English/Chinese

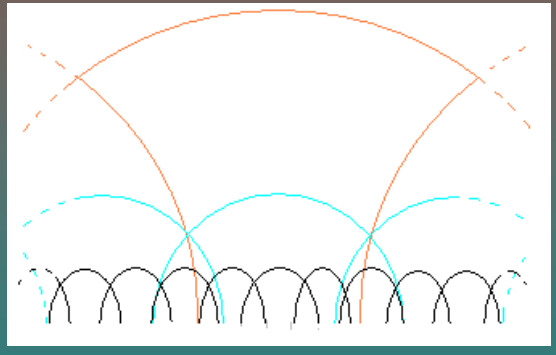
中英双语

真空、时空、物质和 *Smarandache* 几何模型

Vacuum, Space-Time, Matter and the Models of Smarandache Geometry

胡昌伟

Hu Chang-Wei



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The Chinese is taken as the norm if there are different meaning between the Chinese and English in this book.

For my grandmother Zhang Yu-Lian

It is her who gave me second life and a happy childhood

Contents

Pre-publication reviews

In the past, many people researched into physical vacuum from the view of quantum field. In this book, physical vacuum is called the “ether” by the author, who not only describes the interrelation and interconversion between the ether and particles, but also states the macroscopic effects and cosmoscopic interaction of the ether, which lays down a foundation for modern ether theory. What values most is that he points out that it is ether that creates physical space-time theory of quantitative description. He applies related ideas and methods of Smarandache to describe Smarandache geometrical model of relativistic space-time and even the entire universe. These are ground breaking and constructive researches and are worth to be read and recommended.

——Prof. Wu Shui-Qing

former chief editor of Modern Physical Knowledge

Hu Chang-Wei considers, through analysis on the basis of the derivation of the Lorentz transformation by means of fluid mechanics, that Newtonian absolute space-time theory is most basic and real space-time theory, where the physical vacuum is a compressible superfluid, a change of its density can cause a change of actual space-time standards, and thus, leads up to the quantitative effect deviated absolute space-time theory. The effects of relativity and quantum are all quantitative effects, and the space-times of relativity and quantum physics are the space-times twisted by quantitative effects. For the descriptions above, he calls "returning classics with quantitative effects", which is interesting as well as meaningful.

——Prof. Hu Su-Hui,

Once contributing editor of Chinese Science and Chinese Science Bulletin

Some persons think that ether or faster than light velocity cannot exist in vacuum, otherwise

the Lorentz invariability would be destroyed. While Hu Chang-Wei considers this point of view as putting the cart before the horse, because the ether is the material basis of relativity. He points out the relativity is a theory of quantitative description with light as measure space-time, and it regards the change of space-time standards as the change of space-time itself, which is a practicable mathematical model. Since the relativity regards light as a tool of measuring space-time, it is obvious that it does not describe the faster than light velocity. These opinions should be valued.

——Prof. Yang Wen-Xiong

Shanghai Communication University

Preface

Many fundamental concepts in physics remain unsolved:

- What is time? Is it pure relative?
- What is the vacuum? Is it void space or special medium?
- What is mass? Can it be created?

I believe that physicists have not got definite answers for the above questions.

Isaac Newton said: I was like a boy playing on the sea-shore, and diverting myself now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me.

For instance, we still do not know what the clear definition of time in physics is. Because of the influence of relativity, there is too much criticism of Newton's point of absolute time, thus ignoring the right essence. In fact, the absolute time is the scientific abstract and enhanced expression of all kinds of relative time.

In Newton's absolute time expressions, the right contents are:

(1).The absolute time is objective, which has nothing to do with personal feeling;

(2).The absolute time is always in positive direction so that history can never be played again;

(3). The absolute time runs uniformly, independent of the movement of individual objects.

Lorentz was a pioneer in the theory of relativity. He mentioned that there should be a "real" time (True Time) in addition to the relative time. The definition of time in the generalized Galilean transformation is an expression of the Lorentz' "real" time, which corresponds to the universal GMT. When using this definition of time, simultaneity is absolute; the arrow of time is positive. Superluminal motion would not cause time reversal.

Therefore, Physics should give a theorem: "Time Machine" is impossible.

As far as the term "vacuum", most physicists consider it as special medium, instead of void space. To avoid confusion, it is better to introduce a term "ether field" to replace "vacuum".

Mr. Hu has studied the subject of "ether field" more than 30 years. From his research papers, Lorentz transformation can simply be derived from Galilean transformation by using fluid dynamics. It shows that the density of "ether field" corresponds to gravitational potential, which is

a compressible superfluid. The change of density causes the change of space-time geometry. Therefore, the “ether field” is the material basis of relativity theory.

Mr. Hu has also considered some applications of Smarandache's notions, such as Smarandache multi-spaces, Smarandache geometries to fundamental physics and cosmology.

Physics is a developing science. Mr. Hu’s research is an attempt to explore new physics, which deserves people’s attention.

Tsao Chang, Chinese-American Physicist

2012

Explanation of Particular Nouns

1 Ether：A material of vacuum state, namely the physical vacuum, it is without mass itself, and is its un-homogeneous density distribution that creates relativistic mass.

2 Etheron: The most basic or least ether particle.

3 Qi: A matter of vacuum state what called by ancient Chinese.

4 Object: The matter with mass, it is the core of the ether density wave-packet.

5 Absolute description: It is a physical description on the basis of absolute space-time theory, namely Newtonian description.

6 Quantitative description: It is a physical description on the basis of experimental data. There are certain differences between quantitative and absolute descriptions because actual standard tools measured space-time can vary with environment more or less.

7 Quantitative effect: It is a effect caused by the differences between quantitative and absolute descriptions, or a effect created by the variability of actual space-time standards.

8 Smarandachely denied axiom: An axiom behaves in at least two different ways within the same space, i.e., validated and invalided, or only invalided but in multiple distinct ways.

9 Smarandache Geometry: It is a geometry which has at least one Smarandachely denied axiom.

10 cosmoscopic: The space range of galaxies and cluster of galaxies, it is greater by one level than the macroscopic just as the macroscopic is greater by one level than the microscopic.

11 Interval field ether: It is a series of the matter of basic existent form, which is higher by one order than the object, they exist and plays a leading role in respective field interval.

Author's Foreword

This book researches on a series of questions relative to physical basic theory. But I am not a physical specialist, which has a weak side, and a superior side as well.

The weak side is quite obvious. There are not enough mathematical models and many questions could not be spread in a deepgoing way, some contents are only speculative ideas especially after chapter 6 in this book, in which the contents are not mature or perfect of course. There is a Chinese idiom: "throw away a brick in order to get a gem" I regards this book only as a brick thrown away in order to cause peoples to do research further on relative questions, and thus to promote excavation for new science gems.

As for the superior side, the advantage is latent. An ancient poem said: "Cannot recognize the truth of Lu Mountain, only because person is in this mountain." Many physicists has been investigating various physical details and diving in the ocean of mathematical symbols, so that it is difficult for them to avoid the dazzling and they even take the mathematical models as objective truth. For example, physicists considered that the space-time was bent in gravitational field, which is actually only a mathematical description that the matter in vacuum state distributes in the uneven, but real space-time cannot bend. Moreover everybody can have some prejudices, scientists are no exception. A new theory often needs to break through tiers resistance of various prejudices, thus growing gradually; but along with it, being accepted by more and more peoples, it would generate some prejudices resisting other new theories. The relativity is just such that there is always resistance in its development's course; while now it is a source of prejudices that resists the research on the faster than light velocity etc..

A series of questions are proposed and caused in this book. Limited by the weak side of me, some questions are solved concretely; some are only solved initially; others are avoided to be discussed. Several questions and their simple answers are showed below:

1　What is ether? The vacuum is not void, which has been confirmed by a large number of objective phenomenon and experiments. The ether is just a name of the matter in vacuum state. The derivation of the Lorentz transformation by means of fluid mechanics shows the existence of ether in theory.

2　Are physical space-time the real space-time? Not always. The absolute space-time

expressed by Galilean transformation are the real space-time, whose standards are invariable. But actual quantitative relations may deviate from absolute space-time theory more or less because of the variability of space-time measure standards, which is what we call the “quantitative effects”. The physics is an experimental science, its theory should be identified with actual measurement data, which has relation to the behavior of standard measure tools inevitably. Thus physical space-time is not necessarily the real space-time.

3 What is the essence of relativity? The relativity is a quantitative descriptive theory with light as the measure of space-time, and it takes the change of space-time standards as the change of space-time itself, which is only a practicable mathematical model in absolute space-time theory.

4 Is the mass a quantity that represents the size of material? The basic existence forms of matter are various, and the mass is only a quantity that represents the size of object. The ether is another basic existence form that is different from object. It is without mass and has close relation with object of course.

5 How does the ether look like? The ether, which has close relation with object, is a compressible superfluid occupying entire space, whose density field is the gravitational field, the object is the core of its density wave-packet, and the mass center of a object is the point of maximal value of the its density. Microscopically, the ether and real particles are all made up of neutrinos and charge: neutrino with one charge is a charged lepton, neutrino with fractional charge is a quark, and ether is a Bose-Einstein condensation that is composed of the pairs of positive and negative fermions in lowest energy state, where the most basic particle of ether fluid is a pairs of positive and negative neutrinos, which is called the etheron. Transferring a integer charge between positive and negative neutrinos within a etheron, or one obtains a positive charge and other obtains a negative charge, the etheron turns into a photon that is composed of positive and negative charged leptons, a photon that does not form independence wave-packet of ether density is a virtual photon, which is a electromagnetic excited etheron; and a photon that forms independence wave-packet of ether density is a real photon. Transferring a fraction charge between positive and negative leptons within a etheron or photon, they become a pairs of positive and negative quarks, it is a virtual gluon with color that does not form independence wave-packet of ether density, and it is a real meson with independence wave-packet of ether density, it is without color necessarily.

6 Which one between ether and field should enjoy the ontological status? The answer is

ether. Because the ether is the same physical reality as object, while the interactive fields are only the state of ether, they are the ether density wave-packets with different properties, the intensity of strong, electromagnetic and gravitational fields are respectively correspond to the density gradient of virtual gluon, virtual photon and etheron (the least ether particle).

7 How to describe the physical basis of relativity? Here the point is that relativistic space-time standards are decided by ether density, that is, where the ether density is greater, a length standard become shorter, and a time standard become longer. The essence is that the unit length is proportional to an interval between two adjacent ether particles, and the unit time is proportional to the time interval that the light travels through an interval of ether particles, then the ether becomes homogeneous and isotropic four dimensional space-time continuum, and the light velocity is invariable of course.

8 Continued ether is used to show that the interaction among noncontinuous objects are not an action at a distance, now the ether is regarded as composed of etherons. Is it a logic cycle? No! First, in terms of quantitative description, the etheron is the least ether particle (it is not an ether if etheron is divided once more), so that the size of etheron cannot be defined, or it has no size because the unit length is proportional to an interval between two adjacent ether particles. Moreover in terms of absolute space-time theory, the etheron has size, but the theory of interval field ether considers what we are known is only gravitational field ether, and there is microscopic interval field ether in the space among etherons and so on.

9 Why is the light velocity invariable? The invariability of light velocity is a quantitative effect. The light velocity is variable in absolute description, where the light velocity is slower, a actual rulers become shorter, and clocks run more slowly, and thus the light velocity that is measured directly is always invariable. The relativity cannot describe the faster than light velocity because it is a quantitative descriptive theory with light as the measure of space-time, so that it is beyond the reach of its power. The faster than light velocity is like the supersonic velocity, which cannot make us to hear clearly the voice of the past; also the faster than light velocity cannot make us to return to the past.

10 Is the gravitational field the cosmic field dominating entire universe? No, the interaction of gravitational field is not infinite and it is only a macroscopic field, whose interaction is only about the tenth part of the interaction of cosmoscopic field in the cosmoscopic system of

galaxies and cluster of galaxies. The interaction of cosmoscopic field is a cosmoscopic interaction of ether, which causes the mass discrepancy, rather than so-called "dark matter". If the gravitational field is not a cosmic field, then all kinds of cosmologies based on the general theory of relativity are the unmeaning.

11 what is the purpose of Smarandacheh geometry? There is only one real space-time, namely the absolute space-time, but the space-time of quantitative description are various, which can vary with distributive state and existent forms of the ether. Therefore actual space-times of quantitative description is a Smarandacheh multi-spaces, i.e., there are many subspace of different property in one space, which are expressed obviously by Smarandacheh geometry.

My thoughts on physical questions began in the 60s of the 20th; I discussed interval field theory with a close friend Chen Zi-Liang in the 70s; in the 80s, I had described the Lorentz transformation by fluid mechanics means, and recognized that the light is a second sound in superfluid ether; besides, I published a maiden work *The Ether Theory of Interval Field* in Potential Science.

Before 2005, I have nearly no communication with other physical research groups. Later, I discovered wonderful world on web in 2004, and took part in Beijing Relativity Theory Research Federation and Science Salon in Shanghai successively, which let me feel just like a fish in water, so that my physical ideas were refined and sublimed in the exchanges and collisions with various opinions.

I first express my deep gratitude to Dr. Florentin Smarandacheh and a secretary of their association for their proposal and help to publish this book. Since 2005, I have been concerned, supported, and encouraged by Wu Shui-Qing, Fu Yu-Hua of Beijing headquarter and Hu Su-Hui, Tsao Chang and Yin Ye in Shanghai, who help me greatly for the academic progress, and I am very indebted to them, also I am grateful to Ji Hao, Zhu Yong-Qiang, MaoMing-Yi Jiang Zheng-Jie and others for their enthusiasm help. I have benefited from some profitable discussion with Cao Sheng-Lin, Yang Wen-Xiong, Sun Fu-Min, Zhuang Yi-Long. In addition, many people help me to do translation and review of this book, they are Hu Jie, Fang Fei-Fei and graduate students liang Chen, Sun Kai-Min, Peng Tao, Liu Nian in college of information, mechanical and electrical engineering, Shanghai normal university, and I am grateful to them.

Chapter 1 Introduction

There exists various of vacuum phenomena, such as the macroscopic interactions of gravitation and electromagnetism, microscopic spontaneous symmetry breaking and the quark confinement, and microwave background radiation and dark energy in modern cosmology and so on. Therefore, many physicists realized that the 21st century will be a vacuum century[1.2]. What this book want to display is a series of new ideas relative to the vacuum, space-time, matter and the intrinsic relations among them. This book covers a wide range of subjects from the lepton and quark to the entire universe, where lots of contents with three most basic key words: physical vacuum (ether), quantitative effects and related ideas of Smarandache.

1.1 Physical vacuum (ether)

Looking at the world in historic mirror can achieve a better comprehension. Let us polish the historic mirror to grasp today and look ahead further.

The original meaning of a vacuum is a void space. At first, the world is considered to be made up of the object and vacuum. Afterwards, people understand gradually that the real and the void is relative. The space between two men who standing on the ground seems nothing but it is full of dust if we look it carefully, and it is full of atmospheric molecules among the dusts if we detect with instruments. Modern physics shows that there are vacuum fluctuation, vacuum tunneling effect, vacuum phase change etc. in vacuum without any particle, it demonstrates that the physical vacuum is a particular state of matter which resembles the medium[3]. Vacuum in this book means the matter of vacuum state or physical vacuum.

The view that vacuum is not void does not start from the modern physics. It began in the ancient and the qi theory in the ancient Chinese is a representative[4.5]. In 17-19th century, western ether theory[5.6] is also a theory that vacuum is not void, and served as an important part of physics, it was in fashion for a period, but after the birth of theory of relativity, ether theory was on the decline. These will be further introduced in the second chapter.

Tsao Chang**,** the Chinese American who is a senior physicist said that the term 'vacuum' can easily be misunderstood as void space, therefore, the author prefers to use the term 'ether' in physics of 19th century instead of the term vacuum[1]. It is quite realistic and the physical vacuum will be called the 'ether' below.

The concept of ether is throughout in this book. The second chapter introduces qi theory in ancient China and the history of ether theory, and clarifies some problems to rectify some prejudices against ether. The fourth and fifth chapters explain the macroscopic effects of the ether, demonstrating the macro-ether is a special compressible superfluid, whose compressibility, or density variability, creates the gravitational field and relativistic effects. The sixth chapter points out that the electromagnetic exciting is the most basic exciting and proposes further the

electromagnetic quantum assumptions of the kinetic energy, which may be used to explain some knotty problems of electromagnetic phenomena. The chapter 7 describes the microscopic manifestations of the ether, the micro-ether exists as virtual boson, which differs from the real particle only in energy state, it can participate in the interconversion and interaction among the particles. In chapter 8, we propose the interactive theory of cosmoscopic field, which is a cosmoscopic interaction of ether, while the gravitational field is only the macroscopic field. In the cosmoscopic world of galaxies and galaxy clusters, the cosmoscopic interaction has exceed the gravitational interaction, and is its about ten times, which is the cause leading up to mass discrepancy of galaxies world, and yet there is not so-called "dark material". In chapter 9, we point out that the ether mentioned before is only one of countless interval field ether, namely the gravitational field ether, and known physical phenomena can all be seen as the various manifestations of the gravitational field ether. The particularity of the microscopic system is a result that the microscopic interval field ether functions to the gravitational field ether; the particularity of the cosmoscopic system is a result that the cosmoscopic interval field ether functions to the gravitational field ether. Moreover, the interval field ether, a basic existence form of matter, is higher by one order than object, and there would be more high order material basic form above interval field ether.

The ether is different from the space, it is a matter. To clarify, the matter of physics is defined: the matter, which exists in time and space, is a objective reality, it can move, change and convert its form but does not be created or extinguished. According to this definition, the space and time are the objective reality but not a matter; the object is a discrete matter with mass, and an object possesses limited space; while ether is a continuum without mass and occupies the entire space. The ether is closely related to object, the mass is a display of ether uneven distribution, and a object is the core of the ether density wave-packet. Generally a pure medium of object is regarded as consisting of particles with same mass, so that its density can be expressed into the mass of unit volume; a ether is nothing to do with mass, its density can be expressed into the particles number of unit volume.

The above matter definition is on the basis of the universal concept of space-time. Such a universal concept of space-time is classical absolute space-time theory rather than other physics space-time theory. Physical space-time theory is not unified, relativistic space-time theory is different from the absolute space-time theory and it does not have the universal space-time standard; the space-time theory of quantum theory is different from relativistic or absolute space-time theory, its concept of space-time becomes very blurred which is caused by uncertainty principle. All difference between the relativistic or quantum and absolute space-time theories can be attributed to the "quantitative effects".

1.2 Quantitative effect

Originally the physics was attached to the natural philosophy, it was the Newtonian brilliant achievements that made physics into an independent basic science. Newton stood on the shoulders of giants Copernicus, Galileo, Kepler, etc., he took space, time, mass as the basic “brick”, and took calculus and other mathematical methods as the "cement mortar" to establish a spectacular Newtonian mechanics system, which was based on the experiments and observations, was a scientific system with strict structure and rigorous logic, and laid down a solid foundation for the further development of classical physics.

The scientific contributions of Newtonian are beyond compare, Alexander Pope, a British essayist, critic, satirist and one of the greatest Enlightenment poet in the 18th century, he wrote: the nature and the laws of nature hidden in the darkness, God said: "Let Newton do it." and all is illuminated.

In Newtonian space-time theory , the space is flat, uniform and infinite; time passes uniformly with no beginning and ending; a matter moves and changes in space and time; Time and space are independent respectively and both have not relation to the material, and the standards of time and space are always invariable.These are consistent with people's intuition, and have feeling of clear at a glance.

In the late 19th century, the classical physics reached its the peak. When people praised its perfection, two "dark cloud" quietly raised. The first black cloud mainly referred to the contradiction between the experimental results of Michelson - Morley and the ether theory; the second mainly meaned the failure of classical physics theory on the problem of black body radiation. The two dark clouds in the early 20th century, quickly turned into a violent storm, the quantum theory and relativity formed, developed and turned into two physical foundations in 20th century.

Relativistic space-time theory is different from Newtonian space-time theory, its space and time are entangled and compose commonly the four dimensional space-time continuum, which is closely related to the matter, i. e., it is bent by the gravitational field of an object, so that it wriggles along with the movement of the object, which is even inexplicable for a unprofessional person in physics. As to quantum theory, its statistical interpretation of the wave function,the uncertainty relation and so on blurred space-time concept, so that it is difficult to make a space-time description for microscopic particles. Why is it so? Our reply is that the space-time of physics are not always equal to real space-time.

The absolute space-time theory, which is a scientific abstract, describes the world with an invariable space-time standard. However, physics is an experimental science, whose theory should be identical with actual measuring data, so physical space-time is a measurable relative space-time, which is not necessarily to be a real space-time because the tools of measure space-time such as

ruler, clock and particular light can vary with environment more or less. Therefore there are always certain differences between the actual quantitative relation and the Newtonian description. The effects caused by the differences, or the variability of actual space-time standards, are called **quantitative effects**.

Ordinary rulers and clocks can vary with temperature, which is not be considered that space-time is changing because it can be proved that this changes are only the change of rulers and clocks themselves by more accurate tools of measuring space-time. But scientist can regard a change of space-time standard as a change of space-time itself if the most accurate measuring tools can change, and the relativistic space-time theory is just such a physical space-time theory because now the newest standards of length and time are defined by light and the invariable velocity of light., for example, a meter is the distance traveled by light in a vacuum in 1/299,792,458 of a second[7], where the distance traveled by light in a vacuum in a second is always 299792458 meters whether it is fast or slow, the light speed become an invariable defined speed, which is just a premise of relativity, so that we can regard the relativity as a quantitative descriptive theory with light as the measure of space-time, it takes the change of space-time standards as the change of space-time itself, which is only a practicable mathematical model seemed by absolute space-time theory. In order to express conveniently and definitely, the description on the basis of absolute space-time theory is called **absolute description**; the description on the basis of experimental data is called **quantitative description.** Then the relativity or Einstein description is a quantitative description; the relativistic effects are the quantitative effect caused by the difference between Einstein and absolute descriptions.

The theory of relativity has not universal space-time standards, it subverted Newtonian description, which is difficult to be understood. Then someone wrote after what Alexander Pope had written: Einstein comes, physical world returns twilight. Such a twilight is caused by the shortcoming of understanding of quantitative effects.

The quantitative effects are quite weak and can be omitted under macroscopic and low-speed condition, where Newtonian description is identical with quantitative description, it is a absolute description, as well as a quantitative description. It describes physical phenomena with length, time and mass as basic physical quantity, the described images are rather intuitive and distinct. In the Einstein description, the light velocity is invariable and the standards of space and time can

vary with velocity and gravitational potential, then there are certain discrepancies between Newtonian and Einstein descriptions, so that we will feel that we look at ourselves in distorting mirror when we view the world of high-velocity and strong gravitational field. In the microscopic system, the space-time standards are changed rapidly because the density of material is very huge and the velocity is rather fast, and thus there are quite great discrepancies between quantum physics and Newtonian descriptions, so that the physical quantities such as length, time, and mass are replaced by operators, and we can only use the wave function, quantum state and statistical interpretation to describe physical phenomena, which even are considered by someone that it is not necessarily to have the concepts of space,time and mass.

Generally, physicists consider that the physical space-time are the real space-time ,but they are not conscious that the space-time of relativity and quantum theory are not the real space-time so that somebody even doubts objective reality of physical world. We can find certain physical laws, which do not vary with will of a man and is a display of objective reality of physical world. Therefore we should think contrary and change our ideas on the question of space-time theory that take the absolute space-time theory as the real space-time theory, while relativistic space-time theory is a space-time theory twisted by quantitative effects, also the space-time of quantum theory is twisted by quantitative effects.

People can propose many logical assumptions for one physical phenomenon. But the logic is only a rule of thinking. Any objective existence accords with logic, while a logical thing is not sure to be an objective existence. For instance, human organic function is not the best, logically there can be many reasonable assumptions, say, growing wings on the human body, so that human ability can be more stronger etc., but they are all not reality. Therefore physics cannot depart from experiment and mathematics, it should establish mathematical model on the basis of experimental data, and make strict deductive reasoning and express physical laws with mathematical formulas. Only can we make quantitative comparison and appraisement with science experiment and predict new phenomena.

But somebody enlarges the action of mathematics and consider "Whatever is true mathematically is true in reality", which means that the mathematical model reflects the truth of the material, Obviously, the existence of quantitative effects does not be taken into account. Furthermore, somebody put their hopes on the elaborate mathematical models to describe panorama of the physical world. For example, the point model in physics is expanded to the string

and ring etc. by superstring theory, which raises dimensionality of space-time to 11-dimensions or even 25-dimensions, where there are many adjustable parameters so as to broaden the options and attempt to find "ultimate theory" of physics. In fact, the real world has no complete straight line and symmetry, and it is unrealistic that relying on the mathematical symmetry to find "ultimate theory" of physics, which is like searching for a needle in a haystack, just as a kaleidoscope, which use mirror symmetry can change out various wonderful patterns, but it is not possible to change out the real pastoral scenery. This means that the most beautiful mathematical models are difficult to paint a realistic physical reality.

Although physics can not be separated from the mathematics, it is different from the mathematics in essence, whose mathematical model must be based on physical experiment and should explain its physical basis. A series of quantitative relations of relativity and quantum theory are derived, and their mathematical models are established, but their physical interpretations are always having some uncertainty. As we all know, so far, there has been continuing controversy in the interpretations of the basic concepts and principles of quantum mechanics such as statistical interpretation of the wave function. As for the theory of relativity, it also was interrogated continuously, even by Albert Einstein himself. At the time of his 70 birthday, Einstein wrote letters to his old friend Solovine: "You imagine that I regard my life's work with calm satisfaction. But a close look yields a completely different picture. I am not convinced of the certainty of a simple concept, and I am uncertain as to whether I was even on the right track." [8]This passage shows Einstein's straightforward scientific spirit and indicates that there are certain puzzles in relativity. The puzzles of quantum and relativity theory originate from that they are only mathematical models in quantitative description and lack of understanding of their physical basis. We will interpret physical basis of relativity with the compressibility of ether in this book, which is a necessary supplement to relativity.

1.3 Quantitative effects is created by the ether

Scientific development is often from simple to complex, then it is simplified on the new height, and is from simple to complex again and so on, which is a continuous cyclic forward process. Of course, the cyclic form may be different for different subject or stages, some are like the bend of highway on the plain; some are just like the spirality of highway in mountain area. We consider that it is the time when the theory of physics is simplified.

It is the quantitative effects that create the complexity in quantitative description. In order to simplify it, we should start with the quantitative effect and find out the basic cause leading up to the quantitative effects. As indicated above, the quantitative effects are caused by the variability of actual space-time standards. Then what are the variability of actual space-time standards created? It is physical vacuum, namely ether. There are close relations between ether and space-time theory,

which is a highlight in our vacuum theory, and it is showed fully by the derivation of the Lorentz transformation by means of fluid mechanics in section 4.1.

There is a transformation of the fluid from a compressible to an incompressible state, it can simplify calculation, so that it is often applied in practice such as design of aircraft. Substituting this transformation into Galilean transformation to express absolute space-time theory can describe easily the Lorentz transformation of relativistic space-time theory and it shows that absolute and relativistic space-time theories are linked by a particular fluid, which should be a superfluid and whose distribution is infinite in space where the speed of its sound is the speed of light in vacuum, and it cannot be a conventional fluid. It is, in fact, the macroscopic ether, which shows the existence of ether from a flank.

The derived process of the Lorentz transformation shows that macroscopic ether is a kind of compressible superfluid, or its density is variable, so that the light is as a wave in ether, whose velocity should be variable in absolute space-time theory; while the ether is an incompressible, namely the distribution of its density is homogeneous and isotropic everywhere, and the light velocity is invariable in relativistic space-time theory certainly. Then the relativistic length contraction and time dilation occur in where the ether density of absolute description is greater, which is the origin of relativistic effects. According to further analysis (sections 4.2, 4.3), the gravitational field is a ether density field, any object has a ether density wave-packet whose core is itself; the effects of the special theory of relativity are due to the compressibility of the ether and the effects of the general theory of relativity are due to the absolute value of the gravitational potential which corresponds to the ether density. Visibly, the relativity is not a existence beyond matter, and its material basis is just the ether, it is ether that creates the relativistic quantitative effects.

