Basic Principles of Physics

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[Abstract] This paper inherits and develops Newton's dialectical space-time. Physical matter is an objective existence with energy. Physical matter can be further divided into solid matter and field matter. Vacuum space is the absolute space and the speed of field matter in vacuum is a constant C. Based on energy, this paper introduces and defines general mass: For any physical matter with energy E, its general mass is defined as $m_E = E/C^2$. The definition and introduction of the general mass extend Newton's classical dynamics from solid matter to field matter, and Newton‘s classical law of gravitation to the law of general gravitation, which replaces Einstein's special and general relativity. This paper also presents a verification experiment of the law of general gravitation: When the light is far from sun’s atmosphere and $R = 200R_0$, the light deflection angle $\Delta\theta$ should be 0.004367″. For problems faced by standard cosmology, this paper reveals that the general mass of field matter is the so-called dark matter, and the energy of field matter is the so-called dark energy. The universe expands uniformly around the void space at the field speed C, and the expansion of galaxies is accelerating. The estimated values of the general mass and energy of the field matter are approximately consistent with the modern cosmic observation data. Energy is the essence of physical matter, and Inertia, gravitation, space and motion characteristics are the universal basic properties of energy. Inertial mass is the measurement of energy inertial property, gravitational mass is the measurement of energy gravitational property, gravitational constant G makes gravitational mass and inertial mass to be equal, and gravitational mass and inertial mass are unified into general mass. Time and temperature are the measurement of the characteristics of energy moving and changing in space.

[Keywords] physical absolute space, void space, physical matter, energy, solid matter, field matter, general mass, law of gravitation, law of general gravitation, standard cosmology, dark matter, dark energy, cosmic expansion.

1. Introduction

At the end of the 19th century and the beginning of the 20th century, people believed that the building of physics had been built based on Newton's concept of space-time and mechanics. However, there are also two dark clouds in the sky: One is the explanation of blackbody radiation, which later led to the discovery of quantum mechanics. Another dark cloud is the Michelson-Morey experiment that caused the "Ether" crisis, which led to the proposition of the principle of relativity and the assumption that the speed of light in a vacuum is constant, which gave birth to the theory of relativity. Relativity only recognizes relative space-time, which cannot explain the absoluteness of the law of conservation of energy. With the development of modern cosmic observation, general relativity cannot answer many questions such as dark matter, dark energy and the accelerated expansion of the universe.

Maxwell's equations are the important theoretical basis of modern physics. Recent physical

progress[1] has proved that two of the four equations of Maxwell's equations are wrong. A changing electric field in a vacuum cannot excite a magnetic field, and a changing magnetic field cannot excite an electric field. "Electromagnetic wave" does not exist in the physical world. Light is only light itself, not "electromagnetic wave". Modern physics needs major revision.

2. Space and time

2.1 Mathematical space and time

Definition 2.1 Mathematical absolute space is defined as a three-dimensional Cartesian coordinate system: three number axes intersect at the origin O and are perpendicular to each other. These three number axes are called X-axis (horizontal axis), Y-axis (longitudinal axis) and Z-axis (vertical axis). The three coordinate axes conform to the right-hand rule, that is, hold the Z-axis with the right hand and the four fingers of the right hand turn from the positive X-axis to the positive Y-axis, the direction of the thumb is the positive direction of the Z-axis. The three coordinate axes are linear coordinate axes, which are uniform everywhere and extend infinitely. Each point on the coordinate axis corresponds to a real number. Mathematical absolute space is static and invariable.

Definition 2.2 Mathematical relative space is a limited local area of the mathematical absolute space, and it is dynamically variable. The mathematical relative space can be a linear three-dimensional Cartesian coordinate system or a nonlinear mathematical coordinate system. Any point in the mathematical relative space has a one-to-one correspondence point in the mathematical absolute space.

Definition 2.3 Mathematical absolute time is a one-dimensional coordinate axis. Select a point on the coordinate axis as the origin O, and the right direction of the point is the positive direction. The one-dimensional coordinate axis is a linear coordinate axis, which is uniform everywhere and extends infinitely. Each point on the coordinate axis corresponds to a real number.

Definition 2.4 Mathematical relative time is a limited local area of the mathematical absolute time. The mathematical relative time is a one-dimensional linear coordinate axis or a one-dimensional nonlinear coordinate axis. Any point in the mathematical relative time has a one-to-one correspondence point in the mathematical absolute time.

Mathematical absolute space and time are a congenital framework for us to understand the world. They are absolutely invariable and static, and have nothing to do with anything outside. Mathematical relative space and time are the limited local areas of mathematical absolute space and time, which are dynamically variable, and related to external things.

2.2 Physical space and time

Axiom 2.1 Physical absolute space is a three-dimensional infinite linear space, which has no directionality, is uniform and isotropic everywhere; Physical absolute space is absolutely invariable and static, and have nothing to do with anything outside; it is independent of the creation, change and extinction of the universe. With the above characteristics, the physical absolute space can be described by mathematical absolute space, i.e. three-dimensional Cartesian coordinate system.

Physical absolute space is the container where all physical matters exist. Physical absolute space itself has nothing to do with any specific physical matter and energy. It is an absolute vacuum space and can be called void space.

Although we cannot fully prove the existence of the physical absolute space, based on our knowledge of the limited local physical world, the physical absolute space is real and conforms to our perceptual priori. In the past half century, with the expansion and deepening of our exploration of the universe, the physical absolute space can better understand the creation, change and extinction of the universe. The universe is a changing water drop in the physical absolute space.

Definition 2.5 Physical relative space is a limited local area of the physical absolute space. The physical relative space is generally associated with a specific physical matter, so as to better describe the characteristics of this physical matter. Physical relative space is dynamically variable.

Physical relative space can be linear or nonlinear. It may be three-dimensional or non three-dimensional. Any point in the physical relative space has a one-to-one correspondence point in the physical absolute space. With the above characteristics, the physical relative space can be described by mathematical relative space.

Definition 2.6 Physical absolute time is a one-dimensional linear coordinate axis. It is uniform flowing and have nothing to do with anything outside and independent of the creation, change and extinction of the universe. With the above characteristics, the physical absolute time can be described by mathematical absolute time, i.e. one-dimensional Cartesian coordinate axis.

