Canlun Yuan. Absolutionism: the Relationship Between Matter, Space, Time and Movement, viXra.org e-Print archive, viXra:2310.0081 https://viXra.org/abs/2310.0081

Absolutism

—The relationship between matter, space, time and motion

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Abstract: In this paper, the absolute static reference frame of the universe is established, Galileo's relativity principle and the essence of light are analyzed, and the zero result of Michelson-Morey experiment is re-recognized. The conclusion is that the light in two directions reaches the eyepiece at the same time, and when the interferometer is rotated at any angle, the light in two directions still reaches the eyepiece at the same time, and the interference fringes will not move, so the zero result of the experiment is inevitable. This paper analyzes Lorenz's explanation of the zero result of Michelson-Morey experiment, and points out many contradictions and mistakes in it. Because Michelson's wrong calculation result is not consistent with the zero result of the experiment, Lorenz had to set up "length shortening", "clock slowing down" and a Lorenz transformation factor to piece together the zero result of the experiment. It is precisely because these assumptions are incorrect that all the relations and related theories that use Lorentz transformation factors are incorrect. Only Galileo's relativity principle can correctly explain the zero result of Michelson-Morey experiment, and galilean transformation is the theory that correctly describes motion. This paper also re-understands the relationship between matter, space, time and motion, inertia, field, field wave, force and energy, analyzes the essence of nuclear energy, and establishes a new model of the universe. It makes physics return to the correct track of classical theory and deepens and develops classical theory.

Key words: the essence of light, the absolute static reference frame of the universe, wave velocity, Lorentz transformation factor, galilean transformation, matter, mass, space, time, motion, inertia, field, field wave, force, solid matter, field matter, energy, nuclear force potential energy, electromagnetic wave, universe, cosmological principle.

1. Preface

Two dark clouds in the history of physics gave birth to modern physics theory. In the Michelson-Morey experiment【1】 in 1887, the time difference between two vertical lights was measured by Michelson interferometer to determine the absolute speed of the earth. As a result, it is impossible to observe the movement of interference fringes, which proves that the speed of light is the same in different inertial systems and different directions, thus denying the existence of ether (absolute stationary reference system), thus shaking the foundation of classical physics, becoming a beginning of modern physics and occupying a very important position in the history of physics development.

In 1895, Lorentz put forward the Lorentz transformation formula of space-time coordinates, arguing that the length of the interferometer will shrink in the direction of motion, so the interference fringes will not move, thus explaining the zero result of Michelson-Morey experiment.

In 1905, Einstein abandoned the static reference frame ether, and based on the principle of light speed invariance and the principle of special relativity, he derived and established the special theory of relativity, and used Lorentz transformation to explain Michelson-Morey experiment and light speed invariance. Einstein believes that Lorentz transformation is a purely mathematical space shortening, not a shortening of the distance between charged particles that make up the measuring rod, and this space shortening has no substantive physical significance. Relativity holds that space and time are not independent of each other, but a unified four-dimensional space-time whole. It holds that the inertial motion of the reference system is relative, and there is no absolute motion. In any reference system, the speed of light in vacuum is constant, which completely changes people's concept of time and space.

The author of this paper thinks that Galileo's principle of relativity should be reconsidered and the law of relative motion should be found. Two dark clouds are caused by light, because the understanding of light is not enough so far, which leads to the subversion of the concept of time and space. To solve the problems caused by light, we must understand the nature of light and the relationship between space, time, matter and movement. We must return to the correct track of classical theory and deepen and develop it.

2. Galileo's principle of relativity

In 1638, Galileo put forward Galileo's principle of relativity of motion【2】 in Dialogue between Two New Sciences, also known as the principle of relativity of mechanics. This principle holds that the laws of mechanics are the same in all inertial systems, that is, any mechanical experiment made in an inertial system cannot determine the movement of the inertial system relative to other inertial systems. Galileo first explained the fact that "it is impossible to find out whether the inertial system is stationary or moving in a straight line at a constant speed by any mechanical experiment made inside the inertial system". In 1632, Galileo observed the phenomenon in a closed cabin on a ship moving in a straight line at a constant speed, and came to the following conclusion: as long as the ship moves at a constant speed, you can't observe the slightest change in all phenomena. You can't judge whether the ship is moving or at rest according to any phenomenon. When you jump to the stern, you don't jump farther than you jump to the bow, and you don't have to work harder than when you stand in the opposite position. Drops of water hanging from the ceiling will fall vertically on the floor. Not a drop of water falls to the stern, although the ship is moving forward while the drop of water is still in the air. Flies will continue their own flight, which is the same in all aspects, and there will be no situation in which flies gather at the stern.

It is necessary to analyze Galileo's relativity principle in detail, and then use this principle to analyze the zero result of Michelson-Morey experiment. For the convenience of the following description, the car movement and bird flight are analyzed as follows.

2.1 Birds are flying in the car

The bird flies in the car with the same strength as flying on the ground. The bird thinks that it flies in the car at the same speed as flying on the ground, and the speed of flying in all directions is the same. For convenience, consider that the direction of bird flight and car movement is the same.

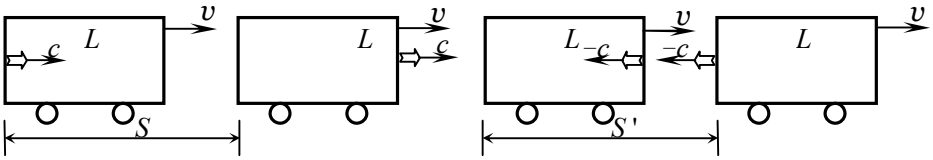


Fig. 1 Birds are flying in the car

For the convenience of the following description, let the car length be L, the car speed be v, and the bird flying speed always be c (note: this is not the speed of light). The time it takes a bird to fly from the tail of a car to the head of a car is the same as the time it takes for the car to move forward. It takes the same time for the bird to fly back from the front of the car to the rear of the car as it does for the car to move forward.

According to the superposition principle of motion, people standing on the ground observed that when the bird flew from the tail of the car to the head of the car, as shown in Fig.1(1), the displacement of the car forward was S, the movement time was $t_1=S/v$, the speed of the bird flying to the head of the car was $c+v$, and the displacement of the bird flying to the head of the car was $L+S$, the time taken to fly to the front of the car is $t_1=(L+S)/(c+v)$, then $t_1=(L+S)/(c+v)=(L+vt_1)/(c+v)$, and $t_1=L/c$.

When the bird flies back from the car head to the car tail, as shown in Fig.1(2), the displacement of the car forward is S', the movement time is $t_2=S'/v$, the speed of the bird flying back to the car tail is $v-c$, the displacement of the forward movement is $S'-L$, and the time for flying back to the car tail is $t_2=(S'-L)/(v-c)=(L-S')/(c-v)$, then $t_2=(L-S')/(c-v)=(L-vt_2)/(c-v)$, and $t_2=L/c$.

According to the superposition principle of motion, people standing in the car or following the car observe that the car seems to be not moving, the displacement of the bird flying in both directions is L, the speed of flying in both directions is c, and the time of flying in both directions

is the same, that is, $t'_1=t'_2=L/c$, as shown in Fig.1.

It can be seen that whether people standing on the ground observe, people standing in the car or people moving with the car observe, it takes the same time for the bird to fly from the car tail to the car head and fly back from the car head to the car tail, that is, $t_1=t_2=t'_1=t'_2=L/c$, the displacement of the car moving forward is the same, that is, $S=S'$. the total time taken for the bird to fly from the back of the car to the front of the car and then from the front of the car to the back of the car is:

$$t = t_1 + t_2 = t'_1 + t'_2 = \frac{L+S}{c+v} + \frac{L-S'}{c-v} = \frac{L}{c} + \frac{L}{c} = \frac{2L}{c} \tag{1}$$

This is in line with the equivalence relation of Galileo's relativity principle. When a bird flies in a car, the flying time of the bird has nothing to do with whether the car is moving or not, but only with the length and flying speed of the car, and the flying speed of the bird is not limited.

2.2 Birds are flying beside the car

When the bird flies next to the car, for convenience, it is also considered that the direction of the bird and the car is the same. Only when the bird flies faster than the car, can it catch up with the car and fly to the front of the car. Therefore, it must be required that the bird flies faster than the car, that is, $c>v$. When the bird flies from the rear of the car to the front of the car, it starts to time. After flying to the front of the car, it flies back to the rear of the car at the same speed.

Let the length of the car be L, the speed of the car be v, and the flying speed of the bird always be c. The time it takes a bird to fly from the tail of a car to the head of a car is the same as the time it takes for the car to move forward. It takes the same time for the bird to fly back from the front of the car to the rear of the car as it does for the car to move forward.

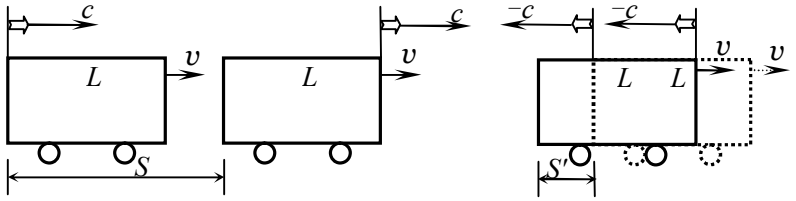


Fig. 2 Birds are flying beside the car

According to the superposition principle of motion, people standing on the ground observed that when the bird flew from the tail of the car to the head of the car, as shown in Fig.2(1), the displacement of the car moving forward was S, the movement time was $t_1=S/v$, the speed of the bird flying to the head of the car was c, and the displacement of the bird flying to the head of the car was $L+S$, the time taken to fly to the front of the car is $t_1=(L+S)/c$, then $t_1=(L+S)/c=(L+vt_1)/c$, get $t_1=L/(c-v)$.

When the bird flies back from the car head to the car tail, as shown in Fig.2(2), the forward displacement of the car is S', the moving time of the car is $t_2=S'/v$, the speed of the bird flying back to the car tail is $-c$, and the displacement of flying back to the car tail is $S'-L$, the time taken to fly back to the rear of the car is $t_2=(S'-L)/(-c)=(L-S')/c$, then $t_2=(L-S')/c=(L-vt_2)/c$, $t_2=L/(c+v)$ is obtained.

According to the superposition principle of motion, people standing in the car or following the car observe, as shown in Fig.2(1), the car seems to be not moving. When the bird flies from the tail of the car to the head of the car, the displacement to the head of the car is L, the speed to the head of the car is $c-v$, and the time to the head of the car is $t'_1=L/(c-v)$.

When the bird flies back from the car head to the car tail, as shown in Fig.2(2), the speed of flying back to the car tail is $c+v$, the displacement of flying back to the car tail is still L, and the time of flying back to the car tail is $t'_2=L/(c+v)$.

It can be seen that whether people standing on the ground observe, or people standing in the car or moving with the car observe, it takes the same time for birds to fly from the car tail to the car head and fly back from the car head to the car tail.

It can be seen that people standing on the ground observe that the flying time of the bird is the same as that of people standing in the car, that is, $t_1=t'_1=L/(c-v)$ and $t_2=t'_2=L/(c+v)$, but the time it takes for the bird to fly to the front of the car and fly back to the rear of the car is different, and the time it takes to fly back to the car is shorter, that is, $t_1>t_2$ and $t'_1>t'_2$, the displacement used

to fly back to the rear of the car is also short, that is, $S>S'$, the total time it takes a bird to fly from the back of the car to the front of the car and then back to the back of the car is:

$$t = t_1 + t_2 = t'_1 + t'_2 = \frac{L}{c-v} + \frac{L}{c+v} = \frac{2L}{c} \cdot \frac{1}{1-\frac{v^2}{c^2}} \tag{2}$$

If the factor $1-\frac{v^2}{c^2}$ in the Eq.(2) is divided into the product of two identical factors, namely $1-\frac{v^2}{c^2} = \sqrt{1-\frac{v^2}{c^2}} \cdot \sqrt{1-\frac{v^2}{c^2}}$, then the Eq.(2) is:

$$t \cdot \sqrt{1-\frac{v^2}{c^2}} = \frac{2}{c} \cdot \frac{L}{\sqrt{1-\frac{v^2}{c^2}}} \tag{2'}$$

When the bird flies beside the car, the total time it takes for the bird to fly from the back of the car to the back of the car is related to the speed of the car, the length of the car and the flying speed. Only when the bird flies faster than the car, that is, when $c>v$, then $t>0$, can the bird fly from the tail of the car to the head of the car; If the speed of the bird is equal to the speed of the car, that is, when $c=v$, then $t\to\infty$, the bird will never fly to the front of the car; If the bird flies slower than the car, that is, when $c<v$, then $t<0$, the bird will never catch up with the car, and the gap is getting farther and farther.