The gravitational field and relativistic quantitative effects result from the ether, which also decides the character of space-time. The special theory of relativity's space-time corresponding to uniform distribution of ether, where there is same space-time standard everywhere in one inertial reference frame, while there are different space-time standards among different inertial reference frames; the general theory of relativity’s space-time corresponds to non-uniform distribution of ether, so the space-time standards are different where the gravitational potential is different. In addition, Newtonian space-time theory has not relation to whether the ether exists, which also can be regarded as a space-time theory of quantitative description under the condition that is without ether or its effect can be omitted.

Micro-physics is obviously different from macro-physics, its concepts, principles and formula etc. were established gradually on the basis of a large number of experimental data, and thus, it is completely a quantitative description and such phenomena as quantum and duality are all the microscopic quantitative effects. Whether are they caused by ether as well? There seem in

line with the logic and can be proved by a fact: the spin as an extra degrees of freedom is put into the non-relativistic Schrödinger equation; and it includes the spin quantum number automatically in the relativistic Dirac equation, which means that the quantum is a representation of the quantitative effects of relativity in the microscopic system.

As mentioned above, the relativistic space-time standards are decided by ether density, whose variability causes the quantitative effects.Obviously,such a description is implemented on the basis of absolute space-time theory obviously because ether is described into a incompressible four-dimensional space-time continuum without the change of density and the image of the entity in relativistic space-time theory. Therefore only on the basis of absolute space-time theory, can we describe the physical basis of relativity with the help of ether, which is a necessary supplementary for the relativity theory. Here we can be conscious further that the absolute space-time is the real space-time, and absolute description reflects the truth of things; while relativistic space-time, namely the four-dimensional space-time continuum, is not a real space-time, and it, in fact, is a "material", a special state of ether what refracted by relativity theory, thus, it is only a mathematical model, although it can describe more correctly the quantitative relationship of things, but it is not sure can reflect the truth of things. For example, the so-called bend of space-time by the general theory of relativity, in fact, is a mathematical description of non-homogeneous distribution of ether, and the real space -time can not bend. The absolute and relativistic space-time theory are two different space-time theory in essence, the relationship between them is not one negates another, but that both have certain complementarity, which will have concrete description in the chapter 5.

Modern physics negated the absolute space-time theory and regarded mathematical models as objective truth to make physical world become queer. If we return on the position of Newtonian space-time theory and describe quantitative effects with the action of ether, or return to the classics with quantitative effects, so the physics can be simplified on new highness, and the physical world will be the bright sunshines.

Nature and Nature' law lay hid in night,
God said, "Let Newton be," and all was light..
Einstein comes with the theory of relativity;
Also the quantum theory playing dice,
then physical world returns twilight.
If we know that the ether exists everywhere,
It is ether that causes queer quantitative effects
Physical sky will be the sunshines bright.

Above ,we laid stress on introducing the relations among ether ,absolute and relativistic space-time theory simply to indicate that the physical space-time are not sure real space-time. Ether's compressibility in absolute space-time theory causes the variability of actual space-time standards, which leads up to relativistic quantitative effects and it is the effects that twist physical

images in the world of high velocity and strong gravitational field. These are the basic content of chapter 1-5 in this book, where we make a lot of comparison and analysis, the contents are more mature.

The manifestations of ether and quantitative effects are different in different space-time system. In chapter 6-9, we research separately on the material existent forms and rules of microscopic system, cosmoscopic system and entire cosmos, and try to propose some assumptions, which are mainly the preliminary ideas and await to be distinguished and deepened further.

1.4 Some Smarandache ideas

Physical development is not alone, it is the result promoted commonly by experiment, philosophy, mathematics, logic, and so on.

Prof. F. Smarandache, a man of many gifts, he is a scientist, and a writer as well. In science, he proposed many novel and useful ideas, such as Smarandache function, Smarandache sequence, Smarandache geometry, and Neutrosophy etc[9]. some of them are applied in this book.

The neutrosophy was proposed by Prof. F. Smarandache in1995, it is a new branch of philosophy that studies the origin, nature and scope of neutralities, as well as their interactions with different ideational spectra; it is the basis of neutrosophic logic, neutrosophic set, neutrosophic probability and neutrosophic physics etc.[10].

Neutrosophic logic, which is to characterize each logical statement in a 3D Neutrosophic Space, where each dimension of the space represents respectively the truth (T), the falsehood (F), and the indeterminacy (I) of the statement under consideration, where T, I, F are independent quantities, which provides the room of selection for incomplete, contradictory and complete informations.

The wisdom of neutrosophic logic can be found in the development process of relativity. In the Einstein's age, the invariability of light velocity described by Maxwell's equations was in contradiction with the law of composition of velocities conformed to principle of relativity. It is generally considered that both of them are opposed and can not be all correct. But Einstein made another selection: the principle of relativity and invariability of light velocity are all correct but the Newtonian space-time theory is in error so that it led up to the birth of space-time theory of quantitative description.

Actually there are Einstein's wisdom of neutrosophic logic in our above ideas: it is generally acknowledged that Einstein space-time theory is opposite to Newtonian space-time theory; while we believe that these two space-time theories are not that one negates another, but have certain complementarity, and the differences between them are caused by ether.

Geometry is a mathematical way to express space-time. Euclidean geometry based on some axioms, its parallel axiom is that there is only one straight line parallel to the known line through a point without known line. In non-Euclidean hyperbolic geometry, the parallel axiom is negated

into that there are at lest two straight line parallel to the known line through a point without known line. In non-Euclidean elliptic geometry, the parallel axiom is negated into that there are not straight line parallel to the known line through a point without known line. An axiom behaves in at least two different ways within the same space, i.e., validated and invalided, or only invalided, this axiom is called Smarandachely denied axiom. A Smarandache geometry is a geometry to have at least one Smarandachely denied axiom.

The space-time of special theory of relativity is different from Newton's space-time, it not only regards time as a special dimension of space, but the space and time are interwoven together to form a four dimensional space continuum, which is flat, can be consider as Euclidean continuum; while the four dimensional space continuum of the general theory of relativity is bended and it is a non-Euclidean continuum, that is to say, the parallel axiom of geometry is established in space-time of special theory of relativity while it is denied in space-time of general theory of relativity. Therefore the parallel axiom is a Smarandachely denied axiom in the space of special and general relativity, and the space-time geometry of relativity is a Smarandache geometry.

Moreover, the space and time is independent respectively in Newtonian space-time theory, which is a common sense for the enormous majority so that can be regard as an axiom, and it is established in Newtonian space-time and is not established in relativistic space-time, thus, the space-time geometry of macro-physics is a Smarandache geometry which includes two Smarandachely denied axioms.

There are three subspaces in the Smarandache geometry of macro-physics: Newtonian, special and general relativistic spaces. As indicated above, it is existed form of ether that decides the characters of physical spaces: the space where it is without ether or its effect can be omitted is the Newtonian three dimensional Euclidean geometry; the space where the ether density is homogeneous is the special relativistic four dimensional Euclidean geometry; the space where the ether density is non-homogeneous is the general relativistic four dimensional non-Euclidean geometry.

The characters of physical space are decided by ether, ether is a matter of basic existence form which is higher by one order than object, and thus we can further express Smarandache geometry by different forms of high order matter. Then we will point out that the cosmological space is a Smarandache geometry of hierarchical and infinite order. We describe the Smarandache geometry models of relativity, macro-physics, the theory of interval field ether and the universe in this book.

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Chapter 2　Vacuum is not void

Relative to the object, the vacuum occupies more space and owns more rich mysteries.

At the earliest, people believed that there was only vacuum except matter in nature. Afterwards, people's understanding of the matter was deepened gradually from the visible and touchable celestial body, material to the molecules, atoms and elementary particles that need be detected by the instruments, or from the object with shape and size to the ether and field without shape and size, so the matter conception changed dramatically since then. Finally, people realized that there was no void vacuum and it was a kind of matter existent form different from the object. The ancients have grasped the knowledge about the materiality of vacuum, in which the qi theory of Chinese antiquity is a representative.

2.1　The qi theory in ancient China[1.2]

Discussing on the origin of matter is an important aspect of the ancient naive materialism. At first, people often regarded one or several specific things as the origin of matter, which was recorded in several ancient civilized countries. China had the theory of the five elements more than 3000 years ago that can be seen in "*Guoyu·Zhengyu*", BoShi who is a historiographer said: “The pre-king considered that all things are available to be shaped by soil, metal, wood, water and fire.” So far, this five elements theory is still the foundation of traditional Chinese medicine. Later, the description of water could be seen in “*Guanzi·Shuidipian*” : “Water is the origin of things and the source of all creatures.” while the description of soil could be found in “Zhuangzi·*Zaiyou*”: “Everything grows from the soil and returns to the soil.” In this respect, there were many records in ancient Greece as well, for example, Thales, the famous Greek philosopher, thought that water was the origin of things about 2,600 years ago, Later, Anaximenes regarded air as the origin of things, instead，Heraclitus thought about fire. In addition, Empedocles reckoned that things are consisted of soil, water, air and fire while Aristotle considered that these four elements form the objects on the ground, the celestial body is made of the fifth element— 'ether'.

It is difficult to be established that one or several specific things are able to be regarded as the origin of things. Then people search the deeper gradation of matter for a solution, for instance, the Pythagorean school of ancient Greece beyond the scope of the matter, and advocated that 'Number

is all things', which promoted the development of mathematics and combination of physics and mathematics, but they reversed the relationship between ' material ' and 'number' because the material is the essence and the number is only a presentation. From gathering sand into a pagoda and forming a forest by numerous trees, ancient Greek Democritus realized that the visible matter should be made up of smaller and invisible matter,so he proposed a kind of atomic theory, which was the forerunner of the modern atomic theory, and was considered to be the greatest scientific conjecture in ancient Greece. In China, people realized gradually that the vacuum should be filled with qi and it is different from object through the vaporization of water and people' feeling of qi etc. It is interconvertible between the qi and object. This qi theory that beyond the object is an ancient masterpiece of "vacuum is not void."

The idea of qi theory could be traced back to 800 BC, it is said in "*Guoyu·Zhouyu*" that: Bo Yangfu explained the reason of earthquake by the disorder of qi between the heaven and earth.

About 1800 years ago, Wang Chong proposed a systematic theory on the basis of the predecessors' thought,The Natural Theory of Qi, which was considered that the qi is the origin of thing, and the world is a nature with qi. Later, the further developing and improving of qi theory by many people make it form a relatively complete system.

The qi was considered as a continuous fluid in vacuum state. Zhang Zai, a master of qi theory, said that "The void is qi", "The void cannot be without qi, which can get together into things, and thing can disperse into the void." In his theory, the material world could be known from united origin of matter by the qi theory , and explained the transformation between the continuous qi and discontinuous object through the internal relations of things. It contained the ideas that the material changes circularly, exists endlessly, and cannot be created or eliminated.

The qi theory includes three basic points: First, the point of view that qi is the origin and the element of the matter; second, the standpoint of vaporization or motion and variation of qi; third, the views of induction, namely the interaction of qi.The qi is one of key words in traditional Chinese medicine theory, it runs in channels of human body, one is in good health if his channels is unobstructed, otherwise, he will be ill. The qi was used to explain the phenomena caused by the field, such as magnetic force, tide and the motion of celestial bodies. For example, the Xuan Ye theory, an ancient Chinese cosmology, thought that:"The sun, moon and stars are levitated in the sky natively, whose movement and existence need qi." Besides, people did not know the existence

of air at that time, so that the phenomena created by air such as the resonance of musical instruments was regarded as a kind of vacuum phenomena and also can be explained by the qi theory.

Cheng Yishan said: "Western various naive materialism presented a situation that each generation surpasses the preceding one and attribute it to the atomic theory finally; while Chinese various naive materialism presented a situation of mutual fusion, and all of them were owed to the qi theory at last." In this aspect, Zhang Dainian pointed out that the basic category of Western materialism is matter or atom while Chinese is qi instead. It is obvious that qi theory is a treasure in historical heritage of Chinese science and culture.

2.2 The rise and decline of ether theory[1-6.12]

In the West, the ether theory is the masterpiece about which vacuum is not void.

The term ether appeared in ancient Greece at the earliest, Aristotle believed that the celestial body is made up of the fifth element ether.

In the 17th century, Descartes maintained that there is no true vacuum or void, and firstly introduced ether into science. He believed that continuous ether completely fills the space not occupied by solid bodies and mediates their interactions by means of a system of vortexes. The whole universe is a system of interlocking vortexes, for instance, the planets are carried around by a sea of ether moving in whirlpool fashion, producing the so-called gravitational effects.

Afterwards, Huygens, a follower of Descartes, shared the view that gravity was nothing more than the action of the ether, which circulates around the center of the earth, striving to travel away from the center； he believed that the light is a wave while the classical physics considered that wave has to propagate through a medium, and thus, he thought that the light is a wave propagated longitudinally in a stationary ether, which transmit impulses without being displaced themselves.

Newton approved the idea of ether instead of the wave theory of light, he held the view that light rays consisted of a stream of particles in rectilinear motion and that the light particles stimulated, or were accompanied by vibrations in an all pervading ether. Newton supposed the density of ether is variable and it is denser in empty space than in the vicinity of massive bodies thereby,so it provides a mechanism for gravitational attraction: the earth moving towards the sun under the pressure of the ether likes a cork rising from the deep sea.

Because the wave theory of light was excluded, the ether theory once declined in the 18th century. In the early 19th century, Thomas Young's famous double slit interference experiment allowed him to precisely measure the wavelength of light, so that the ether theory were rehabilitated again. Later, the polarization of light was discovered soon, which established the fact that light is transverse wave. Then A. Fresnel introduced the transverse wave theory of light on the basis of ether theory, which could account for all the known phenomena of optics. Afterwards, Maxwell inferred the conclusion that 'light consists in the transverse undulations of the same medium which is the cause of electric and magnetic phenomena', and thus both of light and electromagnetism were reduced to the mechanics of a single ether. In addition, knowing about Helmholtz's work of 1858 on vortex motion, which showed that a certain vortex motion would have certain permanence, Thomson argued that, on the assumption that the ether was a perfect fluid throughout space, these permanent vertex rings of the fluid could be identified as ordinary atoms. This was the first model connecting the discrete atom with a continuous plenum, explaining matter by the ether, and avoiding particles acting at a distance or by contact. Thus the ether theory's important position was established in physics.

Martin, W.A.P, a missionary who had come to China, making a specific comparison of Descartes' ether vortex theory with the qi theory, and pointed out that there existed strikingly similar between them, so he concluded that Descartes was influenced by the Chinese qi theory when he conceived his theory of the ether vortex. Both qi and ether represent physical vacuum. China regarded vacuum as a special existent form of the matter more early than the Western, while such modern sciences as the electromagnetic theory and the wave theory of light were born in the West. The modern sciences gave vigor to the ether theory, so that we can regard the ether theory in 19th century as a product of the combination of the ancient Chinese qi theory and modern science in Western.

Ether theory in 19th century described that the ether is absolute still, and the motion of any body is relative to the ether. Then, the earth runs at a speed of 30km per second around the sun, which should have an 'ether wind' at a speed of 30km per second on the earth correspondingly. Does it exist really?

In 1881, Michelson first conducted experiments to measure the ether wind, but he found nothing. In 1887, he cooperated with Morley to do the high-precision experiments, but failed

again, which was called the one of the two dark clouds in the sunshiny sky of classical physics by Kelvin.

On the basis of ether theory, the Michelson-Morley experiment was explained first by G. F. FitzGerald: the forces binding the molecules of a solid might be modified by the motional velocity of the solid through the ether, the dimension of the stone base of the interferometer would be shortened in the direction of motion in this way and that this contraction neutralizes the optical effect sought in the Michelson-Morley ether experiment. Lorentz and others developed FitzGerald's assumption and derived a famous Lorentz transformation.

Generally, attributing the ether theory declined to the rise of the relativity.

Einstein was puzzled by a fact: In the laws of electromagnetism, the speed of light is constant, but we cannot draw such a conclusion in the classical mechanics. He cudgeled his brains for it and found a breakthrough in the space-time theory finally.

In 1905, Einstein published five scientific papers, and one is "*On the electrodynamics of moving media*", which created special relativity. Like the Euclidean Geometry System, on the basis of two principles, his theory can derive many results including Lorentz transformation through mathematical deduction without the help of other assumptions, which seems to be very

excellent from the angle of mathematical logic. Therefore, the mainstream physicists held that the physics do not need the assumption of ether, however, reality is not so .

2.3 The ether is not negated by modern physics

Modern physics is built on the basis of the relativity and the quantum theory. They describe that vacuum is not void with different forms, therefore, the ether is not denied.

It is generally believed that the ether theory has been refuted by the relativity. In fact, Einstein's idea about ether was quite self-contradictory. In Einstein's mind, the ether existed, but he could not really understand it. In 1920, he made a speech about ether and relativity and pointed out: "According to the general relativity, space is endowed with physical qualities, in this sense, ether exists. In accordance with the general theory of relativity, space without an ether is inconceivable. For there would not only be no propagation of light in such a space, but no possibility of existence of scales and clocks, and therefore no spatial-temporal distances in the physical sense. But the ether can’t be thought as endowed with the properties characteristic of

ponderable media, as composed of parts, the motion of which can be followed: nor maybe the concept of motion be applied to it."He not only pointed out the existence of the ether. but also proposed his own opinion of the ether. 1. Ether is the medium for light propagation; 2. The standards of space and time depend on the existence of ether (which is very important, but he did not quite understand it); 3. Ether is different from the conventional material (ponderable media); 4. Ether can not be described by the space-time theory of relativity. these statements are quite right, but he described the ether (physical vacuum) as a four dimensional space-time continuum, while it is impossible that the space-time theory of relativity is used to describe the four dimensional space-time continuum, just like one can not raise oneself by pulling his own hair.， Einstein had to be very evasive about ether because of the impossibility.

There was a paragraph in "*The Evolution of Physics"* wrote by A. Einstein and L. Infeld in 1938: "our attempt to discover the properties of the ether led to difficulties and contradictions. After such bad experiences, this is the moment to forget the ether completely and to try never to mention its name. We shall say: our space has the physical property of transmitting waves, and so omit the use of a word we have decided to avoid. The omission of a word from our vocabulary is, of course, no remedy. Our troubles are indeed much too profound to be solved in this way!" in which his perplexity was revealed. In order to cope with this perplexity, he held out the concept of field. He said in '*The Questions of relativity and Space'* that: "Thus, Descartes was not so far from the truth when he believed he must exclude the existence of an empty space. The notion indeed appears absurd, as long as physical reality is seen exclusively in ponderable bodies, it requires the idea of the field as the representative of reality, in combination with the general principle of relativity, to show the true kernel of Descartes' idea; there exists no space 'empty of field'". Einstein described field into curved space-time, which is something like the Pythagorean school so that regard the geometry structure of space-time as the physical reality.

There exist fields of electricity, magnetism,gravitation and so forth in the vacuum, which are the reflection that vacuum is not void. However, people insist on that "Mass represents the amount of the matter", so that they do not rashly treat the field as a kind of special matter. It's the quantum field theory that makes people to realize the fact that the field is another matter manifestation different from object.The quantum field theory shows, the physical world is made up of a variety of quantum field systems. The excitation of the quantum fields denote the generation of the

particles,and the de-excitation denote its disappearance. The minimum energy state of these quantum fields, namely the ground state, is the vacuum. In the quantum vacuum, there exists the movement of the quantum with zero energy or 'zero oscillation'. For example, a quantum field is limited in a small volume, the energy of zero oscillation may vary with the volume, resulting the 'Casimir effect'[7.8] which can be observed. Besides, there exist the vacuum polarization in the quantum vacuum, which may also produce the observed effects, such as Lamb shift of the hydrogen atom and anomalous magnetic moment of the electron. In addition, also there are the vacuum tunneling effect, vacuum phase change, vacuum condensation and domain structure of vacuum etc, [9] which fully explained that vacuum is similar to the media, acting as a physical reality. It is obviously that the ether is a matter instead of the void, however , quantum field theory puts the materiality of ether on the field.

In fact, field is only a continuous distribution state of physical quantity, for example, the air density field is a state of continuous distribution of the air density in space, and its material basis is air; the temperature field is a state of continuous distribution of the temperature in medium, and its material basis is the medium which can absorb energy. What is the material basis of the vacuum field such as gravitational field and electric field? It is physical vacuum, namely the ether, which is another basic material manifestation different from object. Modern physics discarded the ether as a matter noumenon, and took the field, a ether's state as a representative of the matter. Similarly, it also regard the mathematical description which is a formal description as a substantial description, that is to say, the modern physical over-relies on the formal description of mathematics, and resulted in a dislocation of understanding in essence to some extent.

Ether is the noumenon and field is only a state of ether, which has been demonstrated by the A-B effect[10.11]. In classical electrodynamics, the electric field intensity (E) and the magnetic field intensity (B) are the physical reality, while the scalar potential (φ) and the vector potential (A) are only auxiliary quantities which have no real physical meanings. In the theory of quantum field, although it isφand A that appear in the movement equation of particle, there is only a phase factor changing in the wave function of the particle through gauge transformation, which does not affect the essence of the physical processes, thus, it is generally believed that the potentialsφand A have no real physical meanings in the Quantum mechanics. In 1959, Y. Aharonov and D. Bohm made research on the situation that the field intensity B(E) is zero and the potentialφ(A) is not zero, they

found that the charged particles may cause the phenomenon of quantum interference , which is called the A-B effect and had been verified experimentally by Chambers and others, and it shows that the field (B, E) underdescribes the electromagnetic continuum, while the potential (φ, A) is not enough to describe it. We will point out that the gravitational potential corresponds to the ether density and the potentials φ, A correspond the electromagnetic excitation's ether density in the following passage (4.2, 7.4). Thus, the A-B effect shows that ether is the noumenon, and field is only a state of ether.

Tian Yu Cao's work *Conceptual Developments of 20th Century Field Theories*[12] won high praise. for instance, the review of Sheldon Lee Glashow is: "His lucid account of the development and interpretation of both classical and quantum field theories, culminating in the creation of a gauge field theory of all the forces of nature." However, he considered that the field possesses the ontological status, whose obtainment stemmed from Lorenz's work. He said: "His ether was divested of all mechanical properties, and thus was separated from matter completely. The electromagnetic fields in this scheme were taken to be the states of the ether. Since the ether had no mechanical properties and its properties were just the same as in a void space, which underlay both the electromagnetic field and matter, the electromagnetic field enjoyed the same ontological status as matter. that is, it represented a physical reality independent of matter rather than a state of matter, and possessed, just as matter did, energy, and thus qualified as a non-mechanical substance." This analysis is worth discussing. Generally, only the objects with shape, size and mass may be mechanical. As a vacuum state, the ether should not have obvious mechanical properties. If it were not mechanical properties, there would be no ontological status, then this point is more applicable to the field. The substantiality of the ether, in fact, was required by Lorentz contraction hypothesis. Lorentz assumed that, in addition to the electric and magnetic forces, the molecular forces responsible for the dimension of a body would also be affected when the body moved through the ether, thus, the resultant contraction of the body's dimension would eliminate the effects of ether wind.

Lorentz contraction required that ether is an entity. The cause that Lorentz's ether was misinterpreted as ‘void’, as we said in Chapter One , it is the result of the dislocation between Newton description and quantitative description, which is caused by quantitative effect. Lorentz’s assumption, the length contraction of moving objects under the ether function, was like to think

about the quantitative effect, which is over the Newton description and verged on the quantitative description, so that the ether of Lorentz is misunderstood as ‘void’, just as ether become four-dimensional space-time continuum in the quantitative description of relativity.

Moreover, Prof. Cao considered that it occurred a field programme established on the basis of the field ontology from the beginning of Lorentz's electrodynamics, and this programme gradually developed into the geometrical programme, the quantum field programme and the gauge field programme. He described a prospect of field's evolution by unique perspective and his ideas are novel and orderly. He regarded the field as a noumenon, which was referred to the understanding of noumenon. As he said: "Concerning the ontological status of theoretical terms, the position that I am going to defend in the last chapter is structural realism. Briefly stated, the position holds that the structural relations (often expressed directly by mathematical structures, but also by models and analogy indirectly) in a successful theory should be taken as real, and the reality of unobservable entities are gradually constituted and, in an ideal situation, finally determined in a unique way by these structural relations." Prof. Cao pointed out that the reality of unobservable entities are gradually constituted into determinate mathematical models which is right undoubtedly and demonstrates that the correct mathematical models of physics is from the reality and reflect the reality. However, just like the distorting mirror, such a reflection is often contorted by the quantitative effect. The field programme of geometry, quantum and gauge are a series of development programme of field mathematics models, which reflect the objective reality by the laws of physics in a certain degree, but there are always some dislocations between the mathematical models and objective reality.

Certainly, in the 19th century, the historical limitations also led up to the decline of the ether theory[13],.The classical physics have obvious mechanistic properties,thus, as one part of classical physics, the ether theory is inevitably dyed into the color of mechanistic properties. On one hand, ether theory only holds on the absolute space-time theory, but it cannot be aware that the standards of the actual length and time can vary with the ether density. On the other hand, ether theory just treats ether as a object and the ether is a state there exists no object particles in fact, it is irrelevant to mass and is essentially different from the fluid of object. In the 19th century, ether was regarded as general fluid, and light was a mechanical elastic wave in it, so that an embarrassing situation occurred: Because the light spread tremendously, it would produce powerful resilience when ether

leaves the equilibrium position, which requires that ether is a very hard thing; while an object can move in the ether without resistance, which means that ether is an extremely thin fluid. In fact, any object can move without resistance in the ether whether it is smooth, rough or full of cracks, it means that ether should be a superfluid. There are two different sounds in a general super-fluid: the first sound of density wave, which is the conventional sound; and the second sound of temperature wave[14], which propagates with heat. In the vacuum, the thermal propagation is carried out through thermal radiation, namely, similar to the electromagnetic wave, so that the electromagnetic wave, including the light, is the second sound in ether and electromagnetic excitation of the etheric is equivalent to the "thermal excitation".

In addition, some people regard the ether as the so-called dark matter, which is a thing with mass. They consider ether as particles with mass, which does not accord with the significance that ether is a matter in vacuum state, so that it would brings a lot of contradictions. If there is not the dark matter assumed in the galaxy world, then the orbits of celestial bodies would greatly deviate from Newton's laws. If the dark matter is ether, it exists not only in the galaxy world, but also in the solar system, in which there should be a large number of dark matters, which should make the planets' orbits to deviate from Newton's laws, while the orbits of the planets, in fact, are fully in compliance with Newton's laws. Where does the the ether mass play a great role in the solar system ?

In fact, the mass only represents the amount of objects, and the ether is without mass itself. Of course, there is a close relationship between the mass and ether, which has already been mentioned in the first chapter that the object is the core of ether density wave-packet, which means that the mass is a manifestation of uneven distribution of ether. At first, people did not think that the vacuum state field is a kind of material because they were confined by the concept that "the mass is a quantity represented the matter amount". People admitted the materiality of field until the field quantum was found because the quantum means energy which must be accompanied by mass. However, there exists a question that the gravitational field has not been quantized up to now. Is it not a matter? Actually, the quantum character of the field is a reflection of ether density wave, a representation of interaction and interconversion between ether and object, which would have further explanations in chapter 7.

In addition, some physicists believe that vacuum cannot be ether because it is a Lorentz

symmetry. The Lorentz symmetry is the symmetry of relativistic space-time, whose essence can be explained by the ether actually. As we have already pointed out in the first chapter ,the distribution of ether is homogeneous and isotropic everywhere in relativistic time-space theory, which is just the physical picture of the Lorentz symmetry. Here, ether is a root, and Lorentz symmetry is a tip, it is putting the cart before the horse if we deny the ether by the Lorentz symmetry.