The physical absolute time is essentially due to the movement and change of any physical matter. Time is a measure of the properties of motion and change of physical matter.

Definition 2.7 Physical relative time is a limited local area of the physical absolute time. It is generally associated with the specific moving physical matter, so as to better describe the

characteristics of this physical matter.

The physical relative time is a one-dimensional linear or nonlinear coordinate axis. Any point in the physical relative time has a one-to-one correspondence point in the physical absolute time. With the above characteristics, the physical relative time can be described by mathematical relative time.

Physical matter is an objective existence of physical energy. Physical space and time are the objective existence of physics, but they are not the objective existence of physical energy. Therefore, physical space and time are not physical matter itself, but a universal attribute of physical matter.

Physical space and time are the objective existence of physics, and mathematical space and time are the linguistic description and objective reflection of physical space and time.

Absolute space and time reflect the universality, consistency and stability of the physical matter, while relative space and time reflect the particularity, diversity and movement characteristics of the specific physical matter.

The above discussion on space and time is the inheritance and development of Newton's dialectical space-time. Einstein's relative space-time regards physical space and time as the essence of the specific physical matter, only recognizes the existence of relative space-time and denies absolute space-time.

The theory of special relativity is based on the principle of relativity and the principle of light speed invariance. In fact, there are no two inertial reference frames with relative motion in the physical world, and the vacuum contained therein is independent of each other. Vacuum cannot be placed in a sealed container like air to move with the inertial system, so the principle of relativity does not hold when vacuum is involved. On the other hand, the vacuum of all inertial systems is an inseparable same vacuum. The vacuum has the characteristics of absolute space so the principle of light speed invariance in vacuum must be true. For special relativity, another paper will be further discussed based on the experiment.

3. Physical matter

In philosophy, we define matter as an objective existence. In this way, we can define physical matter as a physical objective existence and an objective existence with energy.

Physical matter can be further divided into two categories: solid matter and field matter. Solid matter includes various forms of macro objects and all micro particles and basic particles. The velocity of solid matter is less than C, and it shows more particle characteristics. There are only four kinds of field matter: electric field, magnetic field, light field and gravitational

field. Field matter can only move in the physical absolute space, so its speed is constant C, which is reasonable and self-consistent. Both solid matter and field matter have energy.

3.1 Energy and mass

Matter is an objective existence of energy. Energy is the essence of physical matte. Both solid matter and field matter have energy, and energy conservation is the most basic law of physics.

According to classical physics, mass refers to the amount of matter contained in an object. Solid matter has inertial mass and gravitational mass. The mass represented by Newton's second law is called inertial mass, and the mass represented by the law of gravitation is called gravitational mass; Inertial mass and gravitational mass are equal.

According to Einstein's mass energy equation, for a solid matter with mass m_E, its energy is

$$E = m_E C^2 \qquad (3\text{-}1)$$

Energy is a more fundamental physical quantity than mass. Different from the definition of mass in classical physics, we define mass based on energy, and the definition of mass of solid matter: For the solid matter with energy E, its mass m_E is defined as

$$m_E = E / C^2 \qquad (3\text{-}2)$$

According to the above definition, in an independent physical system, if there is only solid matter, energy is conserved, and mass must be conserved.

Field matter has field quantum properties. Field quantum is the smallest unit of field. The field quantum of the electric field is the electric field quantum, the field quantum of the magnetic field is the magnetic field quantum, the field quantum of light field is the quantum of light field, i.e. photon, the field quantum of gravitational field is the quantum of gravitational field. The velocity of the field matter is constant C, and its energy

$$E = h\gamma \qquad (3\text{-}3)$$

According to classical and modern physics, field matter also has the energy as solid matter, and its energy is conserved. However, the traditional definition of mass of solid matter cannot be extended to the field matter.

Formula (3-2) mass definition is based on energy, which is easy to extend to field matter. The definition of mass of field matter: For field matter with energy E, its mass is defined as:

$$m_E = E / C^2 \qquad (3\text{-}4)$$

The energy of the field matter is $E = h\gamma$, then the mass of the field matter

$$m_E = h\gamma / C^2 \qquad (3\text{-}5)$$

The above formula (3-5) defines the mass of the field matter. The velocity of the field matter is equal to the field velocity C. the force applied to the field matter will not produce acceleration and deceleration, but will change its energy and momentum.

Based on the above mass definitions of solid matter and field matter, we have a general mass definition of matter: For any physical matter with energy E, its general mass is defined as

$$m_E = E / C^2 \qquad (3\text{-}6)$$

Based on the above definition of general mass, in an independent physical system, energy is conserved, and the general mass must also be conserved.

For a solid matter, its energy includes three parts: the static mass at absolute zero, kinetic energy and thermal energy，then the total energy of the solid matter：

$$E = m_0C^2 + K(v, t)\, m_0 \qquad (3\text{-}7)$$

Where, the coefficient K (v, t) is a function of the velocity v and the temperature t of the solid matter.

The general mass of solid matter

$$m = m_0 + K(v, t)\, m_0/C^2 \qquad (3\text{-}8)$$

According to the above formula (3-8), the general mass of the solid matter is variable. The higher speed and temperature, the greater general mass of the solid matter.

The coefficient K (v, t) is a function of v and t, which will be discussed in another paper.

3.2 Newton's second law and momentum law

Solid matter satisfies Newton's second law

$$\mathbf{F} = m_E\mathbf{a} \qquad (3\text{-}9)$$

Where m_E is general mass of the solid matter and **a** is its acceleration.

The velocity of the field matter is constant C, and the field matter has no acceleration. Therefore, Newton's second law of formula (3-9) does not hold for the field matter.

Acceleration can be expressed as the differential of velocity, so Newton's second law of formula (3-9) can be expressed as:

$$\mathbf{F} = m_E\, d\mathbf{v}/ dt$$

Then

$$\mathbf{F} = d(m_E\,\mathbf{v}) / dt \qquad (3\text{-}10)$$

Where momentum $p = m_E\,\mathbf{v}$, for solid matter, Newton's second law is equivalent to the momentum theorem. The momentum theorem of formula (3-10) can be expressed as:

$$\mathbf{F} \cdot dt = d(m_E\,\mathbf{v}) \qquad (3\text{-}11)$$

or

$$\mathbf{F} \cdot dt = d\mathbf{p} \qquad (3\text{-}12)$$

For a solid matter, its general mass is unchanged (strictly speaking, the general mass of the solid matter changes slightly with the change of its velocity and temperature), and the impulse

will change the velocity of the solid matter.