2.3 Comparative analysis of two situations

The total round-trip time of birds flying outside the car is longer than that of birds flying inside the car, which is $\frac{1}{1-\frac{v^2}{c^2}} > 1$. The reason for the difference between the two situations is that when the bird flies in the car, the speed of the car is superimposed, which makes it impossible to find out whether the car is stationary or moving in a straight line at a constant speed in any mechanical experiment made in the car, and the flight time of the bird has nothing to do with whether the car is moving; When the bird flies outside the car, the speed of the car is not superimposed, and the round-trip time of the bird's flight is related to the speed of the car, and the time $t_1=L/(c-v)$ for the bird to fly from the car's tail to the car's head is very long, but the time $t_2=L/(c+v)$ for the bird to fly from the car's tail to the car's head is very short. For example, if the bird's flying speed $c=30\text{m/s}$, the car's moving speed $v=29\text{m/s}$ and the car's length $L=15\text{m}$, the bird's flying time in the car is $t=1\text{s}$, and the bird's flying time outside the car is $t=15\text{s}$.

Now if we assume that there are two relationships:

$$L = L'\sqrt{1-\frac{v^2}{c^2}} \tag{3}$$

$$t = \frac{t'}{\sqrt{1-\frac{v^2}{c^2}}} \tag{4}$$

Substituting Eq.(3) and Eq.(4) into Eq.(2), we get

$$\frac{t'}{\sqrt{1-\frac{v^2}{c^2}}} = \frac{2}{c} \cdot L' \sqrt{1-\frac{v^2}{c^2}} \cdot \frac{1}{1-\frac{v^2}{c^2}}$$

$$t' = \frac{2L'}{c} \tag{5}$$

This Eq.(5) is similar to Eq.(1). However, the round-trip time of a bird flying outside a car is not equal, and it takes longer to fly from the tail of the car to the head of the car. There is no reason to divide the ratio of time into two equal parts, and there is no reason to divide it into the product of two identical factors. Therefore, this assumption is unreasonable, and it is meaningless. That is to say, the hypothetical Eq.(3) and Eq.(3).

2.4 The bird collided with the car

In Fig.2(2), if the bird flies from the rear of the car to the reflector of the car head outside the car and bounces back to the rear of the car after a collision, the momentum is conserved. Let the mass of the car be M, the mass of the bird be m, the speed of the car after collision be v', and the

speed of the bird be c'.

Seen from the ground, $Mv+mc=Mv'-mc'$

Looking at it in the car, $0+m(c-v)=0-m(c'+v')$, get $-mv+mc=-mv'-mc'$

The solution is $v'=v$, $c'=-c$.

The speed of the car is constant, and the bird flies back at the same speed in the opposite direction. The speed has nothing to do with the quality.

3. Absolute static reference system of the universe

The motion of objects is the basis of physics and a physical phenomenon we see every day. Galileo, Newton and Lagrange have studied it thoroughly. Kinematics theory doesn't introduce "observation", which means that people know the state of an object "instantly" by default. This implies a premise that people "move with the object", and the result obtained in this way is of course the "truest" state of the object. The scene depicted is like an architectural drawing, which is a picture with equal proportion and no perspective everywhere, reflecting the truest scene of the scene, which is in line with people's understanding of the object.

In practice, because it is inconvenient for people to follow the object, they usually observe the movement of the object with their eyes through the light emitted or reflected by the object in the distance. In this way, the conclusion of the movement theory deviates from what people actually "observe", but this situation has been ignored. People can only observe the scene in one position, and what they see is a distant and perspective picture, with unequal proportions everywhere, which reflects the scene is not a real scene, so the world we observe is not a real world, but an observation visual effect【5,6】.

Physical laws are the inherent laws that objects follow, and they are not different because of people's subjective observation angles and ways, which is the meaning of Galileo's relativity principle.

The laws of motion of an object (speed and acceleration) include its inherent properties (such as its mass) and its effects (such as momentum and kinetic energy), which follow the laws of Newton's theory of motion, but are not different from people's observation methods.

However, the motion of an object is different because people choose different observation methods, that is, they choose different reference systems subjectively, but there is no unified reference system, which leads to different speeds and accelerations, that is, relative motion. If the observation method is unified, that is, the reference system is unified, there will be no such differences, and the result of the movement will be the only certainty, so there will be no relative movement, but absolute movement.

Thus, the deviation caused by the concept of "reference system" and the concept of "inertia" are completely eliminated, and of course there are no concepts of "inertial system" and "non-inertial system".

However, such absolute motion will complicate the problem, which is not intuitive for people, so that it is impossible to calculate the motion state of objects. In physics, there is no such way as absolute motion. Instead, we choose the nearest object as the reference system and assume that the reference system is "static", which can make the problem simple. This is why Galileo and Newton studied motion from common objects, and the laws obtained are in line with people's understanding.

However, the choice of reference system introduces an implicit assumption: it is assumed that the reference system is static. This assumption is obviously not true. Because for another moving object as a reference system, that reference system is not static. For this problem, philosophy can only say that "motion is absolute and stillness is relative".

The untenable assumption will inevitably lead to a series of irreparable loopholes: different reference systems, different speeds and accelerations (motion states), different momentum and kinetic energy, and it is uncertain whether they are moving or stationary. Later, Newton's law of motion was established by introducing the "inertial force" of an object without force, which contradicted the concept of force, even the rotating bucket could not explain it, and the research on kinematics could not move forward here.

Although the description and implementation of unified absolute motion without reference system are very complicated, it can solve these problems theoretically and logically, and smooth the relationship between matter, space, time and motion.

In addition, in electromagnetic theory, as long as there is a theory of relative motion, there

are all the above problems. Faraday electromagnetic induction, the movement of wire cutting magnetic induction line will produce induced electromotive force, and the physical mechanism is still unknown. In the first case, the magnetic field is static and the wire is moving, and the free charge in the wire is directionally moved to one end of the wire by Lorentz force, resulting in electromotive force. In the second case, when the wire is stationary and the magnetic field moves, a changing magnetic field is generated, and the changing magnetic field generates an electric field, which makes the charge in the wire move directionally and produces electromotive force.

From the point of view of relative motion, these two situations are completely equivalent. Then, the Lorentz force in the first case is equivalent to the electric field force in the second case, that is to say, the charge inside the moving wire in the first case moves under the action of the electric field force generated by the magnetic field. Then, the magnetic field in the first case does not move, how can an electric field be generated? That is to say, how Lorentz force is produced is still a mystery.

The velocity $c=\frac{1}{\sqrt{\varepsilon_0\mu_0}}$ of electromagnetic wave (light wave) in vacuum solved by Maxwell's equations is relative to vacuum, although the reference frame is not clearly pointed out. If you have to point out a medium for it, then vacuum is its "medium", vacuum is its reference frame, it is not relative to the reference frame of any other substance, it is only relative to vacuum, and it is propagating in pure space, and its speed is absolute speed. It is the only absolute velocity without reference frame. This is the true meaning of the principle that the speed of light is constant.

The velocity of electromagnetic wave (light wave) in vacuum solved by Maxwell's equations, although the reference system is not clearly pointed out, can not be understood as taking any object as its reference system, let alone that the electromagnetic wave velocity (light speed) is unchanged relative to any reference system.

Conversely, the speed of light is absolute, but it can be used as a benchmark. If light is taken as the reference system, an object that retrogrades at the speed of light $\boldsymbol{c}$ relative to the propagation direction of light in an inanimate vacuum space is considered to be at rest in the vacuum space, that is, $\boldsymbol{v-c=0}$ (object regression velocity − light speed = rest). In an inanimate vacuum, the retrogression speed of an object relative to the propagation direction of light minus the speed of light is the absolute speed of the object in the vacuum, $\boldsymbol{v-c=v'}$.

However, electromagnetic wave (light wave) is a kind of fluctuation, which is the fluctuation of electromagnetic field. Wave has many unique properties, which are completely different from those of (solid) objects, and the movement of objects has nothing to do with light. If the speed of light is used to describe the motion of an object, even the quality of the object, the speed of time, the length of space and the energy of matter, it is not appropriate.

"The speed of light is constant" is conditional, not unconditional. The speed of light is constant, relative to a reference system such as a medium or a vacuum. For a medium, the speed of light is relative, and for a vacuum, the speed of light is absolute. That is to say, the light in the medium moves as a whole (or it is called propagation, not movement) with the medium. For a vacuum, the light propagates in that fixed and pure space, which is the real meaning of the constant speed of light.

In order to study the motion of objects and the behavior characteristics of light, we should introduce a universal absolute stationary reference frame【5～8】, and all motions can be studied in the universal absolute stationary reference frame. Such motion is absolute motion, which is equal everywhere in the universe, and its coordinate origin and direction can be arbitrarily selected, especially when studying the behavior of light. With the absolute static reference system of the universe, there is a unified reference system standard, and any motion can be studied in this reference system. In this reference system, all motions are absolute motions. In this way, the research results will not be different because of the different reference systems selected, and there will be no contradictions caused by "non-inertial systems".

The reference systems that are still in the absolute static reference system of the universe are all regarded as the absolute static reference system of the universe.

Objects moving in the absolute static reference frame of the universe are of course not the absolute static reference frame of the universe, but the moving reference frame (including inertial system and non-inertial system). According to different moving speeds, there are many such reference frames. The original physics used such reference frames, and there is no unified standard. So studying the movement of other objects in such reference frames can only be called relative

reference frames. The motion state (velocity and acceleration) and kinetic energy of the research results are different with different relative reference frames.

4. The Laws of motion or wave relativity and superposition

Canlun Yuan, the author of this paper, deepened and developed Galileo's principle of relativity of motion, and put forward the principle of superposition of motion, the law of relativity and superposition of motion or wave, and the law of relativity and superposition of light speed 【5,6】.

Galileo's relative principle of motion: For relative motion (displacement, velocity and acceleration), the observed relative motion parameter $\boldsymbol{c}'$ in any reference system is the vector difference between the motion parameter $\boldsymbol{c}$ and of the reference system the motion parameter $\boldsymbol{V_o}$:

$$\vec{c}' = \vec{c} - \vec{V}_o \tag{6}$$

For example, when a ship is in the river, the motion state of the ship is different when viewed from the ship, the river and the shore.

Principle of motion superposition: for superposition motion (displacement, velocity, acceleration and other parameters), the observed superposition motion parameter $\boldsymbol{c}'$ in any reference system is the vector sum of motion parameter $\boldsymbol{c}$ and of the towed object motion parameter $\boldsymbol{V_m}$:

$$\vec{c}' = \vec{c} + \vec{V}_m \tag{7}$$

For example, the overall flow of the medium drags waves, the movement of the earth drags all objects on the earth to move together, and the train drags all objects on the train to move together.

The complicated situation is that there is both relativity and superposition of motion. For example, the earth goes around the sun, trains run on the earth, people walk on the train, and bugs crawl on people…

These two principles are not only applicable to all the motion of objects, but also to all waves, so we can get the Laws of motion relativity and superposition, Laws of wave relativity and superposition.

Laws of relative and superposition of motion or wave: In any reference frame, the observer moves at the speed $\boldsymbol{V_o}$. When the whole homogeneous medium moves uniformly at the velocity $\boldsymbol{V_m}$, the wave source generates concentric spherical waves with the velocity $\boldsymbol{c_w}$ on the medium, and also moves uniformly with the medium at the velocity $\boldsymbol{V_m}$ without changing the shape (medium drag effect). The wave velocity $\boldsymbol{c'_w}$ observed by the observer at any point is the difference between the vector of the wave velocity $\boldsymbol{c_w}$ in the medium and the observer velocity $\boldsymbol{V_o}$, and the sum of the vector of the overall motion velocity $\boldsymbol{V_m}$ of the medium, regardless of the motion velocity $\boldsymbol{V_s}$ of the wave source. It is called General formula of relative and superposition of motion or wave velocity:

$$\vec{c}'_w = \vec{c}_w - \vec{V}_o + \vec{V}_m \tag{8}$$

General formula of relative and superposition of motion displacement:

$$\vec{S}'_w = \vec{S}_w - \vec{\mathrm{S}}_o + \vec{\mathrm{S}}_m \tag{9}$$

General formula of relative and superposition of motion acceleration:

$$\vec{a}'_w = \vec{a}_w - \vec{a}_o + \vec{a}_m \tag{10}$$

These two principles are not only suitable for all movements and waves, but also for all electromagnetic wave (light wave) velocities, so that the Laws of relativity and superposition of light speed can be obtained.