The concept of ether is changing with the development of history: the ether of Descartes was different from Aristotles', and there were certain differences between Descartes ether and the ether In 19th century, while our ether theory will abandon the mechanical character and absorb the cream of modern physics, especially, the relativity and quantum field theory. It is a modern deduction and the negation of negation of the ether theory in 19th century.

Now more and more people realized that it is necessity to rehabilitate ether, for instance, dozens of people admitted that the ether or similar matter to the ether exists in Beijing Relativity Theory Research Federation, a lot of people published works, for example, Xiong Cheng-Kun and Liu Liang-Jun's the theory of Taijizi; Jiang Zheng-Jie's the theory of φ quantum and others.[15-22].

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Chapter 3 The Changes of Space-Time Theory

The concepts of space and time have the narrow and broad difference in meaning. The narrow concepts of space- time is their original meaning that the space is the stage of existence, development and change of the matter and time is the representation of the sequence and persistence of events. The broad concept of space not only contains the time, but also widely used to express the manifestation of some things, and some independent parameters in it were treated as the dimension of "space", for example: there are Hill Alberta space and vector space in mathematics, momentum space and isospin space in physics, social space and imaginative space in other areas and so on. Chen Wei proposed " 11/30 Two-Dimensional Time Coordinate System" on the basis of his "11/30 Global Earthquakes Time Periodic Law"[1], which is meaningful yet In this book, the time and space only refers to their original meaning.

By seeing the sun, moon and the stars move from east to the west circularly; the things occur and change ceaselessly, the ancients gradually formed the concept of time and space, and tried to measure them. At first, the human body was the most convenient and simplest measurement tool, for instance, they could use pulse to measure time, and use palm or pace to calculate the length. The cycle of astronomical phenomena were the best unit of time for a longer period of time, such as year, month and day. Later, they gradually invented a variety of space-time measurement tools such as the hourglass, scale and watch.

Time and space can be measured, so people try to describe them further, which is related to the cosmology. The word "cosmos" is expresses by "Yu-Zhou" in China. The "Yu" represents the space, and the "Zhou" represents the time.

3.1 Cosmos and space-time

Mankind use their sense organs and instruments to perceive the world. In ancient times, the cosmos is all things that people can see.

There are three main cosmologies in ancient China[2]：theories of Gaitian, Huntian and Xuanye.

The Gaitian theory appeared about 3,000 years ago. At first, it was described that "The

heaven is something round like a cover, and the earth is something square like a chessboard ". of course, this was just a visual metaphor because the round is difficult to coincide with the square. Then, it was gradually evolved into that both the heaven and earth were vault; the center of the heaven was the Polaris, where the distance between heaven and earth was 80,000 miles; the earth was still; the sun, moon and stars were on the celestial sphere and moved around the center with the celestial sphere and the solar orbit may vary with the seasons. The Gaitian theory thought that the earth was flat so that it just described half of the celestial sphere.

Between 300 B.C. and A.D. 400**,** people gradually realized that both heaven and earth were spherical, and the earth can move as well, and thus, it resulted in the theory of Huntian. Zhang-Heng, who was called oriental Aristotle, was a representative of the Huntian theory. He said: "The university is just like an egg, the heaven is round like the eggshell, and the earth is like the yolk, which lies within the heaven alone,the heaven exists in the qi, and the earth floats in the water." He had designed and made elaborately an armillary sphere, which turned a circle on one day and the rise and fall of stars on the instrument were almost coincides with the actual astronomical phenomena under the push of the water.

Above two cosmologies thought that the blue sky has a shell, which means that visible cosmos was limited. Another cosmology, the Xuanye theory, whose period was almost as the Huntian theory, denied explicitly the existence of the celestial shell,it considered that the celestial shell seen by people is not true because it is very far away from us, just like that the distant mountain is green, and the deep valley is black, neither the green and black are their original colors. The sun, moon and stars are naturally exist in the space, and their movements depend on the qi. Here, the gravity was seen as the role of 'Qi', and 'Qi' was a kind of vacuum state material.,this description is near to the modern awareness , but it does not describe the motion laws of the stars, so that its value of application is less, and does not spread widely.

In the West, Ptolemy, 7 years junior to Zhang heng, who put forward the Ptolemaic geocentric system on the basis of summing up the achievements of ancient Greek astronomy, it could make accurate calculations to the movement of celestial bodies that can be observed at that time, especially the planetary motions so that it was considered to be the truth in 1,500 years. Ptolemy thought that the complicated planetary motions could be compounded by the simple circular motions in which the each planet ran according to two or more circular orbit systems, one

was called deferent, and another was called epicycle.

In Nicolaus Copernican era, with the improvement of the accuracy of astronomical observations, the circle number of the deferent and epicycle were even up to about 80. Copernicus who born in the 15th century believed in the natural simplicity,harmony and realized that the Ptolemaic geocentric system was certainly problematic, and it cannot solve the problems by mending in the original system, so the significant breakthrough should be made. He found that each planet had three common periodic motions, namely the periodic motions of one day, one year and the precession of the equinoxes through years of careful researches. If these were classified as the earth's rotation, revolution and the earth's axis swing, we could simplify the planet's movement a lot. Therefore, it would be more reasonable that the center of cosmos was the sun, and thus, the heliocentric theory was proposed, and broke through the old ideas that the earth was the center of the universe and was fixed without motion.

The breakthrough of geocentric theory by Copernicus led up to some new breakthroughs in other areas. Shortly after his death, there were three bright stars rising in the scientific community. They were Galileo. Galilei, Johannes. Kepler, and Rene. Descartes.

Galilei, a master opened modern science, who created a method of physical research which combined experiments with mathematics. He proposed the principle of relativity that showed the homogeneity of space and time and found the isochronism principle of a simple pendulums, which provided a theoretical basis for the invention of the clock. Furthermore, he developed the astronomical telescope and saw the true faces of the planets, which created the conditions for expanding the cosmos space to infinity.

Kepler, who was known as a sky lawmaker found the orbit of the planet was an ellipse, which ended up the deferent and epicycle systems that planetary orbit was synthesized by the circular motions, and summed up the three laws of planetary motions, which laid the foundations for Newton's law of universal gravitation.

Descartes, a pioneer of modern Western philosophy,who first introduced the ether into science was the modern founder of ‘vacuum is not void’. He combined geometry with algebra that both were originally without relation and introduced coordinate system to establish a correspondence between the planar points and the paired numbers so that the algebraic equations could be used to represent geometric curves, and the mathematics is from the constant to the

variable age, which made the description of time and space become imaginal and convenient.

In Newtonian era, people have formed such a conception of space and time: the space and time are a place where everything exists, moves, develops and changes and they are not related to the material. The space is used to describe the position and shape of the material,it is infinite; while time is used to describe the order of things, it is a persistent performance of the matter existence, movement and change with no beginning and end. The concepts of space and time were a foundation of Newtonian physics.

3.2 Newtonian space-time theory

Newtonian space-time theory is also called absolute space-time theory. In "*Philosophiae Naturalis Principia Mathematica*", Newton said:"The characteristics of absolute space have nothing to do with all the external things, it is uniform everywhere and never move. Relative space is some structures which can move in the absolute space, or a measurement of absolute space." "The absolute, true and mathematical time is decided by its own characteristic, which passes uniformly and has nothing to do with all the external things. The relative presentational and ordinary time is a measure that is the perceptible and the exterior continuity of the movements,which is often used to take the place of the real time such as one hour, one day, one month and one year." "The order of the time interval as well as the sequence of space cannot be changed… Everything is listed the order in the time and arranged the place in the space."

In Newtonian's opinion, space and time represent respectively the extension and sequentiality of the matter existence . These two intuitive conceptions which are obtained by the human experience are simple, understood easily and needless to define, above are just some explanations[4].

Newton's descriptions of space and time are quite exact. Absolute space and time are the scientific abstractions, so people always understand them through the relative space and time, for example, the space in a carriage is relative space, which can move and be measured. The absolute space is abstracted through many understanding of such relative spaces, it is always relative still rather than move with the carriage. Identically, the absolute time is abstracted through the understanding of relative time such as one day, one month and one year, it runs uniformly.

Abstraction plays an important role in human thought, it is indispensable when we describe

the world,for example, the person is an abstract concept, which is abstracted from numberless and concrete you, me and him, it does not represent concrete one, but our population. A concrete person may have some distinct states, temper and behaviors and his life is very short while the person represents the general character of human beings, and its existence is long. Therefore, abstraction is a course or result that concentrate common and essential attribution through the integrations and analyses related information. It comes from the concreteness, but superior to that, because it can reflect the essence of things more comprehensively and generally than concreteness. Similarly, the abstract absolute space and time would be more universal and authentic than the concrete relative space and time.

Space and time are the most basic physical quantities in classical physics. The space-time theory is the space-time relations of substance in movement, which is the most basic physics relation. Galileo transformation was derived according to the prevailing sense of the time and space at that time, it expressed the absolute space-time theory.

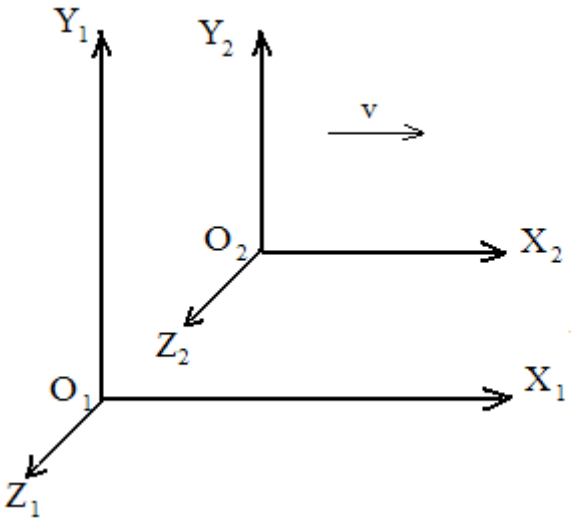

Figure 3.1: Two parallel inertial coordinate systems

Shown in figure 3.1, we can establish two parallel rectangular coordinates systems on two different inertial reference systems,: $O_1(x_1, y_1, z_1)$、$O_2(x_2, y_2, z_2)$. Their X-axis are parallel to each other. "O_2" makes uniform linear motion along the X-axis with speed v relative to "O_1", then there exists relationship of Galileo transformation in Newtonian space-time theory.

$$\begin{cases} x_2 = x_1 - vt_1 \\ y_2 = y_1 \\ z_2 = z_1 \\ t_2 = t_1 \end{cases} \quad (3.1)$$

The equation (3.1) is the space-time relationship between two different inertial reference systems, which can be used to analyze the basic characteristics of the Newtonian space-time theory, there are mainly three points:

First, space and time have nothing to do with the material because there are no parameters related to the property of matter in Galileo Transformation.

Second, time and space are independent because the equation "$t_1 = t_2$" tells us that the time is universal, and it does not vary with the space.

Third, the standards of time and space will not change, which is the unit's value of the time and length, is the specific interval of time and length, which do not change in Galileo transformation.

About time, there are two given events P and Q, whose time interval is $t_{1p} - t_{1q}$ and $t_{2p} - t_{2q}$ respectively from O_1 and O_2, then $t_{2p} - t_{2q} = t_{1p} - t_{1q}$ due to $t_1 = t_2$, that's to say, a time interval is invariable in Galileo transformation.

As for the length, let A and B are two ends of a rigid rod, the rod lying still on the X-axis in the system O_1,and the locations of its two ends are x_{1B} and x_{1A}. To the observer on the system O_2, the rod is relatively moving with speed $-v$, the measured positions of the rod's ends are x_{2B} and x_{2A}. Applying the Galileo transformation, we can get two equations: $x_{2B} = x_{1B} - vt_B$ and $x_{2A} = x_{1A} - vt_A, t_B = t_A$ because the two ends of the rod are moving at the same time, so $x_{2B} - x_{2A} = x_{1B} - x_{1A}$, that's to say, the space interval is invariable in Galileo transformation, which shows that the space does not vary with the time.

A person who stands on the ground sees the moving of train on the track, while another on the train sees the sweeping of trees on the ground outside the window. Therefore the movement is

always relative in form. Many people, including Newton, thought that the absolute space-time theory meant there was an absolute stationary space which is a misunderstanding because there is not existent room of a absolute stationary space in Galileo transformation. A relative space is able to be measured and to describe its movement, but the space with universal significance refers to the abstract space, which is without shape and size, it is used to express the motion of the matter, thus, the space is without motion itself. However, the statement, “a matter moves in space and time”, which make people to think that space is always relatively stationary. As is known to all, the movement of the material is relative to the reference frame, so the stationary space can be understood as that there is a relative stationary absolute space in any inertial reference frame, which is completely equivalent in Newtonian physics. The so-called static space-time, in fact, is a space-time reference system that describes physics, it can be arbitrarily defined because Newtonian standard of space-time has nothing to do with the material environment. We can determine a rigid coordinate system in any inertial reference frame so as to make space-time description of things. This coordinate system, which is relative rest to the reference frame, is an abstract mathematical expression of an absolute space.

The space and time can be divided into absolute and relative space and time. The absolute space-time theory with above three characteristics expressed by the Galileo transformation, what it describes was not only the space-time of classical physics but also the objective space-time with universal significance, namely the real space-time. Strictly, the physical space-time are all the relative space-time which can be measured, but not the real space-time. Some people think that there is no space-time if matter does not exist, therefore, it is a mistake thought that the absolute space-time has nothing to do with the matter because space-time and material are inseparable. Here there is a problem defined about ‘irrelevant’ and ‘relevant’. The space-time is used to measure the motion of matter, no matter means no space-time, while the absolute space-time has nothing to do with the matter, its meaning is that the space-time and matter are independent respectively and the movement and change of the matter can not affect the standards of space-time. A space-time with a variable standards, can be it regarded as a real space-time with universal significance? There are some dislocations between the absolute and quantitative description because of the quantitative effects,but we can reveal the mechanism of quantitative

description on the basis of absolute description, which is the significance of absolute description.

3.3 Relativistic space-time theory

The Newtonian space-time theory is the result of accumulating experience for a long time, while the relativistic space-time theory is a product of Einstein's personal genius. Einstein was more sensitive to space-time phenomena from childhood. It is said that his father gave him a compass when he was five, which excited his curiosity: Why does the pointer always point to one direction? Since then, “why” sprang up within him one after another and he was often lost in thought. When he was at age 16, he had considered such a question: If a person runs to follow the light, and tries to seize it, what will happen? Finally, his thinking focused on the relationships between the relativistic principle and the law of light propagation.

The principle of relativity put forward by Galileo and indicated that the laws of mechanics have the same form in all inertial reference system and any mechanical experiments cannot distinguish the inertial reference system from the rest and uniform motion, which means that the space-time is uniform and isotropic everywhere with no special inertial reference system. According to this principle, if a beam of light runs relative to an inertial reference frame O_1 at a speed of c, and the speed of O_2 is v relative to O_1, then the light runs with speed c+v relative to O_2, which means that the speed of light is variable. However, in electromagnetism, the speed of light is invariable in vacuum. It is said that Einstein had puzzled in a long term by this contradiction. Later, in a discussion with friends, he suddenly realized the truth that the the problem was the the last basic idea that we would have suspected, namely the simultaneity. He said: “The concept of time can’t be given an absolute definition, but there is an inseparable relationship between time and signal speed,so the difficulties mentioned above are all solved by this new concept. 5 weeks later, the special relativity theory was born.” Here, he pointed out that the key of establishing relativity is that there is an inseparable relationship between time and signal speed, in fact, signal speed is the speed of light because it is the known fastest signal speed, thus, he connected the standards of time and length with the speed of light because the speed of light is the path length of the light spreading in the unit of time, which confirms our point of view above that the relativity is a space-time theory with the light as a space-time measurement.

Lorentz and others have proposed the Lorentz transformation before Einstein,whose

explanation was that the length of moving object would contract in the direction of movement under the action of ether. Einstein made mathematical deduction on the basis of the principle of relativity and invariability of light velocity to derive the Lorentz transformation. He thought that the Lorentz transformation shows a space-time theory different from the Newtonian, and it becomes the Newtonian space-time when the moving speed is zero, that is to say, the Newtonian space-time theory is just an approximate theory.

If the relationship between two coordinate systems is just as the Figure 3.1, the Lorentz transformation is the following equations:

$$\begin{cases} x_2 = \beta (x_1 - v t_1) \\ y_2 = y_1 \\ z_2 = z_1 \\ t_2 = \beta (t_1 - v x_1 / c^2) \end{cases} \qquad \left(\beta = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \right) \tag{3.2}$$

We can obtain several features of space-time of the special theory of relativity from the equation (3.2), .

First, the length standard may vary with the moving speed.,we assume that A and B are two ends of a measuring-rod, which lie on the X-axis at rest in the O_2 , its static length is $x_{2B} - x_{2A}$. By the look of observer in O_1, AB is moving, and A and B are always moving at the same time. According to the equation (3.2), its length is:

$$x_{1B} - x_{1A} = (x_{2B} - x_{2A})\sqrt{1 - v^2 / c^2}$$

So the length of moving rod $x_{1B} - x_{1A}$ is $\sqrt{1 - v^2 / c^2}$ times more than the static length $x_{2B} - x_{2A}$, namely the length contraction. Let the unit length of moving rod is dr and the static one is dr_0,

$$dr = \sqrt{1 - v^2 / c^2}\, dr_0 \tag{3.3}$$

Second, time standard can vary with the moving speed. To assume a clock on the origin of coordinate system（x_2=0）, it records the moment at which two events occur with an interval of one second: t_{21}=0 and t_{22}=1. According to the Lorentz transformation, the moments of these

two events are $t_{11}=0$ and $t_{12}=\frac{1}{\sqrt{1-v^2/c^2}}$ by the look of of observer in O_1. This shows that the time interval or standard of moving objects become longer or the time expansion. Let the unit time of moving clock is dt, and the unit time of static clock is dt_0, then

$$dt=\frac{dt_0}{\sqrt{1-v^2/c^2}} \qquad (3.4)$$

Third, the space and time are entangled instead of mutual independence, which is clearly indicated by the fourth equation in Lorentz transformation.

Fourth, the length and time have relation to object. In Newtonian space-time theory, there is no essential relation between speed and object; while the speed is related to the mass of object in the relativity as equation (3.5).

$$m=\frac{m_0}{\sqrt{1-v^2/c^2}} \qquad (3.5)$$

Therefore, the length and time related to speed have something to do with the object's mass.

As indicated above, the basis characteristics of the space-time theory in special relativity are just opposed to Newtonian space-time theory.

What the special relativity describes is the space-time relationship among the inertial reference frames. If a person take a rocket of accelerated motion, what will happen of the space-time relationships? This is a question discussed by general relativity. Einstein established the general relativity through the assumption that the inertial mass is equal to the gravitational mass [6].

In Newtonian mechanics, there are two kind of mass with different significance:

$F=m_i\times a$ F stands for the force; m_i stands for the inertial mass; a is acceleration.

$F=m_g\times G$ m_g stands for the gravitational mass; G is gravitational intensity.

If the inertial mass is equal to gravitational mass, the acceleration is equivalent to gravitational field intensity. The acceleration is the time change rate of speed, and the gravitational field intensity is the space change rate of gravitational potential, thus, the space-time is connected to gravitational potential.

The standard of time and length may vary with the gravitational potential in general relativity,

so we can derive a simple expression by the equivalence principle and the law of energy conservation. Let an object falls free towards an isolated gravitational field of a heavenly body, its first velocity is zero; when it is r away from the heavenly body, the velocity is v and the gravitational potential is φ, (which is zero where it is infinite away from the heavenly body.), its sum of potential and kinetic energy are always equal to zero $\frac{1}{2}mu^2 + m\varphi = 0$, namely

$$\varphi = -\frac{1}{2}v^2 \tag{3.6}$$

Substitute (3.6) into (3.3), (3.4), we obtain:

$$dr = \sqrt{1 + 2\varphi / c^2}\, dr_0 \tag{3.7}$$

$$dt = \frac{dt_0}{\sqrt{1 + 2\varphi / c^2}} \tag{3.8}$$

The equations (3.7) and (3.8) are identical with the result of Schwarzschild solution in general relativity[7],of which dt_0 and dr_0 respectively refer to the proper unit length and unit time on the reference frame that is far away from the gravitational field.

The distribution of gravitational potential is uneven in the gravitational field and the standard of space-time may vary with the gravitational potential, which is described as “gravitational field makes the space-time bending” by the general relativity.

General relativity describes the gravitational field with Riemannian geometry existing local inertial frame and its equation is

$$R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R = kT_{\mu\nu} \tag{3.9}$$

The left of equation (3.9) is the Einstein tensor which characterizes the space-time properties of gravitational field and the right of equation is the matter energy-momentum tensor as the source of gravitational field. Here, the structure and properties of space-time depend on the material distribution and the gravitational field around a object makes four-dimensional space-time continuum bended, whose meaning is that the space-time would be flat and smooth if there exists no object or energy; when a massive object enters the flat space-time, flat space become bended ,which is like a sheet on the Simmons mattress, if a bowling is put on it the sheet will be sagged, and the objects on the sheet move due to the sag. So-called gravitation is caused by this kind of space-time bending.

In 1916, Einstein established the general relativity and proposed a cosmological mode at the second year. He thought that cosmos should be static and "limited and boundless", whose meaning is that four-dimensional space-time of the cosmic is just like a sphere in higher dimensional space, and the area of sphere is limited without boundary. He added a cosmic constant ' Λ 'in equation (3.9) in order to obtain a static cosmic solution,

Later, some people pointed out that the cosmological mode which is the solution of equation (3.9) is not stable, and it is either expansion or contraction. In 1929, Hubble discovered that the red shifts of spectral lines in extragalactic nebula were roughly proportional to the distance from the earth. Assuming that red shift was the Doppler effect of galaxy radial direction moving, the relationship between red shift and distance meant that the universe was expanding. Since the cosmos was expanding, it must have a starting point so that result in the rise of big-bang cosmology, which meant that matter, time and space were produced in a split second of the big-bang, this seemed very absurd so that few people believed it at first. Later, the microwave background radiation was found, which was treated as the afterheat of the big-bang, and the abundant degree of helium in the universe also accord with the prediction of the big-bang theory and so on, then the big-bang cosmology gradually became the standard cosmology model. After expanding universe mode being recognized, Einstein had said with emotion that it was the biggest mistake in his life to introduce the cosmological constant. However, many modern people believe that the introduction does not violate any fundamental principle and it may represent the energy-momentum tensor of the cosmic vacuum field or so-called dark energy.

Whether the evidence of the big-bang cosmology is credible, strained or coincidental are left to be discussed in Chapter 8.

3.4 Other space-time theory

The theory of relativity does not end the research on space-time theory. On the contrary, the relativistic space-time theory introduces the paradoxes of twins, submarine and garage and so on[8-10],which promote people to explore new space-time theory.

3.4.1 High-dimensional space-time theory of strings theory[11, 12]

Relativity theory makes two major changes of space-time theory. First, it treats time as a

special dimensional of space so that it expands the dimension of space. Second, it expresses the gravitation by a geometry.

The strings theory expanded further the dimensions of space along with the changed ideas of relativity. The mathematical equations of strings theory require the space is nine dimensions, with the time dimension, up to ten dimensions. Moreover, the maxium dimensions of space in theory is 11, even 25 dimensions, which is given by M-theory.

Strings theoreticians believe generally that the elementary particle in standard model are tiny vibratory closed string and all particles can be formed by the vibration and movement of closed strings. The string does not move in usual three-dimensional space but in the high-dimensional space that we are different to image. Here our past concept of space is wrong and it moves with a strange and surprising way. In essence, all particles are the different vibrations of the string of same texture, in fact,they play different 'tone' on the same chord. and the strings theory unifies the four fundamental forces as well: The vibration of string describes the force among the particle with charge which is the end of open string,. and the gravitation is the vibration of closed string.

However, most people feel that the space is always the three-dimension, which is considered by strings theory that it is reasonable of the existence of high-dimension and can be explained by an example of a water pipe: The surface of the water pipe is two-dimension, but, it is like a one-dimensional straight line when we observe it from a distance. Why?Because two dimension of water pipe are different and it is easy to see the dimension along the pipe stretched direction; while the circular dimension is very short and difficult to be found because it is curled up, and you can clearly see the circular dimension only when going up to it . By the same reason, in the strings theory, the three dimensional space and the one dimensional time are macroscopic dimensions which are easy to be detected, but another 7-dimension are microcosmic space dimension which are difficult to be explored. It is said that string is only 10^{-33} cm, which is 17 orders of magnitude lower than the smallest scale that we can achieve today. In order to see the string with today's technology,the accelerator must be as big as the galaxy.

String theoreticians believe that the relativity and quantum theory would never be splice together in our three-dimensional space, just like two unrelated fragments,however, if we rise the dimension of space to ten dimensions, these two unrelated fragments would be surprisingly to integrate seamlessly, and become two interdependent pillars of a more complete theoretical

building. Although we cannot image and describe a ten-dimensional space in three-dimensional space, we can deduce its existence by complicated mathematical equations.

In strings theory, there are many adjustable parameters. String theoreticians believe firmly that we are able to find the ultimate theory of physics as long as adjust these parameters,however, this theory is difficult to be falsified and get result. For example, strings theory predicted a new particle, which was within the detectable range of a high-energy accelerator, but in fact, it was not detected, so the superstring theoreticians only need to alter a parameter and correct themselves: The mass of new particle exceeds the detection range of the high-energy accelerator. On the other hand, if we require a negative or zero cosmological constant, there would be infinite kinds of different theories while requiring a positive cosmological constant, the theoretical number is limited about $10^{500.}$in which want to find an ultimate theory. It is easier to fish a needle out of the ocean than to find an ultimate theory.

The ultimate theory of physics, in fact, does not exist. One physicist said: “I was once fascinated by the modern methods of those ideas: super-symmetry, superstring and hidden extra dimensional space etc.. However, a few years ago, perhaps because I had a more profound understanding of the historical and cultural process of the scientific thought, the circumstances changed suddenly that I began to suspect the unification, and thought that it was nothing but the reprint of real monotheism in science and searched the existence of God in the equation ”

The relativity is a physical mathematical model, which treats the change of actual space-time standard as the change of space-time itself. However, it is better to regard it as a mathematical theory than a physical theory,because it inspires the advancement of mathematics. so that many string theoreticians obtained the Fields Medal which was known as the Nobel Prize of mathematics, but this could not prove that it was a correct physical theory. Ptolemaic deferent-epicycle theory stimulated the development of triangle and number theory, but it was not correct for this reason. As an old scientist said: “In balance, the mathematics only belongs to us, rather than the cosmos.”

3.4.2 General Galileo Transformation (GGT)[13.14]

Lorentz transformation expresses the relativistic space-time theory. then some people explored the new space-time theory by starting with the amendments of Lorentz transformation

formula. F. R. Tangherlini and Professor Tsao Chang proposed and developed the “general Galileo Transformation (GGT)”, which is a try in this respect.

Let $O_0(X,Y,Z)$ become a special inertial system, and $O(x,y,z)$ is an inertial system, which is moving along the X-axis with speed v and the GGT are:

$$\begin{cases} x = \beta(X - vT) \\ y = Y \\ z = Z \\ t = \beta^{-1}T \end{cases} \tag{3.10}$$

By the equation (3.10), GGT not only has the nature of Galileo Transformation, which means that the time change has nothing to do with space coordinate between two inertial systems and simultaneity is absolute, but also has the nature of Lorentz transformation, which is to say that there is a factor β^{-1} in the time transformation and a factor β in the space transformation.

Professor Tsao Chang pointed out that when we described the movement of sub-light-velocity particles and photons, the GGT theory and special relativity were consistent with the experiment, but the formulation of special Relativity was simpler. However, when we described the superluminal particles, the time defined by GGT theoretical had the advantage of special relativity because the tachyons in the framework of GGT always made forward movement in time, so the time inversion does not occur in different frame of reference.