For a field matter, the velocity of the field is constant C, and the impulse will change the general mass of the field matter.

Energy and momentum are the two most basic physical quantities. Energy conservation and momentum conservation are the two most basic laws of physics, which hold true for both solid matter and field matter.

4. Law of general gravitation

4.1 Law of gravitation

In 1687, the greatest physicist Newton discovered the law of gravitation based on the research results of scientific pioneers such as Copernicus, Galileo and Kepler: Any two objects have gravitational force, and the magnitude of the gravitational force is proportional to the product of the masses of the two objects and inversely proportional to the square of their distance. The formula is:

$$\mathbf{F} = G\, m_1\, m_2 / r^2 \qquad (4\text{-}1)$$

The above formula is used for solid matter. Where, **F** is the gravitational force of two solid matters, m_1, m_2 is the mass of two solid matters, r is the distance between two solid matters, and G is the gravitational constant, $G = 6.67 \times 10^{-11} N \cdot m / kg^2$.

4.2 Law of general gravitation

Formula (3-6) above defines the general mass of physical matter based on energy. There is general mass in both solid matter and field matter. Based on the general mass, Newton's law of gravitation can be extended to the law of general gravitation: Any two physical matters have gravitational force, and the magnitude of gravitational force is proportional to the product of the general masses of the two physical matters and inversely proportional to the square of their distance. The formula is:

$$\mathbf{F} = G\, m_{E1}\, m_{E2} / r^2 \qquad (4\text{-}2)$$

Where, m_{E1}, m_{E1} is the general mass of two physical matters, $m_{E1} = E_1 / C^2$, $m_{E1} = E_2 / C^2$.

Substituting the general mass $m_{E1} = E_1 / C^2$ and $m_{E1} = E_2 / C^2$ into the formula (4-2), then

$$\mathbf{F} = G\,(E_1 / C^2)(E_2 / C^2) / r^2$$

$$\mathbf{F} = (G/C^4)\, E_1\, E_2 / r^2$$

Let $G_E = G / C^4$, that is, $G_E = 8.23 \times 10^{-45}\ N \bullet m / J^2$ be the general gravitational constant, then

$$\mathbf{F} = G_E\, E_1\, E_2 / r^2 \qquad (4\text{-}3)$$

The formula (4-3) above is the law of general gravitation based on energy: Any two physical matters have gravitational force, and the magnitude of gravitational force is proportional to

the product of the energy of the two physical matters and inversely proportional to the square of their distance.

From formula (4-3), let **D** = **F** / E_2, we define

$$\mathbf{D} = G_E E_1 / r^2 \qquad (4\text{-}4)$$

D is the strength of the gravitational field of energy E_1 at the distance r.

In summary, physical matter is an objective existence with energy. The energy is the essence of physical matter. Inertia and gravitational characteristics are the universal properties of energy. Inertial mass is the measurement of energy inertial property, and gravitational mass is the measurement of energy gravitational property. The gravitational constant G makes gravitational mass and inertial mass to be equal, and gravitational mass and inertial mass can be unified into general mass.

4.3 Verification experiment of the law of general gravitation

When Einstein published the theory of general relativity in 1915, he proposed three key verification experiments:

- Deflection angle of light in gravitational field;
- Mercury perihelion advance;
- Gravitational redshift.

Below we will calculate the deflection angle of light passing through the sun based on the law of general gravitation.

4.3.1 Perihelion deflection angle of light

Photons have a general mass m_E. Based on the law of general gravitation, when photons pass through the sun nearby, photons will deflect under the gravitational action of the sun.

The general mass of the sun $M_E = 1.989 \times 10^{30}$ Kg, and its radius $R_0 = 6.955 \times 10^8$ m.

Without losing generality, let the wavelength of light $\lambda = 570$nm, the frequency $\gamma = 5.26 \times 10^{14}$ Hz, then the photon energy:

$$E_\gamma = h\gamma$$
$$= 6.626 \times 10^{-34} \times 5.26 \times 10^{14}$$
$$= 3.487 \times 10^{-19} \text{ J}$$

Its general mess:

$$m_E = E_\gamma / C^2$$
$$= (3.487 \times 10^{-19}) / (3.0 \times 10^8)^2$$
$$= 3.874 \times 10^{-36} \text{ Kg}$$

The momentum of the photon:

$p_0 = m_E C$

$=3.874x10^{-36}\ x3x10^{8}=1.162x10^{-27}\ Kg\cdot m\cdot s^{-1}$

As shown in Figure 4.1, photons pass through the sun nearby along the x-axis direction, and the vertical distance from the light to the sun's center R = R_0. The light is symmetric on the left and right sides of the x-axis. First, we only consider that the photons are in the right half of the x-axis, x is from 0 to L_x and let L_x = 20R.

