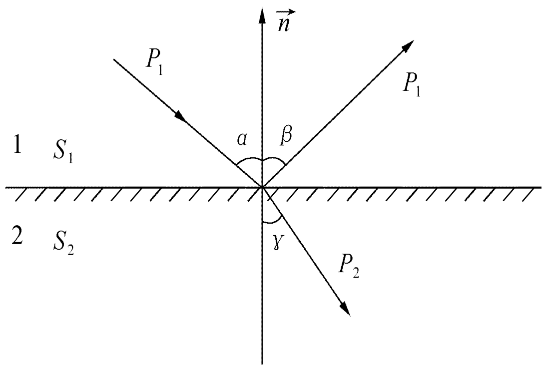

Fig. 6 the reflection and refraction of a photon at the interface

As shown in figure 6. Similarly, when a photon is reflected or refracted at the interface, its energy is invariable, and its tangent component of momentum is invariable too.

In area 1, the energy of the photon is

$$E_1 = m_0 f(S_1) c_1^2 = m_0 \beta S_1 \left(\sqrt{\frac{W}{S_1}} \right)^2 = m_0 \beta W$$

The magnitude of the photon's momentum is

$$P_1 = m_0 c_1\ f(S_1)\frac{\pi}{2}$$

In area 2, the energy of the photon is

$$E_2 = m_0 f(S_2)c_2^2 = m_0 \beta S_2 \left(\sqrt{\frac{W}{S_2}}\right)^2 = m_0 \beta W$$

The magnitude of the photon’s momentum is

$$P_2 = m_0 c_2\ f(S_2)\frac{\pi}{2}$$

[Law of Reflection]

The tangent component of the photon’s momentum before refection is $P_{1t} = P_1 \sin\alpha$.

The tangent component of the photon’s momentum after refection is $P_{1t}' = P_1 \sin\beta$.

$$\because P_{1t} = P_{1t}' \qquad \therefore \alpha = \beta \tag{23}$$

The angle of incidence is equal to that of reflection, ——this is just the law of refection.

[Law of Refraction]

The tangent component of the photon’s momentum before refraction is $P_{1t} = P_1 \sin\alpha$

The tangent component of the photon’s momentum after refraction is $P_{2t} = P_2 \sin\gamma$

$$P_{1t} = P_{2t} \qquad P_1 \sin\alpha = P_2 \sin\gamma$$

$$m_0 c_1\ f(S_1)\frac{\pi}{2}\sin\alpha = m_0 c_2\ f(S_2)\frac{\pi}{2}\sin\gamma$$

Since $f(S) = \beta S$ and $c = \sqrt{\frac{W}{S}}$, we get

$$\beta S_1 \sqrt{\frac{W}{S_1}}\ \sin\alpha = \beta S_2 \sqrt{\frac{W}{S_2}}\ \sin\gamma$$

That is, $\dfrac{\sin\alpha}{\sin\gamma} = \sqrt{\dfrac{S_2}{S_1}}$

Since $\frac{c_1}{c_2}=\sqrt{\frac{S_2}{S_1}}$ and $\frac{c_1}{c_2}=\frac{n_2}{n_1}$, we get the following relation:

$$\frac{\sin\alpha}{\sin\gamma}=\frac{c_1}{c_2}=\frac{n_2}{n_1} \tag{24}$$

This happens to be the law of refraction of light at the interface.

Dear friends. The theory of No-Shape-Substance, which is built on the ground of a natural, objective and logical frame of classical physics, makes the physical laws more truthful to nature. It also makes all the physical laws, experiments and phenomena very natural, harmonic and logic.

Reference:

[1] Ji Qi. New Physics[M[. Harbin: Publishing House of Northeast Forestry University, 2006.

[2] Ji Qi. The review on the basic physical laws—the New Physics[J], Phys. Essays 21, 163 (2008).

[3] Einstein Collected Edition, Hunan Science and Technology Publishing Company, 2002.

[4] Bolian Cai, “Special Relativity Theory”, Higher Education Press, 1991.

[5] Wenwei Ma, *Physics*, Higher Education Press, 1999.

[6] Guangjiong Ni, Hongfang Li, “Modern Physics”, Shanghai Science and Technology Publishing Company, 1979.

[7] Shujie Tan, Hua Wang, “Important Experiments on Physics”, Science and Technology Literature Company, 1987.

[8] Yiling Guo, Huijun Shen, “Famous Classical Physics Experiments”, Beijing Science and Technology Publishing Company, 1991.

[9] Yuanzhong Zhang, *the Experimental Basic of Theory of Special Relativity*，Science Press，1979.

[10] W.Bertozzi,Am.J.Phys.32.551(1964)

[11] Ji Hao , Experiment of Measuring Electronic Energy with Calorimetry Method, Chinese scientific and technological achievements, 2009.1, P34-35

[12] Yuanxing Lei, The Chaos of Time-Space, Sichuan Science and Technology Publishing Company, 2001.

[13] Demin Huang, On the Nature of Physical Phenomena, Shanxi Science and Technology Publishing Company, 2001.