Professor Tsao Chang has incisive views on the concept of time. He thought that there were many concepts of time in physics, and the variety of time definitions could be interrelated by certain mathematical formulas. Einstein’s concept of time is only an advisable option, but it cannot replace the all. For example, it is uses the U.S. eastern time in Atlanta, while it uses the U.S. central time in Huntsville,there is one hour time difference between the local time of these two places. Someone goes by aeroplane from Atlanta at 10:00am to Huntsville, the local time is 9:45am, so he needs to put the watch pointer reversal 15 minutes, obviously, it does not mean that time is inverted, because what he uses is all the local time. If he uses the Greenwich time, he need not adjust the watch. Similarly, the relativistic time just represents one local time, the standards of time are different in different place. If there exists superluminal motion, it will cause the retrogression of time. However, the GGT time is just like the Greenwich time, which can not happen retrogression of time in superluminal motion.

3.4.3 Theory of material space

The concept of material space originated from the thought of Descartes. He believed that there is not void space, and the vacuum is filled with ether. We have pointed out that the four-dimensional space-time continuum of relativity, actually, is the image of ether in relativistic space-time theory. Therefore, the relativistic space is a material space. However, Einstein and contemporary physicists are rarely aware of this. Professor Tsao Chang pointed out definitely that: "Since ether or vacuum is an objective material as a background field, the interaction between ether and moving objects should be a research subject, and the basis of relativity should be re-inspected."

Dr. Yin Ye claimed clearly the concept of material space,he proposed The Multi-Layer Model of Material Space on Universe[15] ,whose main points are as follows:

(1) All the existent spaces are the material spaces.

(2) Material space has a multi-layer structure, which is from dense to thin and from the low level to the high level. The densest space is the singularity, and the thinnest space is no space, no space which is an assumed void space and the singularity are the limit space.

(3) The spaces that can be seen around the earth are the space of solid state, liquid-state, gas state and vacuum,all of them are material spaces. The human bings live in the gas-state space and fish live in the liquid-state space.

(4) Vacuum is a material space,the local cosmos is a limited enclosed space consisting of vacuum state materials. It is called the "YIN space" outside the local cosmos.

(5) Relative to high level space, the low level space shows discrete quantization in material stratum, for example, the fish is a kind of solid state, water is continuous liquid state; a gas-state star exists independently in vacuum which is continuous; YIN space is also consecutive, and the cosmic vacuum balls are distributed separately in YIN space. The sketch map of the multi-layer model of material space on universe is shown in figure 3.2:

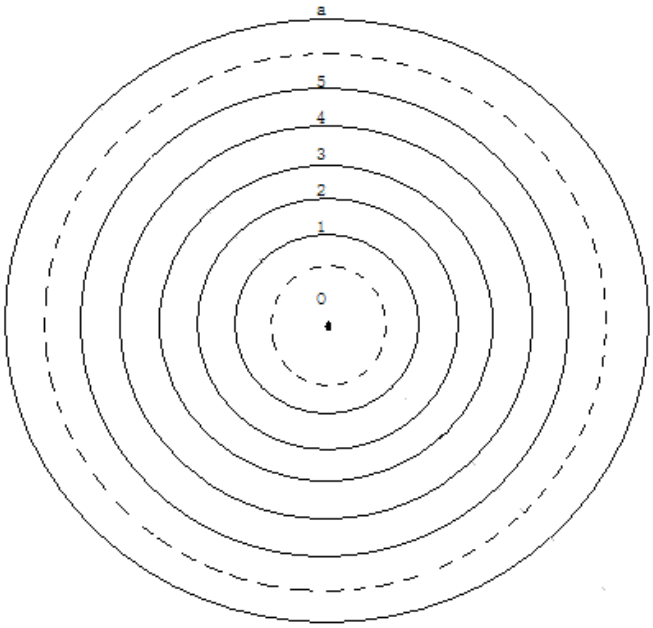

Figure 3.2: The sketch map of the multi-layer model of material space on universe: The center '0' is singularity, '1' is solid-state space, '2' is liquid-state space, '3' is gas-state space, '4' is vacuum space, '5' is YIN space, 'a' is no space.

On the basis of material space, Dr. Yin Ye further proposed further that the mass and the energy of vacuum space are interconvertible, and it is follows the conservation law of material of mass and space in the expansion with invariable energy density so that the scope of conservation law of energy is expended to the one including the energy of vacuum space . Here Dr. Yin Ye proposes a new concept: product of mass and space, which is the product of the volume and its mass[16]. Pay attention that the change of the volume of mobile only refers to the volume change caused by the special relativity effects.

Dr. Yin Ye had incisive research on the paradox of relativity, he thought that the principle of Galilean Relativity is an approximate principle because there is not absolute inertial system, Einstein absolutized the principle of Galilean Relativity, which was not only the excellence of Einstein, but also the mistake of him. Einstein obtained the symmetrical special Relativity with two absolute principles, while it implicated a deviation between symmetrical theory and asymmetrical reality, which causes paradoxes when this deviation cannot be neglect. Relativity neglects the difference among reference frames, which leads up to the relativity of time. The

paradoxes that caused by the relativity will disappear completely through amending relativity[17].

3.5 A Smarandache geometrical model of macro-physics

The space-times theory described by Newtonian and Einstein were the space and time of macroscopic physics, where there are three different space-time geometry.

Newtonian space and time is three-dimension Euclidean space and one-dimension time. Euclidean space is a rigid geometry, namely not deformation, whose concrete manifestation is that the distance s between any two points has nothing to do with the selection of reference frame and it is:

$$ds^2 = dx_1^2 + dx_2^2 + dx_3^2 = \text{invariant} \tag{3.11}$$

It is obvious to Newtonian space because the length standard of Newton is the same everywhere. In addition, Newtonian standard of time is also the same everywhere, so it is rigid that any time interval has nothing to do with the selection of reference frame.

In special relativity, the standard of space and time may vary with the reference frame, so that the equation (3.11) is no longer invariant. Does this mean that space-time of the special relativistic theory are not the Euclidean rigid space? The answer is no. The space and time of the special relativistic theory are intertwined, Minkowski treated time as a special one-dimensional space, and used $x_4 = \sqrt{-1}ct$ to replace the usual time coordinate, the distance between any two points has nothing to do with the selection of reference frames in this four-dimensional space-time, as shown in equation(3.12).

$$ds^2 = dx_1^2 + dx_2^2 + dx_3^2 + dx_4 = \text{invariant} \tag{3.12}$$

Therefore, the four-dimensional space-time continuum of special relativity is Euclidean geometry.

In general relativity, space-time geometry is determined by the material and its movement. Here, space-time lost its rigidity and become something like the mollusk, which will ‘wriggle’ with the movement of substances. Then, equation (3.12) can not establish, that is to say, the space-time of general relativity become a kind of Non-Euclidean geometry. In Euclidean geometry, the straight line is the shortest between two points; while the shortest is the bending geodesic in Non-Euclidean geometry.

In Euclidean geometry, the coordinate axis is straight line,three-dimensional space has three axes, and four-dimensional space has four axes. To any point p of space, we can make n (dimension number) straight lines parallel to coordinate axis and pass this point, then, we can confirm its location ' $p\ (x_1, x_2 \cdots x_n)$ '. In non-Euclidean geometry, one point is confirmed by n curves . The general relativity treats infinitesimal curved surface as the Euclidean plane, dealing with the distance ds between infinite of approach two points as a plane segment, then four-dimensional space-time line element is shown as following:

$$ds^2 = g_{\mu\nu} dx_\mu dx_\nu \quad (\mu,\ \nu = 1、2、3、4) \qquad (3.13)$$

$g_{\mu\nu}$ represents the metric tensor of space-time property of this point

Macrophysics includes three different space: Newtonian space, special relativistic space and general relativistic space, so a Smarandache geometrical model can be constructed intuitively and simply.

As shown in figure 3.3, the external of semi-ellipse ACB is generic Newtonian space, the straight line and parallel are usual straight line and parallel, which are suitable for three-dimensional Euclidean geometry. The inner of semi-ellipse ACB is the space of relativity theory, which is divided into two parts by the straight line AC, in which 'S_1' represents special relativistic space, here, we define that the Smarandache line is a radial that sets out from any point and could be extended infinitely in one direction, it is denoted as S_1- Line, which represents the straight line which is involved by time in four-dimensional space of special relativity. Moreover the two disjoint S_1- lines are parallel. Then, any point P in the S_1 can make S_1- Line only in the direction of AB, and there is only one S_1- Line parallel to the given S_1- Line CA, it indicates that S_1 is a four-dimensional Euclidean geometry. S_2 represents general relativistic space, we define that Smarandache straight line is a segment that connects two points on the edge, denoted as S_2- Line, which represents the localized straight line in four-dimensional space of general relativity, and the two disjoint S_2- Lines are called the parallel. Then, there will be countless S_2- Lines parallel to the given S_2- Line AC by any point Q in the S_2 which does not include the points on AC, so 'S_2' is a four-dimensional Non-Euclidean geometry. We can see that the external geometry space of semi-ellipse ACB is the essential space, and two geometry space S1and S2 are the result of setting boundary on the basis of this essential space and redefine straight line and parallel.. This

situation has closely relation to the physical essence among Newtonian space, special and general relativistic space. Newtonian space is the most basic space and time, which has two meaning, one is the real space ,the other is the space of absolute description that can neglect function of the ether or without the ether. The relativistic four-dimensional space is the quantitative description space which is caused by the action of compressible ether in Newtonian space, the ether density is homogeneous in the special relativistic space while it is non-homogeneous in the general relativistic space.

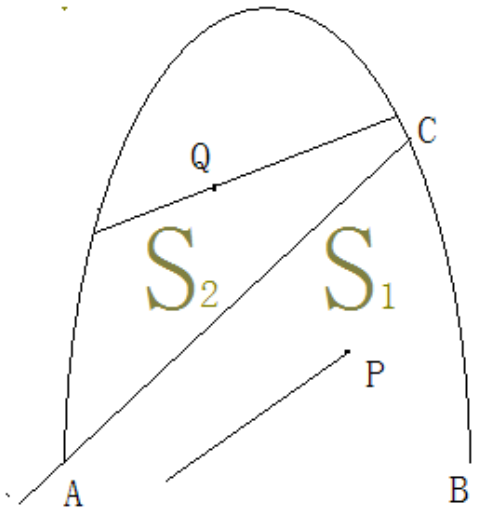

Figure 3.3 A Smarandache geometrical model of macro-physics

In figure 3.3, the Smarandache geometrical model of macro-physics can be showed by a rectangle or triangle which loses a side, we choose semi-ellipse so as to lay a foundation for structuring the interval field ether theory and Smarandache geometrical model of universe in the rear. so that it can make the graphs more beautiful.and clearer.

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Chapter 4 Macroscopic ether and space-time theory

For trying to explain why the Michelson-Morley experiment failed to detect the absolute motion of the earth, for the first time in history, FitzGerald proposed that ether had the relativistic ability to contract the dimensions of any object: contraction occurring in the direction of motion and in proportion to the speed through the ether. Then the Lorentz transformation was completed progressively by Larmor (1897, 1900)[1] and Lorentz (1899, 1904)[2.3]and was brought its modern form by Poincare (1905)[4.5], who give this transformation the name of Lorentz. Eventually, Einstein (1905) showed in course of his development of special relativity, that this transformation concerns the nature of space and time[6]. The different derived ways of Lorentz transformation led to different explanations of it, Lorentz transformation can be derived by the way of fluid mechanics on the basis of Galileo transformation, which fully shows the intrinsic relations among the absolute space-time theory, macroscopic ether and relativistic space-time theory.

4.1 The derivation of the Lorentz transformation by means of fluid mechanics

In fluid mechanics, the velocity potential ϕ of an incompressible fluid satisfies the following equation:

$$\Delta\phi(x.y.z)=0 \qquad (4.1)$$

Let a body move with velocity v in an infinite compressible fluid, which causes disturbances in the velocity, density and pressure. If the disturbances are assumed to be infinitesimal quantities of the first order, the equation of linearization can be obtained[7]:

$$\left(1-\frac{v^2}{c^2}\right)\frac{\partial^2\phi}{\partial x^2}+\frac{\partial^2\phi}{\partial y^2}+\frac{\partial^2\phi}{\partial z^2}=0 \qquad \left(\frac{v}{c}<1\right) \qquad (4.2)$$

where c is the speed of sound in the fluid.

The following transformation (3) can be used:

$$\begin{cases} x'=\beta x \\ y'=y \\ z'=z \end{cases} \qquad \left(\beta=\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}\right) \qquad (4.3)$$

Substituting (4.3) into (4.2), the resulting equation is identified with (4.1):

$\Delta\phi\left(x^{'}.y^{'}.z^{'}\right)=0$.

Therefore, (4.3) is the transformation of the fluid from a compressible to an incompressible state.

If two parallel right-angled coordinate systems $O_1(x_1,y_1,z_1)$, $O_2(x_2,y_2,z_2)$ are constructed on two special fluids that satisfy equation (4.2), if their x-axes are superposed, and if O_2 with speed v moves in the positive x-direction, a Galilean transformation can be performed between them, as in Eqs. (4.4) and (4.5):

$$\begin{cases} x_2 = x_1 - vt_1 \\ y_2 = y_1 \\ z_2 = z_1 \end{cases} \tag{4.4}$$

$$\begin{cases} x_1 = x_2 + vt_2 \\ y_1 = y_2 \\ z_1 = z_2 \end{cases} \tag{4.5}$$

(Note: here, the time t is written as t_1 and t_2 separately.)

Substituting（4.3）into（4.4）and（4.5）, where x_1 in （4.4）and x_2 in（4.5）do not change because they are the proper length, gives Eqs. (4.6) and (4.7):

$$\begin{cases} x_2^{'} = \beta\left(x_1^{'} - vt_1\right) \\ y_2^{'} = y_1^{'} \\ z_2^{'} = z_1^{'} \end{cases} \tag{4.6}$$

$$\begin{cases} x_1^{'} = \beta(x_2^{'} + vt_2) \\ y_1^{'} = y_2^{'} \\ z_1^{'} = z_2^{'} \end{cases} \tag{4.7}$$

Substituting the first equation in（4.6）into（4.7） leads to

$$t_2 = \frac{1}{v\beta}\left(x_1^{'} - \beta^2 x_1^{'} + \beta^2 vt_1\right) = \beta\left(t_1 - \frac{x_1^{'}\left(\beta^2-1\right)}{v\beta^2}\right), \quad \beta^2 = \frac{c^2}{c^2-v^2},$$

$$t_2 = \beta\left(t_1 - \frac{vx_1^{'}}{c^2}\right) \tag{4.8}$$

If the speed of sound c in the special fluid is the speed of light in a vacuum, then the combination of（4.6）and（4.8）is the Lorentz transformation.

Above derivation had been published by author with pan-name Yue Gong in *Potential Science* (1989.4)[8], in which there was a Mr. Liao Ming-Sheng's paper about close relationship between fluid dynamics and relativity[9]. Now more and more people such as Yang Xin-Tie, Liu Wei-Ping have realized the intrinsic relations between fluid mechanics and relativity, and obtain many results of the study[10.11].

In the derivation above, the special fluid, whose distribution is infinite in space where the speed of sound is the speed of light in vacuum, cannot be a conventional fluid. It is, in fact, the macroscopic ether, and the ether as a superfluid can satisfy the demand of equation (4.2), which proves the existence of ether as a propagational medium of light from another angle.

The theory of quantum fields assumes that the physical vacuum is the basic state of the quantum field, which is only a microscopic description. There are significant difference between microscopic and macroscopic image of same matter. For instance, microscopically, the water is composed of molecules, which moves at random and is difficult to be found its most fundamental characteristic as a kind of fluid of continuity. Furthermore, in microscopic system, the ether is not only related to gravitational field but also involves electromagnetic and color field, so that the image of ether become quite complex. Above derivation shows clearly that macroscopic ether is a compressible fluid, which opened up a new field of vision for the research. Moreover, the ether is mainly related to gravitational field in macroscopic system, which can show its truth even more.

4.2 Corresponding relations between two descriptions

The derivation of fluid mechanics of the Lorentz transformation is a course that transforms a compressible ether in absolute space-time theory into a incompressible ether in relativistic space-time theory, where the absolute space-time theory is basic and primary, and the absolute description is a basic description which measures the world with the united space-time standards; while relativistic space-time theory is attained through the transformation of fluid mechanics on the basis of absolute space-time theory, so it is secondary, and the relativity is a quantitative description, which measures the world with a variable space-time standard. There are certain disparity obviously as well as some correspondence relations between these two descriptions.

The ether should satisfy the equation of continuity: $\frac{\partial \rho}{\partial t} + div \rho \vec{u} = 0$. Using the Lorentz

covariance, it can be shown that

$$\begin{cases} \rho' = \beta\rho\left(1-\dfrac{vu_x}{c^2}\right) \\ \rho' u_x' = \beta\left(\rho u_x - v\rho\right) \\ \rho' u_y' = \rho u_y \\ \rho' u_z' = \rho u_z \end{cases} \tag{4.9}$$

The density ρ can be replaced by mass m in（9）, which is the transformation of mass and momentum in the theory of relativity. Therefore, the density of ether is related to the mass. Because mass is a characteristic of an object and does not have spatial extension, and in view of the relationships between mass and a gravitational field, the intrinsic relationship among the ether, gravitational field and objects can be found. The distribution of the ether density is closely related to the objects in the unified ether ocean of the cosmos. The object is the core of the ether density wave-packet, and its mass center is the point of maximal value of the ether density. Here, the corresponding relationships between the quantitative and absolute descriptions are as follows: the absolute value of the gravitational potential corresponds to the ether density, the intensity of the gravitational field corresponds to the gradient of the ether density, and the mass corresponds to the increment of the ether density (relative to the average density of the ether). In acoustics, $dp = d\rho c^2$, where dp is the increment of the density, $d\rho$ is the increment of pressure, and c is the speed of sound. According to the relationship between the mass *m* and energy *E, E=mc*^{2}, and thus, the energy corresponds to the increment of the ether pressure (relative to the average pressure of the ether).

The object is the core of the ether density wave-packet, which means that ether density's smooth distribution or without the point of maximal value represents nothing, namely the vacuum; ether density's wave distribution or existing the point of maximal value represents having, namely having object. Any object can have its own gravitation ether density wave-packet. The object is moving really itself when it moves, but the ether which is around the object is only waving, that is to say, the ether does not make macroscopic movement itself. Therefore, relative motion of the object, for example, the movement of the earth around the sun, does not produce so-called the ether wind, thus, the negative result of Michelson-Morley experiment is very natural. Actually, even if there exists the ether wind, the Michelson-Morley experiment would continue to be

negative. By applying numerical simulation and sound interference experiments, Liu Wei-ping and others demonstrated that the stripe of loop sound interference is invariant to the speed of wind in compressible fluid[11].

As the old saying goes: the ether is big boundlessly and small without inner.,because ether fills the university, so that it is big boundlessly; quantitatively, the distance between two adjacent ether particles is invariable and is the most basic unit of length whether the density of ether is thin or thick, it is difficult to define the size of ether, which is a explain of 'it is small without inner'. In fact, the invariability of the distance between two adjacent ether particles in quantity is also the origin of quantum, which will be shown below.

When an object moves, the object in straightaway, in effect, drives the ether in part because its point of maximal value of ether density is moving with the object though the ether around is just waving. For an axisymmetric rotational body, its rotation does not change the distribution of density of ether around it, so that it does not drive the ether in effect. Moreover , when two objects are making relative motion without bump, the inter-cross between two ether wave-packet will have no influence on the relation of their velocity so that the equation（4.2） can be established, and the derivation of fluid mechanics of the Lorentz can be realized completely.

The increase of mass or energy of moving object is due to the compressibility of the ether: if an object moves in a compressible ether, its own density is increasing, that is to say, the mass-velocity relation of the special theory of relativity $m = \frac{m_0}{\sqrt{1-u^2/c^2}}$, could be regarded as the relation between the density or pressure of ether and velocity:

$$\rho = \frac{\rho_0}{\sqrt{1-u^2/c^2}} \qquad (4.10)$$

ρ is the increment of density of moving ether wave-packet; ρ_0 is the increment of density of relative static ether wave-packet. and

$$p = \frac{p_0}{\sqrt{1-u^2/c^2}} \qquad (4.11)$$

Where the p is the increment of pressure of moving ether wave-packet; p is the

increment of pressure of relative static ether wave-packet.

Above shows that the kinetic energy is the increment of the ether pressure relative to the static one, and the potential energy is the difference of the ether pressure between a body lie to two points of different gravitational potential.

Please note that the increase of ether pressure does not mean there exist general dynamic effect, what it corresponds is only the change of energy. Moreover, it also means that motion is not completely relative, while it has relation to ether field where the object is located, which will be explained further later.

Both time and length are the most basic physical quantities, then the difference of space-time theory is necessarily to cause change of other physical quantities. The matter in classical physics is only the object, which has not relation to vacuum, while the matter in relativity is related to vacuum, the mass or energy can vary with velocity and gravitational potential, and the increment of ether density of the object or the mass is the product of ether non-homogeneous distribution, i.e., the inertia originates from the change of ether density. When an object is moving, the ether distribution around it can vary with it, it is obvious that ether can not be the absolute frame of reference

The following table shows the corresponding relationships between these two descriptions

The Table of Corresponding Relationships Between the Absolute and Quantitative Descriptions

Absolute Description	Quantitative Description
Ether is a compressible superfluid	Ether is an incompressible space-time continuum
Ether density	Absolute value of the gravitational potential
The field of ether density	Gravitational field
The gradient of ether density	The intensity of the gravitational field
The increment of ether density	Mass

The increment of ether pressure	Energy
Homogeneous distribution of ether density	Plane space-time
Inhomogeneous distribution of ether density	Bent space-time
Space-time standard is invariable	Space-time standard is variable
Increase in the ether density	Space contraction, time dilation
Light velocity can vary with ether density	Light velocity is a constant in a vacuum
Light bends to where the ether density is higher	Light travels along the geodesic
Every object has its own ether density wave-packet, whose superposition compose the universe.	Space-time is bent by objects, and the cosmos is finite without boundary

The space-time theory of qualitative description is different from that of absolute description, they would have different reflection to the same thing. In the absolute description, the gravitational field is the field of ether density and the ether is a compressible superfluid; the deflection of light in the gravitational field is bending toward to the direction that the ether density is greater**,** which is identical with the propagational way of conventional sound etc. While quantitative description considers that the gravitational field is the field of time-space curvature; the ether is a homogeneous continuum of four dimensional space-time; the light spreads along the geodesic in the curved space and time etc..

There is the disparity between absolute and quantitative descriptions, which gives a solution to the puzzle of the ether theory in 19th century: The intuitional mechanical model (absolute description) of ether of Fresnel and others can not accord with the quantitative relations completely; while the ether model given by Lorentz can accord with the quantitative relations, but it loses the intuitional character of mechanics, so the disparity between absolute and quantitative descriptions should be grasped accurately. The absolute description is more intuitional and reflect the original visage of things, but it is not necessarily identify with quantitative relations

completely; the quantitative description can identify with actual quantitative relations well, but it often twists the truth of things. Thus,we should combine these two descriptions organically, they are complementary each other**.**

4.3 The physical basis of relativity

The relativistic phenomena includes kinematical effects of the special theory of relativity and the gravitational effects of the general theory of relativity.and both of them are created by the variability of actual space-time standards. Why does the actual space-time standard change? As indicated above, it is due to the change of ether density. Therefore we can regard further the change of space-time standard as the effects of changes of ether density. Where the ether density is greater, the measuring-rod become shorter, and clocks run more slowly. In light of this, the kinematical effects are due to the compressibility of the ether: When an object moves in a compressible ether, its own density is increasing so that the measuring-rod becomes shorter, and the clock runs more slowly. The gravitational effect is due to the ether density, which corresponds to the gravitational potential, where the absolute value of the gravitational potential is greater, ether density is greater ,the measuring-rod becomes shorter, and the clock runs more slowly.

According to the method of fluid mechanics, the ether can be described as being composed of countless ether particles. Then, the unit length is proportional to an interval between two adjacent ether particles, and the unit time is proportional to the time interval that the light travels through an interval of ether particles. Using such standards to measure the ether, it becomes homogeneous and isotropic, and the light velocity is invariable. In addition, both the standards of length and time have a relationship with the interval of the ether particles, thus, relativistic space and time are entangled.

Lorentz and others considered that Lorentz contraction of the moving object was a contraction of the object itself and it was not definite to absolutize the length contraction of moving object. The derivation of fluid mechanics of the Lorentz transformation shows that the length contraction and time expansion reflected by he Lorentz transformation are all only the vacuum effects, namely the change effects of ether density. Now the most accurate measured tool of space and time is light, whose velocity in absolute description can change when it travels in inhomogeneous ether; while the light velocity is invariable in the quantitative description, but the

wave length and frequency of light can change so that the standard of length and time changed, that is to say, where the light velocity is slower in absolute description, the standard of length is shorter and the standard of time is longer in quantitative description.

Below we use one dimensional space-time lines of ether distribution to further explain related cases.

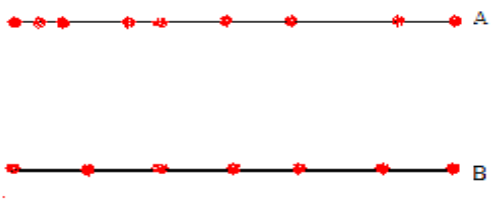

Figure 4.1 The one dimensional space-time lines of ether distribution in absolute space-time theory.

As shown in Figure 4.1, the space-time is flat and the ether is compressible in absolute space-time theory, so the distribution of ether can be homogeneous as well as inhomogeneous on an one dimensional space-time straight line. The red point stands for the ether particle, the the distribution of ether on straight line A is inhomogeneous, while that on straight line B is homogeneous.

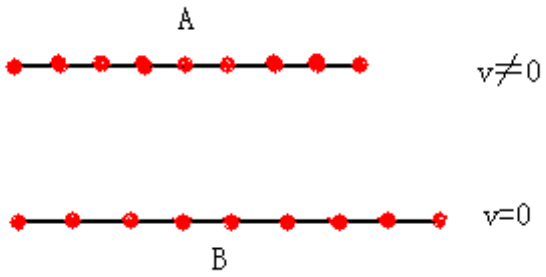

Figure 4.2 The one dimensional space-time lines of ether distribution in the special theory of relativity.

The one dimensional space-time line of ether distribution is also a straight line in the special theory of relativity because it corresponds to the state of homogeneous distribution of ether density, but the density of ether particles are different in different inertia frame of reference because of the

compressibility of the ether, as shown in Figure 4.2

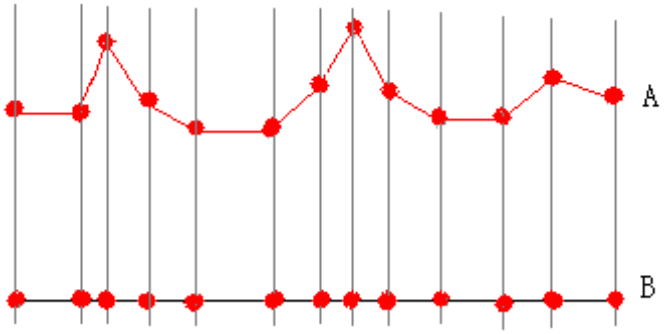

Figure 4.3 The comparison between one dimensional space-time lines of ether distribution in general theory of relativity and absolute space-time theory.