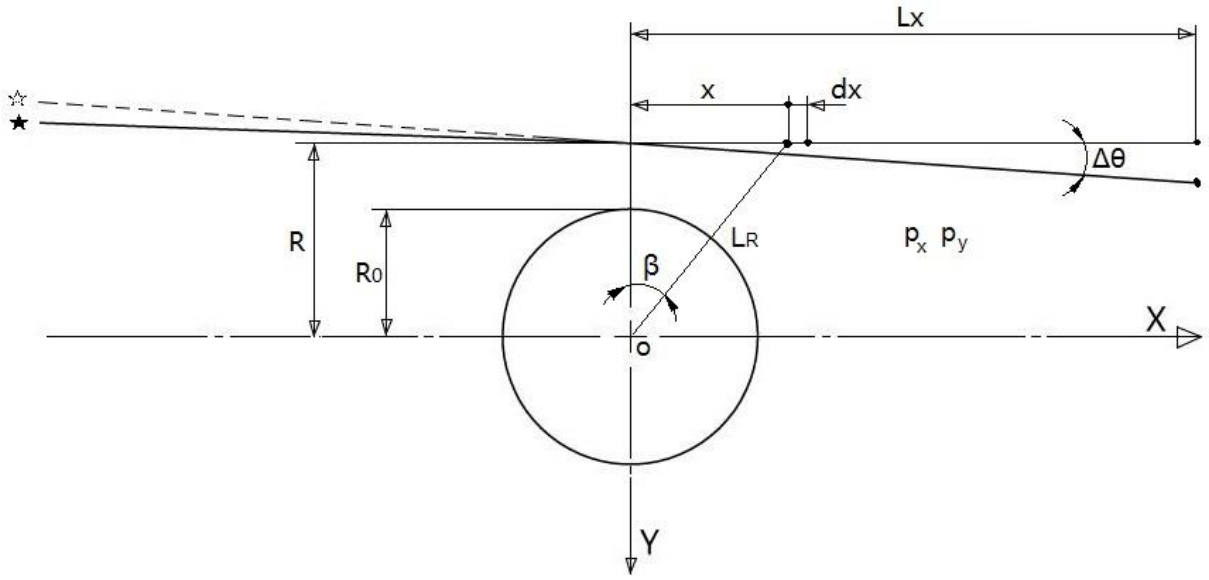

Figure 4.1 Deflection angle of light

When the photon is located at x in x-axis, the distance between the photon and the sun center:

$L_R = (R^2 + x^2)^{1/2}$

then $\cos\beta = R / L_R$

$\cos\beta = R / (R^2 + x^2)^{1/2}$

According to formula (4-2), the photon is subjected to the general gravitational force of the sun:

$F = G M_E m_E / L_R^{\ 2}$

$= G M_E m_E / (R^2 + x^2)$

The component force of general gravitation F along y-axis direction:

$F_y = F \cos\beta$

$= (G M_E m_E / (R^2 + x^2))(R / (R^2 + x^2)^{1/2})$

$F_y = G M_E m_E R / (R^2 + x^2)^{3/2}$

When the photon moves from 0 to L_X along the x-axis, the momentum increase of the photon along the y-axis direction p_{yh} is the integration of the general gravitational force F_y with time, i.e:

$$py_h = \int_0^{Lx} F_y \, dt$$

Where dt = dx /C，then

$$py_h = \int_0^{Lx} F_y \, dx/C$$

$$= \int_0^{Lx} (G M_E m_E R /(R^2+x^2)^{3/2})(dx/C)$$

$$py_h = (G M_E m_E R/C) \int_0^{Lx} \frac{1}{(R^2+x^2)^{3/2}} dx$$

Let momentum proportional coefficient:

$P_k = G M_E m_E R/C$

Momentum integral part:

$$P_I = \int_0^{Lx} \frac{1}{(R^2+x^2)^{3/2}} dx$$

Then $p_{yh} = P_k P_I$

Pyh is the momentum increase of the photon along the y-axis on the right half x-axis. Since the x-axis is symmetrical, when the photon moves from - L_X to L_X, the total momentum of the photon along the y-axis direction:

$p_y = 2 p_{yh}$

The momentum of the photon along the x-axis is the initial momentum of the photon p_0:

$p_x = p_0$

Under the gravitational action of the sun, the velocity of the photon remains unchanged, but the momentum and general mass of the photon change. The velocity direction of the photon deflects and the deflection angle is Δθ，then:

$\tan\Delta\theta = p_y / p_x$

$\Delta\theta = \tanh（p_y / p_x）$

Based on the above analysis, we use computer software for numerical processing. The below is the computer program code for calculating the photon deflection angle.

```
//#################################################################//
//#                        Deflection angle of light                #//
//#             based on the law of general gravitation             #//
//#################################################################//
private void btnRun_Click(object sender, EventArgs e)
{
    double m_dblG = 6.67E-11;          //define and init gravitational constant G
    double m_dblC = 3.0E8;             //define and init light speed C
    double m_dblR0 = 695500000.0;      //define and init sun's radius R0
    double m_dblME = 1.989E30;         //define and init sun's general mess ME
    double m_dblm = 3.874E-36;         //define and init photon's general mess mE
```

```
double m_dblpx = 1.162E-27; //define and init photon momentum    along the x-axis

double m_dblR = 0.0;              //define the distance from the light to the sun's center R
double m_dblLx = 0;               //define the length of x-axis
double m_dbldx = 0;               //define integrated differential element dx at x-axis
ulong m_uNCount = 0;              //define the count of differential elements
double m_dblPk = 0.0;             //define the momentum proportional coefficient Pk
double m_dblPI = 0.0;            //define the momentum integral part PI
double m_dblpy = 0.0;             //define the momentum the photon along the y-axis
double m_dblAngle = 0.0;         //define the deflection angle of light

//---------------------------------
ulong i = 0;
ulong j = 0;
string strTemp = "";
double dblTemp = 0.0;

double dbldPI = 0.0;                 //define the differential element dbldPI
double dblx = 0.0;                   //define x value at x-axis
double dblRx = 0.0;                   //define dblRx =（R^2 + x^2）^3/2

//---------------------------------
strTemp = txtR.Text.Trim();
m_dblR = Convert.ToDouble(strTemp);
m_dblR = m_dblR * m_dblR0;         //Init the distance from the light to the sun's center
strTemp = txtLx.Text.Trim(); ;
m_dblLx = Convert.ToDouble(strTemp);
m_dblLx = m_dblLx * m_dblR;                    //Init the length of x-axis

strTemp = txtdx.Text.Trim(); ;
m_dbldx = Convert.ToDouble(strTemp);         //Init differential element dx at x-axis

double dblnCount = m_dblLx / m_dbldx;
m_uNCount = Convert.ToUInt64(dblnCount); //Init the count of differential elements
strTemp = Convert.ToString(m_uNCount);
txtn.Text = strTemp;

m_dblPk =(m_dblG * m_dblME * m_dblm * m_dblR);
m_dblPk = m_dblPk / m_dblC;               //Init the momentum proportional coefficient Pk
strTemp = Convert.ToString(m_dblPk);
txtPk.Text = strTemp;

//=========================================================
//calculte m_dblPI: dx/（R^2 + x^2）^3/2, (dblRx =（R^2 + x^2）^3/2)
for (i = 0; i <= m_uNCount; i++)
{
      dblx = i * m_dbldx;                              //calculate x value at x-axis
      dblRx = dblx * dblx + m_dblR * m_dblR;
      dblRx = Math.Pow(dblRx, 1.50);                 //calculate dblRx =（R^2 + x^2）^3/2

      dbldPI = m_dbldx / dblRx;                      //calculte the differential element dbldPI
      m_dblPI = m_dblPI + dbldPI;                     //calculte the current m_dblPI
```

```
            j++;
            if (j >= 1000)
            {
                strTemp = Convert.ToString(m_dblPI);
                txtPI.Text = strTemp;
                Application.DoEvents();                    //show the current results
                j = 0;
            }

        }//end for

        //=========================================================
        //show the results
        strTemp = Convert.ToString(m_dblPI);
        txtPI.Text = strTemp;

        m_dblpy = m_dblPk * m_dblPI;
        m_dblpy = 2 * m_dblpy;                          //the photon momentum along the y-axis
        strTemp = Convert.ToString(m_dblpy);
        txtPy.Text = strTemp;

        dblTemp = m_dblpy / m_dblpx;
        m_dblAngle = Math.Tanh(dblTemp);
        m_dblAngle = m_dblAngle * 180 / 3.14159;
        m_dblAngle = m_dblAngle * 3600.0;          //deflection angle of light
        strTemp = Convert.ToString(m_dblAngle);
        txtAngle.Text = strTemp;

    } //end
```