The Laws of relative and superposition of light speed: in any reference frame, the observer moves at the speed $\boldsymbol{V_o}$. When the whole homogeneous medium moves uniformly at the speed $\boldsymbol{V_m}$, the light source produces concentric spherical light waves with the speed $\boldsymbol{c}$ on the medium, and also moves uniformly with the medium at the speed $\boldsymbol{V_m}$ without changing the shape (medium drag effect). The speed of light $\boldsymbol{c'}$ observed by the observer at any point is the difference between the vector of the speed of light $\boldsymbol{c}$ in the medium and the observer's speed $\boldsymbol{V_o}$, and the sum of the vector of the overall moving speed $\boldsymbol{V_m}$ of the medium, regardless of the moving speed $\boldsymbol{V_s}$ of the light source. It is called the general formula of relative and superposition of light speed:

$$\vec{c}' = \vec{c} - \vec{V}_o + \vec{V}_m \tag{11}$$

General formula of light wave displacement relative and superposition:

$$\vec{S}' = \vec{S} - \vec{S}_o + \vec{S}_m \tag{12}$$

The Laws of relativity and superposition of motion or wave is a more universal Laws, which is not only applicable to the relativity vector subtraction relationship and superposition vector addition relationship of object motion (displacement, velocity and acceleration), but also to the relativity vector subtraction relationship and superposition vector addition relationship of wave motion (displacement and velocity).

General formula of wave velocity superposition: when the uniform medium flows uniformly at the overall moving speed V_m, the concentric waves generated by the wave source on the uniform medium also move uniformly with the medium at the speed V_m without changing the shape. The wave velocity c'_w observed by the observer at any point is the difference between the vector of the wave velocity c_w in the medium and the observer velocity V_o, and the vector sum of the overall motion velocity V_m of the medium:

$$\vec{c}'_w = \vec{c}_w - \vec{V}_o + \vec{V}_m \tag{13}$$

The wave velocity observed by the observer is constant and has nothing to do with the moving speed V_s of the wave source (excluding V_s). The same is true of sound waves and electromagnetic waves (light waves), and this formula applies to all fluctuations.

5. The essence of light

Canlun Yuan, the author of this paper, reanalyzed the nature of light【4 ~ 6】. According to Maxwell's electromagnetic theory, **light is an electromagnetic wave, which is alternately excited by electric and magnetic fields and propagates forward in space**. Light can propagate not only in a vacuum, but also in a transparent substance (solid substance). Light is electromagnetic wave, electromagnetic wave is also light, and light and electromagnetic wave are completely equivalent concepts. The same below.

Light has the common characteristics of reflection, refraction, superposition, interference, diffraction and polarization.

Light is a form of fluctuation, not movement. It can't be called the movement of light, but the propagation of light. Light propagates in fluctuating forms and fluctuating energy. Light is not matter, has no mass, has no inertia, is not affected by force, accelerates or decelerates, is not dragged by light source, but can be dragged by electromagnetic medium. In the same homogeneous substance, light does not change direction when it propagates. When a light source emits light, it immediately produces light, and it spreads at a uniform speed.

The movement of the light source does not affect the speed and direction of light propagation. Light diffuses out immediately after it is generated from the light source, and has nothing to do with the light source since then. Each kind of light generates and propagates independently of each other, superposes when they meet, and propagates independently after separation. Light propagates energy without mass. These unique properties of light determine the unique behavior of light, which is also obviously different from the properties of physical substances. When light is reflected by an object, the object becomes a new light source.

The principle that the speed of light is constant is incorrect. Relative to the same homogeneous substance (light medium), the speed of light is the same, which is the real meaning of the constant speed of light. The speed of light satisfies the laws of relativity and superposition of speed of light. Vacuum is the best medium for light propagation. In vacuum, relative to the vacuum medium reference system. The speed of light is c. The speed of light satisfies the laws of relativity and superposition of speed of light. The speed of light is not the upper limit of all speeds, but the movement speed of solid matter can exceed the speed of light. Vacuum is the most ideal medium for electromagnetic wave propagation, with the fastest propagation speed (c) and the lowest refractive index (1).

Although there is no solid substance as the medium in vacuum, it takes the substance in the form of electromagnetic field as the medium. The electric field and magnetic field are alternately excited in space and propagate forward. This fluctuation is in the form of electromagnetic waves. In the process of alternating excitation of electric field and magnetic field, the electric field and magnetic field in the back weaken and disappear, and the electric field and magnetic field in the front are excited, which are generated in the excitation process, and the change is one. It can be seen that the propagation speed of electromagnetic wave is the speed at which electric field and magnetic field are alternately excited in space and propagate forward, so **electromagnetic field is**

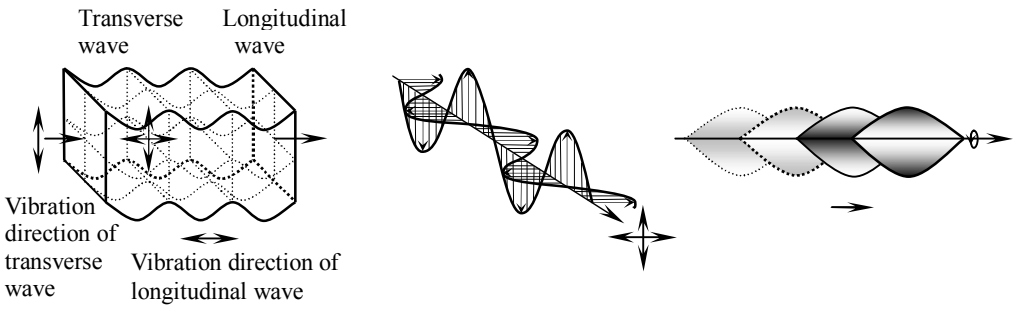
the medium for electromagnetic wave propagation.

Maxwell solved the electromagnetic wave equation from the equations. Electromagnetic wave equation and mechanical wave Eq.(string vibration equation) have exactly the same form. The mechanical wave velocity solved by the mechanical wave equation is relative to the medium and has nothing to do with the motion of the wave source. Similarly, the electromagnetic wave velocity $c = \frac{1}{\sqrt{\varepsilon_0 \mu_0}}$ solved by the electromagnetic wave Eq.(where $\boldsymbol{\varepsilon_0}$ is the dielectric constant in vacuum and $\boldsymbol{\mu_0}$ is the magnetic permeability coefficient in vacuum), then the electromagnetic wave velocity in vacuum is also relative to the electromagnetic field of the electromagnetic wave medium in vacuum and has nothing to do with the motion of the wave source. The electromagnetic field of electromagnetic wave medium in vacuum is the reference system of light speed $\boldsymbol{c}$ in vacuum. With this definite frame of reference, Maxwell's electromagnetic theory and Galileo's principle of relativity are not contradictory.

In the solid matter, the electromagnetic wave velocity is $c_w = \frac{1}{\sqrt{\varepsilon \mu}} = \frac{c}{n}$ (where $\boldsymbol{\varepsilon}$ is the dielectric constant of the solid matter, $\boldsymbol{\mu}$ is the magnetic permeability coefficient of the solid matter, which is related not only to the solid matter, but also to the frequency of electromagnetic waves, and $\boldsymbol{n}$ is the refractive index of the transparent solid matter to light). Similarly, the electromagnetic wave velocity of solid matter is relative to the electromagnetic field of electromagnetic wave medium in solid matter, and has nothing to do with the motion of wave source. Electromagnetic wave medium electromagnetic field in solid matter is the reference system of light speed c_w in solid matter.

When light propagates in a (transparent) solid substance, the electromagnetic field is also used as the propagation medium. The (transparent) solid matter is not the propagation medium of light, but the electromagnetic field is the propagation medium of light. Electromagnetic field propagates slowly in solid matter, and light propagates slowly in (transparent) solid matter, which is $\boldsymbol{c_w=c/n}$. The overall movement (flow) speed of solid matter is not synchronous with the propagation speed of electromagnetic field in solid matter, resulting in the propagation speed of light in transparent solid matter is not synchronous, but lagging behind. That is to say, the physical matter does not drag the electromagnetic field completely synchronously, nor does it drag the electromagnetic wave completely synchronously, but only partially. The solid matter drags the electromagnetic field in a certain proportion, and the two actions slow down the propagation speed of light by moving the (transparent) solid matter as a whole, which is related to the dielectric constant and density of the solid matter.

All waves (including electromagnetic waves) are body waves inside the medium and surface waves at the interface of the medium. There are both shear waves and longitudinal waves in body waves. The surface wave at the interface of medium is shear wave, while the bulk wave in medium is longitudinal wave. Any surface parallel to the propagation direction in a medium is a shear wave, and any surface perpendicular to the propagation direction in a medium is a longitudinal wave. As shown in Fig.3(1).



(1) Body waves have both shear waves and longitudinal waves.

(2)Transverse vibration direction of electromagnetic wave

(3)Longitudinal vibration direction of electromagnetic wave

Fig. 3 Vibration direction of body wave and electromagnetic wave

When the electric field and magnetic field are alternately excited to form electromagnetic

waves, the electric field waves and magnetic field waves vibrate simultaneously in the propagation direction and perpendicular to the propagation direction, and the electromagnetic waves have both transverse waves and longitudinal waves. According to the conservation of energy when electric field and magnetic field are alternately excited, the phase difference between electric field wave and magnetic field wave is 90 degrees. As shown in Fig.3(2) and Fig.3(3).

Because the nature of light involves wave theory, Maxwell electromagnetic theory and quantum mechanics theory, the situation is complicated, so far, the existing theories have no in-depth understanding of the nature of light. Here is only a brief introduction to the conclusion of the author's new research. The author will discuss the nature of light again in the subsequent new quantum mechanics article. This theory can perfectly explain all the problems about light. The author will explain it in a subsequent article.

6. Re-understanding of zero results in Michelson-Morey experiment

Xiaochun Mei and Canlun Yuan analyzed the zero result of Michelson-Morey experiment【7】, which should also be compared and analyzed in the absolute static reference frame of the universe. As long as the total time of light emission and reflection of two arms of Michelson-Morey experimental interferometer is analyzed and compared with that of light emission and reflection of two arms after the interferometer rotates 90 degrees, whether the interference fringes move or not can be judged, and thus whether the light is dragged by "ether" substances can be verified. After Michelson-Morey experiment【1】, the result is zero, that is, the interference fringes have not moved, which shows that the total time of light emission and reflection of the two arms is equal, and the total time of light emission and reflection of the two arms is also equal during and after the interferometer rotates 90, as shown in Fig.4(1). Now analyze it from five situations.

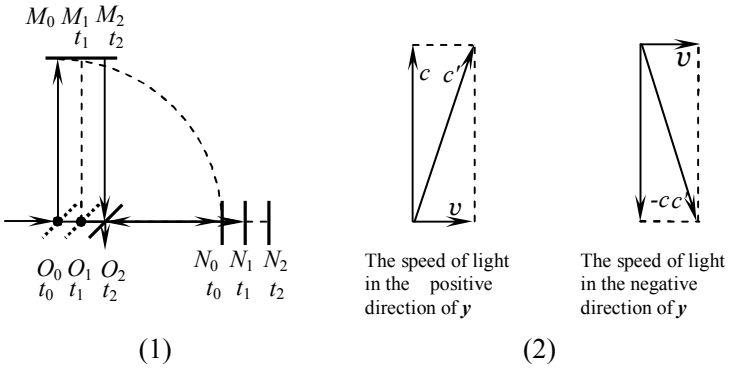


Fig. 4 Michelson-Morey experimental analysis

6.1 Observing the Interferometer in the Absolute Static Reference System of the Universe

If the M-M experiment is done in the absolute static reference frame of the universe, the observer, interferometer and light source are all stationary in the absolute static reference frame of the universe, and there is no relative motion, which is the simplest case. In the ***x*** direction, the optical path of light from the beam splitter to the mirror and the optical path of light returning from the mirror to the beam splitter are both equal, and both are the interferometer arm length ***L***, so the propagation time of light on the two optical paths is the same, which are $t_{x1}=L/c$ and $t_{x2}=L/c$ respectively. The same is true in the **y** direction. The time for light to travel in both optical paths is the same, which is $t_{y1}=L/c$ and $t_{y2}=L/c$ respectively.