What the general relativity studies is the space-time of presence of acceleration or the gravitational field. The distribution of ether density is inhomogeneous in absolute space-time theory, while it is homogeneous in the special theory of relativity.The invariability principle of light velocity is still established in the general relativity, so the distribution of ether density is also homogeneous,but the four-dimensional space-time continuum composed by homogeneous ether is curved, in which the so-called space-time curvature, in fact, is the change rate of space-time standards. If the behaviors of normal clock and ruler in two places are different, the explanation of general relativity is that the space-time curvatures of this two place are different. Thus, the interval of two adjoining ether particles is the same on one dimensional space-time lines of ether distribution of general relativity, but this one dimensional space-time lines of ether distribution is curved. As shown in Figure 4.3, the one dimensional line of ether distribution is a straight line B in the absolute space-time theory while it is a curved line A in the general relativity theory, and the ether particles on line A and B are the one-to-one correspondence, which are connected by the vertical line in Figure 4.3 . On the curved line A, it can be found that the absolute value of the slope of the line between two adjacent ether particles is greater where the ether density is greater, and the positive or negative symbol of slope is determined by the increase or decrease of the ether density, the one dimensional space-time lines of ether distribution in the general relativity is a curve, which is the so-called space-time bending. The real space-time can not be curved, in fact, this so-called bending is only a mathematical description of the inhomogeneous ether distribution.

Overall, the theory of space-time can be divided into two major types, one is the scientific

abstract theory, which has no substantive contact with objects, namely the absolute space-time theory and it is the real space-time theory, the other is the space-time theory relying on the matter, which is connected with the material world by measuring. For example, ancients define the direction of sunrise and sunset as the east and west, the directions that is perpendicular to the ground are the up and down; an interval between two sunrises is a day, this space-time theory is according to the observation of ground by people, and it can be called "the space-time theory of ground". The relativistic space-time theory is created by ether, which can be called "the space-time theory of ether". This kind of space-time theory has relation to the measuring tools, which can build a mathematical model and do quantitative description and test, but also have certain restriction. For example, the space-time theory of ground is effective on the specific ground, even on the earth, the direction of up and down and the length of a day are different on different ground, which is similar to the situation of the relativity theory that there are different space-time standard in where the velocity or gravitational potential are different.

The absolute space-time theory is more fundamental and more abstract than the space-time theory relying on the matter, which can explain the mechanism of the space-time theory relying on the matter and point out their limitations.

4.4 The limitations and approximations of relativity

The special theory of relativity considers that any relative motion can cause relativistic effects, which is not necessarily so. For example, a fixed stars moving around the earth caused the rotation of the earth, which does not cause relativistic effects, otherwise the velocity of the fixed stars would be much greater than the light speed when the fixed stars are more than one light-year away from the earth.

What the special theory of relativity discusses is the condition that the ether density distributes uniformly, namely, it is without gravitational field. Because it neglected its basis ether, so that it lead up to some paradoxes which are difficult to be solved in special relativity, in fact,it regarded the ether as a "space-time matter" and the so-called uniform space-time is just the uniform distribution of ether in quantitative description, which means that two persons A and B are in relative motion with velocity v, A believes its own is stationary and the ether density around it is p everywhere, B moves in this environment; but B considers its own is stationary, the ether

density around it is q everywhere, and A moves in this environment. However, p≠q i.e., they are unequal in weight due to the compressibility of the ether or the existence of kinematical effect, which is a basic reason causing the paradoxes. What the figure 4.2 shows is one dimensional space-time lines that the observer is stationary on the B and A is in motion.

According to the relativistic phenomenon which is caused by the changes of the ether density. relative motion can be divided into formal and substantial motion, the formal motion is that the ether density itself of the moving objects does not change, what it causes is only the observed effect , and the formulas of relativity are ineffective. The substantial motion is that the ether density itself of the moving objects can change, it would produce real effects, and the formulas of relativity are effective. The phenomenon of the fixed stars moving around the earth caused by the earth's rotation is only the formal motion because they do not affect each other between the ether wave-packets of the earth and the fixed stars. Of course, the pure formal or substantial motion do not exist, and it is probable that both of relative motion, one is the substantial motion and the other is formal motion, for example, the movement of particle in the ether field of the earth is a substantive motion basically, while the earth moves relative to the particle is the formal motion because ether wave packet of the earth does not be affected by the particle as a whole. In contrast, for the relative motion between the sun and earth, the motion that Earth moving around the sun is a substantive motion, and the motion that sun moving around the earth is a formal motion. So the heliocentric theory is greater than the geocentric theory. It is obvious that the relativity of the movement is always set up in form, but both of relative motion are not necessarily equalization essentially.

When objects are moving, the ether distribution around them will change. Therefore ether ia not an absolute frame of reference. Because the kinematical effects are due to the compressibility of the ether density, the ether where an object is located must be used as the reference frame. When studying the movement of bodies in the galaxy, the sum of the ether without the galaxy could be regarded as a homogeneous background field, and thus, the galactic ether wave-packet should be used as the reference frame. When studying the movement of a planet in the solar system, the galactic ether wave-packet becomes part of the background field because the distance is nearly the same between each planet and the galactic center. Thus, the solar ether wave-packet should be used as the reference frame. However, the solar ether wave-packet becomes part of the

background field on the surface of the earth, and thus, the ether wave-packet of the earth should be used as the reference frame when studying phenomena on the earth. The experiment of atomic clocks flying around the earth conducted by Hafele and Keating in 1971 proved this point. The experiment showed that, on average, a flying clock is slower by 59×10^{-9} seconds than a clock on the ground after flying towards the east, and the flying clock is faster by 273×10^{-9} seconds than the clock on the ground after flying towards the west, which demonstrates that “a moving clock is always slower” is not necessarily true. Here, the center of mass of the earth must be taken as the origin of the coordinates system. Only in this way can the calculations with the formulas of the special theory of relativity lead to results that are roughly in agreement with the experiment. Actually, this coordinate system with the center of mass of the earth as the origin is the same as the coordinate system with the ether wave-packet of the earth as the reference frame.

If a charged body is at rest on the ground, it does not produce a magnetic field, which has already been confirmed by experiments. According to the principle of relativity, when the charged body is moving on the ground, it would produce a magnetic field in the ground reference, while it has not a magnetic field in the frame of reference that is relative rest to the charged body. Is it real? Zhu Yong-Qiang, Ji Hao and Hao Jian-Yu in the Institute of Shanghai Orient Electromagnetic Wave made a new instrument which can detect a weak magnetic field (10^{-7}G) and it is called "the orthogonal combination of capacitance and inductive coil", they are used to make a experiment that track and observe the production of magnetic field by the moving charged body in Oct. 2007. The result shows that when the direction of motion is parallel to the direction of the capacitance plate, the instrument detected out a weak magnetic field which is caused by the moving charged body , that is to say, the movement of charged body can produce the magnetic field must regard the earth as the frame of reference[15], they also believe that earth is an experimental reference system, which is restricted in the adjacent areas of the earth. There are myriads of different experimental reference systems in different areas in the universe, for example, the moon should be taken as the experimental reference system on the moon, while the sun should be taken as the experimental reference system on the sun, which is identical with the view of this book.

About the limitations of the relativity, some people believe that the new ether drift shown by the anisotropy of microwave background radiation, namely the earth has the velocity which is

about 390km/s[16] relative to the microwave background radiation, clearly proving the existence of absolute motion, which indicates that the absolute coordinate system will return to the physics in a certain new form, which is worth discussed. The local absolute motion is existent, but it always has certain range. As described above, the motion relative to the earth is absolute motion on ground; the motion relative to the sun is absolute motion in the solar system; and the motion relative to the galactic center is also absolute motion in this galaxy. What is the corresponding range of the absolute motion shown by the anisotropy of microwave background radiation? It may be the local cluster of galaxies because the velocity of the solar system moving around the Galactic center is 220km/s and the center of the Milky Way galaxy, which has the velocity of 600km/s moving around the the super-local-clusters of galaxies; while the anisotropy of microwave background radiation shows that the velocity of the earth is 390km/s. The microwave background radiation is also the wave of ether, so let us analyze the density of ether, namely the distribution of gravitational potential. The order of magnitude of the gravitational potential of the celestial body is GM/r (G is the gravitational constant, M is the mass of celestial body, r is the distance away from the mass center of the celestial body) then it can be found by a simple calculation that the gravitational potential of the earth < that of sun < that of Milky Way galaxy on a some point of the ground. Thus, the higher level of the celestial body is, the larger gravitational potential is theoretically, but the absolute motion shown by the anisotropy of microwave background radiation means that the gravitational potential would reach a maximum value in the local clusters of galaxies, that is to say, the gravitational potential of the local super-clusters of galaxies is smaller than the local clusters of Galaxies on the ground.

In addition, the relativity has certain approximation. In the past, the cosmological principle was used to derive the Lorentz transformation intentionally or unconsciously, namely, the universe is homogeneous and isotropic, which ensures that the Lorentz transformation is linear[17], but it also leads up to the latter approximation because time and space is closely related to the matter in relativity theory, and the cosmological principle can be only a large range of statistical approximation. In fact, the derivation of fluid mechanics of the Lorentz transformation in this book also shows the approximation of the relativistic formulas because the formula (4.2) is linearized, which means conditioned and approximate, and it sets up only when the ether is a complete superfluid, which would have a certain critical speed, critical density, critical pressure

and so on. The ether density can vary with the velocity of the object , and loses his superfluidity to certain extent, so that the relativistic formulas will be no longer effective. Actually, Einstein said" For the large field density and the material density, field equations and the field variables in these equations would not have the true meaning. Overall, We need a clear understanding that the equations can not be extended to this region."[18]

Ji Hao in the Institute of Shanghai Orient Electromagnetic Wave published a series of experimental reports relative to the relativity in the period of 2006-2009[19-22] which was called "Ji Hao experiments", whose experimental data were between the classical and relativistic theory ,but it is more closer to the classical theory, which is worth thinking further.

4.5 On the light barrier

There are many superluminal theories, observations and experiment results,such as the superluminal expansion of the quasars, the superluminal phenomenas in the quantum tunnel effect and so on[23-25].

According to our ether theory, we can make a comparison between the superluminal and supersonic. It is well known that an objects moving in the air can compress the air and cause the resistance. When the speed of an object is close to the speed of sound, its density and pressure of the air in front will increase sharply so that form a sound barrier. Similarly, when an object is moving in the vacuum, its mass and energy, or the density and pressure of its own ether wave-packet, can increase with the motion velocity. When the speed of the object is approaching the light, the density and the pressure of the ether will tend to infinity and forms the light barrier.

The human has already conquered the sound barrier. It generally makes the front of the moving object become sharp to push constantly frontal air so that it can not form the sound barrier and reach to supersound. In addition, the small things such as the things smaller than the air molecules gap can easily push the encountered air molecules to reach the supersound. Actually, majority of microscopic particles are making the supersonic motion, which give us a reference to understand the superluminal.

We can regard the superluminal neutrino as the supersonic motion of the small things. According to the relativistic formula, a object with static mass, no matter how small the mass is, its total mass will tend to infinity when the velocity close to the speed of light. Thus, if the rest

mass of neutrino is zero, superluminal neutrino is no wonder. In addition, as indicated above, the density of ether can increase with the velocity of the object. when it reaches a certain extent, the ether will lose superfluidity and relativistic formula be no longer effective, which means that the relativistic mass-velocity relation has a certain scope of application and it does not establish when the velocity of an object reaches the speed of light. therefore it can also be superluminal, if the neutrino has the mass, and we will have a further discussion about the mass of neutrino in the section 7.4.

According to the analogy above, an object accompanies an ether density wave-packet, and it is able to form a light barrier when its speed is close to the speed of light. In order to reach the superluminal, we must agitate ether and stop it into the light barrier. However, ether is completely superfluidity, so that it is difficult to be agitated. But we still have solution to solve it ,we will point out that the ether in the electromagnetic field is excited by the electromagnetism, which is like the thermal excitation of the superfluid and causes the viscosity, this is to say, a ether with electromagnetism is probable to be agitated. Therefore, a electromagnetic device, say, the hight-speed rotating electromagnetic field, may stimulate and drive the ether to open a way for the superluminal.

We believe that human will breakthrough the light barrier in the future with the development of science and technology.

Now some people believe that the superluminal is impossible, their reason is that the superluminal will destroy the Lorentz symmetry, which is just the relativistic space-time symmetry, and is a mathematical model, whose physical interpretation is that the ether distribution is homogeneous and isotropic everywhere in quantitative description, and it is the result depicted by the relativity with light as the measure of space-time. When the speed of an object achieves or exceeds to the speed of light, the measuring tool of space-time of the relativity does not function. Using the Lorentz symmetry negated the superluminal, which is that denying a physical reality with a mathematical model beyond its applied scope, it is untenable.

Pro. Yang Wen-Xiong in Shanghai Jiaotong University proposed that the sub-light velocity and superluminal can be described by the Laurent series, its positive power expansion of Laurent series can describe the sub-light velocity and its negative power expansion can describe the superluminal. Moreover, the mass of superluminal particle is still the positive[26], which is the

superluminal what people aspire really.

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Chapter 5 Quantitative effects of relativity

Space and time are two most basic physical quantity. The absolute space-time theory describes space-time with ideal and absolute invariable standards; while the relativity describes space-time with actual and variable standards, so the space-time theory of the relativity is not equal to the one of Newton, but there exist some relations between them.

In fact, the relativity theory can not depart from the absolute space-time theory because it explains how the space-time standard changes with the help of the relative invariable quantity, namely the quantity of the absolute description. According to the understanding about the absolute space-time in section 3.2, , the proper quantity in relativity theory is just the specific quantity of absolute description.

5.1 The equations of quantitative effects of relativity.

Both Newtonian and relativistic space-time theory consider that they are equivalent among inertial frames of reference. Actually there are difference in essence between them. The absolute space-time theory considers that the space-time standards are identical in any inertial frame of reference; while relativistic space-time theory shows that the space-time standards are different in different inertial frame of reference.

The special theory of relativity points out that the relationship between unit length dr ,unit time dt and velocity v in an inertial frame of reference are the (3.3) and (3.4), i. e.:

$$dt = \frac{dt_0}{\sqrt{1 - v^2 / c^2}} \tag{5.1}$$

$$dr = \sqrt{1 - v^2 / c^2}\, dr_0 \tag{5.2}$$

where dr_0 and dt_0 are the proper unit length and time respectively in this inertial frame of reference. They do not vary with velocity and are used to measure the change of space-time standards on objects in relative motion with any velocity. Thus, they are the unit length and time in the absolute description on this inertia frame of reference, and Eqs.(5.1) and (5.2) are the relations of space-time standards between quantitative and absolute descriptions, and are equations of quantitative effects that the special theory of relativity amends absolute space-time theory quantitatively.

Similarly, the general theory of relativity states that the unit length dr and unit time dt vary with gravitational potential, which were expressed by Eqs. (3.6), (3.7) and (3.8), and they are numbered into Eqs. (5.3), (5.4) and (5.5):

$$\varphi = -\frac{1}{2}v^2 \tag{5.3}$$

$$dt = \frac{dt_0}{\sqrt{1+2\varphi/c^2}} = \frac{dt_0}{\sqrt{1-2GM/c^2 r}} \tag{5.4}$$

$$dr = \sqrt{1+2\varphi/c^2}\,dr_0 = \sqrt{1-2GM/c^2 r}\,dr_0 \tag{5.5}$$

Eqs. (5.4) and (5.5) are identical with the results of the Schwarzschild solution[1].

The dt_0 and dr_0 in (5.4) and (5.5) are the unit length and unit time on the reference frame that is far away from the gravitational field. They do not vary with the gravitational potential; that is, they are the unit length and unit time in the absolute description. Therefore Eqs. (5.4) and (5.5) are the equations of quantitative effects in the general theory of relativity.

The equations of quantitative effects can be used to explain relativistic phenomena simply.

5.2 The application of the equations of quantitative effects

The quantitative effect of relativity theory is caused by the variability of actual space-time standards, which looks like a “magician”, and it can describe the invariable in essence into the variable in quantity; or describe the variable in essence into the invariable in quantity. Two examples are given below.

5.2.1 The delay of radar echo

About the experiment on the delay of radar echo[2][3], there are distinct analysis and solution in the book *Gravitation and Spacetime*[4], which points out that the causes of delay are the deflection and the velocity become slower of light in gravitational field. The route’s addition caused by the deflection of light is very small, which is a two-order omissible amendment. Therefore the major cause of the delay of radar echo is that the light velocity become slower in the gravitational field. In the book, the velocity of light is calculated out by the gravitational field equation of linearization through many steps, the result is:

$$c_0 = 1 - \frac{2GM}{r} \tag{5.6}$$

where the light velocity c =1; G is gravitational constant; M is the mass of a heavenly body; r is the distance away from the center of mass of the heavenly body.

In fact, it can be derived by Eqs. (5.4) and (5.5) simply: the relation between velocity unit of quantitative description dr/dt and velocity unit of absolute description dr_0/dt_0 is :

$$dr/dt = \frac{\sqrt{1+2\varphi/c^2}\,dr_0}{dt_0/\sqrt{1+2\varphi/c^2}} = (1+2\varphi/c^2)dr_0/dt_0 \tag{5.7}$$

Let the velocity of light without gravitational field is c, then the light velocity of absolute description (unit dr_0/dt_0) is:

$$c_0 = (1+2\varphi/c^2)c = (1-\frac{2GM}{c^2 r})c \quad (\text{unit } dr_0/dt_0) \tag{5.8}$$

The Eq. (5.8) is identical with Eq. (5.6) completely.

As for the time of gravitational delay of light, applying calculus on the basis of equation (5.8) can be derived. For convenience, let the value of light velocity is 1, and c is the coordinate value rather than the light velocity.

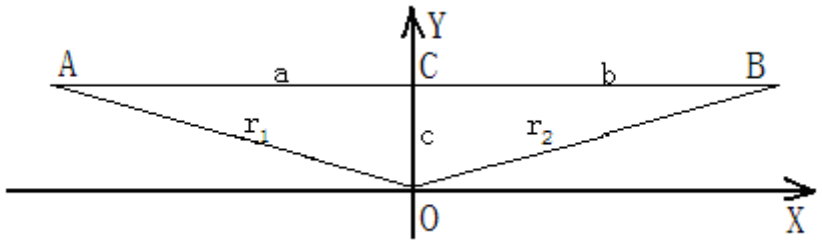

Figure 5.1 The route of light between the earth (A) and a planet (B) in gravitational field of the sun (O)

As shown in Figure 5.1, a ray of light travels along approximate straight line ACB from the earth A (-a,c) to a planet B (b,c) in solar gravitational field, and its traveled time is:

$$\Delta t = \int_{-a}^{b} \frac{dx}{dx/dt} = \int_{-a}^{b} \frac{dx}{1-2GM/r} \approx \int_{-a}^{b} (1+\frac{2GM}{r})dx = \int_{-a}^{b} (1+\frac{2GM}{\sqrt{x^2+c^2}})dx \text{, obtain}$$

$$\Delta t = b + a + 2GM \ln \frac{\sqrt{b^2 + c^2} + b}{\sqrt{a^2 + c^2} - a} \qquad (5.9)$$

The third term on the left of the Eq. (5.9) stands for unidirectional time of gravitational delay, which is the greatest when the earth and objective planet lie on the opposite site of solar two side. At this time, both of $\frac{c}{a} and \frac{c}{b}$ are very little, their square terms can be omitted, then it can be obtained

$$\Delta t \approx 2GM \ln \frac{4ab}{c^2} \qquad (5.10)$$

The time t of the Eq. (5.10) is not the time of earth, and the time of earth is the proper time t_0 approximately. According to the (5.4),

$$\Delta t_0 = \sqrt{1 + 2\varphi / c^2}\,\Delta t \approx (1 - \frac{GM}{r})\Delta t = 2GM(1 - \frac{GM}{r}) \ln \frac{4ab}{c^2} \qquad (5.11)$$

The experiments of gravitational delay of light have made not only through the Mercury[2]and the Venus[5], but also through the Sailor spaceship[6] and Viking Mars probe[7] etc., moreover**,** the values between the experiments and theory are accordant well[4].

Obviously, the conclusion that the velocity of light becomes slower in a gravitational field is an absolute description, which is the result of measuring the velocity of light over the whole solar gravitational field with an invariable space-time standard. Quantitatively, the principle of the invariability of the velocity of light is still established because the standards of space-time in a gravitational field can vary with gravitational potential. Using the quantitative space-time standard of one point to measure the velocity of light of this point, according to (5.7), if the quantitative unit dr / dt is substituted for the absolute unit dr_0 / dt_0 in (5.8), then the velocity of light is always constant c:

$$c_0 = (1 + 2\varphi / c^2)\ \ c / \left(1 + 2\varphi / c^2\right) = c \qquad (dr / dt) \qquad (5.12)$$

Thus, the variable light velocity in absolute description is described into the invariable in quantitative description.

The absolute description's velocity of light become slower in the gravitational field leads up to the gravitational delay of light, and can be observed and calculated, which demonstrates that the absolute description reflects objective circumstances, and also shows the complementarity between these two descriptions.

5.2.2 Gravitational red shift of spectral-line

The proper frequency v_0 of light in the vacuum is invariable in the absolute description, but it is variable in the quantitative description because its space-time standards can vary with gravitational potential, and clock goes differently in the gravitational field . Thus, measuring the frequency of one light with two clocks of different standards leads up to the quantitative red shift of spectral-line.

For one light, a clock goes slower, namely time standard is longer and the measured frequency of light is higher, that is to say, the frequency of light is proportional to the local time standard;[3] therefore, according to (5.4), the frequency of light in gravitational field is

$$v = \frac{kv_0}{\sqrt{1+2\varphi/c^2}} = \frac{kv_0}{\sqrt{1-2GM/c^2 r}} \approx k\left(1+\frac{GM}{c^2 r}\right)v_0 \qquad (5.13)$$

Where the k is a proportional coefficient.

Equation (5.13) shows that the frequency of light can vary with the gravitational potential. When a photon moves from where the absolute value of the gravitational potential is greater to where is less, measuring with local time standards, its frequency is lowering, namely the spectral-line is in red shift. For one photon, if it lies radial site r_1 and r_2 successively, the ratio of frequency of them is:

$$\frac{v_1}{v_2} = \frac{\sqrt{1-2GM/c^2 r_2}}{\sqrt{1-2GM/c^2 r_1}} \qquad (5.14)$$

The (5.14) is the formula of gravitational red shift of light in Schwarzschild geometry. Thus, invariable frequency of light in essence is described into the variable quantitatively.

5.3 The analytic method of effect energy and its application

The sections 5.2.1 and 5.2.2 apply the equations of quantitative effects (5.4) and (5.5) to simply solve the delay of radar echo and the gravitational red shift of spectral-line. According to the the equations of quantitative effects, a analytic method of effect energy is proposed further, which can be used to solve simply the perihelion precession of planet and the deflection of light in gravitational field.

5.3.1 The analytic method of effect energy

Substituting Eq.（5.3）into the mass-velocity formula of special theory of relativity $m=\frac{m_0}{\sqrt{1-u^2/c^2}}$, obtain

$$m=\frac{m_0}{\sqrt{1+2\varphi/c^2}}\approx\left(1-\frac{\varphi}{c^2}\right)m_0=\left(1+\frac{GM}{c^2r}\right)m_0 \qquad (5.15)$$

Eq.(5.15) is the relation of mass-gravitational potential, the energy E corresponds to mass m, Eq (5.15) can be written into the relation of energy- gravitational potential (5.16):

$$E=\frac{E_0}{\sqrt{1+2\varphi/c^2}}\approx\left(1-\frac{\varphi}{c^2}\right)E_0=\left(1+\frac{GM}{c^2r}\right)E_0 \qquad (5.16)$$

The (5.15) and (5.16) also the equations of quantitative effects of the general theory of relativity, approximately, the (5.16) shows that the object in gravitational field has two energy: the proper energy E_0 and the effect energy $\frac{GM}{c^2r}E_0$. So we can transform the questions of general theory of relativity into the classical questions: the motion of a object on the basis of absolute space-time theory can be regard as the sum of the proper motion which is caused by proper energy E_0 and the effect motion caused by effect energy $\frac{GM}{c^2r}E_0$, this effect motion does not change the system of proper motion, while it moves the whole system of proper motion. For example, the system of proper motion of a planet is the ellipse, the effect energy of the planet makes whole ellipse rotated slowly, namely the precession, rather than change the form of ellipse.

It is not interconvertible between proper energy and effect energy so that the relation between them is different from the relationship between total energy and branch energy and their proportion is fixed. The proper energy and effect energy represent respectively their ability of doing work that lie in same gravitational interaction. therefore the ratio of displacement or angular displacement of two energy motion is equal to the ratio of two energy and it is called the analytic method of effect energy, which is briefly expressed as follows.

The analytic method of effect energy：The relativistic motion of a object in gravitational field can be resolved into the proper motion caused by proper energy and the effect motion caused by

effect energy; the effect motion does not change the system of proper motion, but change the motion state of whole system of proper motion; the ratio of displacement or angular displacement of two energy motion is equal to the ratio of two energy, it is about $\frac{GM}{c^2 r}$.

Of course, the analytic method of effect energy is still an assumption yet, its establishment due to whether it is consistent with the facts. This method is used to calculate the perihelion precession of planet and deflection of light in gravitational field, the results are identical with the formulas completely that is derived by the general theory of relativity, which shows that it is reasonable and. Superior.

5.3.2 The perihelion precession of planet

About the perihelion precession of a planet, above had pointed out the effect motion has relevance only to precession. Here the effect energy plays a role in extra kinetic energy of angular direction, which makes the angle what the vector radius rotates is not 2π, but $2\pi+\alpha$ when the planet accomplishes a period's elliptic motion, the α is just the angle of precession. Both of two action are with the same direction and step between kinetic energy of angular direction of the extra and proper motion all the time, thus, the precession angle can be derived simply: To calculate the ratio of angular direction kinetic energy between precession and proper motion, then applying the analytic method of effect energy, the precession angle can be derived in proportion when the planet accomplishes a period of elliptic motion.

When the effect motion is not be considered, the angular direction motion of a planet is created by angular direction kinetic energy of proper motion of the planet. First we calculate the ratio of the angular direction kinetic energy and the sum energy of the planet.

For circular orbit, all of kinetic energy are the angular direction kinetic energy, whose value is half of potential energy because the gravity acceleration $a=\frac{v^2}{r}=\frac{GM}{r^2}$, the kinetic energy $\frac{1}{2}mv^2=\frac{1}{2}m\frac{GM}{r}$, where the $m\frac{GM}{r}$ is potential energy, then angular direction kinetic energy of a planet is $\frac{1}{3}$ of the sum of energy. For elliptic orbit, part of kinetic energy becomes the radial direction kinetic energy, which is not related to angular direction motion. When the

planet is situated in the aphelion, its kinetic energy is $\frac{GMm}{2(a+c)}$ (G is gravitational constant; M is the solar mass; m is the planet mass; a is the half of long axis; c is half of focal distance); when the planet is situated in the perihelion, its kinetic energy is $\frac{GMm}{2(a-c)}$, then the average kinetic energy of elliptic motion is: $\frac{1}{4}GMm\left(\frac{1}{a-c}+\frac{1}{a+c}\right)=\frac{GMm}{2a\left(1-e^2\right)}$, ($e$ is the eccentricity); while the kinetic energy of circular motion with radius a is $\frac{GMm}{2a}$, which is $1-e^2$ time as much as the average kinetic energy of elliptic motion because the energy that elliptic motions of the same long axis are the same. Therefore the proper angular direction kinetic energy of proper motion is about $\frac{1-e^2}{3}E$ （E is the sum of energy of proper motion system）

According to the the analytic method of effect energy, the angular direction kinetic energy of planet precession is $\frac{\varphi}{c^2}E$, while the angular direction kinetic energy of proper motion is $\frac{1-e^2}{3}E$, the ratio of them is $\frac{3\varphi}{c^2\left(1-e^2\right)}$, thus, when the planet accomplishes a period of elliptic motion (2π), the angle of precession is

$$\alpha=\frac{2\pi\times 3\varphi}{c^2\left(1-e^2\right)}=\frac{6\pi\left(2\pi a/T\right)^2}{c^2\left(1-e^2\right)}=\frac{24\pi^3a^2}{\left(1-e^2\right)c^2T^2} \tag{5.17}$$

Where the T is the time that the planet goes in one cycle.