Figure 4.2 shows the running interface and results of the program above.

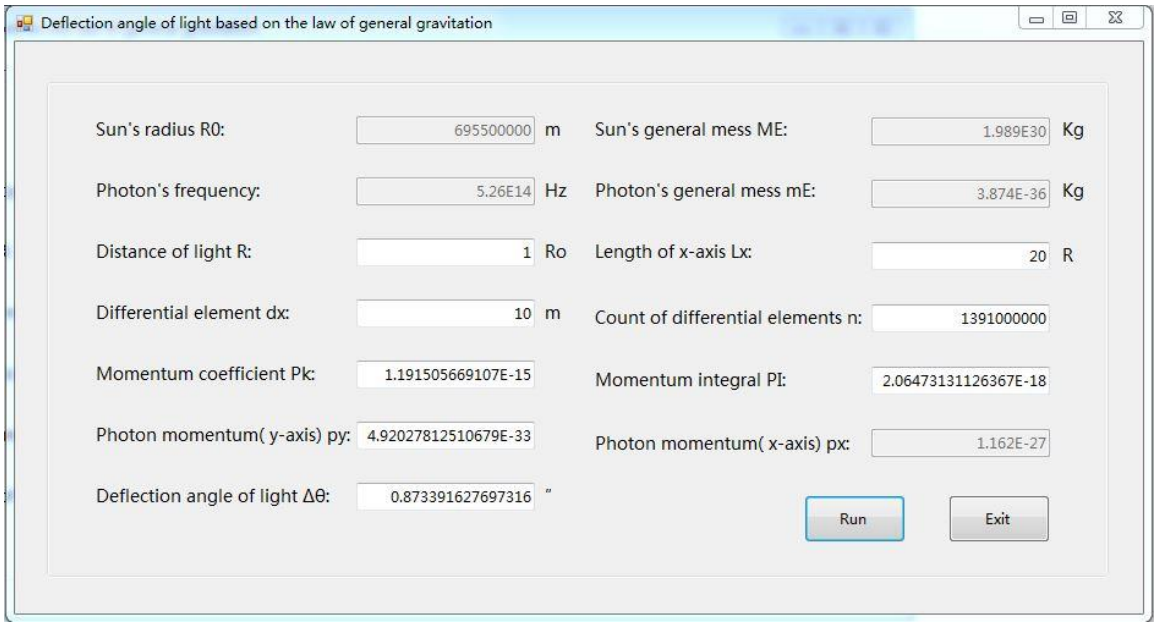

Figure 4.2 Program interface of deflection angle of light

The sun's radius R_0 = 695,500,000m and its general mass $M_E = 1.989 \times 10^{30}$ kg. The photon's frequency γ= 5.26×10^{14} Hz and its general mass $m_E = 3.874 \times 10^{-36}$ kg. When the light passes through the sun nearby, let $R = R_0$, $L_X = 20R$ and the integrated differential element dx = 10m on the x-axis. With computer numerical processing and calculation, the following is obtained:

Momentum proportional coefficient value:

$P_k = 1.192 \times 10^{-15}$

Momentum integral partial value:

$P_I = 2.065 \times 10^{-18}$

Momentum of the photo along the y-axis

$p_y = 4.920 \times 10^{-33}$ Kg·m·s^{-1}

Momentum of the photo along the x-axis:

$p_x = 1.162 \times 10^{-27}$ Kg·m·s^{-1}

Deflection angle of the photon:

$\Delta\theta = 0.8734''$

In 1915, based on general relativity, Einstein calculated that the perihelion deflection angle of light was 1.75″.

On May 29, 1919, in order to verify Einstein's theory of light deflection, the British scientist Eddington organized two teams to the west coast of Africa to photograph and observe the total solar eclipse. The deflection angles obtained by the two teams were 1.98″ and 1.61″ respectively. The observation results were in good agreement with Einstein's theoretical calculations, and the general relativity began to be accepted by people.

There is a big error between Eddington's observation results and the deflection angle of 0.8727″ calculated by the law of general gravitation. In fact, when light passes through the sun nearby, the influence of the sun's atmosphere on the light needs to be considered.

As shown in Figure 4.3, in order to make a rough estimate of the impact of the sun's atmosphere on the light, the radius of the outer periphery of the sun's atmosphere is taken as 20 times of the radius of the sun. It is assumed that the atmospheric pressure in the sun's atmosphere is constant, which is a standard atmospheric pressure of the earth. Referring to the atmospheric environment of the earth, the refractive index n_2 of the light under a standard atmospheric pressure is 1.00029, and the refractive index n_1 in the vacuum is 1.00000.