The total time of light emitted and reflected by both arms is equal, as shown in Fig.4(1):

$$t_y = t_{y1} + t_{y2} = \frac{L}{c} + \frac{L}{c} = \frac{2L}{c} \tag{14}$$

$$t_x = t_{x1} + t_{x2} = \frac{L}{c} + \frac{L}{c} = \frac{2L}{c} \tag{15}$$

Comparing Eq.(14) and Eq.(15), we can get the following

$$t_{y1} = t_{y2} = t_{x1} = t_{x2} = \frac{L}{c} \tag{16}$$

$$t_x = t_y \tag{17}$$

If the observer, interferometer and light source are relatively stationary and move in the absolute static reference frame of the universe, the results are exactly the same.

This shows that the light in two directions reaches the eyepiece at the same time, and when the interferometer is rotated at any angle, the light in two directions also reaches the eyepiece at the same time, and the interference fringes will not move.

6.2 Interferometer for observing the movement with the earth in the earth reference system

The observer, interferometer and light source are all at rest on the earth, and they all move with the earth in the absolute static reference frame of the universe at the speed $\boldsymbol{v}$ to the $\boldsymbol{x}$ direction. The four are relatively stationary, and light propagates in the earth reference frame at the speed $\boldsymbol{c}$. This is exactly the case of Michelson-Morey experiment.

In fact, the earth reference system can be regarded as an inertial reference system. According to Galileo's principle of relativity of motion, the physical facts in the earth reference system are exactly the same as those in the absolute static reference system of the universe. Its motion law is exactly the same as that in section 6.1, and it will not be affected by the earth's motion, so it will not produce the movement of interference fringes. The analysis results are exactly the same.

6.3 Interferometer for observing the motion with the earth in the absolute static reference frame of the universe.

The observer is stationary in the absolute static reference frame of the universe, and the interferometer and the light source move along with the earth in the absolute static reference frame of the universe at the speed $\boldsymbol{v}$ to the $\boldsymbol{x}$ direction. The interferometer, the light source and the earth are all relatively stationary, and the light emitted from the light source of the interferometer moving along with the earth propagates in the earth reference frame at the speed $\boldsymbol{c}$. According to the principle of motion superposition and motion relativity, the speed of light can be added and subtracted.

In fact, the Michelson interferometer has been made into a whole instrument with two sealed arms. Light can only propagate in the two arms perpendicular to each other, but not in the oblique direction.

At time $\boldsymbol{t_0}$, the light is reflected by the semi-lens, and emitted in the $\boldsymbol{y}$ direction, and the light propagates in the earth reference system at speed $\boldsymbol{c}$. At any moment, the half lens and the mirror in the $\boldsymbol{y}$ direction move synchronously to the $\boldsymbol{x}$ direction. After time $\boldsymbol{t_{y1}}$, it reaches the mirror in the $\boldsymbol{y}$ direction, and the optical path is $\boldsymbol{O_0M_1}$. At this time, the interferometer and the mirror have moved in the $\boldsymbol{x}$ direction by $\boldsymbol{vt_{y1}}$; At time $\boldsymbol{t_1}$, after the light is reflected by the mirror, it propagates in the negative direction of $\boldsymbol{y}$ after time $\boldsymbol{t_{y2}}$, and the optical path is $\boldsymbol{M_1O_2}$. At this time, the interferometer and the mirror have moved in the $\boldsymbol{x}$ direction by $\boldsymbol{vt_{y2}}$, as shown in Fig. 4(1). Then, according to the principle of motion superposition, the displacement is vector addition, and the velocity is vector addition, In the $\boldsymbol{y}$ direction, the actual optical path is the sum of the vectors of displacements in two directions, $O_0M_1 = \sqrt{L^2 + (vt_{y1})^2}$, the speed of light is the vector sum of speeds in two directions, $\vec{c}' = \vec{c} + \vec{v}$, $c' = \sqrt{c^2 + v^2}$; In the negative direction of $\boldsymbol{y}$, the actual optical path is the vector sum of displacements in two directions, $M_1O_2 = -\sqrt{L^2 + (vt_{y2})^2}$, and the speed of light is the vector sum of velocities in two directions, $\vec{c}' = -\vec{c} + \vec{v}$, $c' = -\sqrt{c^2 + v^2}$, as shown in Fig.4(2). Then the time required for light propagation is $t_{y1} = \dfrac{\sqrt{L^2 + (vt_{y1})^2}}{\sqrt{c^2 + v^2}}$ and $t_{y2} = \dfrac{-\sqrt{L^2 + (vt_{y2})^2}}{-\sqrt{c^2 + v^2}}$, respectively, and $t_{y1} = t_{y2} = \dfrac{L}{c}$ is obtained, this is equivalent to the time $t_{y1} = t_{y2} = \dfrac{L}{c}$ required to travel through optical paths $\boldsymbol{O_0M_0}$ and $\boldsymbol{M_2O_2}$ at the speed of light $\boldsymbol{c}$. Then the total time in the $\boldsymbol{y}$ direction is:

$$t_y = t_{y1} + t_{y2} = \frac{L}{c} + \frac{L}{c} = \frac{2L}{c} \tag{18}$$

At this time, the interferometer and the mirror have moved in the $\boldsymbol{x}$ direction:

$$\Delta x = vt_y = \frac{2vL}{c} \tag{19}$$

According to the principle of motion superposition, in the positive direction of $\boldsymbol{x}$, the speed of

light c in the earth reference system should be superimposed on the speed of motion v of the earth when observed in the absolute static reference system of the universe, and the observed speed of light is $c+v$. When the optical path of light propagating from the half lens O_0 to the mirror N_1 in the x direction is $L+vt_{y1}$, the required time is $t_{x1}=\frac{L+vt_{y1}}{c+v}=\frac{L+v\frac{L}{c}}{c+v}=\frac{L}{c}$; After the light is reflected by the mirror N_1, in the negative direction of x, the speed of light $-c$ in the earth's reference frame should be superimposed with the speed of motion v of the earth, so the observed speed of light is $-c+v$, and the optical path when it propagates to the half lens O_2 in the negative direction of x is $-L+vt_{y2}$, so the required time is $t_{x2}=\frac{-L+vt_{y2}}{-c+v}=\frac{L-v\frac{L}{c}}{c-v}=\frac{L}{c}$. The total time obtained is:

$$t_x=t_{x1}+t_{x2}=\frac{L}{c}+\frac{L}{c}=\frac{2L}{c} \tag{20}$$

Comparing Eq.(18) and Eq.(20), we can get the following:

$$t_{y1}=t_{y2}=t_{x1}=t_{x2}=\frac{L}{c} \tag{21}$$

$$t_x=t_y \tag{22}$$

This shows that the light in two directions reaches the eyepiece at the same time, and when the interferometer is rotated at any angle, the light in two directions also reaches the eyepiece at the same time, and the interference fringes will not move.

6.4 An observer observes an interferometer moving along with the earth in the positive *x* direction in any reference frame.

Interferometer and light source move along with the earth (in the absolute static reference system of the universe) in the direction of x at the speed v, and the interferometer, light source and earth are all relatively stationary. The light emitted from the light source of the interferometer moving along with the earth propagates in the earth reference system at the speed of light c. The observer moves in another direction at another speed V_o in any reference frame (for simplicity, it is selected to move in the positive direction of x at the speed V_o) to observe the light emitted by the light source of the interferometer on the earth, as shown in Fig.5. According to the principle of motion superposition and motion relativity, the speed of light can be added and subtracted.

The Michelson interferometer, an integral instrument with two sealed arms, is also used for experiments. Light can only propagate in two arms perpendicular to each other, but not in the oblique direction.

At time t_0, the light is reflected by the semi-lens, and emitted in the y direction, and the light propagates in the earth reference system at speed c. At any moment, the half lens and the mirror in the y direction move synchronously to the x direction. After time t_{y1}, it reaches the mirror in the y direction, and the optical path is O_0M_1. At this time, the interferometer and the mirror have moved in the x positive direction by vt_{y1}; At time t_1, after the light is reflected by the mirror, it propagates in the negative direction of y after time t_{y2}, and the optical path is M_1O_2. At this time, the interferometer and the mirror have moved in the positive direction of x by vt_{y2}, as shown in Fig.5(1). Then, according to the principle of motion superposition and motion relativity, the displacement formula is $\vec{S}'_w=\vec{S}_w-\vec{S}_o+\vec{S}_m$ and the velocity formula is $\vec{c}'_w=\vec{c}_w-\vec{V}_o+\vec{V}_m$. In the positive direction of y, the superposition vectors of optical paths add up to $\vec{S}'=\vec{S}_w+\vec{S}_m$, and the value is $\sqrt{L^2+(vt_{y1})^2}$, and the included angle between its direction and the positive direction of x is θ, ($\tan\theta=\frac{L}{vt_{y1}}$); Subtract the relativity vector of the optical path, which is the total optical path $S'=\sqrt{L^2+(v-V_o)^2t^2_{y1}}$, as shown in Fig.5(2). In the negative direction of y, the superposition vectors of optical paths add up to $\vec{S}'=\vec{S}_w+\vec{S}_m$, and the value is $-\sqrt{L^2+(vt_{y1})^2}$, and the included angle between its direction and the positive direction of x is θ, ($\tan\theta=\frac{-L}{vt_{y1}}$); Subtract the relativity vector of the optical path, which is the total optical path $S'=-\sqrt{L^2+(v-V_o)^2t^2_{y1}}$, as shown in Fig.5(3). In the

positive direction of ***y***, the superposition vectors of light speed add up to $\vec{c}'_w = \vec{c}_w + \vec{V}_m$, and the value is $\sqrt{c^2+v^2}$, and the included angle between its direction and the positive direction of ***x*** is ***θ***, ($\tan\theta = \frac{c}{v}$); Subtract the relativity vector of the speed of light, which is the total speed of light $c' = \sqrt{c^2+(v-V_o)^2}$, as shown in Fig. 5(4). In the negative direction of ***y***, the superposition vectors of light speed add up to $\vec{c}'_w = \vec{c}_w + \vec{V}_m$, and the value is $-\sqrt{c^2+v^2}$, and the angle between its direction and the positive direction of ***x*** is***θ***, ($\tan\theta = \frac{-c}{v}$); Subtract the relativity vector of the speed of light, which is the total speed of light $c' = -\sqrt{c^2+(v-V_o)^2}$, as shown in Fig.5(5). Then the time required for light propagation is $t_{y1} = \frac{\sqrt{L^2+(v-V_o)^2 t_{y1}^2}}{\sqrt{c^2+(v-V_o)^2}}$ and $t_{y2} = \frac{-\sqrt{L^2+(v-V_o)^2 t_{y2}^2}}{-\sqrt{c^2+(v-V_o)^2}}$, respectively, and $t_{y1} = t_{y2} = \frac{L}{c}$ is obtained. Then the total time in the y direction is

$$t_y = t_{y1} + t_{y2} = \frac{L}{c} + \frac{L}{c} = \frac{2L}{c} \tag{23}$$

In the ***x*** direction, according to the principle of relativity of motion, the observed velocity of interferometer and mirror is $v - V_o$, at which time the interferometer and mirror have moved in the ***x*** direction.

$$\Delta x = (v - V_o)t_y = \frac{2(v-V_o)L}{c} \tag{24}$$

According to the principle of superposition of motion and relativity of motion, we can know that the observed light speed $c' = c + v - V_o$ in the positive direction of ***x***, and $c' = -c + v - V_o$ in the negative direction of ***x***.