Eq.（5.17）is identical with the formula completely that is derived by the general theory of relativity[8].

5.3.3 The deflection of light in gravitational field

As shown in Figure 5.2, , a photon moves along level line MAN when it is without the gravitational field. In fact, the photon moves along curve ABC, which is an approximate straight line,the angle between ABC and MAN is very small, O is the mass center of a heavenly body; R=AO is its radius; MN‖ EF‖ DC‖ OG.

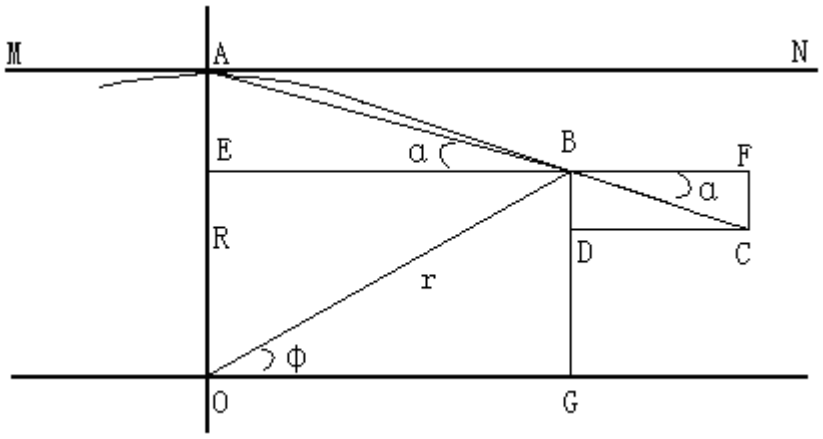

Figure 5.2 The deflection of light in gravitational field

When a photon reaches an arbitrary point B on the curved line ABC, ∠FBC=α is the accumulative total angle of light deflection from A to B. Because the ABC is an approximate straight line and the light deflection is occurred chiefly nearby the point A, therefore the straight line AB, the curved line BC and its tangent on point B are nearly in a line when the point B is quite far away the point A. Then ∠ABE=∠FBC= α , $tg\alpha = \frac{AE}{BE} = \frac{R - r\sin\phi}{r\cos\phi}$, $r\sin\phi = \frac{R}{1 + ctg\phi tg\alpha}$, because the angle of deflection of light is very small when $\phi = \alpha$, the α is enough accurately equal the total angle of light deflection that the photon passes through the whole gravitational field from the point A, at this time,

$$r\sin\phi = \frac{R}{2} \qquad (5.18)$$

The proper motion system of photon is the straight line motion with invariable velocity; its effect motion does not change the proper motion system and only makes the system of straight line in parallel displacement slowly, which can be resolved into a perpendicular displacement BD of its effect motion and a level displacement BF of its proper motion on the point B, and the ratio of this two displacement is $\frac{GM}{c^2 r}$ (M is the mass of a heavenly body, r is the radius of vector and it is a variate), which is a momentary value. For obtaining the accumulative total angle of light deflection on point B, another situation is able to be considered: let the mass center of a heavenly body with same mass is situated in the point G, whose radius is BG, and a photon sweeps levelly

the point B, then the BF stands for the level displacement of its proper motion while the BD stands for the perpendicular displacement of its effect motion. At this time, the momentary angle of light deflection is α, namely the accumulative total angle of light deflection from A to B, thus, we can apply the analytic method of effect energy to calculate $\frac{BD}{BF}=\frac{GM}{c^2BG}$, and use the (5.18)to calculate the accumulative total angle of light deflection that the photon begins from point A to pass trough the whole gravitational field is:

$$\alpha \approx tg\alpha = \frac{BD}{BF} = \frac{GM}{c^2 r\sin\phi} = \frac{2GM}{c^2 R} \tag{5.19}$$

The moved loci of light before and after point A are symmetric, so its total deflection angle is: $\frac{4GM}{c^2R}$, which is identical with the formula that is derived by the general theory of relativity[9].

5.4 The invariable conditions of light velocity

Before 17th century, people believed that light velocity was infinite, which first was doubted by Galileo. Later, astronomers verified that the light velocity was finite through the phenomenas of satellite eclipse of Jupiter and the aberration etc. in 18th century. Einstein took the invariability of light velocity as a basic principle in the beginning of 20th century. We point out that the invariability of light velocity is only a quantitative effect, and it is conditioned.

In the original paper of relativity theory *On The Electrodynamics of Moving Bodies,* the principle of the invariability of light velocity was defined by Einstein: "Any ray of light moves in the``stationary" system of co-ordinates with the determined velocity c, whether the ray be emitted by a stationary or by a moving body" Einstein indicated clearly that the invariability of light velocity was established only in the ``stationary" system of co-ordinates.

He assumed further that a rod with two ends A, B, whose axis lying along the axis X, moves with uniform velocity v in the positive direction of X, let a ray of light depart from A at the time t_A, let it be reflected at B at the time t_B, and reach A again at the time $t_A^{'}$, here all of the time t_A, t_B, $t_A^{'}$ and the length of moving rod r_{AB} were measured in the stationary system. Then he said: "Taking into consideration the principle of the constancy of the velocity of light we find that

we find that $t_B - t_A = \frac{r_{AB}}{c-v} and t_A^{'} - t_B = \frac{r_{AB}}{c+v}$."[10]

As stated above, if there are two frame of reference A and B, they move relatively with velocity v. Then by the Einstein point of view, an observer on the A considers that the light velocity relative to him is c, and it is $c \pm v$ (the same direction is the negative and the opposite is the positive) relative to B; while an observer on the B considers that the light velocity relative to him is c, and it is $c \pm v$ relative to A because the space-time standards between A and B are different, the light velocity is variable when using the single space-time standard, and it is shown by the result of the generalized Sagnac Effect Experimental.

A French scientist Georges Sagnac made a experiment in 1913 and discovered a physical effect, which is called the Sagnac effect,[11] and it shows that two counter-propagating light beams take different time interval a closed path on a rotating disk, while the light source and detector are rotating with the disk. When the disk rotates clockwise, the beam propagating clockwise takes a longer time interval than the beam propagating counter-clockwise, both of them travel on the same light path in opposite direction. The travel-time difference between them is $\Delta t = 4A\Omega / c^2$, where A is the area enclosed by the path and Ω is the angular velocity of the rotation.

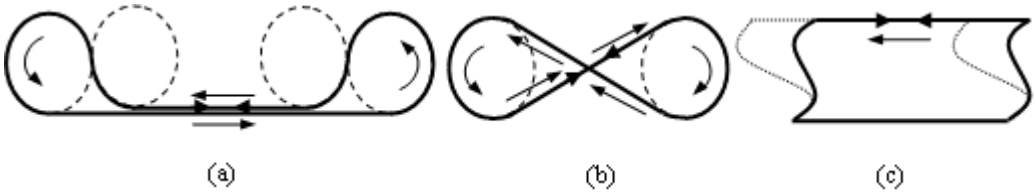

Figure 5.3 The generalized Sagnac Effect Experimental

In recent years, Chinese-American scientists prof. Ruyong Wang and others substitute a fiber optic conveyor (FOC) for the rotating disk shown as Figure 5.3, and thus, the medium of light not only can make uniform circular motion but also can make uniform straight motion such as (a)and (b); moreover, they made the experiment of cutting apart the parallelogram as c shows that the above is moving and the following no motion below etc. Experiments show that any segment of the loop contributes to the total phase difference between two counter-propagating light beams in the loop. The contribution is proportional to a product of the moving velocity vector V and the length vector L of segment:

$$\Delta t = (2/c^2)V\cdot\Delta L \tag{5.20}$$

Where the motion whether is straight or circular is all like this, and the travel-time difference has not relation to a refractive index of light medium. This conclusion includes the Sagnac effect for rotation as a special case, so that it is called the generalized Sagnac effect[12.13], whose nature is not rotation and loop area,but the velocity and length of the segment.

In the generalized Sagnac effect Experiments, let a segment Δl of optic fiber move with uniform velocity v, and it is measured with the standards of length and time in the stationary system, by Einstein's viewpoint, the light velocity is c - v that its direction is identical with v; and it is $c+v$ that its direction is opposite to v, then the phase difference that two counter-propagating light beams travel through the segment of optic fiber is $\Delta t = \frac{\Delta l}{c-v} - \frac{\Delta l}{c+v} = \frac{2v\Delta l}{c^2 - v^2}$, where $c^2 - v^2 \approx c^2$ because the v is far little to the c, and thus $\Delta t \approx \frac{2v}{c^2}\Delta l$, which is identical with Eq.(5.20). Obviously, the generalized Sagnac effect support the formulation of Einstein for the principle of invariance of light velocity.

The actual space-time standards vary with environment. The space-time standards are invariable and the Galilean law of composition of velocity is established in one inertia frame of reference, while relativistic law of composition of velocity, in fact, is a velocity transformation between two different inertia frame of reference. In the instance above, a light beam sends from A to B, then the observer on the A can calculate by the Galilean law of composition of velocity: the velocity of the light beam relative to A is c and is c- v relative to B;In order to attain the velocity of this light beam relative to an observer on the B, namely, the observer is transferred from A to B, the relativistic law of composition of velocity should be used, whose calculated result is c.

As stated previously, the velocity of light is variable, while relativistic invariability of light velocity is a quantitative effect caused by the actual variability of space-time standards in absolute space-time theory. Owing to light velocity is a invariable definitional velocity, so where the light velocity is slower in absolute description, the actual most accurate rule is contracted and the most accurate clock goes slower, therefore the light velocity of immediate measure is always the invariable, in which the immediate measure refer to the measure that measuring meter, recorder and measured situation are all on the same situation. If it is not the immediate measure, then a light velocity is variable. In the generalized Sagnac effect, the space-time measure tools in

stationary system are used to measure the light velocity in moved system, hence the light velocity is variable. Therefore there exist the superluminal motion in nature, which can not be measured directly, but it can be measured indirectly such as comparative method. For example, the light velocity become slower in gravitational field, which is a indirect measured result;and the existent of the superluminal motion in the quasar and tunnel effect are all the result of indirect conjecture.

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Chapter 6 Further research on the electromagnetic phenomena

The electromagnetic interaction is the dominator in the atomic system as well as a frequent visitor of long-range in the macroscopic system. The photon as an electromagnetic wave is a kind of microscopic particles, also it is the continuous macroscopic wave in the ether. Therefore, electromagnetism is a vinculum linking the macroscopic with the microscopic. We first to make the research on electromagnetism before exploring the microscopic system.

6.1 The electromagnetism is the most basic stimulating of the ether

We have pointed out above that light is the second sound of the superfluid ether, which is only a side of the matter.

In the superfluid of object, the propagation velocities of the first and second sounds are different, and the ratio between them tends to $\sqrt{3}$ [1] when the temperature tends to absolute zero, which is obtained by the thermodynamic formulas that are based on kinetic theory. Obviously, this method does not apply to ether. The first sound in the ether is a density wave, namely a mass wave. The second sound in ether is a "temperature wave", which is a heat transfer or a energy wave. It is closely related between the mass and energy, a body with mass must have energy, and a body with energy must have mass. Therefore, these two sounds become one in the ether. However, light mainly shows the characteristic of electromagnetic wave because the electromagnetic interaction is much stronger than the gravitational interaction

Any object whose temperature is greater than absolute zero is emitting the electromagnetic wave. therefore the starting energy of electromagnetic excitation is the smallest and it should be the most basic excitation in the ether. It looks like the superfluidity molecules at the absolute zero, if one once gains kinetic energy, it is able to excite into the thermal motion of molecules. As for the mechanism of electromagnetic excitation will be described specifically in Chapter 7.

A known fact that the movement of the object with electricity or magnetic can radiate electromagnetic waves. Does the movement of the neutral object without electricity or magnetism disturb the ether at the vacuum state? The following is an answer.

6.2 the hypothesis of electromagnetic quanta of the kinetic energy

It is generally believed that the kinetic energy of the object has no necessary relation with the electricity and magnetism, but it is not necessarily so.

The energy of photon is pure kinetic energy, and pure electromagnetic energy as well. There is a vector relation among its energy flow density vector S, electric field intensity E and magnetic field intensity H:

$$S = E \times H \tag{6.1}$$

As is known to all, the wave-particle duality of the photon is applicable to the general object. Then does the vector relation (6.1) apply to the general object? This problem is worth studying. For example, the wire cutting the magnetic field can generate induced electromotive force, where it is accords with Eq. (6.1) among three directions of movement of the wire, magnetic field and induced electromotive force. There is a similar relations about other electromagnetic induction relating to kinetic energy. Hence we propose an assumptions below.

The electromagnetic quantum hypothesis of the kinetic energy: the vector relationship of photon (6.1) is applies to the kinetic energy quantum of general object, that is to say, each kinetic energy quantum satisfies the relation:

$$S_0 = E_0 \times H_0 \tag{6.2}$$

A moving object includes countless kinetic energy quanta whose direction of S_0 are accordant, and their sum of vector S is the kinetic energy flow density vector of this object, while the distribution of E_0 and H_0 is isotropic on the plane that is perpendicular to S and do not show obvious electromagnetism, and their arrangement can be influenced by external field of electricity or magnetism, which means that the kinetic energy of object is a latent electromagnetic energy. This can be further described by the ether:The relativistic kinetic energy of object is related to the ether pressure of the object with ether wave-packet itself. When the ether is disturbed, it will produce electromagnetic excitation. Each kinetic energy quantum is a ether particle, it satisfies the Eq. (6.2). Its direction of vector can vary with the external electric or magnetic field. When a neutral object without electricity or magnetism is moving, it can form the kinetic energy quanta which does not spread outside. When a object with electricity or magnetism is moving, it can not only radiates electromagnetic wave, but also has the kinetic energy.

6.3 The analysis of examples

Applying above hypothesis, we can make some new explains and descriptions for electromagnetic induction, several examples are analysed below.

6.3.1 The Lorentz force

The cause of Lorentz force can be described that there are countless kinetic energy quanta when a particle with charge q moves with velocity v, all of them satisfy Eq.(6.2), and direction of S_0 are accordant, and their sum of vector S is the kinetic energy flow density vector of this object, while their arrangement of E_0 and H_0 is homogeneous and isotropic on the plane that is perpendicular to S, and their sums of vector are zero. When there exists a external magnetic field H, the direction of all H_0 would change, so that their vector's sum $H' = -H$, and there is electric field E on the direction that is perpendicular to S and H', $E \times (-H) = S'$ （$S' \le S$, and only the photons can be the sign of equality）,

$$E = S' \times H = v \times B \qquad (6.3)$$

E acts on a electric charge and lead up to the Lorentz force $F = qE = qv \times B$.

Eq.（6.3） is can be regarded as a macroscopic formula of kinetic energy quanta hypothesis. When the v is light velocity c, we are able to derive the equation of electromagnetic wave: $\sqrt{\varepsilon}E' = \sqrt{\mu}H'$ by Eq.（6.3）.

6.3.2 The effect of single pole

The effect of single pole is a phenomenon of electromagnetic induction of moving conducting magnet. As shown in Figure 6.1, A and E are the two poles of magnet, the points of A and B are two slip connections, rotating with constant angular velocity around the axis AE, there is a stable current in the circuit AVBCDA. Historically, the effect of single pole had been caused disputation[1]: the Faraday considered that the magnetic line of force do not rotate along with the magnet, so the BCDA cuts the magnetic line of force, thus the current occur; while the Weber considered that the magnetic line of force can rotate along with the magnet, so the AVB cuts the

magnetic line of force, which creates the current; both of them are short of evidence[2]. By the hypothesis of electromagnetic quanta of kinetic energy, it is no need to consider whether the wire cuts the magnetic line of force, the current can occur in the wire, whose direction is perpendicular to the directions of the magnetic field and movement. Therefore the principles of the effect of single pole and the Faraday disc are identical, the electric current in circuit AVBCDA depends on the induced electromotive force between C and D: $U_{CD} = \frac{1}{2} B\omega r^2$.

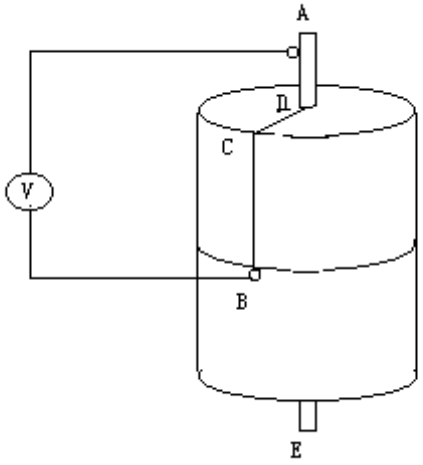

Figure 6.1 The effect of single pole

Actually, earth itself is a giant monopole effect devices: the earth's magnetic field, rotation direction and electric field that is perpendicular to the ground all constitute the orthogonal vector relationship.

6.3.3 Wilson-Wilson experiment

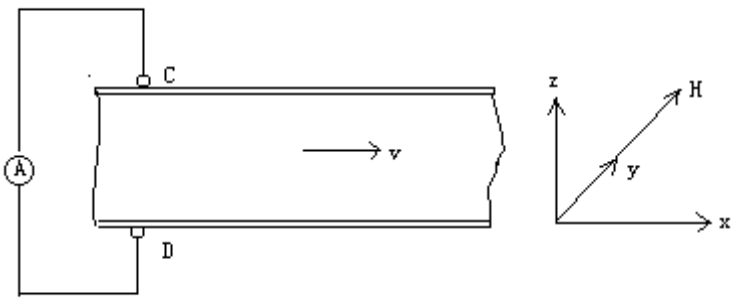

Figure 6.2 The schematic of Wilson-Wilson experiment

M. Wilson and H. A. Wilson made an experiment in 1913. As the figure 6.2, there is an infinite plate capacitor, which is full of electromagnetic medium（ε,μ）; whole capacitor moves with velocity v along the positive direction of axis x; there are slip connections C and D on the plates and a ballistic ammeter A; there exists a homogeneous magnetic field H, whose direction is positive direction of axis y; when the direction of magnetic field turn back $\left(H\to -H\right)$, the ammeter shows that the electric current occurs.

It is generally considered that the experiment should be analyzed with the Maxwell-Minkowski's electrodynamics, its result is that the current value is directly proportional to the factor $\left(\varepsilon\mu -1\right)$. Here, it can be calculated simply with the hypothesis of electromagnetic quanta of kinetic energy: because whole capacitor moves with velocity v along the positive direction of axis x, and there exists a homogeneous magnetic field which is facing the positive direction of axis y, so there must be induced electromotive force E in the direction of axis z within the capacitor, by the （2）, $E=v\times B$, then $D=\varepsilon E=\varepsilon\mu v\times H$, it charges the capacitor in a moment. When the direction of H is turned back$\left(H\to -H\right)$, there is an impact current in CAD, its value will be directly proportional to the factor $\varepsilon\mu$. In the experiment, the factor $\varepsilon\mu$ (18) is more close to the experimental value (24) than the factor $\left(\varepsilon\mu -1\right)$ (17)[2].

6.3.4 The physical basis of the lightning electrification[3][4]

The lightning, whose energy is very large, and the time of its once flash is 40ms, so that its current is up to 10^4-10^5A. The process of electrification can make the electric field intensity up to 4×10^5V/m and make the space charge volume up to 2×10^{-8}C/m^3 in the thundercloud. There are many theories about the electrification mechanism of the lightning. For example, precipitation particles collide with the composition of cloud, it can lead to the separation of charge; the cloud convection movement resists the electric force to transports and accumulates the charges; and so on. But all of them are unsatisfactory. Using our hypothesis can take the huge energy of the lightning as the part of kinetic energy which the atmosphere is moving violently is turned into obvious electric energy. The thundercloud has conditions to realize the course of electrification.

a Kinetic energy turning into explicit electromagnetic energy needs the external

electromagnetic field. In normal circumstances**,** the ground is negatively charged, the atmosphere is positively charged,and the atmospheric electric field exists at any time and can vary with the weather conditions. In sunny day, the vertical atmospheric electric field is an average of 120V/m on the land, and it is 130V/m on the ocean. Thundercloud has gone through the electrification process, and forms the electric dipole mode, its upper is high 6km with the positive charge, the mid is the 3km height with negative charge, and the bottom is 1.5km height with the positive charge. In addition, the atmosphere has the earth's magnetic field, which and atmospheric electromagnetic field create the external condition for the electrification of the lightning.

b The strong convection exists in thunderstorm ,its instantaneous wind velocity is about 15-25m/s and sometimes even is up to 40m/s. Its huge kinetic energy is the source of the lightning energy.

c The thickness of strong electrized cloud layer is at least 3-4km, and the cloud layer with the ice crystals is easy for electrification, which refers to the specific mechanism of electrification may be related to "electrokinetic effect".

Electrokinetic effect: fluid running through a porous plug can produce a certain voltage difference before and after the porous plug. A turbulence can be produced when a fluid running through a porous plug, which seems that it plays a role in the conversion between the latency and explicitness of the electromagnetic energy. Therefore, the system of lightning is like a huge, complex electrokinetic effect system, in which the cloud is like a moved, variable and numerous layer superposed porous plug, which interacts with the strong convective atmosphere can stimulate the mechanism of electrification. In addition, the presence of the cloud layer of great humidity creates the conditions for discharge.

6.3.5 The causes of basic magnetic field of the heavenly bodies

For the causes of the magnetic field of celestial bodies, the orthodox view attributes it to the self-excitation current within rotational celestial bodies at present. But this assumed self-excitative system needs to satisfy certain conditions, which is quite complex and in contradiction with the universality of magnetic field of heavenly body.

Because the earth itself is a huge single pole effect device, the presence of the earth's rotation and the electric field perpendicular to the ground can stimulate out the magnetic field of

north-south direction. Then what are there relationship between the motion state of celestial bodie and its magnetic and electric field? We do some analysis and comparison about the relevant physical quantities of the six planets as below table showed

The relation table among the physical quantities of the six planets

(the relevant data is from [5])

Physical quantity	Mercury	Venus	Earth	Mars	Jupiter	Saturn
Average velocity of orbital motion v	1.6076	1.176	1	0.81	0.4384	0.3236
mass m	0.0558	0.8150	1	0.1074	317.893	95.147
Spin cycle t	58.81	243.675	1	1.03	0.41	0.43
Magnetic moment p	lower limit 5×10^{-5}	Upper limit 5×10^{-5}	1	0.004	19000	550
$\left(\frac{mv^2}{t}\right)^2$	6×10^{-6}	2×10^{-5}	1	0.0047	22206.31	536.89

We can know from the table, $p\approx\left(\frac{mv^2}{t}\right)^2$, which can be take as:

$$p=k\left(\frac{mv^2}{t}\right)^2 \quad \text{(k is the constant)} \tag{6.4}$$

The magnetic moment of planet is influenced by many factors, such as the solar wind, the angle between rotational vector and orbital velocity or magnetic moment, the distribution of the residual magnet and possible self-excitative electric current etc.. But the equation（6.4）shows that the basic magnetic field of a celestial body is created by its own motion way. Of cause, it is yet need to design experiments to be tested and fixed

6.4 Experimental conceiving

6.4.1 The light velocity in the electric or magnetic field

Radar echo delay shows that gravitational field can affect the light velocity. Light is electromagnetic wave, so the electric or magnetic field should be able to affect the light velocity (if the measurement is made directly at any point in the vacuum within the electric or magnetic field, the light velocity is constant value.).

We all know that the light velocity in the physical media is less than in vacuum. It is generally attributed to the interaction between light and real particles. In fact, the interior of the atomic constituting the object is totally empty. For example, the hydrogen atom, its radius is at least 0.53×10^{-10}m, and the radius of its nuclei (proton) is less than 1×10^{-15}m. The proportion of the volume of the nucleus in an atom is much smaller than the proportion of the volume of the sun in the solar system. A electron is even considered to be a point particle. Then it is almost all the vacuum within an atom , but it is full of the electromagnetic fields. Therefore, the interaction between the light and object is mainly the interaction between the light and electric or magnetic field. This indicates that the light velocity decreasing in the medium is related to the electric or magnetic interaction.

Of course, whether the electric and magnetic field affect the light velocity should be answered by the experiment, which is conceived below.

a Experimental principle: using the principle of the Michelson interferometer, adding a strong magnetic or electric field in the optical path of the Michelson interferometer to observe whether can cause the change of the interference fringes when the magnetic or electric field is changed, hence to distinguish whether the magnetic or electric field affect the light velocity.

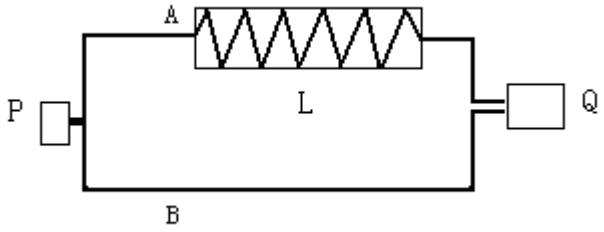

Figure 6.3 The fiber optic cable type Michelson interferometer: P is light source; Q is interference screen; A and B is fiber optic cable; L is magnetic (electric) field generator.

b Experimental device: the impact of the gravitational field is very weak to the light velocity, so that people detect that the light velocity become slower with the earth, sun and a planet as experimental platform. The impact of electric or magnetic field to the light velocity should be much stronger than gravitational field. But to discover this effect in the laboratory, it must enlarge this effect, which can start from the two aspect, lengthening the optical path in the magnetic or electric field and enhancing the intensity of the magnetic or electric field. The optical path of Michelson interferometer used by laboratory is too short, and it is at least tens or hundreds of meters for this experiment in our estimation. It can also use the fiber optic cable to replace the optical path of Michelson interferometer. The fiber optic cable type Michelson interferometer is showed as the Figure 6.3. The longer the fiber optic cable in L is, the better it will be under the premise that is not light leaked. As for the magnetic or electric field in L, its intensity and direction had better can be adjusted so that it is convenient to quantitative analysis. Of course, it can be made step by step,for instance, it is made gradually with different intensity and direction of the magnetic or electric field, such as making their direction vertical or parallel to the light, and so on.

c Experimental procedures: For the fiber optic cable type Michelson interferometer, at first, without opening L, let a laser beam send into the two fiber optic cable A and B at the same time, and adjust the interference screen to obtain the clear interference image. Then, opening L, if there is a change of interference fringes, we should observe and analyze the relationship between the interference fringes and the intensity or direction of the magnetic or electric field. In addition, it can also test about the relationship between the interference fringes and the intensity or frequency of alternating electromagnetic field. For the interior of fiber optic cable is not vacuum, it is required to test repeatedly with different refractive index of the fiber optic cable to prove that the change of the interference fringes has nothing to do with the refractive index of the light conduction medium.

Fiber optic cable type Michelson interferometer exists the magneto-optical effect including Faraday effect, magnetic birefringence effect, and photoelectric phenomenas and so on, which has a certain impact on the interference fringes and makes the experimental analysis complicated. In this regard, it can make the length of two cable A, B the same, and also make the form of placing the same. Of course, it had better increase the optical path in the magnetic or electric field rather

than the fiber optic cable used.