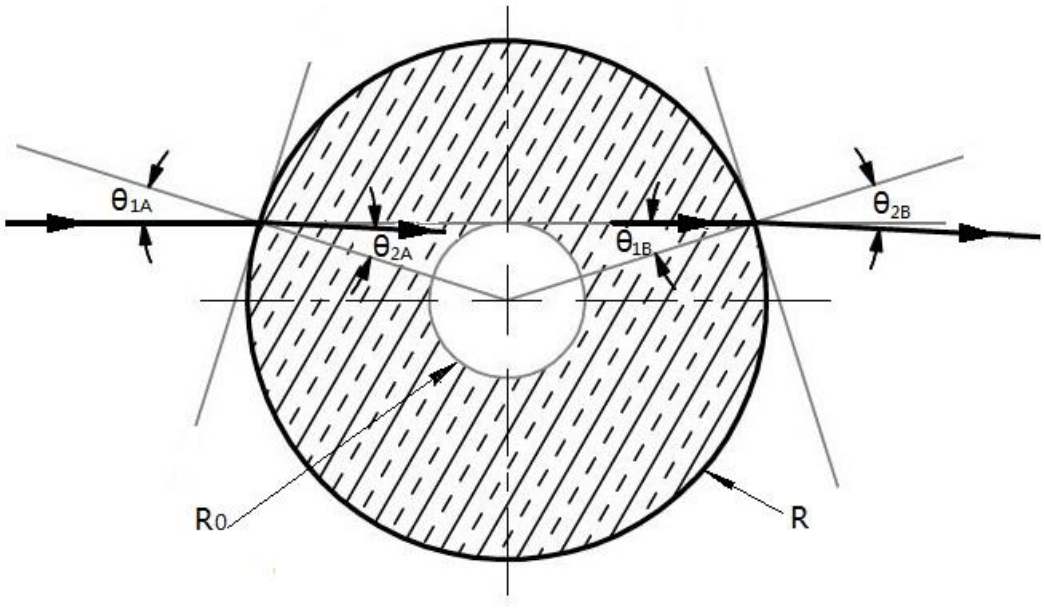

Figure 4.3 Deflection angle of light under sun's atmosphere

As shown in Figure 4.3, with the refraction equation of light propagation.

$$n_1 \sin\theta_{1A} = n_2 \sin\theta_{2A} \qquad (4\text{-}10)$$

Where $\sin\theta_{1A} = R_0/(20R_0) = 0.05$

Then $\theta_{1A} = 0.050021$ arc

Substitute $n_1 = 0.00000$, $n_2 = 1.00029$, $\sin\theta_{1A} = 0.05$ into formula (4-10) and obtain:

$$\sin\theta_{2A} = 0.05/1.00029 = 0.0499855$$

Then $\theta_{2A} = 0.050006$ arc

When the light enters the sun's atmosphere from the vacuum, the deflection angle of the light:

$$\theta_{1A} - \theta_{2A} = 0.050021 - 0.050006 = -0.000015 \text{ arc}$$

That is $\theta_{1A} - \theta_{2A} = 3.029''$

Similarly, when the light emits from the sun's atmosphere to the vacuum, the deflection angle of the light is equal to that when the light enters the sun's atmosphere from the vacuum, so the total deflection angle of the light caused by the sun's atmosphere:

$$\Delta\theta_{Air} = 2 \times 3.029 = 6.058''$$

The deflection angle $\Delta\theta_{Air}$ above is much larger than the deflection angle obtained by the British scientist Eddington observation experiment. Therefore, Eddington's observation experiment on May 29, 1919 did not prove the theoretical prediction of Einstein's general

relativity on the perihelion deflection angle of light. The observation experiment on the deflection angle of light passing through the sun must eliminate the influence of the sun's atmosphere.

4.2.2 The deflection angle of light far away from sun's atmosphere

In order to eliminate the influence of sun's atmosphere on the deflection angle of light, the light must pass the sun far away from sun's atmosphere. For this reason, referring to Figure4.1, let the distance between the light and sun's center R = 200R_0. Figure 4.4 shows the running interface and results of the computer program.

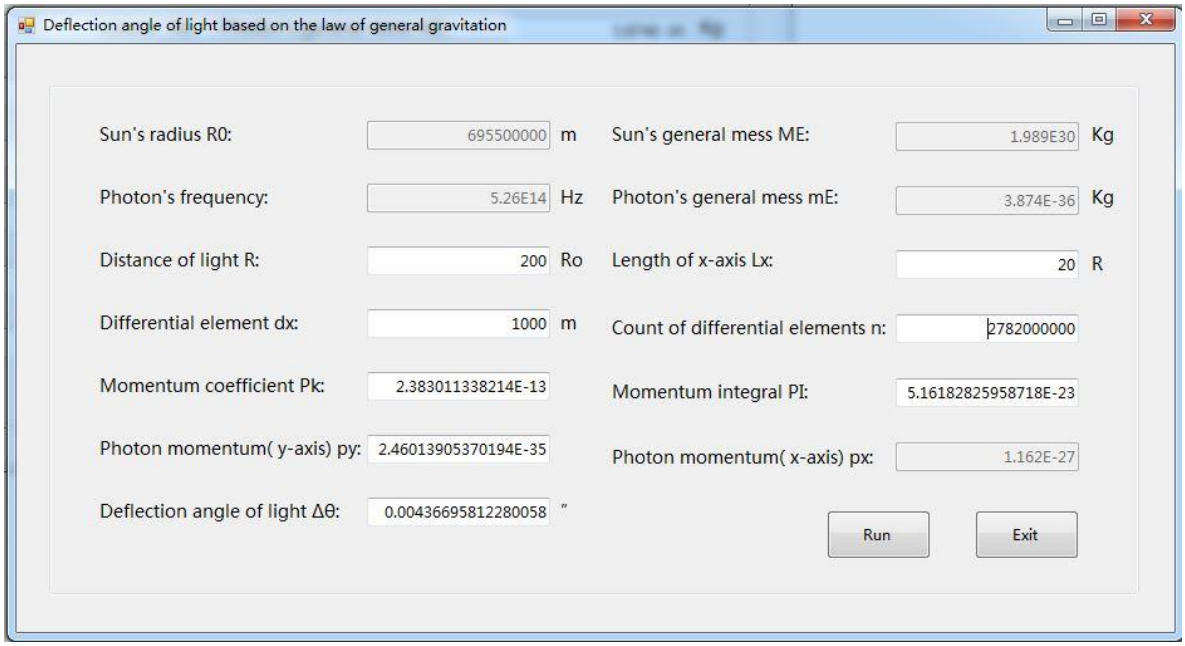

Figure 4.4 Deflection angle of light far away from sun's atmosphere

With the results of computer program，when R = 200R_0, the deflection angle of light Δθ is 0.004367″. Purple Mountain Observatory, Chinese Academy of Sciences, is at the leading level in the world on the observation and measurement of light deflection angle between galaxies, and its measurement accuracy can reach 0.000001″.