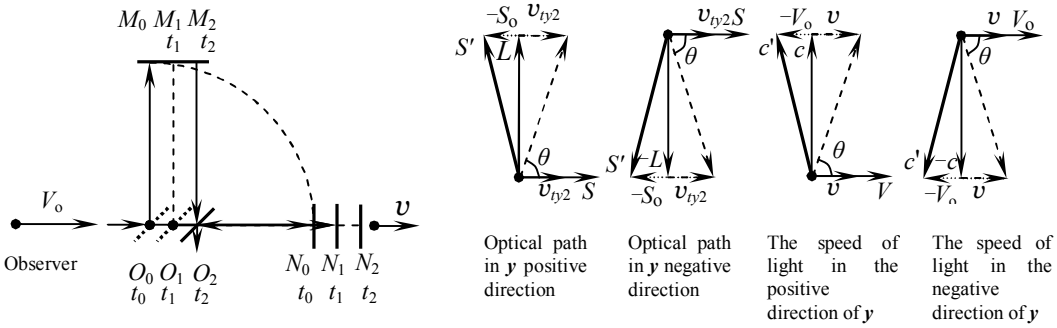
When the optical path of light propagating from the half lens O_0 to the mirror N_1 in the ***x*** direction is $S' = L + (v - V_o)t_{y1}$, the required time is $t_{x1} = \frac{L + (v-V_o)t_{y1}}{c + v - V_o}$, and $t_{x1} = \frac{L}{c}$ is obtained; After the light is reflected by the mirror N_1, in the negative direction of ***x***, the observed light speed is $-c + v - V_o$, when the optical path is $S' = -L + (v - V_o)t_{y1}$ when it propagates to the half lens O_2 in the negative direction of ***x***, the required time is $t_{x2} = \frac{-L + (v-V_o)t_{y2}}{-c + v - V_o}$, and $t_{x2} = \frac{L}{c}$ is obtained. The total time obtained is

$$t_x = t_{x1} + t_{x2} = \frac{L}{c} + \frac{L}{c} = \frac{2L}{c} \tag{25}$$

Comparing Eq.(23) and Eq.(25), we can get the following

$$t_{y1} = t_{y2} = t_{x1} = t_{x2} = \frac{L}{c} \tag{26}$$

$$t_x = t_y \tag{27}$$



Optical path in ***y*** positive direction

Optical path in ***y*** negative direction

The speed of light in the positive direction of ***y***

The speed of light in the negative direction of ***y***

(1) (2) (3) (4) (5)

Fig. 5 Michelson-Morey experimental analysis

From the optical path and velocity synthesis of each part in this section, the above-mentioned motion relativity principle and motion superposition principle are satisfied, that is, the law of phase and superposition of (motion) wave velocity.

This shows that the light in two directions reaches the eyepiece at the same time, and when the interferometer is rotated at any angle, the light in two directions also reaches the eyepiece at the same time, and the interference fringes will not move.

6.5 An observer observes an interferometer moving in any direction with the earth in any reference frame

Interferometer and light source move along with the earth (in the absolute static reference system of the universe) in the direction of x at the speed v, and the interferometer, light source and earth are all relatively stationary. The light emitted from the light source of the interferometer moving along with the earth propagates in the earth reference system at the speed of light c. However, the observer moves in another direction at another speed V_o in any reference frame, and the direction of movement is an angle α with the positive direction of x. If the speed is decomposed into $V_{ox}=V_o\cos\alpha$ and $V_{oy}=V_o\sin\alpha$, the speeds in the two decomposed directions can be calculated respectively. Observe the light emitted by the light source of the interferometer on the earth, as shown in Fig.6(1). According to the principle of motion superposition and motion relativity, the speed of light can be added and subtracted.

The Michelson interferometer, an integral instrument with two sealed arms, is also used for experiments. Light can only propagate in two arms perpendicular to each other, but not in the oblique direction.

At time t_0, the light is reflected by the semi-lens, and emitted in the y direction, and the light propagates in the earth reference system at speed c. At any moment, the half lens and the mirror in the y direction move synchronously to the x direction.

After time t_{y1}, it reaches the mirror in the y direction, and the optical path is O_0M_1, at this time, the interferometer and the mirror have moved in the x positive direction by vt_{y1}; at time t_1, after the light is reflected by the mirror, it propagates in the negative direction of y after time t_{y2}, and the optical path is M_1O_2. At this time, the interferometer and the mirror have moved in the positive direction of x by vt_{y2}, as shown in Fig.6(1). Then, according to the principle of motion superposition and motion relativity, the displacement formula is $\vec{S}'_w=\vec{S}_w-\vec{S}_o+\vec{S}_m$ and the velocity formula is $\vec{c}'_w=\vec{c}_w-\vec{V}_o+\vec{V}_m$. In the y direction, the superposition vectors of optical paths add up to $\vec{S}'=\vec{S}_w+\vec{S}_m$, and the value is $\sqrt{L^2+(vt_{y1})^2}$; Subtract the relativity vector of the optical path, which is the total optical path $S'=\sqrt{L^2+(v-V_o\sin\alpha)^2t^2_{y1}}$, as shown in Fig.6(2). In the negative direction of y, the superposition vectors of optical paths add up to $\vec{S}'=\vec{S}_w+\vec{S}_m$, and the value is $-\sqrt{L^2+(vt_{y2})^2}$; Subtract the relativity vector of the optical path, which is the total optical path $S'=-\sqrt{L^2+(v-V_o\sin\alpha)^2t^2_{y2}}$, as shown in Fig.6(3). In the positive direction of y, the superposition vectors of light speed add up to $\vec{c}'_w=\vec{c}_w+\vec{V}_m$, and the value is $\sqrt{c^2+v^2}$, and the included angle between its direction and the positive direction of x is θ, ($\tan\theta=\frac{c}{v}$); Subtract the relativity vector of the speed of light, which is the total speed of light $c'=\sqrt{c^2+(v-V_o\sin\alpha)^2}$, as shown in Fig.6(4). In the negative direction of y, the superposition vectors of light speed add up to $\vec{c}'_w=\vec{c}_w+\vec{V}_m$, and the value is $-\sqrt{c^2+v^2}$, and the angle between its direction and the positive direction of x is θ, ($\tan\theta=\frac{-c}{v}$); Subtract the relativity vector of the speed of light, which is the total speed of light $c'=-\sqrt{c^2+(v-V_o\sin\alpha)^2}$, as shown in Fig.6(5). Then the time required for light propagation is $t_{y1}=\frac{\sqrt{L^2+(v-V_o\sin\alpha)^2t^2_{y1}}}{\sqrt{c^2+(v-V_o\sin\alpha)^2}}$ and $t_{y2}=\frac{-\sqrt{L^2+(v-V_o\sin\alpha)^2t^2_{y2}}}{-\sqrt{c^2+(v-V_o\sin\alpha)^2}}$, respectively, and $t_{y1}=t_{y2}=\frac{L}{c}$ is obtained. Then the total time in the y direction is

$$t_y = t_{y1} + t_{y2} = \frac{L}{c} + \frac{L}{c} = \frac{2L}{c} \tag{28}$$

In the $\boldsymbol{x}$ direction, according to the principle of relativity of motion, the observed velocity of interferometer and mirror is $\boldsymbol{\upsilon - V_o \cos\alpha}$, at which time the interferometer and mirror have moved in the $\boldsymbol{x}$ direction.

$$\Delta x = (\upsilon - V_o \cos\alpha) t_y = \frac{2(\upsilon - V_o \cos\alpha) L}{c} \tag{29}$$

According to the principle of superposition of motion and the principle of relativity of motion, we can know that in the positive direction of $\boldsymbol{x}$, the observed light speed $\boldsymbol{c' = c + \upsilon - V_o \cos\alpha}$, and in the negative direction of $\boldsymbol{x}$, the observed light speed $\boldsymbol{c' = -c + \upsilon - V_o \cos\alpha}$.

If the optical path of light propagating from the half lens $\boldsymbol{O_0}$ to the mirror $\boldsymbol{N_1}$ in the $\boldsymbol{x}$ direction is $\boldsymbol{S' = L + (\upsilon - V_o \cos\alpha) t_{y1}}$, the required time is $t_{x1} = \frac{L + (\upsilon - V_o \cos\alpha) t_{y1}}{c + \upsilon - V_o \cos\alpha}$, and $t_{y1} = \frac{L}{c}$ is obtained; After the light is reflected by the mirror $\boldsymbol{N_1}$, the observed light speed is $\boldsymbol{-c + \upsilon - V_o \cos\alpha}$ in the negative direction of $\boldsymbol{x}$, and the optical path when it propagates to the semi-lens $\boldsymbol{O_2}$ in the negative direction of $\boldsymbol{x}$ is $\boldsymbol{S' = -L + (\upsilon - V_o \cos\alpha) t_{y1}}$, then the required time is $t_{x2} = \frac{-L + (\upsilon - V_o \cos\alpha) t_{y2}}{-c + \upsilon - V_o \cos\alpha}$, and $t_{y2} = \frac{L}{c}$ is obtained. The total time obtained is

$$t_x = t_{x1} + t_{x2} = \frac{L}{c} + \frac{L}{c} = \frac{2L}{c} \tag{30}$$

Comparing Eq.(28) with Eq.(30), we can get the following

$$t_{y1} = t_{y2} = t_{x1} = t_{x2} = \frac{L}{c} \tag{31}$$

$$t_x = t_y \tag{32}$$

From the optical path and velocity synthesis of each part in this section, the above-mentioned motion relativity principle and motion superposition principle are satisfied, that is, the law of phase and superposition of (motion) wave velocity.

In fact, in the last section, $\boldsymbol{V_o}$ in the $\boldsymbol{x}$ direction is replaced by $\boldsymbol{V_o \cos\alpha}$, and $\boldsymbol{V_o}$ in the $\boldsymbol{y}$ direction is replaced by $\boldsymbol{V_o \sin\alpha}$.

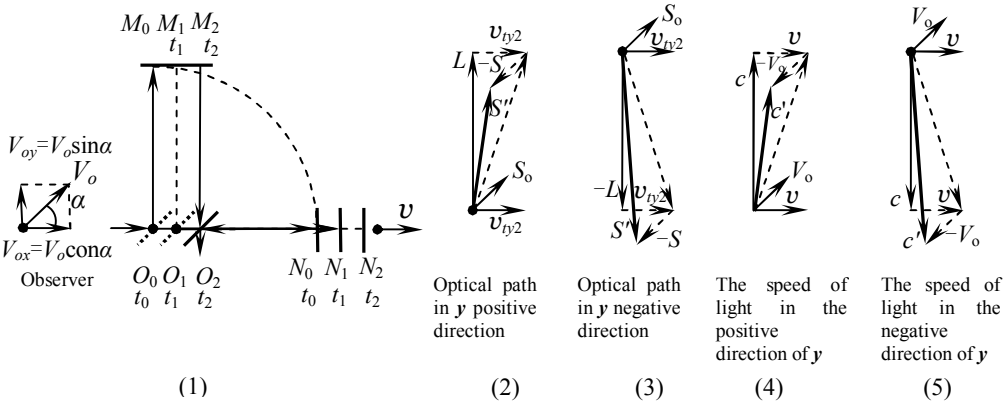


Fig. 6 Michelson-Morey experimental analysis

This shows that the light in two directions reaches the eyepiece at the same time, and when the interferometer is rotated at any angle, the light in two directions also reaches the eyepiece at the same time, and the interference fringes will not move.

Through the analysis of the above five cases, the same results are obtained. In the Michelson-Morey experiment, the time for light to travel back and forth on both arms is equal, and $\boldsymbol{t_{x1} = t_{x2} = t_{y1} = t_{y2} = L/c}$, no matter what the included angle between the two arms of the interferometer, no matter how much the interferometer rotates, no matter which direction it is in, and no matter how fast it moves, it does not affect the propagation time of light on both arms. This is in line with the principle of relativity of motion put forward by Galileo in the Dialogue between Two New Sciences in 1638.