6.4.2 the space-time effect in ether whirlpool

a Experimental purpose

Our view about ether is that relativistic phenomena are the quantitative effect caused by the change of the ether density. Where the ether density is lager , the measuring rod is shorter, and the clock goes slower, which has experimental evidence that the frequency of light can vary with gravitational potential, while which corresponds to the ether density, so that the time standard can vary with the ether density. Our experimental purpose is further to verify this point with a new method.

b Experimental principle

Suppose that there is a vortex in the ether, then due to the uneven distribution of ether density, it will have the "space-time mutation" effect. The rotation of the neutral object is difficult to drive the ether because the ether is a superfluid, while there is electromagnetic excited ether in the electric or magnetic field, they will move with the change of the electric or magnetic field. Therefore, our experimental principle is to use the strong electric or magnetic field with high-speed rotation to create an ether vortex with space-time mutation.

c Experimental device

It is a powerful, rotatable electric or magnetic field, whose intensity, velocity, direction and shape can be suitably adjusted so that it is convenient to quantitative analysis, of course, it can also make them separately. To place some special light source as "space-time meter" on different places in the field and use the spectral analysis to detect whether it exists the space-time mutation effect. The experiment device should be remote control.

d The association about the ether vortex

The ether vortex with space-time mutation would be accompanied a strong electromagnetic unusualness. In the ether vortex, the ether density is the less in the center, and is bigger on the edge, which is a negative structure of gravitational field, and thus, it would make special interaction with the external gravitational field. These characteristics make one to associate the UFO because it has strong electromagnetic unusualness, and causes the space-time mutation, also can do anti-gravity movement. Many people believe that the UFO may not exist, and it, in fact, is

the product that real flying body such as rocket, meteor, aircraft refracted by atmosphere. We consider that the UFO as ether vortex is existent, however, their formation is often related to flying objects, or it is probable that ether vortex is caused by the interactions among atmospheric movement, magnetic storm and flying objects such as rocket, meteor, airplanes with their behavior such as the parts fall off, explosion etc..

As for the so-called encounter with UFO, and rumors of contact with aliens are all the hallucinations that are produced by the effect of ether vortex in human brain. Psychologists have pointed out many times that illusions are caused by the UFO, near-death experience and narcotic drugs have the similar mode. Therefore the experiment device must be remote control.

A ether vortex is the ether in disturbance, it is probable to be used to prevent the formation of the light barrier so as to play a role in faster than light velocity.

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Chapter 7 Microscopic ether and particles

Humans can not directly feel the microscopic phenomena. People make scientific experiments and theoretical analysis with the help of various instruments, and find many characteristics that are different from macroscopic phenomena, such as quantum, duality and so on. What are these specificity caused by? Are they linked with the macroscopic phenomena? Let's make some discussion.

7.1 The quantum is a display of relativistic quantitative relation in the microscopic system

The mass-velocity relationship in the special relativity is

$$m = \frac{m_0}{\sqrt{1-u^2/c^2}} \approx (1+\frac{u^2}{2c^2})m_0 \qquad (7.1)$$

The relationship between mass and gravitational potential in general relativity is

$$m = \frac{m_0}{\sqrt{1+2\varphi/c^2}} \approx (1-\frac{\varphi}{c^2})m_0 = \left(1+\frac{GM}{c^2 r}\right)m_0 \qquad (7.2)$$

Eq. (7.1) is a special case of Eq.(7.2) that when the gravitational field intensity is zero, or the gravitational potential is constant, it is suitable for uniform linear motion. What phenomena will occur by applying the analytic method of effect energy? This analytic method points out that the effect motion can not generally change the proper motion system, and only change the motion state of entire proper motion system. If both of the proper and effect motions are combined and remain uniform linear motion in the mass, where the effect motion is only the transverse vibration or the spin that its direction of vector is parallel to the direction of system motion. Moreover, this direction of spin vector can only be two kinds: the same or the opposite direction of system motion. Does this effect motion exist? Macroscopically, it seems impossible. But it, microscopically, is true because micro-particles have the wave- particle duality and the intrinsic spin. In fact, if we link the angular frequency of the spin and the duality, the spin quantum number will appear.

According to Newtonian mechanics, the relationship between the energy of a rotating object E_1 and angular momentum L is

$$E_1 \propto L\omega \tag{7.3}$$

Where the ω is angular frequency)

In duality, the relationship between energy E_2 and angular frequency ω is

$$E_2 = h\nu = \frac{h}{2\pi}\omega \tag{7.4}$$

If $E_1 \propto E_2$, we can get

$$L \propto \frac{h}{2\pi} \tag{7.5}$$

Eq. (7.5) is similar to the formula of spin quantum number.

Of course, regarding the spin as rotation around a fixed axis is just a poor and visual descriptions and explanation. Actually, intrinsic spin of electron is a quantitative effect and does not equal as rotation around a fixed axis. Quantum mechanics also points out that the electronic spin is a new degree of freedom and has nothing to do with the space motion of the electron. Therefore, the above estimate is in general, and the wave function of the matter wave caused by the quantitative effect can not only take the real number, but should take the plural form. It is noteworthy that Schrodinger equation is a semi-qualitative, semi-quantitative and non-relativistic theory, it can derive the quantization of some physical quantities, but the spin is placed into the theoretical framework as an additional degree of freedom, while Dirac equation, which is an equation of quantum mechanics with special relativity invariability, includes automatically the spin quantum number of particles, which indicates further that Intrinsic spin of the particle is a reflection of the quantitative effect of the special theory of relativity in the microscopic system

Actually, not only the intrinsic spin of the particle is a reflection of the quantitative effect of the special theory of relativity in the microscopic world, but also the quantum nature of light can be seen as a reflection of that. A photons is an electromagnetic excited ether, while a most basic quantitative effect in the relativity is the invariability of light velocity, which means that each photon model should have some common characteristics quantitatively. For this common characteristics, we can make the two assumptions.

First, photon is composed of the ether wave packet stimulated by electromagnetism, in which every electromagnetic unit has the most basic electric moment, magnetic moment, spin and energy value h (the Planck constant). Therefore, if we make an analog between the speed of light and

the speed of sound, then the light velocity is at the same level with excited ether particle because the velocity of sound is at the same level with the average velocity of the air molecules, and quantitatively, because the variability of light velocity, the ether particle is either stationary (not excited), or moving with the light velocity (excited), that is to say, moving ether particle must be excited into an electromagnetic unit, an electromagnetic unit represents a wave crest. Then the greater linear density of electromagnetic unit is, the higher its frequency will be and the bigger the photon's energy (or mass) is, $E = hv$, (E represents the energy of photon, v is its frequency). The energy of each electromagnetic unit can be different and it is generally greater at the center in absolute description; while that must be identical in quantitative description.

In addition, the velocity of sound vis-a-vis the average velocity of air molecules are equivalent, which means that the speed of light is actually a statistical result. For such statistics, quantum and duality, adding the high density and great velocity of objects in microscopic system, the variability of space-time standard is enlarged, and thus, the quantitative effects such as probability, uncertainty principle occur in the microscopic system,

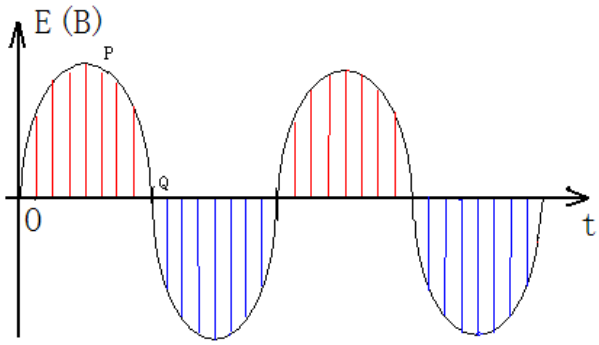

Figure 7.1 The hypothesis one : a peak in the low-energy electromagnetic wave is a photon, which is a wave-packet made up of many electromagnetic excited units. A red line indicates a positive electromagnetic unit; a blue line indicates a negative electromagnetic unit.

This assumption regards a photo as a wave-packet consisting of the electromagnetic unit, and an electromagnetic excited unit represents a wave crest, which brings up a problem. It is that macroscopic electromagnetic waves such as the radio waves, its one wave crest should be made up of many electromagnetic units, i. e. its a wave peaks is a wave-packet of electromagnetic excited units, or is a photon. Then as the Figure 7.1 shows that the frequency of low-energy

electromagnetic wave is determined by the number of wave peaks in the unit time, while the frequency of high-energy photon is determined by the number of electromagnetic units in the unit time. Then there should exist the electromagnetic waves of the high frequency photons in the low-energy electromagnetic waves, which is in contradiction obviously.

The second assumption is that the photon is an object with the mass, or a photon is an ether wave-packet with a electromagnetic excited unit as its own core. Quantitatively, each electric or magnetic amplitude of electromagnetic unit is the identical, and the greater the absolute value of slope of the curve of its wave peak is, the higher frequency is, and the energy is greater as shown in Figure 7.2, which is identical with the one-dimensional ether distribution lines in the space-time of general relativity described by the Figure 4.3, i. e. the place where the ether density is greater, the absolute value of slope of linked line between two adjacent ether particles is bigger, which is accord with the facts that the density of the ether wave packet of the photon is greater, its mass or energy is great. Therefore the photon waveform lines shown by Figure 7.2 reflects the ether density distribution of the photon in absolute space-time theory, which confirms our viewpoint that the first and second sound in superfluid ether are combined into one, that is to say, the fluctuations of electromagnetism and ether density are synchronous.

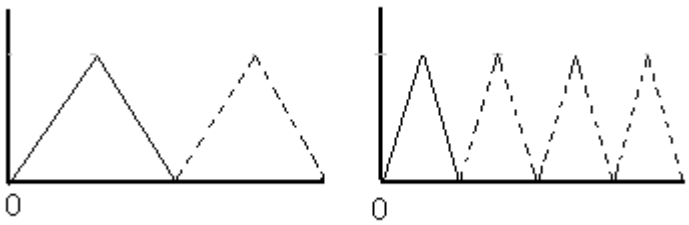

Figure 7.2 The vertical axis represents the amplitude of the electric (magnetic), each electric (magnetic) amplitude of the electromagnetic excited unit is identical. Horizontal axis represents the optical path per unit time. The greater the absolute value of the slope of wave peak is, its frequency or energy is higher.

For the above analysis, the second assumption is more reasonable. Here, quantitatively each electric or magnetic amplitude of electromagnetic excited unit is identical, and its energy is only related to the frequency, but not amplitude. As for the macroscopic electromagnetic waves, its

amplitude is the superposition of many electromagnetic unit, hence, the energy of the macroscopic electromagnetic waves has the relation with frequency as well as amplitude.

The quantum of electric charge is similar to the quantum of photon. The charge is a concept of quantitative description, we believe that its meaning of absolute description is a dislocation in ether because the fact that the dislocation is very similar to the charge in the image of photograph and mathematical manifestation[1]. In the quantitative description, the distribution of the ether is homogeneous and isotropic everywhere, the charge is just the dislocations in it. The uniformity of the four-dimensional space-time creates the basic quantity of Burgers vector of perfect dislocation, which is the root cause of the base quantity of charge. Taken a step further**,** the fractional charge can be regarded as the result that a dislocation in the ether expanding into partial dislocation, which is part structure of the whole dislocation, and can not exist alone, it is the reason that a quark with fraction charge can be not existent independently.

Are there the quantum of space and time? Quantitatively, the answer is yes. The most basic ether particle is called the etheron, it is like the molecules of ether fluid, it would be not ether if it were re-segmented. Therefore, the interval of adjacent two etheron is the most basic length quantum; and the time interval that the light going through the interval of adjacent etherons is the most basic time quantum. However, in the absolute description, the quanta of length and time can vary with the ether density. A length quantum within hadron is shorter than that in the atomic space, and yet the length quantum in the atomic space is shorter than that on the ground and so on, i.e., there are not so-called length and time quantum in absolute space-time theory, and the quantum phenomena are only the quantitative effects.

7.2 On the wave-particle duality

Object is the core of the ether density wave packet, which includes the basic elements of the duality phenomenon that the object is a particle itself, while its accompaniment ether wave packet is fluctuated.

The object particles can be divided into two major categories: the photon without rest mass, the lepton and hadron with rest mass. The reason why the photon has no rest mass is that it is purely an ether wave, i.e., the etherons consisting the photon do not make the macroscopic motion, and only transfer electromagnetic excitation continuously and show its fluctuation. However, the

photon, which has a maximum value of ether density, is a wave packet of ether density and travel with the speed of light, so that shows to be a particle. As for the lepton and hadron with rest mass, in which the bare lepton or bare hadron stripped the ether wave packet, their movement is real, while the etherons within their ether density wave packet do not make the macroscopic motion, and are only in fluctuation, which are the descriptions of the duality.

There is the dislocation between the absolute description and the quantitative description, it is far more obvious in the microscopic system than that in the macroscopic system. In the macroscopic world, the scene in the absolute description is that ether density distribution is uneven in the ether ocean of the universe, the center of mass of object is an maximal value point of ether density, and the gravitational field is the ether density field. While the the scene of quantitative description is that the distribution of ether density is always homogeneous everywhere in the cosmic ether ocean, which is the so-called four-dimensional space-time continuum and yet the presence of the object makes the uniform space-time continuum "bending", the gravitational field is just the curvature field.of the space-time. In the microscopic world, the absolute description points out that an object particle not only is a maximal value point of ether density but also a dislocation in the ether. The electrons without the nucleus and the protons within the nucleus are all the perfect dislocation, while all kinds of hadron are make up of the quarks with partial dislocation. As for the microscopic quantitative description, owing the emergence of charge, the four-dimensional space-time continuum has become fragmentary so that only using the quantum and duality make a description indistinctly.

7.3 The standard model of particle physics

The standard model of particle physics is now the basic description of physicist for the material least unit of universe, it considers that the most basic object particles composed the universe are the three generations leptons and three generations quarks, which are showed as below table.

Table 7.1 The generations and electric charge (the superscript) of fermions

	Neutrinos	Charged leptons	Quarks

First generation	$v_e^{\ 0}$	e^{-1}	$d^{-\frac{1}{3}}$	$u^{+\frac{2}{3}}$
Second generation	$v_\mu^{\ 0}$	μ^{-1}	$s^{-\frac{1}{3}}$	$c^{+\frac{2}{3}}$
Third generation	$v_\tau^{\ 0}$	τ^{-1}	$b^{-\frac{1}{3}}$	$t^{+\frac{2}{3}}$

There are six kinds of leptons and quarks in table 7.1. Both lepton and quark are the fermions whose spin are the 1/2 and they have their own anti-particle so that a total of 24 kinds of the most basic fermions. The interaction among microscopic particles are the exchange of gauge particles, which are the bosons whose spin are the integer, and include the photon in electromagnetic interaction, intermediate vector bosons $W^{\pm}$、Z^0 in weak interaction and gluon in strong interaction.

The week-electromagnetic unified theory in the standard model considers that the week and electromagnetic interaction are unified, just as electric and magnetic interactions are only the two different representations of same interaction. Originally the intermediate vector bosons and photon are the same gauge particles that the mass is zero, it is due to the spontaneous symmetry breaking of vacuum, the intermediate vector bosons obtain huge energy through the Higgs mechanism, while the photon keeps its zero static mass.

The quantum chromodynamics (QCD) in standard model considers that the strong interaction among hadrons is due to the interaction between gluon and quark which compose the hadron. The quark has two degrees of freedom flavor and color, the electromagnetic and week interactions among quarks are going through the flavor degree of freedom, while the strong interaction among quarks are going through the color degree of freedom. Every flavor quark has three kinds of color charges and eight kinds of gluons with different color or flavor.

The standard model in particle physics was crowned with great success by describing correctly all experimental phenomena of electric-weak and strong interaction. But there are defects in this theory system, the Higgs field is indispensable as well as inharmonic because it has brought a theoretical flaw, namely so-called mediocrity and unnaturalness[2]; and up to now the prophesied Higgs particle haven't be discovered. Moreover, there are tens of the most basic particles, such as leptons, quarks and gauge bosons, which deviates from the meaning of "the most basic". Thus it is imperative to explore new physics beyond the standard model of particle physics.

There are already technicolor, supersymmetery, litter Higgs particles and extra dimension etc. which began with new mathematical model to probe; while our new thinking lay stress on internal relations of things, especially on the relation between ether and particle, where the main points are finding basic essences composing all particles and giving a real meaning to the virtual particles in vacuum state.

7.4 The intrinsic relations between ether and particle

The table 7.1 shows the symmetries of the generations and electric charge of fermions. What does it mean? We propose assumptions below.

Assumption one: the neutrino and electric charge are the two essentials composing lepton and quark

According to table 7.1, we think that the neutrino and electric charge are the two essentials composing fermions, neutrinos with one charge are the charged leptons, neutrinos with fractional charge are the quarks; there are three kinds of neutrinos, which are the basis dividing the fermions into three generations, v_e with -1 charge is e, v_e with $-\frac{1}{3}$ charge is d, v_e with $+\frac{2}{3}$ charge is u; v_μ with -1 charge is μ, v_μ with $-\frac{1}{3}$ charge is s, v_μ with $+\frac{2}{3}$ charge is c; v_τ with -1 charge is τ, v_τ with $-\frac{1}{3}$ charge is b, v_τ with $+\frac{2}{3}$ charge is t. The fermions can possess and transfer each other $0、\pm\frac{1}{3}、\pm\frac{2}{3}、\pm1$ electric charge; the three neutrinos are three states of one matter, just as there are solid, fluid and gas for one matter. Owing to the respective conservation of three lepton numbers, it is not interconvertible among three neutrinos; but it is interconvertible among three pairs of positive and negative neutrinos, which should be a way to realize neutrino oscillation.

There is close relation between ether and particles. The quantum field theory considers that the vacuum is the ground state of quantum field, whose excitation or de-excitation represents the produce or disappearance, which means that ether and particle are interconvertible. But the ether can not be made up of pure fermions because the fermions cannot all focus on the lowest energy state due to the Pauli exclusion principle.

As for the bosons, whose spin is a integer and can be regarded as the coupling of two or even

number fermions. Bosons could be condensed in the lowest energy state[3] in principle , which means that the ether should be composed of bosons. Moreover， the Dirac equation of description fermions has two solutions of positive and negative energy state, it is positive particle in positive energy state and the hole in negative energy state is an anti-particle; while ether is a state without positive particle and anti-particle, or the ether is the state that positive and negative particles are just in pairs. Various pairs of positive and negative particles, in fact, all can be produced or annihilated in pairs in vacuum, which fully demonstrates that the ether is a set of pairs of positive and negative particles lain the lowest state. Therefore we propose the second assumption below.

Assumption two: the ether, a set of virtual bosons making up of positive and negative particles is a most basic and most universal Bose-Einstein condensation, a boson of vacuum state is a virtual particle that is nothing to do with mass and without form and size, the essence of "virtual" is the lowest energy state that does not form a ether density wave-packet with its center itself, or is without the increment of the ether pressure because the mass corresponds to the increment of the ether density and the energy corresponds to the increment of the ether pressure.

The ether is made up of the pairs of positive and negative fermions, which seems to be a unmatter, which was introduced in the context of ‘neutrosophy’ (Smarandache, 1995) and ‘paradoxism’ (Smarandache, 1980), which are based on combinations of opposite entities ‘A’ and ‘antiA’ together with their neutralities ‘neutA’ that are in between[4].

The variety of fermions lead up to the variety of virtual bosons, namely the vacuum degenerate. The ether is made up of the pairs of positive and negative neutrinos ($\nu_e - \overline{\nu_e}$, $\nu_\mu - \overline{\nu_\mu}$ or $\nu_\tau - \overline{\nu_\tau}$), they are just the etheron in pure gravitational field; In the electromagnetic field; there are the virtual pairs of positive and negative charged leptons, namely the virtual photons ($e - \bar{e}$, $\mu - \bar{\mu}$, or $\tau - \bar{\tau}$), they are called "electromagnetic excited unit" above and can be regarded as a result of transferring one charge between the positive and negative neutrinos within a etheron; In the color field, there are pairs of positive and negative quarks ($d - \bar{d}$, $u - \bar{u}, s - \bar{s}$ etc.), they are color excited ether, and is a result of transferring a fraction charge between the positive and negative leptons within a etheron or photon, in which the colored are gluons, the uncolored are so-called quarks sea. Otherwise, the intensity of the gravitational,

electromagnetic and color fields correspond respectively to the gradient of the density of etherons, photons and gluons, or the gravitational field is a field of etheron density; the electromagnetic field is a field of virtual photons density and the colour field is a field of gluons density.

The etheron is like a vacuum particle of ground state said by Chen Shu-Qiao, its wave function satisfies $\phi_0 = \phi_0^* = \phi_0\phi_0^* = 1$, which is a scalar particle of zero mass, namely a Goldstone boson. Chen Shu-Qiao made comprehensive quantitative description for the image of vacuum dynamics[5].

The object is the core of the ether density wave-packet, which means that the ether distribution states of uniform and increasing or decreasing monotone are all the vacuum state; only the waved distribution of ether density, or there is the point of maximal value of the ether density can have the object, where the meaning of symmetry breaking is displayed. Both object and ether are made up of neutrinos and electric charge. As Figure 7.3 shows, the composition are the same among a virtual photon, a real photon and a pair of positive and negative charged leptons, the virtual photon lies the lowest state of energy or does not forms a independent ether density wave-packet, and thus it is without form and size; the real photon has a independent ether density wave-packet, and is an alone particle with energy; while a pair of positive and negative charged leptons is a combination of two independent ether density wave-packets; they are different energy states of the same composition. Also there is same composition between virtual gluon and corresponding meson, the former is virtual particle with color; the latter is real particle without color.

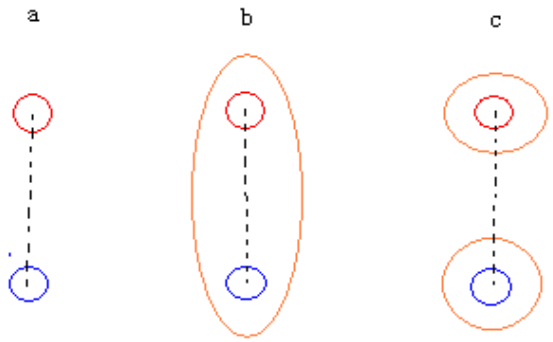

Figure 7.3 A red ring stands for a lepton with positive charge; a blue ring stands for a lepton with negative charge and a yellow ring stands for a ether wave-packet. The a is a virtual photon; the b is a real photon and the c is a pairs of charged leptons.

Theoretically, there are three photons: horizontal photon longitudinal photon and scalar photon divided by polarization coefficient. On the other side, the operator (A) and state vector $|a\rangle$ have not direct meaning, what have direct meaning is the average value of operator in the state vector $\langle a|Aa\rangle$ and the module of state $\langle a|a$ or scalar $\langle a|b\rangle$, while the average value of operator in the state vector, the module of state and scalar product are all decided by the horizontal photon, and the longitudinal photon and scalar photon are without contribution, thus the horizontal photon is the real photon, the longitudinal photon and scalar photon are the virtual photons, which can be described further: a virtual photon is a pair of positive and negative charged leptons, in which the lepton carries the positive charge, the other carries the negative charge, both of them have the magnetic charge due to their spin, which is called longitudinal photon, it is a unit of electric lines of force when the positive and negative charge of the two leptons are not canceled and their magnetic charges are canceled; which is called scalar photon, and is a unit of magnetic lines of force when the positive and negative charge of the two leptons are canceled and their magnetic charges are not canceled. The static electric field is a density field of longitudinal photons; the static magnetic field is a density field of scalar photon. Moreover, the eteron can be regarded as a virtual photon that both electric and magnetic charges are canceled, so it is reasonable for Yan Cheng-He to have a point of view that the gravitation is a epitaxy of electromagnetic force [6].

All the virtual particles are particles of vacuum state, where the etheron are the most basic vacuum particle, and a ether fluid composed by the etheron is completely a superfluid; other virtual particles such as virtual photon and virtual gluon are the excited state of electromagnetism and color of etheron, they can participate in electromagnetic and strong interactions, and therefore they have certain viscosity. Obviously, quantum vacuum is not the most basic vacuum state, but is the electromagnetic or color exciting vacuum state. Moreover the interval of etherons is the most basic length unit of quantitative description, so that the size of etheron itself is difficult to be fixed, then the size of fermions composing etheron can only be token as zero, which is also a display of quantitative effect. In the absolute space-time theory, the etheron and fermions should have their

size and form, which are proposed assumptions by many persons. For instance, Qi Hua points out clearly that photon, electron and quark have their own structure, the annihilation of positive and negative particles is only a phase transition[7]. But it is different to make a quantitative description now because it is beyond present quantitative system.

A gravitational field accompanies an object, which is the core of the ether density wave-packet. The most basic object particle is the fermions, in which the charged leptons and hadron composed by quarks have obvious mass, which demonstrates that the ether density wave-packet itself can not be caused by gravitational interaction, it should be created by electromagnetic and strong interactions, namely the dislocation in ether. The neutrino, which does not participate in electromagnetic or strong interactions, can not form a ether density wave-packet with the center itself. Now some experiments show that a neutrino has small mass, what it reflects is: its existence makes homogeneous and isotropic etheron's crystal lattices take place a tiny deformation instead of forming a dislocation, that is to say, the neutrino has not its ether density wave-packet itself, so that the relativistic mass-velocity relation does not apply to neutrino and it can surpass light velocity easily.

7.5 Interconversion among particles

For convenience, the h is used to stand for a fermion, then according to above assumptions, h = neutrino + electric charge, whose value can be 0、$\pm\frac{1}{3}$、$\pm\frac{2}{3}$、±1; and can transfer charge 0、$\pm\frac{1}{3}$、$\pm\frac{2}{3}$、±1 among fermions; thus we can make the new description for the conversion among the particles：It is the course that transferring charge among fermions and recombine among quarks under the conditions of participation of virtual bosons and conservation of energy generally, which can conform to facts and is a display of its rationality. We will give the decay of part particles as the examples to describe below.

The symbols: $\xrightarrow{h_1\cdots(b)\to h_2}$ stand for transferring b share of electric charge from fermions h_1 to h_2; within the [ ] stand for a fermions' composition of a single real particle or a mid state; within the $\langle\ \rangle$ stand for a virtual boson; after the $\Rightarrow$ stand for the result of decay accorded with the conservation of energy.