Table 4-1 shows the deflection angle values calculated by the computer program when R is 20R_0, 40R_0, 60R_0, 80R_0, 100R_0, 120R_0, 140R_0, 160R_0, 180R_0 and 200R_0 respectively.

Table 4-1 the deflection angle of light far away from sun's atmosphere

R	Pk	PI	p_y	p_x	Δθ(″)
20R_0	2.383E-14	5.162E-21	2.460E-34	1.162E-27	0.043670
40R_0	4.766E-14	1.290E-21	1.230E-34	1.162E-27	0.021835
60R_0	7.149E-14	5.735E-22	8.200E-35	1.162E-27	0.014557

$80R_0$	9.532E-14	3.226E-22	6.150E-35	1.162E-27	0.010917
$100R_0$	1.192E-13	2.065E-22	4.920E-35	1.162E-27	0.008734
$120R_0$	1.430E-13	1.434E-22	4.100E-35	1.162E-27	0.007278
$140R_0$	1.668E-13	1.053E-22	3.145E-35	1.162E-27	0.006239
$160R_0$	1.906E-13	8.065E-23	3.075E-35	1.162E-27	0.005459
$180R_0$	2.145E-13	6.373E-23	2.733E-35	1.162E-27	0.004852
$200R_0$	2.383E-13	5.162E-23	2.460E-35	1.162E-27	0.004367

5. Standard cosmology and its problems

Cosmology is the astrophysics that studies the origin, evolution and ending of the universe. The big bang cosmology is strongly supported by Hubble expansion, light element abundances and cosmic microwave background radiation. It has become standard cosmology and is accepted by most physicists. However, standard cosmology is facing many challenges such as cosmic accelerating expansion, dark matter and dark energy.

5.1 Space structure of the universe

With axiom 2.1, physical absolute space is a three-dimensional infinite linear space, which has no directionality, is uniform and isotropic everywhere; Physical absolute space is absolutely invariable and static, and have nothing to do with anything outside. Physical absolute space is the container where all physical matters exist. Physical absolute space itself has nothing to do with any specific physical matter and energy. It is an absolute vacuum space and can be called void space.

In the past half century, with the expansion and deepening of our exploration of the universe, the physical absolute space (void space) can better understand the creation, change and extinction of the universe. There is no field matter and no energy in the void space. The void space exists independently of the universe. Before the big bang, the void space already existed. During the evolution of the universe, the void space and the universe exist together. Even after the demise of the universe, the void space still exists. The universe is a changing water drop in the void space.

The universe was born tens of billions of years ago. When the big bang occurred at a certain point in the void space, the field matter in the universe radiated energy to the void space at the field speed C. That is, the universe expands uniformly around the void space at the field speed C. Figure 5.1 shows the space structure picture of the universe based on modern

observations.

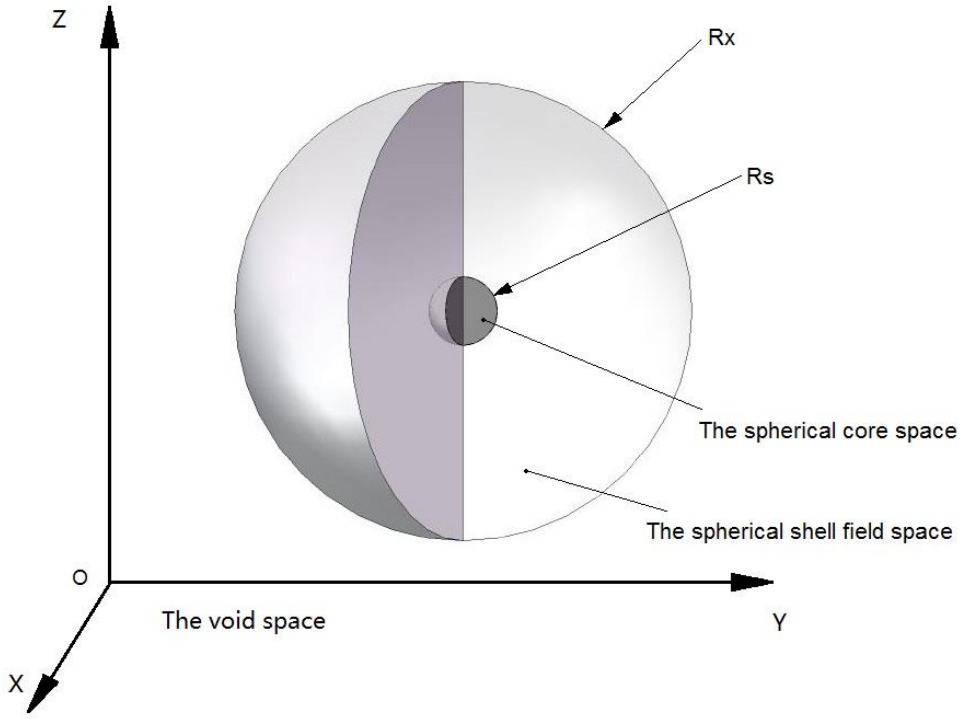

Figure 5.1 The space structure picture of the universe

See Figure 5.1, the universe is a sphere suspended in the void space. The center of the sphere is the origin of the big bang. The universe is composed of **the spherical core space and the spherical shell field space.**

The spherical core space is centered on the origin point of the big bang. Based on modern cosmic observation, its diameter D_S is 10 billion light-years to 20 billion light-years. As an estimated value, the diameter of the spherical core space:

D_S=15 billion light-years

Its radius:

R_S=7.5 billion light-years

Also based on modern cosmic observation, as a prediction value, the maximum relative retrograde velocity between two stars:

V_S= 0.30C

The age of the universe:

$T_S = D_S / V_S$

$= 15 / 0.3$

T_S = 50 billion light-years

Thus, the outer diameter of the spherical shell field space:

D_X=100 billion light-years

Its radius:

R_X=50 billion light-years

The spherical core space is composed of solid matter and field matter, and the spherical shell field space is completely composed of field matter. The space outside the spherical shell field space is void space. Since the birth of the big bang, the expansion speed to the void space has been constant at the field speed C.