7. Essence of Lorentz transformation factor

In reference【1】, the purpose of Michelson-Morey experiment is to measure the speed of the earth in the ether (that is, the speed of the ether wind). If "ether" exists, and the propagation of light speed in "ether" obeys Galileo's speed superposition principle: assuming that "ether" is stationary relative to the sun, the instrument moves to the right with the orbital speed $\boldsymbol{v}$ relative to "ether" in the experimental coordinate system. The light emitted by the light source is divided into two beams by the beam splitter, and the beam 1 is reflected by the reflector $\boldsymbol{M_1}$ and then projected to the observation screen by the beam splitter. The light beam 2 is reflected by the mirror $\boldsymbol{M_2}$ and projected to the observation screen through the beam splitter, which forms interference with the light beam 1. The speed of light in the "ether" is $\boldsymbol{c}$, and the speed of the earth relative to the ether is $\boldsymbol{v}$, as shown in Fig.7. The propagation speeds of beam 1 returning from $\boldsymbol{M_1}$ and arriving at $\boldsymbol{M_1}$ are different, which are $\boldsymbol{c+v}$ and $\boldsymbol{c-v}$ respectively, and the time required to complete the round trip is $t_x = \frac{L}{c+v} + \frac{L}{c-v}$. The time for beam 2 to complete the round trip is $t_y = \frac{2L}{\sqrt{c^2 - v^2}}$, and the optical path difference between beam 2 and beam 1 to reach the observation screen is

$$\Delta x = c\left(\frac{L}{c+v} + \frac{L}{c-v} - \frac{2L}{\sqrt{c^2 - v^2}}\right) \approx \frac{Lv^2}{c^2} \tag{33}$$

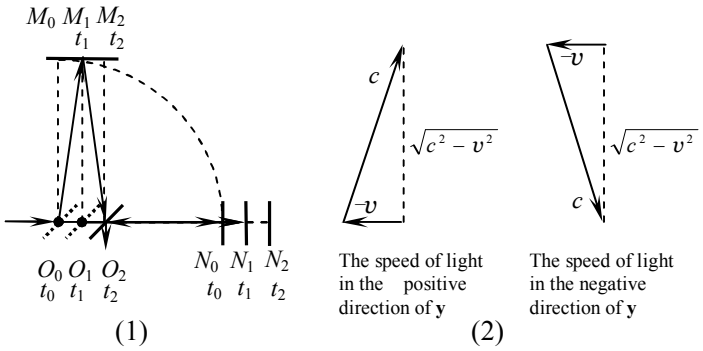


Fig. 7 Michelson's Analysis of Michelson-Morey Experiment

Reference【1】 says: In 1895, Lorenz put forward a more accurate formula of length contraction, and conveniently slowed down the time a little, which is the famous Lorenz transformation. Through the moving object of the ether, the longitudinal linearity shrinks (parallel to the direction of motion), and its shrinking ratio coincides with the calculation of Michelson-Morey experiment. At the same time, the time in this direction also slows down, so that the speed of light in this direction remains unchanged. This is the earliest model with constant light speed. Why change the time? No one knows, and there is no theoretical basis. This version with constant speed of light recognizes the existence of ether. There is no paradox. According to his assumption, when the observer moves at a certain speed relative to the ether, the length shrinks in the direction of movement to explain the Michelson-Morey experiment, and the time slows down to meet the fact that the speed of light has not changed in the direction of the measuring rod. In this way, Lorenz put forward that the speed of light is constant without abandoning the concept of ether.

The process of Lorenz's analysis of Michelson-Morey experimental results is summarized as follows:

7. 1 Michelson confused the reference frame.

It can be seen from reference【1】that Michelson confused the reference frame in his analysis of Michelson-Morey experimental results. In his analysis, actually, the light was not emitted from the interferometer on the earth, but from the outside of the earth. The light did not propagate in the $\boldsymbol{y}$ direction and reflected back to the semi-lens, but was dragged by the "ether", moving in the diagonal direction and moving in the opposite direction to the semi-lens, as shown in Fig.7. The relative speed of light waves changes to

$$\vec{c}_y = \vec{c} - \vec{v}$$

$$c_y = \sqrt{c^2 - v^2} = c \cdot \sqrt{1 - \frac{v^2}{c^2}} \tag{34}$$

The time for beam 2 to complete the round trip is

$$t_y = \frac{2L}{\sqrt{c^2 - v^2}} = \frac{2L}{c} \cdot \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{35}$$

At this time, the interferometer and the mirror have moved in the x direction.

$$\Delta x = v t_y = \frac{2vL}{\sqrt{c^2 - v^2}} = \frac{2vL}{c} \cdot \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{36}$$

The optical path difference between the light beam 2 and the light beam 1 reaching the observation screen is Eq.(33).

7. 2 Lorenz assumed that "the length is shortened" and "the clock is slowed down" to piece together the zero result of Michelson-Morey experiment.

Lorenz still used the principle of velocity superposition $c' = c \pm v$【1】 in his analysis, which means that the speed of light can superimpose the speed of motion, then

$$t_x = t_{x1} + t_{x2} = \frac{L}{c+v} + \frac{L}{c-v} = \frac{2L}{c} \cdot \frac{c^2}{c^2 - v^2} = \frac{2L}{c} \cdot \frac{1}{1 - \frac{v^2}{c^2}} \tag{37}$$

Lorenz assumes that there are these two relations:

$$L = L' \sqrt{1 - \frac{v^2}{c^2}} \tag{38}$$

$$t_x = \frac{t'_x}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{39}$$

Substituting Eq.(38) and Eq.(39) into Eq.(37), we get

$$\frac{t'_x}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{2}{c} \cdot L' \sqrt{1 - \frac{v^2}{c^2}} \cdot \frac{1}{1 - \frac{v^2}{c^2}}$$

To be satisfied

$$t'_x = \frac{2L'}{c} \tag{40}$$

Lorenz's assumptions Eq.(38) and Eq.(39) are exactly the so-called "length shortening" and "clock slowing down"【1, 3, 7, 8】, which are the same as the assumptions Eq.(3) and Eq.(4). After Lorentz transformation factor shortens the length of motion and slows down the clock at the same time, equation Eq.(40) conforms to the definition of time in equations (1) and (5) of the above analysis, but this is pieced together by equations Eq.(38) and Eq.(39) assumed by Lorentz. See the analysis in Section 2.2. In Section 2.3, it has been analyzed that when the bird flies next to the car, there is no physical correlation between the bird and the car, and the assumed Eq.(3) and Eq.(4) are not valid. Therefore, the Eq.(38) and Eq.(39) assumed by Lorenz are not valid, that is to say, there is no so-called "shortening the length" and "slowing down the clock".

7. 3 Lorenz thinks that "light does not obey Galileo's velocity superposition principle", but uses this principle to analyze the zero result of Michelson-Morey experiment.

The result of Eq.(33) is an approximation, and there is no complicated formula that needs to be approximated in the above analysis. Eq. (33), Eq. (34) and Eq. (37) all use the Galileo velocity superposition principle, which contradicts Lorenz's view that "light does not obey Galileo velocity superposition principle". The speed of light of Eq.(34) has also become smaller, and it does not obey the speed of light. Comparing equations Eq. (16), Eq. (21), Eq. (26) and Eq. (31), it can be seen that the optical path of Eq.(35) does not take into account the displacement $\Delta x = v t_y = 2vL/c$ generated in the x direction, and the time required is $t_y = t_{y1} + t_{y2} = 2L/c$. Therefore, Eq.(33)～Eq. (39) are not valid.

7. 4 Lorentz forcibly changed the actual shape of light wave front with Lorentz transformation factor.

Now, from the graphic analysis, enlarge Fig.7(1) to Fig.8(1). At time t_0, the wavefront emitted by the light source at point O_0 is curved as shown in the figure. Although the actual beam is emitted in the y direction, the wavefront emitted by the light source at point O_0 is a spherical wave, and the wavefront is curved as shown in the figure, and the actual optical path is O_0M_0. Lorenz thinks that "ether" drags the light, and the optical path is O_0M_1, which increases the optical path. In the x direction, the displacement Δx of the mirror is not taken into account, so these two periods of time $t_y=t_{y1}+t_{y2}=2L/c$ are calculated less. Finally, after calculation, it is not consistent with the actual experimental results, so Lorenz has to assume a Lorentz transformation factor $\sqrt{1-\frac{v^2}{c^2}}$ and shorten the calculated optical path O_0M_1 to the actual optical path O_0P. This is the reason for the expressions Eq.(38) and Eq.(39) of "shorter length" and "slower clock".

Lorenz thinks that "ether" drags the light and lengthens the wavefront of the light wave into a flat sphere. Fig.8(2) is inconsistent with the actual experimental results, so the Lorentz factor is used to shrink the elongated wavefront flat sphere into a sphere, which is still inconsistent with the actual experimental results, and the Lorentz factor is used to increase the movement time of the light source, that is, the moving light source is forced to stand still, which is consistent with the actual experimental results. This is the essence of Lorentz transformation factor.

To sum up, the zero result of Michelson-Morey experiment can only prove that absolutely still ether does not exist, and can only be explained by Galileo's relativity principle, but not by Lorentz transformation.

Lorentz transformation factor is meaningless, and all formulas and theories containing Lorentz transformation factor are also incorrect. Of course, Lorentz transformation is also incorrect. All physical quantities transformed by Lorentz are not real. Lorentz transformation is like a mirror. Through Lorentz transformation, the authenticity of all physical quantities is changed.

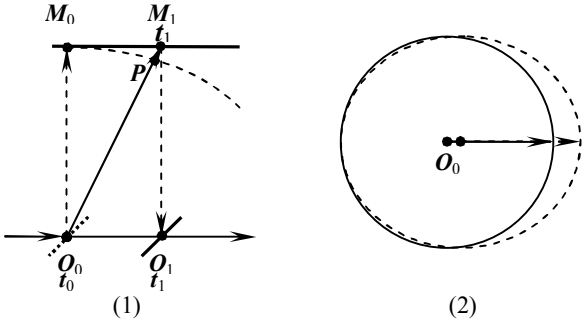


Fig. 8 Michelson-Morey experimental analysis

8. Galilean transformation

In all cases, the light in two directions in Michelson-Morey experiment reaches the eyepiece at the same time. When the interferometer is rotated, the light in both directions also reaches the eyepiece at the same time, and the interference fringes will not move, so it is inevitable to get a zero result.

In addition, there is no sign of the existence of "ether" substance, and there is no situation that "the speed of light is constant in any reference system", and of course there is no Lorentz transformation factor. The speed of light observed in each reference frame follows Galileo's law of vector relativity and superposition.

Lorentz transformation factor is incorrect, and Lorentz transformation is also incorrect, so all relations and theories using Lorentz transformation factor are incorrect.

Abandoning Lorentz transformation factor, Lorentz transformation and Lorentz velocity transformation, the laws of motion and wave velocity superposition of objects should return to galilean transformation and its inverse transformation, and Galileo velocity transformation. galilean transformation and Newton's theory of motion are the correct theories to describe motion.

$$x'=x-vt,\quad y'=y,\quad z'=z,\quad t'=t \tag{41}$$

$$x = x'+\upsilon t',\quad y = y',\quad z = z',\quad t = t' \tag{42}$$

$$\upsilon'_x = \upsilon_x - u,\quad \upsilon'_y = \upsilon_y,\quad \upsilon'_z = \upsilon_z \tag{43}$$

$$\vec{\upsilon}' = \vec{\upsilon} - \vec{u} \tag{44}$$

From the above analysis, it can be seen that the assumption that the speed of light is constant is incorrect, and it is incorrect to think that the speed of light in different directions in the moving reference system is the same. The light waves emitted by the light source in any moving reference frame are all spherical waves propagating at the speed of light in vacuum, which are isotropic. The satellite positioning system moves with the earth in the absolute static reference frame of the universe, and the light source emits spherical light waves. From Eq.(30) and Eq.(13), it can be seen that this is similar to the case of Michelson interferometer. No matter in which direction and at what speed, as long as the distance is the same, the time required for light propagation will not be affected, and the satellite positioning system can accurately locate.

"Aberration phenomenon" is also explained in this way.

9. The Relationship among Matter, Space, Time and Motion

Matter, time, space and motion are the most basic concepts in physics, among which mass, length and time are the most basic physical quantities in mechanics and kinematics. They jointly define other physical quantities and jointly derive their units. It is necessary to clarify their concepts and relationships.

9. 1 Basic physical quantity

The length $\boldsymbol{L}$(m), the time $\boldsymbol{t}$(s), the mass $\boldsymbol{m}$(kg) and the amount of substance $\boldsymbol{n}$(mol) among the basic physical quantities of physics are the basic physical quantities of kinematics, and other physical quantities are derived from them, such as speed, acceleration, momentum, angular momentum, energy and force, which constitute the physical quantities of the classical mechanical system. They have corresponding standard original devices, including International prototype metre, cesium-beam atomic clock, and International Prototype Kilogram, as measuring standards and proofreading standards. The physical meaning of the basic physical quantity is the physical standard, the measurement standard, the uniform scale and the constant. The mass of the weight is fixed, the scale of the ruler is uniform, and the delay rhythm of the clock is uniform. Basic physical quantities are independent of each other, and other physical quantities are defined by basic physical quantities, which are called derived physical quantities. Derived physical quantities are not standard, but can be changed.

9.2 Speed cannot be used as the standard of physical quantity

Velocity $\boldsymbol{\upsilon}$(m/s) is defined by both length and time, and it is the displacement ($\boldsymbol{\upsilon=s/t}$) of an object in unit time. It is a derived physical quantity, and velocity is not qualified as a measurement standard, so it cannot be used to define other physical quantities.

The propagation speed $\boldsymbol{c}$ of light in vacuum is the speed relative to the reference frame of vacuum medium, which is determined by the characteristics of vacuum medium, and it is a constant value. But even if the speed of light is constant, it can't be used as the standard of physical quantity.

9.3 Material and quality

Matter is called "thing" in life. In physics, tangible substances such as solids are called objects. When called by matter, it includes all substances in various forms. In philosophy, the objective existence except human consciousness is called matter. The best thing to understand is the "things" in life, which forms the concept of matter in the human brain. Then, the measurement of matter is based on "how much". In terms of quantity, there is a difference between a lot of things and a small pile of things, which is the difference in quantity. This is the concept of mass of matter, which is a scalar, and it is directly added and subtracted numerically. The same substances, especially microscopic substances, are considered to be the same as long as they are of the same kind. You only need to add up the numbers to know how many there are.

In order to measure the amount of substances, people have made a standard object, and it is stipulated that the standard object contains 1 kilogram of substances, which is called the standard kilogram original device. With this standard, any other substance can be compared with it, and we can know how much substance this object has, and express its mass in kilograms. How much matter an object has, as long as it is not transferred, the total amount remains unchanged. No matter how it splits, how it reacts, how it moves, how it is stressed and where it is placed, its total

mass is conserved. The tool for comparing the mass of a substance is a balance, with one end being a known quality standard (weight) and the other end being the object to be compared. Of course, the principle of the balance is the relationship between gravity. As long as the balance is balanced, the quality of the object is the quality of the standard weight. On the earth, on the moon and anywhere else, when the balance is balanced, the quality of the object will be known. When moving to a place without any gravity, this equivalence relation still holds. From this, it can be known that the balance uses the difference of gravity to judge whether it is balanced, which is a matter of technical principle, not the essential problem of object quality.

Mass is a physical quantity that represents the amount of substances contained in an object, that is, the molar mass in chemistry. If the mass is zero, it means that there is no matter. If you put something on the balance, but there is no weight on the other end of the balance, and the balance is still balanced, it means that nothing is put. The reason why quality is the most basic property of matter.

Various substances have various properties, some are charged, and there are various shapes, forms, states and positions.

Mass is the number of substances contained in an object, which is an intrinsic property of an object. It does not need to be externally endowed with mass, and its number has nothing to do with whether the object is moving or not, and it has nothing to do with whether the object is attracted or not, and has nothing to do with all the states and forms of the object. When an object is moving and changing, as long as the substance contained in the object is not transferred, its total amount is constant, which is the law of conservation of mass.

Newton found that there is universal gravitation between any matter, and the gravity of other objects is directly proportional to the mass of the object, that's all. But it doesn't mean that mass can be characterized by gravity, that is to say, "gravitational mass" is meaningless.

9.4 Space

The existence of matter must occupy space, and space can accommodate matter. The space center occupied by matter is determined as its position in space.

Space is the place where matter exists. The distance between different positions in space is linked by a straight line segment, which is the length. The original meter is artificially specified as the standard of length and made into a scale to measure other lengths.

In order to determine the position and change of matter in space, coordinates and reference systems are cited.

Space is a place, which is equivalent to a container. The basic feature of space is nothing. Space can contain substances or nothing. So, space has nothing to do with any matter.

9.5 Sports

The position of matter can be changed, and the change of matter's position in space is movement.

The movement of matter in space and the change of matter itself are continuous, progressive and sequential, and it takes time. Matter continuously occupies the space position in front, and at the same time continuously empties the occupied space in the back, and the vacated space is generally occupied by other substances, so that matter moves. The motion is continuous, forming a motion trajectory, which is continuous and differentiable, and there is no intermittent jumping motion.

It should be clear that mass is the amount of matter contained in an object, and it has nothing to do with the state of the object (such as whether it is moving, whether it is on or off, whether it is changing, whether it is abnormal, and where it is). Quality is the most basic physical quantity of matter. With quality, we can talk about sports. Without quality, we can't talk about sports. Objects are the main body of motion and have mass, and there is no movement without matter and mass.

9.6 Time

The process of material movement is fast or slow, which is manifested in time. People use the periodic changes of the sun and the moon to measure the speed, take the clock as the standard, measure the speed of the movement of objects, measure the speed of the change of things, and measure the sequence of movement and change, forming a causal relationship. The sequence and speed of material movement process reflect time. In the process of material moving and changing, other things are moving and changing, and the clock standards everywhere are delayed synchronously with the same rhythm.

9.7 Inertia

The movement of an object, when it starts and stops, feels some easy difficulties, which is inertia and unchangeable. It is called inertia and a feeling, which is not easy to measure with a standard quantity. Inertia is the nature of an object in motion (including at rest), which is related to its mass. Galileo and Newton found that the greater the mass of an object, the harder it is to change its state of motion, and the stronger the characteristics of inertia, and the difficulty of changing its state of motion is proportional to its mass, that is, inertia is proportional to its mass, and the proportional coefficient is 1, that's all.

Inertia is not represented by symbols, inertia does not specify physical quantities that can participate in calculation, and Newton's law of inertia does not have a mathematical expression, but uses mass to measure the size of inertia. If m is used to represent the inertia of an object and m is used to represent the mass of an object, then M=km, and now the ratio k=1 is considered.

Inertia is only related to mass and has nothing to do with all other factors. Inertia is not mass, inertia is not force, inertia is only the motion characteristics of objects when they move. Inertia cannot be equated with gravity, and inertia cannot be attributed to the interaction between objects. That is to say, "inertial mass" is meaningless.

9.8 Field and Field wave

Like the above-mentioned matter, the field also exists objectively, and it can be regarded as a special matter. A field has no mass, but only strength, and its strength is called field strength, which is a vector, and the strength of the same field follows the vector superposition relationship. The type and field strength of the field characterize the properties of the field.

Now it is known that there are four kinds of fields, namely, gravitational field, electromagnetic field (electric field and magnetic field), weak force field and strong force field. The field is produced by matter, and the field exerts a force on matter, namely, gravity, electromagnetic force (electric field force and magnetic field force), weak force and strong force.

The field has no definite shape and no obvious boundary. The distribution of the field in space does not monopolize the space, but can be superimposed in space.

The intensity change of a field cannot be described as motion, but as transmission, propagation or fluctuation, and its law is not a motion equation, but a wave equation.

Coulomb's law of electrostatic field and Newton's law of universal gravitation of gravitational field have neither the variable of speed nor the variable of time, that is, it has nothing to do with speed nor time, but only with distance, that is to say, no matter how far the distance is, the field can work and is instantaneous. The transmission of static field has no process and no time, that is to say, the transmission speed of static field is infinite. Static field is static in the absolute static reference frame of the universe. With matter, there are corresponding kinds of fields.

The intensity change of field is described by wave equation, which produces field fluctuation in space, and its wave velocity is only related to the wave medium. In the absolute static reference frame of the universe, the field wave velocity is constant.

It is common that electric and magnetic fields excite each other and spread in space to form electromagnetic waves, that is, light waves. The electromagnetic wave velocity solved by electromagnetic wave equation is $c'=\frac{1}{\sqrt{\varepsilon\mu}}$ in medium and $c=\frac{1}{\sqrt{\varepsilon_0\mu_0}}$ in vacuum.

Field wave is only the wave form of the field, not the field itself, and field wave is not matter. The propagation speed of field wave is only the propagation speed of the wave form of the field in space, not the transmission speed of the field itself, so the propagation speed of field wave is limited, not the transmission speed of the field (infinite).

Similarly, electromagnetic wave (light wave) is only the wave form of electromagnetic field, not the electromagnetic field itself, and electromagnetic wave (light wave) is not matter. The propagation speed of electromagnetic wave is only the propagation speed of electromagnetic wave form in space, not the transmission speed of electromagnetic field itself, so the propagation speed of electromagnetic wave is limited, not the transmission speed of electromagnetic field (infinite).

Field wave is the messenger of people's cognition. When people observe things with instruments, they will eventually be converted into signals that can be perceived by human senses. All non-contact ways to perceive and observe things use field wave as the messenger. Usually, the object is made to emit or reflect light waves, and the movement of the object is observed by light signals. Most of the information received by human beings is to see the light wave signals emitted by the object with eyes【5, 6】.

Electromagnetic wave (light wave) is only the fastest messenger of known information, but it

is not the fastest moving speed of matter, let alone the upper limit of speed.

Light is electromagnetic wave, the speed of light is constant, and the speed of light is constant relative to medium or vacuum (medium). Light is not a matter, light is not a particle, light is not a field, it has no mass, no field strength, no force, no acceleration process, no inertia, and it is the speed of light when it is produced. The speed of light is only related to the medium of light. In a vacuum, the speed of light is the fastest without any obstacles. There is nothing in a vacuum, and light can spread, and it is the fastest. Vacuum is the best medium for light to spread. The mechanism of light propagation in media is different. When light propagates in glass, water, air and other media, it is hindered and its speed is slow.

Galilean transformation is the transformation of the motion of objects, while Maxwell's equation is the propagation law of electromagnetic waves, which are two different forms. It is normal that Maxwell's equation does not meet galilean transformation covariant, and it is unnecessary and should not covariant. All wave equations (including mechanical waves and electromagnetic waves) are covariant to galilean transformation, so there is no need to use Lorentz transformation to reconcile the relationship between Maxwell's equations and galilean transformation. Moreover, some studies show that Maxwell's equations and galilean transformation are covariant【9】.

9.9 Force and Energy

The above-mentioned matter with mass is called solid matter, and the field is called field matter. In a broad sense, matter is divided into solid matter and field matter. $\boldsymbol{\Phi}$ is used to represent the field strength of field matter, and $\boldsymbol{Q}$ is used to represent the quantity of the category attribute of solid matter, which is called charge quantity, such as mass and charge.

At present, there are four kinds of fields, namely, field state matter, namely gravitational field state matter, electromagnetic field state matter (electric field state matter and magnetic field state matter), weak field state matter and strong field state matter. Field matter is produced by physical matter, and field matter exerts a force on physical matter they are gravity, electromagnetic force (electric field force and magnetic field force), weak force and strong force respectively.

Field matter is produced by the charge of the physical matter, and at the same time exerts a force on the charge of other physical matters. The physical matter that produces field matter is the field source. For example, the mass attribute charge $\boldsymbol{m}$ of a physical substance produces a gravitational field, and the matter in the gravitational field produces a gravitational effect on the mass attribute charge of other physical substances; The charge attribute charge $\boldsymbol{q}$ of a physical substance produces an electric field state substance, which in turn produces an electric field force on the charge attribute charge $\boldsymbol{Q}$ of other physical substances. The current attribute charge $\boldsymbol{i}$ of a physical substance produces a magnetic field substance, which in turn produces a magnetic force on the current attribute charge $\boldsymbol{I}$ of other physical substances.

According to the law of universal gravitation and Coulomb's law, $\boldsymbol{\Phi}$ represents the field strength, and $\boldsymbol{Q}$ represents the charge of the type attribute of the solid material, so the field strength at the distance from the field source $\boldsymbol{r}$ is

$$\Phi = K\frac{Q}{r^2} \tag{45}$$

Here, the force generated by the field substance on the charge $\boldsymbol{Q'}$ of the category attribute of other physical substances is

$$F = Q'\Phi = K\frac{QQ'}{r^2} \tag{46}$$

The field strength of the field substance produced by the physical substance as the field source is distributed in space according to certain laws (such as the law of universal gravitation and Coulomb's law). In a local area far away from the field source, there is no physical substance, only the field substance. At this time, it can be considered that field matter can exist independently of the field source.