5.2 Dark energy and dark matter

Physical matter is divided into solid matter and field matter, and matter is an objective existence of energy. Based on the energy，we have a general mass definition of physical matter: For any physical matter with energy E, its general mass is defined as:

$m_E = E / C^2$

General mass is the basic measure of energy for both solid matter and field matter. In an independent physical system, energy is conserved, and the general mass must also be conserved.

From the above analysis, it can be concluded that there are no dark energy and dark matter in the universe, the so-called dark energy is the energy of field matter, and the so-called dark matter is the general mass of field matter.

Based on cosmic observation, the temperature is 2.7K at the cosmic microwave background radiation of 13.7 billion light-years. According to the Stefan-Boltzmann law of blackbody radiation, the radiation power per square meter

$p_1=\sigma T^4$ w•m^{-2} J•s^{-1}•m^{-2} （5-2）

Substitute σ=5.67x10-8 J•S^{-1}•m^{-2}•K^{-4}, T=2.7K into the above formula and obtain:

$p_1=3.01x10^{-6}$ J•s^{-1}•m^{-2}

Since the earth is located in the spherical core space, the above 2.7K cosmic radiation is observed from the opposite direction of radiation emission, and the real radiation power per square meter should be greater than the above calculated value. The p_1 should be multiplied by a scale coefficient K_S, which can be measured experimentally. Here, it is estimated that the scale coefficient K_S is 1000.0, so p_1 is:

$p_1 = 3.01x10^{-3}$ J•s^{-1}•m^{-2}

Since the velocity of cosmic radiation C = $2.9979x10^8$ m•s^{-1}, the energy density of radiation per cubic meter：

$E_1= p_1/C$

$$E_1=1.004x10^{-11}\ J•m^{-3}$$

The above radiation energy density E_1 is estimated as the average energy density of the field matter in the all cosmic. The universe with a radius R_X = 50 billion light-years, its spherical volume:

$$V_X = （4\pi/3）R_X^3$$
$$= （4\pi/3）（50x10^9 \times 9.46x10^{15}）^3$$

$$V_X = 4.431x10^{80}\ m^3$$

Total energy of the field matter in the universe：

$$E_X = E_1 V_X$$
$$= （1.004x10^{-11}）（4.431x10^{80}）$$

$$E_X = 4.449x10^{69}\ J$$

The total general mass of the field matter in the universe：

$$M_X = E_X / C^2$$

$$M_X = 0.494 \times 10^{53}\ Kg$$

Based on the above analysis and calculation, the total energy of the field matter is the so-called dark energy, and the total general mass of the field matter is the so-called dark matter. The estimated values of the general mass and energy of the field matter are approximately consistent with the modern cosmic observation data.

5.2 Cosmic accelerating expansion

Figure 5.1 shows the space structure picture of the universe. During the birth and evolution of the universe, the field matter in the universe radiated energy to the void space at the field speed C. That is, the universe expands uniformly around the void space at the field speed C.

During the evolution of the universe, the solid matter in its spherical core space is constantly transformed into field matter, and radiates into the spherical shell field space. Thus, the general gravitation force from spherical core space, which attracts galaxies together, becomes smaller and smaller, and the general gravitation force from spherical shell field space, which separates galaxies from each other, becomes larger and larger. The relative retrograde speed between galaxies is getting faster and faster, that is, the expansion between galaxies is accelerating.

6. Conclusion

This paper inherits and develops Newton's dialectical space-time. Space and time are universal properties of physical matter. Absolute space-time reflects the universality, consistency and stability of the physical matter, while relative space-time reflects the particularity, diversity and movement characteristics of specific physical matter.

Physical matter is an objective existence with energy. Physical matter can be further divided into solid matter and field matter. Solid matter includes various forms of macro objects and all micro particles and basic particles. The speed of solid matter is less than C. There are only four kinds of field matters: electric field, magnetic field, light field and gravitational field. Field matter can only move in the physical absolute space, so its speed is constant C， which is reasonable and self-consistent. Energy is the essence of physical matter and field matter.

Based on energy and Einstein mass energy equation, we introduce and define general mass: For any physical matter with energy E, its general mass m_E is defined as:

$$m_E = E / C^2$$

The definition and introduction of general mass, combined with the momentum theorem, extends Newton's classical dynamics from solid matter to field matter, which replaces Einstein's special relativity.

The definition and introduction of general mass expands Newton's classical law of gravitation to the law of general gravitation, which replaces Einstein's general relativity that have been patched all over.

This paper also presents a verification experiment of the law of general gravitation: When the light passes through the sun far away from sun and $R=200R_0$ (R_0 is the radius of the sun), according to the law of general gravitation, the deflection angle of light $\Delta\theta$ is 0.004367″.

For many problems faced by standard cosmology, This paper reveals that there are no dark energy and dark matter in the universe, the so-called dark energy is the energy of field matter, and the so-called dark matter is the general mass of field matter.

The universe expands uniformly around the void space at the field speed C. As the solid matter in the spherical core space is getting less and less, and the field matter in the spherical shell field space is getting more and more, the relative retrograde speed between galaxies is getting faster and faster, that is, the expansion of galaxies is accelerating.

Physical matter is an objective existence with energy. The energy is the essence of physical matter, and it is the only essence of physical matter. Therefore, physical matter and energy are completely equivalent, and general mass is the measurement of energy. Inertia, gravitation, space and motion characteristics are the universal basic properties of energy, that is, any physical matter or energy has inertia, gravitation, space and motion characteristics.

Inertial mass is the measurement of energy inertial property, and gravitational mass is the measurement of energy gravitational property. The gravitational constant G makes

gravitational mass and inertial mass to be equal and the values of gravitational mass and inertial mass are equal to those of general mass. However, inertial and gravitational properties are different universal properties of energy, so inertial mass and gravitational mass are two different physical measures. In the momentum theorem, the general mass actually represents the inertial mass of energy. In the law of general gravitation, the general mass actually represents the gravitational mass of energy.

Any physical matter or energy has the characteristic of space and the characteristic of moving and changing in space. Length is the measurement of energy space characteristic, and time and temperature are the measurement of the characteristic of energy moving and changing in space. Time is not the property of energy.

Mass, length, time and temperature are the basic measurements of physical matter or energy.

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