The force produced by the field substance on the solid substance is conservative, so the solid substance in the field substance has potential energy, and the potential energy of the solid substance at the distance from the field source r is:

$$E_P = \int Fdr = Q'\int \Phi dr = K\frac{QQ'}{2R} \tag{47}$$

Different types and properties of physical substances have different charges, and the

properties of the field substances produced are also different. There is no difference between positive and negative and polarity in the quality attributes of physical matter, so the generated gravitational field matter is unidirectional, attractive to other physical matter, and widely distributed in space. Although the gravitational field matter is weak, it is the force that dominates the operation of cosmic celestial bodies. However, there is a difference between positive charge and negative charge in the charge properties of physical substances, so the generated electric field state substances are bidirectional, attracting and repelling the charges of other physical substances. When the electric field state substances generated between different charges are superimposed, they can cancel out part of each other, so that the distribution of electric field state substances is entangled between charges, while the distribution in the external area is weak. Similarly, the current property also has two directions, and the generated magnetic field state substances have two directions of polarity. When the magnetic field state substances with different polarities are superimposed, they can cancel out part of each other, so that the distribution of the magnetic field state substances is rolled between magnets with opposite currents or different polarities, while the distribution in the external area is weak. The distribution of electric field state matter and magnetic field state matter in space is limited. Although the intensity is very strong, it is not the force that dominates the operation of cosmic celestial bodies. The nuclear force in the nucleus is a short-range force, and the strength of nuclear force field substances (weak field substances and strong field substances) produced by the charge of nuclear entity substances decreases rapidly with the increase of distance, and the distribution of nuclear force field substances is limited to adjacent nuclear entity substances.

The charge of the nuclear substance in the nucleus produces nuclear force field substances (weak force field substances and strong force field substances), and the nuclear force field substances simultaneously produce nuclear force (weak force and strong force) on the charge of the nuclear substance in the nucleus. The nuclear substance in the nuclear force field state substance has nuclear force potential energy. Because the nuclear force field state substance, especially the strong field state substance, is very strong, the nuclear force potential energy is very large. When a nuclear reaction occurs, it will release huge nuclear force potential energy, which is nuclear energy.

9.10 Energy of electromagnetic wave

When the field source of solid matter moves in space, the distribution of field matter produced at every moment will change in space, which will cause the distribution of adjacent field matter to change in space.

For example, the field source of solid matter with electric charge (electric charge) moves in space, especially in periodic motion with non-uniform speed (such as simple harmonic vibration), which causes the distribution of electric field state matter to change unevenly. According to Maxwell's electromagnetic theory, the distribution of magnetic field state matter excited by this change also changes unevenly, and electric field state matter and magnetic field state matter alternately excite each other to change, which causes the distribution of adjacent electric field state matter and magnetic field state matter in space. In vacuum or homogeneous medium, the electromagnetic wave is isotropic and spherical, and the wavefront is spherical. Even if light is emitted in a certain direction by technical means, it is also a part of spherical wave.

According to Maxwell's electromagnetic theory, the energy density of electromagnetic waves is【10, 11】:

$$w = \frac{1}{2}(\varepsilon \vec{E}^2 + \frac{1}{\mu}\vec{B}^2) = \varepsilon \vec{E}^2 = \frac{1}{\mu}\vec{B}^2 \tag{48}$$

Comparing the energy density of mechanical waves, we will find that the two forms are the same:

$$w = \frac{1}{2}(m\vec{\upsilon}^2 + k\vec{x}^2) = m\vec{\upsilon}^2 = k\vec{x}^2 \tag{49}$$

Φ and ***M*** are used to uniformly represent the coefficients and vectors. The energy density of electromagnetic waves and mechanical waves and the total energy of the space throughout the field are all in this form, which can be written in these two formulas:

Energy density:

$$w = M\Phi^2 \tag{50}$$

Total energy:

$$W = M\int \Phi^2 d\tau \tag{51}$$

Maxwell's equation describes the electromagnetic field state substances (electric field state substances and magnetic field state substances) produced by solid substances as field sources and their changing rules. Maxwell's equation remains unchanged for Galilean transformation, and the light speed $c'=\frac{1}{\sqrt{\varepsilon\mu}}$ in the medium (relative to the medium) and $c=\frac{1}{\sqrt{\varepsilon_0\mu_0}}$ in the vacuum (relative to the vacuum) are solved.

9.11 The Relationship among Matter, Space, Time and Motion

Matter, space and time are different physical concepts, expressed by different physical quantities, and each has its own basic physical quantity, which is independent of each other and has no influence on each other. They all have absoluteness, and they form a moving relationship. In the absolute static reference system of the universe, matter is in absolute motion, and in other moving reference systems, it is in relative motion.

Matter is put into space, and space is a container for containing matter. Matter changes in space, and matter moves in space. Take the matter out of the space, the original space is still there, and it becomes a real space with nothing, that is, a vacuum. The real space can be filled with other substances. Matter and space can be separated, but they cannot be bound together.

Matter is the subject, space is the place, and movement and change are the movement and change of matter, the change, transfer and separation of the position of matter in space, not the change of space. Matter moves in space, and its position is different, and it moves fast and slow. Without matter in space, space is empty, without matter moving in space, space is empty, whether there is matter or not, and whether matter is moving or not, space has not changed.

The quantity, position and state of matter can be changed, but space cannot be changed, nor can the speed of time be changed.

Matter cannot change space, nor can it change time. Exercise cannot change matter, nor can it change space, nor can it change time.

10. Superposition, Orthogonal normalization and Equivalence Principle of Field Matter【10, 11】

10.1 Superposition of field matter

The field strength of a field substance is an intensity quantity, and it is a directional vector, so it has superposition. If the system has multiple field sources of the same kind of solid matter, their category attributes are the same, that is, their charge category attributes are the same, and the field state substances they produce have the same category attributes, they will be superimposed. The field state substance at any point is the vector superposition of field state substances produced by multiple field sources at this point, that is, the field strength is:

$$\Phi=c_1\phi_1+c_2\phi_2+\ldots+c_n\phi_n=\sum_n c_n\phi_n \tag{52}$$

10.2 Orthogonal normalization of field matter

Only when the category attributes of two kinds of field substances are the same as those of their corresponding physical substances can energy be produced. The field strengths $\boldsymbol{\Psi_k}$ and $\boldsymbol{\Psi_l}$ of the two field states satisfy the following orthogonal normalization relation:

$$\int \psi_k^* \psi_k d\tau = \delta_{kl} = \begin{cases} 1, (\text{When } k=l) \\ 0, (\text{When } k\neq l) \end{cases} \tag{53}$$

The proof is as follows, because only when $\boldsymbol{k=l}$, there is

$$W = M_k\int \phi_k^*\phi_k d\tau = M_l\int \phi_l^*\phi_l d\tau = M\int \phi_k^*\phi_l d\tau$$

$$= M\cdot\frac{W}{M}\int (\sqrt{\frac{M_k}{W}}\phi_k^*)\cdot(\sqrt{\frac{M_l}{W}}\phi_l^*)d\tau$$

$$= W\int \psi_k^*\psi_l d\tau$$

That is to say, when $\boldsymbol{k=l}$, $\boldsymbol{W=W}$, $\int \psi_k^*\psi_l d\tau = 1$ (can form energy); When $\boldsymbol{k\neq l}$, $\boldsymbol{W=0}$, $\int \psi_k^*\psi_l d\tau = 0$ (can't constitute energy).

For example, mass m and velocity υ can form kinetic energy, and dielectric constant ε and electric field E can form electric field energy (that is, $\upsilon\cdot\upsilon=\upsilon^2$, and $E\cdot E=E^2$, which means $W=W$ when $k=l$); Conversely, mass m and electric field E cannot form energy, and neither can dielectric constant$\varepsilon$and velocity υ (because $m\cdot E=?$， and $\varepsilon\cdot\upsilon=?$, which means $W=0$ when $k\neq l$).

10.3 Equivalence of field matter

When different field substances coexist in a system, its total energy can be equivalent to the energy formed by the charge of any field substance and its corresponding entity substance, which is actually the law of conservation of energy. Its expression is:

$$W = M\int \Phi^*\Phi d\tau = \sum_n W_n = \sum_n M_n \int \phi_n^*\phi_n d\tau \tag{54}$$

Normalize ϕ toΨ (where M/W is called normalization coefficient)

$$\frac{M}{W}\int \Phi^*\Phi d\tau = \sum_n \frac{M_n}{W}\int \phi_n^*\phi_n d\tau = \sum_n \frac{W_n}{W}\frac{M_n}{W_n}\int \phi_n^*\phi_n d\tau$$

Namely:

$$\int \Psi^*\Psi d\tau = \sum_n \frac{W_n}{W}\int \psi_n^*\psi_n d\tau = \sum_n \frac{W_n}{W} = \sum_n |C_n|^2 = 1$$

Use binomial theorem to combine n integral terms in the above formula, where k, l=1,2,3,…,n, and $k\neq l$ (that is, the case of adding **0** in the following formula):

$$\begin{aligned}\int \Psi^*\Psi d\tau &= \sum_n \int |C_n\Psi_n|^2 d\tau + 0 \\ &= \sum_n \int |C_n\psi_n|^2 d\tau + \sum_n 2|C_k^*C_l|\int \psi_k^*\psi_l d\tau \\ &= \int (\sum_n |C_n\psi_n|)^2 d\tau\end{aligned}$$

Another expression of equivalence can be obtained: Ψ can be expanded into series Ψ_n:

$$\Psi = \sum_n C_n\psi_n \tag{55}$$

The relation can be obtained again:

$$|C_n|^2 = \frac{W_n}{W} \tag{56}$$

$$\sum_n |C_n|^2 = 1 \tag{57}$$

$$C_n = \int \psi_n^*\Psi d\tau \tag{58}$$

This shows that $|C_n|^2$ represents the proportion of energy generated by the n th field substance in the total energy of the system, also represents the proportion of energy generated by one of the field substances in the total energy of the system w/W, and also represents the proportion of energy in the system w/W.

For example, a charged body moves in an electric field and a magnetic field. It has kinetic energy, electric field energy and magnetic field energy, but its total energy can be replaced by any one of kinetic energy, electric field energy or magnetic field energy. It can even be replaced by another energy, or it can be replaced by multiple energies.

11. Universe

Matter, exists objectively, with more or less, without birth or extinction;

Space, up and down, left and right, long and wide, boundless;

Time, through the ages, is long and short, without beginning and end;

Movement, from here to there, is fast and slow, static and moving.

Matter can be moved but can't be destroyed, space can't be born or long, and time can't be born or retired.

Material is eternal, space is boundless, time is eternal, and movement is eternal.

Principles of the universe【12】:

The first principle of the universe: the real world is three-dimensional and has no other dimensions.

The second principle of the universe: in the real three-dimensional world, any solid matter is a three-dimensional entity with volume, size, shape, boundary and quality.

The third principle of the universe: matter is divided into physical matter and field matter,

with physical matter having charge and field matter having strength.

The fourth principle of the universe: field matter is produced by physical matter, and field matter exerts a force on physical matter.

The fifth principle of the universe: space and matter constitute the universe, matter exists in space, and the change of matter's position in space is movement, and the order and speed of matter's movement process reflect time.

The sixth principle of the universe: field matter exerts a force on physical matter, which makes physical matter have potential energy, motion makes physical matter have kinetic energy, and field matter has energy.

The seventh principle of the universe: the most basic solid matter (particle) is single component (the simplest), homogeneous, unstructured, isotropic, stable and inseparable.

The movement, transfer, separation and change of matter (celestial bodies) in the universe all occur in the infinite universe, and the explosion, division and merger of celestial bodies are all local movements and changes in the universe.

The universe is infinite, time has no beginning or end, no beginning, no end, no center, no boundary and no exterior. There are things that move and change in the universe, and the local changes in the universe are the range we can study and observe.

Gravitation is the dominant force of celestial movement, and the way of leading celestial movement is chaotic and orderly.

For example, in the solar system, at some point, the nebula exploded by a celestial body is condensed again due to gravity, the center is condensed into the sun, the part is condensed into a planet, and the part of the planet is condensed into a satellite. The original nebula has gravitational potential energy because of universal gravitation, which is the original motive force of the whole galaxy. The parts of the nebula attract each other, thus changing the state of motion, or accelerating condensation, or moving in a curve. The conic curve is in line with the characteristics of universal gravitation, so the comets of the planets and satellites revolve and rotate in this way.

Acknowledgement

The author of this paper thanks Xiaochun Mei, director of Fuzhou Institute of Original Physics, for his strong support and help.

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4/12/2022