7.5.1 The decay of unstable hadrons

All hadrons are composed of quarks, and there are gluons among quarks. The baryon is made up of three quarks, such as a proton $p[uud]$, a neutron $n[ddu]$ while the meson is made up of two quarks, such as a pion $\pi^-[d\bar{u}]$, $\pi^0[u\bar{u}]or[d\bar{d}]$. As for the unstable hadrons, the "unstable" lies in that the quarks and virtual boson composed the hadron can be recombined into new particles without transferring electric charge, so that they are very unstable and very short life, for example:

$$\Delta^-\left[ddd\left\langle u-\bar{u}\right\rangle\right]\Rightarrow n\left[ddu\right]+\pi^-\left[d\bar{u}\right]。$$

7.5.2 The decay of stable strange baryons

The baryons including quark s are the strange baryons. The decay of stable strange baryons is generally the course that the s turns into u, and the u turns into d after transferring one electric charge between quark s and u, then recombination under the participation of virtual gluons, which can only be $d-\bar{d}$、$u-\bar{u}$ due to the conservation of energy. Such a course is identical with actual major ways of decay (except Σ^0):

$$\Lambda^0\left[uds\left\langle u-\bar{u}\right\rangle\right]\xrightarrow{s\cdots(-1)\to u}\left[udud\bar{u}\right]\Rightarrow p\left[udu\right]+\pi^-\left[d\bar{u}\right],或\mathrm{n}\left[\mathrm{ddu}\right]+\pi^0\left[u\bar{u}\right]$$

$$\Lambda^0\left[uds\left\langle d-\bar{d}\right\rangle\right]\xrightarrow{s\cdots(-1)\to u}\left[ddud\bar{d}\right]\Rightarrow n\left[ddu\right]+\pi^0\left[d\bar{d}\right]$$

$$\Sigma^+\left[uus\left\langle u-\bar{u}\right\rangle\right]\xrightarrow{s\cdots(-1)\to u}\left[uuud\bar{u}\right]\Rightarrow p\left[uud\right]+\pi^0\left[u\bar{u}\right]$$

$$\Sigma^+\left[uus\left\langle d-\bar{d}\right\rangle\right]\xrightarrow{s\cdots(-1)\to u}\left[udud\bar{d}\right]\Rightarrow p\left[uud\right]+\pi^0\left[d\bar{d}\right],或n\left[dud\right]+\pi^+\left[u\bar{d}\right]$$

$$\Sigma^-\left[dds\left\langle u-\bar{u}\right\rangle\right]\xrightarrow{s\cdots(-1)\to u}\left[ddud\bar{u}\right]\Rightarrow n\left[ddu\right]+\pi^-\left[d\bar{u}\right]$$

$$\Xi^0\left[uss\left\langle u-\bar{u}\right\rangle\right]\xrightarrow{s\cdots(-1)\to u}\left[usud\bar{u}\right]\Rightarrow \Lambda\left[sud\right]+\pi^0\left[u\bar{u}\right]$$

$$\Xi^0\left[uss\left\langle d-\bar{d}\right\rangle\right]\xrightarrow{s\cdots(-1)\to u}\left[dusd\bar{d}\right]\Rightarrow \Lambda\left[dus\right]+\pi^0\left[d\bar{d}\right]$$

$$\Xi^-\left[dss\left\langle u-\bar{u}\right\rangle\right]\xrightarrow{s\cdots(-1)\to u}\left[dsud\bar{u}\right]\Rightarrow \Lambda\left[dsu\right]+\pi^-\left[d\bar{u}\right]$$

$$\Omega^0\left[sss\left\langle u-\bar{u}\right\rangle\right]\xrightarrow{s\cdots(-1)\to u}\left[ssud\bar{u}\right]\Rightarrow \Lambda\left[dsu\right]+k^-\left[s\bar{u}\right],或\Xi^0\left[ssu\right]+\pi^-\left[d\bar{u}\right]$$

$$或\Xi^-\left[dss\right]+\pi^0\left[u\bar{u}\right]$$

As to the decay of Σ^0, it is a course that the virtual boson within Σ^0 is transformed into the photon:

$$\Sigma^0\left[uds\left\langle d-\bar{d}\right\rangle\right]\xrightarrow{d\cdots\left(\frac{2}{3}\right)\to\bar{d}}\left[uds\left\langle e-\bar{e}\right\rangle\right]\Rightarrow\Lambda\left[uds\right]+\gamma\left[e\bar{e}\right]$$

Other non-main ways of decay are all the result of transferring fractional electric charge among quarks, for example:

$$\Sigma^-\left[dds\left\langle u-\bar{u}\right\rangle\right]\xrightarrow{s\cdots\left(\frac{2}{3}\right)\to\bar{u}}\left[dde(\mu)\bar{\nu}_e\left(\bar{\nu}_\mu\right)u\right]\Rightarrow n\left[ddu\right]+e+\bar{\nu}_e,\text{或}n\left[ddu\right]+\mu+\bar{\nu}_\mu$$

7.5.3 The decay of neutron and charged leptons

Owing to the restriction of energy, it is the virtual photon that participate in the decay of neutron and charged leptons:

$$n\left[udd\right]\left\langle e-\bar{e}\right\rangle\xrightarrow{d\cdots(-1)\to\bar{e}}p\left[udu\right]+\bar{\nu}_e+e$$

$$\mu\left\langle\bar{e}-e\right\rangle\xrightarrow{\mu\cdots(-1)\to\bar{e}}\nu_\mu+\bar{\nu}_e+e$$

$$\tau\left\langle\bar{e}-e\right\rangle\xrightarrow{\tau\cdots(-1)\to\bar{e}}\nu_\tau+\bar{\nu}_e+e$$

Due to the huge energy of τ, it is probable to exist uncolored virtual pairs of positive and negative quarks around it so that it can stimulate out hadrons.

Above description can accord with facts in the table of particles, which shows the rationality of our assumptions.

7.5.4 Decay branching ratio

According to above decayed formulas and simple calculation, it can be discovered that the branch ratio of disintegration is related to the combinative relations among quarks by the simple calculation, the combinative relations are ud, ud, uu in p[uud], ud,ud,dd in n[ddu], $u\bar{d}$ in π^+, or $u\bar{u}$ in π^0 etc. We already know that the branch ratio，$\Lambda\to p\pi^-$ is (64.2±0.5)%，$\Lambda\to n\pi^0$ is (35.8±0.5)%，$\sum^+\to p\pi^0$ is （51.6±0.7）%，$\sum^+\to n\pi^+$ is （48.4±0.7）%. Let the combinative probability uu is bigger by 15.5% than dd, $d\bar{u}$ or $u\bar{d}$ is bigger by 12.5%

than $d\bar{d}$ or $u\bar{u}$, then the combinative relations of $p\pi^-$ are $uu,ud,ud,d\bar{u}$, while that of $n\pi^0$ are $dd,ud,ud,u\bar{u}$, and therefore the branch ratio of $\Lambda \to p\pi^-$ is bigger by 28% (15.5%+12.5%) than that of $\Lambda \to n\pi^0$; similarly the branch ratio of $\sum^+ \to p\pi^0$ is bigger by 3% (15.5%-12.5%) than that of $\sum^+ \to n\pi^+$.

7.6 The mechanism of the interaction

There are four basic interactions: gravitational, electromagnetic, strong and weak interactions, which are described by two theories of mutual exclusion. The general relativity describes the gravitational interaction, which is described into an action between curved space-time and objects. Three other interactions are described by the quantum field theory, it regards the interactions as the exchanging field quantizations: electromagnetic interaction exchanges the photons, strong interaction exchanges the gluons, weak interaction exchanges the intermediate vector bosons. Here the interactions are regarded as exchanging field quanta, in fact, is only a visual description, its true meaning is that the force fields all consist of field quanta, namely the boson, which are always in continuous virtual-real interconversion and oscillation. Formally, the general relativity and quantum field theory are incompatible as the fire and water, in fact, they have a common characteristic, that is unbalanced. As we have pointed out, the so-called space-time bending is a mathematical expression of the uneven distribution of ether density. When the object is in the uneven ether, there are A, B etherons to be functional respectively before and after it, A≠B, thus the gravitation occurs. Similarly, other force fields are also caused by the uneven distribution of field particles (the exciting etherons).

Below, we agree on that different quark has different flavor, and different leptons as well; the flavor numbers of positive and negative particles are just opposite,and that of a pair of positive and negative particles is zero.

Qualitatively, we can regard interaction as the action between charges such as electric, magnetic and colour charges, which cannot exist independently itself but only attach on the neutrino, the neutrino with electric charge is charged lepton, the neutrino with colour charge, as a characteristic of fractional charge, is quark. The electric or magnetic lines of force are two

different chain of virtual photons; they can transmit the electromagnetic interaction. Similarly, we can consider that the gluons compose the colour lines of force, which transmit the strong interaction, and make the quarks recombined. The distribution of virtual particle chains are the smooth, in which have not real particles in stationary field; while the lines of force are waving and form many wave-peaks, which are the real field quanta with rest mass zero in moved field. But the weak interaction of zero distance can not be described like so, his real quantum has huge mass. The interaction is described as exchanging gauge particles, which is only a mathematical model.

According to the above analyses, strong interaction is the regrouping among the quarks. It does not change the flavor of a particle, so that it has the largest flavor symmetry. The flavor has the relation to the electric charge and has no relation with the color charge.

As for the transformation of the particles, the electromagnetic interaction is transferring electric charge within a pair of positive and negative particles. For example, the decay of Σ^0, although it changes the flavor of the two fermions (d and $\overline{d}$), the total number of flavor does not change, so that it has a better flavor symmetry.

The weak interaction is also the charge transferred between the particles, and it changes the total number of flavor. Therefore,its flavor symmetry is the lowest. Qualitatively, weak interaction is the interaction between the positive and negative non-asymmetric charges. Because the charge must be attached on the neutrino, so weak interaction should be the interaction between the neutrinos with the non-asymmetry of positive and negative charge, their observable real interactive particles would be a pair of neutrinos (Z^0) or the pair of neutrino and charged lepton ($W^{\pm}$), they are not the pair of two independent ether wave-packets, but it is includes two particle in one ether wave-packet, so that its mass is very great.

The gravitational interaction is the interaction between the ether particles, and the so-called gravitational quantum should be made up of two etherons, whether it can form an ether wave-packet with it as the core is a problem. It has been pointed out above that the electromagnetic excitation is the most basic excitation in the ether, which once is disturbed, it will produce the electromagnetic waves to spread outward. Therefore, the gravitational quanta may not exist, and so-called gravitational waves, in fact, is included in the electromagnetic waves.

The above means that the virtual particles in the interaction not only has the relationship with

the observable field quant, but also has the differences. The former does not form the independent ether wave-packet, while the latter is the real particle with the ether packet. In addition, an etheron is a pair of positive and negative neutrinos, and yet the weak interaction quantum is a pair of two neutrinos with the non-asymmetry charge. Therefore, Chen Shao-Guang believes that gravity is a manifestation of the vacuum polarization effect of the weak interactions, which has a certain reason[8]. Just as the quantum theory of the electromagnetic field is closely related to the quantum theory of electrons, the quantum theory of gravitational field will have some connection with the quantum theory of the neutrino.

In addition, if there is the hadron in the course of weak decay, this course will include the strong interaction because new quarks will regroup into hadrons, which is a strong interaction. therefore the general weak decay of stable strange baryon exists the strong interaction actually at the last moment of decay.

In the microscopic system, real particles and virtual particles are all moving, changing, exchanging energy, transferring charges and transforming the real and virtual roles. The quantum character of field is the dynamic performance of the interrelation and interconversion between the ether and object.

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Chapter 8 Cosmoscopic interaction of ether

Human lives in the macroscopic world, the visible physical phenomena can be described generally by classical physics, which is intuitive and easy to understand. As described above, there are some physical phenomenas that are difficult to be understood, such as duality, quantum, the uncertainty principle in the microscopic system. Similarly, in the cosmoscopic system of galaxies and galaxy clusters, there exists the cosmological red shift, quasars and dark matter and so on, which are also difficult to be understood, and have been studied for a long time. Some of them seem to have been resolved, but it is actually far away from satisfactory and the dark matter is one of these problems.

8.1 Review of the dark matter problem[1]

We call the world of galaxies and galaxy clusters as the "cosmoscopic system". Astronomers have two ways to determine how much matter fills the universe. They tot up everything they see. And they measure how fast the visible objects move, apply the laws of physics and deduce how much mass is needed to generate the gravity that restrain those objects. Vexingly the two methods give different answers. Most astronomers conclude that some invisible mass also lurks out there, i.e., the famous dark matter.

As early as in 1932, A. H. Oort who is the young Dutch astronomer studied the movement that stars pass through the Galactic plane and found that according to the actual movement of these stars, using Newtonian mechanics formula to calculate, the mass of the Galactic disk is at least three times larger than the total mass of the visible luminary. In 1933, F. Zwicky who is a Swiss astronomer found that the dynamical mass of the Coma cluster is even 400 times larger than its photometric mass. In 1936, Smith and others found that the dynamical mass of the Virgo cluster is 200 times larger than its photometric mass. At that time, the errors of observational datas are greater. Now it is believed that similarly, it is about 10 times. these "mass discrepancy" phenomenons show that if the moved rules of the cosmoscopic body is also in line with Newton's laws of mechanics, then, it must exists a large number of "dark matter" that are not found by people.

There are some uncertain factors in the above discoveries, while the discovery of V. Rubin

and others in 1978 is believed to be a strong evidence. They found that the spiral galaxies including the Milky Way galaxy, outside the luminescent circle, the rotation speed of body has nothing to do with the distance. According to the Newton's laws of mechanics, the square of the speed of the orbital motion of body is inversely proportional to the distance. Therefore, if Newton's laws of mechanics remain valid, it would say that there is a huge dark matter halo outside the galaxy.

If the dark matter really exists, what is it? At first, it was thought as the common matter that is difficult to be observed, such as pervasive gas and dust in out space, planets, senile and dimmed heavenly bodies and black holes. But these ordinary objects were regarded through observation and analysis, that they can not meet far the requirements in their quality and quantity. Therefore, it should be mainly composed of matter that is not realized by the humanity. Dark matter is abnormal matter, its quantity is much more than the ordinary objects, so this situation is very abnormal. However, modern cosmology treats the dark matter as a treasure because it believes, in the early universe, that the cosmological density parameter remain 1 after the inflation, while baryon matter can not be rapidly composed in the inflation, so that its density parameter is much smaller than 1, and thus, most of the substances of the universe should be non-baryon matter. At present, modern cosmologists believe that the common baryon matter is only about 4%, dark matter is about 23%, the dark energy is about73% in the cosmic matter composition. What is the dark matter after all? This is a most substantial question, up to now, has no answer.

Dark matter is mainly composed of the matter that is not realized by humanity. Thus, some present-day ether theoreticians believe that ether is just the dark matter. But they ignore a basic fact that the existence of dark matter is only displayed in the cosmoscopic system up to now, in which the moved rules of the celestial bodies are already complete departure from Newton's mechanics laws if take no account of the existence of the dark matter with the mass and gravity, while the ether exists in the cosmoscopic system as well as in the macroscopic world, and yet the moved rules of the planets in the solar system are in full compliance with Newton's laws without considering the role of dark matter, which is computed by somebody that the dark matter mass in solar system is much larger than the mass of the sun and the planets. Where is the gravitational interactions of dark matter in solar system? Actually, the ether, which is the physical vacuum without the mass, is nothing to do with the dark matter with mass.

In short, the problem of dark matter originates from the "mass discrepancy" phenomenon of the cosmoscopic system. Its essence is that in the cosmoscopic system, Newton's laws of mechanics is not sufficient to explain the motion state of conventional matter. In this regard, if the Newtonian laws is still effective, we must recognize the presence of a large number of unconventional dark matter, which is the mainstream view of contemporary physics. thinking that the Newtonian laws of mechanics have limitations, it should be appropriately amended in the cosmoscopic system in order to avoid the introduction of the dark matter, which is the basic idea of alternative theory of dark matter.

As early as in 1830s, British astronomer H. Jeans has pointed out that the gravity-distance relation of gravitational law should be amended in the galaxy system. In 1963, A. Finzi in University of Rome proposed another modification program on the gravitational law. Israeli physicist M. Milgrom pointed out that these two above modification of gravity-distance relation can not reproduce the observed results. He proposed a Modified Newtonian Dynamics in 1983 (MOND Theory)[2]. Here, he introduces a constant a_0. When the gravitational acceleration is much greater than a_0, Newton's second law applies as usual: the gravitation is proportional to acceleration. But when the gravitational acceleration is small compared with a_0, Newton's second law is altered: force becomes proportional to the square of the acceleration. This modified theory can well reproduce the observed data. For example, the orbital velocities in the spiral galaxy, instead of declining with increasing distance from the galactic center, flatten out to a constant value, this constant velocity is proportional to the fourth root of the galactic mass. In this regard, it is better than the dark matter theory. Therefore, it is seen as the most successful alternative to the dark matter theory. However, this modified theory lacks of fundamental theoretical basis. It is just a "phenomenological theory" that in ord to explain the observed data. Moreover, it can not describe well the "mass discrepancy" of the rich cluster of galaxies, and it can not explain the phenomenon of gravitational lensing. It can be seen that the modified theory is less than ideal.

Is there an fundamental theory without the help of dark matter? This is possible.

8.2 The gravitational field is not a cosmic field

Both of dark matter and MOND theories have some shortcomings, and have a common point of regarding the gravitational field as the cosmic field which can dominate whole universe. There are obvious character of interval action for known basic fields: the color field as the strong interaction is mainly functioning within atomic nucleus or hadron; the electromagnetic field is possessed of leading position in atomic system; only in solar system can the gravitational field be the dominator. How can we think that gravitational field is able to monopolize the whole cosmos, since it can not function obviously in microscopic system? Microscopic, macroscopic and cosmoscopic were stipulated artificially. Let us make an assumption: there were a special knowledgeable creatures on electron, they can call "macroscopic" for our microscopic, and call "cosmoscopic" for our macroscopic, if our macroscopic gravitational field is cosmic field, then their "macroscopic field" (electric field) can be equal to their "cosmoscopic field" (gravitational field) too, but it does not establish, so gravitational field is not cosmic field, but only a macroscopic field, there is cosmoscopic field which is different from gravitational field in the cosmoscopic system. In fact, the gravitational field intensity corresponds to the ether density gradient, which means that gravity is a attribution of ether continuity, it will tend to disappear when the ether density decrease to a certain extent and the ether loses continuity. Therefore, gravitational field is not cosmic field, but a macroscopic field, there is cosmoscopic field which is different from gravitational field in the cosmoscopic system. The mass discrepancy is the reflection there is interaction of cosmoscopic field, and is without so-called "dark matter".

8.3 Interactive theory of cosmoscopic field

Cosmoscopic world, the measuring unit of space is one hundred thousand or one billion light year; its distance is fixed with "standard candlepower" its luminosity is indicated by velocity dispersion of spectral lines; its age is estimated by Hubble law and its mass is calculated by mass-luminosity relation and virial theorem. However, These methods bring relative larger error. Therefore it is enough accurate to use the Newton's law to describe the cosmoscopic world. The Newton's law is also have the advantage of simplicity and clarification. Then we attempt to describe it according to the classic law.

8.3.1 Basic hypotheses of the cosmoscopic field

The force in electric field, magnetic field and gravitational field has the same equation to express: $F = f\frac{m_1 m_2}{r^2}$. f is a constant, m_1、m_2 represent respectively the value of two electric charges in the electric field; the two mass or gravitational charges in the gravitational field, etc.. In terms of the cosmoscopic force, it has the same expressional form as well.

Hypothesis 1: The cosmoscopic force F between two cosmoscopic charges u_1 and u_2 is

$$F = H\frac{u_1 u_2}{r^2} \qquad (8.1)$$

H is a constant of cosmoscopic force; r is the distance between their centers of cosmoscopic charges.

Then, how to define the value of cosmoscopic charge? We all know that electrics and mass are the property of object, it is proper to discuss the cosmoscopic charge through investigating materiality of celestial bodies as well. On the other hand, one of the characteristics of cosmoscopic force is that within a certain range the more the space is, the more obvious the cosmoscopic force is, which indicates that cosmoscopic charge has the property of space extensive. Though mass has no such property, object is surrounded with gravitational potential (ether density), intensity of gravitational field is the gradient of gravitational potential. It was mentioned above that in the quantum theory, field intensity is underdetermined, potential is overdetermined, therefore, potential is a reality that is more foundational than field. Similarly, then gravitational potential is more substantive than gravitational field, and the cosmoscopic charge should has something to do with the gravitational potential. Therefore, we propose the another hypothesis below according to some observational data.

Hypothesis 2: The heavenly body' cosmoscopic charge u has relation to gravitational potential $\frac{m}{r}$ within effective radius L

$$u = p\sqrt{\iiint_{\Omega}\frac{m}{r}\,d\nu} = \sqrt{p2\pi \quad \hat{m}} \qquad 0 < r \leqslant \mathrm{L} \qquad (8.2)$$

p is a constant; m is the mass of the heavenly body; r is the distance away from the center of mass, Ω is the volume of the sphere with radius r; c is a negative constant of cosmoscopic effect, it can be omitted when the r is quite big; the effective radius of cosmoscopic charge distribution $L = b\sqrt{m+h}$, b and h are constants; the u does not vary

with r when $r > L$.

Cosmoscopic field is an active field. When the distribution of cosmoscopic charges are spherically symmetric, the intensity of field could be obtained by the result of calculation like in the electric field: make a sphere to take the mass center of celestial body as the spherical center with r as the radius, and assume that all the cosmoscopic charges within the sphere (effective cosmoscopic charges) are in the center of the sphere, then we can calculate the cosmoscopic field intensity that is r far away from the mass center without thinking about the effect of cosmoscopic charge outside the sphere.

In order to judge these two hypothesis above, it is necessary to compare the calculation with the observation data. The relevant analysis are given in the next section.

8.3.2 Some analyses of cosmoscopic field

According to the second hypothesis, in the Cosmoscopic system, c can be negligible, effective cosmoscopic charge is following:

$$\begin{cases} u = pr\sqrt{2\pi m} \cdots\cdots\cdots\cdots r < L \\ u = pb\sqrt{2\pi \left(m m+ h\right)} \cdots\cdots r > L \end{cases} \qquad (8.3)$$

Applying hypothesis 1, the cosmoscopic forces have three circumstance between two heavenly bodies with mass m_1 and m_2 (the effective radius, m_1 is L_1, m_2 is L_2), they can be shown that

a, $F = H\dfrac{u_1 u_2}{r^2} = 2\pi p^2 H\sqrt{m_1 m_2}$, $\qquad r < L_1, r < L_2 \qquad (8.4)$

The F is irrelative to r.

b, $F = \dfrac{2\pi H p^2 b\sqrt{m_1 m_2\left(m_2 + h\right)}}{r}$, $\qquad L_1 > r > L_2 \qquad (8.5)$

The F is inversely proportional to r.

c, $F = \dfrac{2\pi H p^2 b^2\sqrt{m_1\left(m_1 + h\right)m_2\left(m_2 + h\right)}}{r^2}$, $\quad r > L_1, r > L_2 \qquad (8.6)$

The F is inversely proportional to r^2.

In the periphery of the galaxy, substance does circular motion around it. In this circumstance, we could assume that these outer substance is within the effective radius of cosmoscopic charge distribution of the galaxy, while mass center of the galaxy is not within the effective radius of cosmoscopic charge distribution of outer substance, and the h may be omitted because the mass of the body is quite large in cosmoscopic system. Eq. (8.5) is applied here. Then, centripetal acceleration of outer substance should be the sum of gravitational acceleration and cosmoscopic force acceleration:

$$a = \frac{v^2}{r} = a_1 + a_2 = \frac{Gm}{r^2} + \frac{k\sqrt{m}}{r} \tag{8.7}$$

Where $k = 2\pi Hp^2 b$, v is the orbital velocity of the body; m is the effective mass of the galaxy, thence

$$v = \sqrt{k\sqrt{m} + \frac{Gm}{r}} \tag{8.8}$$

Thus the velocity v will tend to a fixed value $\sqrt{k\sqrt{m}}$ when the r is sufficient large, which is in congruity with discovery by Rubin and others.

When the orbital velocity is $\sqrt{k\sqrt{m}}$, the square of centripetal acceleration is:

$$a^2 = \frac{v^4}{r^2} = \frac{k^2 m}{r^2} = q\frac{Gm}{r^2} \qquad \left(q = \frac{k^2}{G}\right) \tag{8.9}$$

Eq. (8.9) shows the result of the MOND theory and observations: the gravitation is directly proportional to a^2, and the v^4 is directly proportional to the m. In our point of view, MOND theory is based on a kind of approximate situation: periphery substance is within the effective radius of cosmoscopic charge distribution of galaxy, while mass center of galaxy is outside of effective radius of cosmoscopic charge distribution of periphery substance, and the power of cosmoscopic field is much larger than that of gravitational field, so that the gravitational interaction can be omitted.

Originally, people thought that the acceleration of celestial bodies refers to gravitational acceleration; Now, acceleration of celestial bodies is the sum of gravitational and cosmoscopic acceleration, which means that mass of celestial bodies used to be calculated by gravitation law is

not pure mass of gravitation, and it also includes “cosmoscopic mass” caused by cosmoscopic force. Suppose mass of one body is M, this mass includes gravitational mass m and cosmoscopic mass m', M= $m+m'$. The gravitational acceleration of celestial bodies used to be calculated through the equation $a=\frac{G(m+m')}{r^2}$, now it should be replaced by $a=\frac{Gm}{r^2}+\frac{k\sqrt{m}}{r}$, these two equations produce following another equation:

$$m'=\frac{kr\sqrt{m}}{G} \qquad (8.10)$$

Portion of cosmoscopic mass m' is just so-called “dark matter”. From equation(8.10), we know that cosmoscopic mass m' is proportional to r, which means the farther the distance between celestial body and mass center of galaxy is, the more the dark matter calculated by Newton’s law is and it is increasing continuously from within to without. In addition, people will get different values of mass of galaxy when they do calculation by using the celestial body inside of galaxy and that of outside of galaxy. In this circumstance, we usually do not doubt about the former value and believe that the latter value is influenced by the dark matter. Then we believe the former m' is equal to m ,and the latter m' is considered as mass of “dark matter”, which is the reason produced illusion that dark matter is distributed outside of galaxy.

The following content is about the estimable calculation of some quantity of the Galaxy.(all the MKS system of units)

It is known that mass of Milky Way includes cosmoscopic mass, which is pretty larger than its gravitational mass. We assume that gravitational mass is m =4×10^{40}, $\sqrt{k\sqrt{m}}$ =2×10^{5}, then $k\approx2\times10^{-10}$. Then, suppose there is a celestial body about 50 thousand light year far away from the center of Milky Way, the ration of gravitational acceleration and cosmoscopic force acceleration of this celestial body is : $\frac{Gm}{r^2}:\frac{k\sqrt{m}}{r}\approx1:7.089$, meaning in this position, gravitational force is less than 1/7 of cosmoscopic force.

Let $\frac{G}{b^2}=10^{-12}$, then, $b\approx8.1686$, therefore, $L_{太阳}=b\sqrt{m}\approx 1.2$ light year; $L_{银河}$

$\approx 1.2\times 10^5$ light year, which is three times longer than the radius of Milky Way. This seems to indicate that gravitation is no longer useful when we think about interaction among galaxies.

Furthermore, MOND theory could not correctly explain the movement related to gravitational lens; Our theory could explain it: photon is a kind of particle whose mass is dynamic, it also has gravitational potential, meaning it has cosmoscopic charge to engage the interaction of cosmoscopic field. Therefore, light bends in gravitational field as well as in cosmoscopic field, and cause lens phenomenon. The cosmoscopic force in galaxy is much larger than gravitational force, in other words, the "gravitational lens" phenomenon, in fact, is mainly the "cosmoscopic force lens" phenomenon.

8.3.3 Explanation four anomalies in astrometry

In modern astrometry, there are four abnormal phenomenon discovered successively, which have not been explained correctly so far[4]. The interactive theory of cosmoscopic field has the possibility to give a reasonable explanation.

We have mentioned above that mass of celestial body calculated by gravitational law is not pure gravitational mass and it also includes "Cosmoscopic mass" caused by Cosmoscopic force, which will be basic cause that creates four abnormal phenomenon.

8.3.3.1 Pioneer anomaly

in 1970s, America launched two spacecraft flying across solar system and toward almost opposite direction, named Pioneer 10 and Pioneer 11. During the period of time of sending back signals, they flew for dozens of Astronomical units. There was always a anomalous acceleration that was acting on them with a magnitude $a = 8.74\times 10^{-10}\mathrm{m/s^2}$, directed towards the sun. There was no other explanation to this abnormal phenomenon except that it was caused by system error. To the interactive theory of cosmoscopic field, it is quite simple to explain: It is caused by cosmoscopic force which is constant and irrelevant with distance when sun and spacecraft are both within their effective radius. Furthermore, we all know that mass of the sun is measured in earth. This mass also include cosmoscopic mass in fact, and thus, there would be no abnormal phenomenon discovered when spacecraft is flying near earth's orbit; once the spacecraft is flying

far away from earth's orbit, abnormality seems to be obvious. Meanwhile, it indicates here the constant h to be the larger.

8.3.3.2 The increase of orbital eccentricity of the moon

In the year 2006, William first pointed out that orbital eccentricity of moon is increasing with the time passing by. Later, many people proved it though verification to ensure the existence of this phenomenon. It really becomes a challenge to Physical basic principal. In the interactive theory of cosmoscopic field point of view, this phenomenon is possible: In the past, people thought that the moon orbit was completely decided by gravitational force, and mass of moon was purely gravitational mass; As a matter of fact, the interaction of cosmoscopic field also contributes a little to the moon orbit, thus generally the mass of moon thought by us includes cosmoscopic mass; Gravitational force between objects is inversely proportional to square of distance, while according to (2), cosmoscopic force, as a constant, is irrelevant to distance. Therefore, it is sure some error in the moon orbit calculated by Newtonian gravitational law. Though this error is fairly small, it will cause the phenomenon of increase of orbital eccentricity with the accumulation of time.

8.3.3.3 The long term increase of astronomical unit

From the year 2005, people have been discovering that astronomical unit has been increasing, which puzzled scientists. The interactive theory of cosmoscopic field point of view, the reason of this phenomenon is the same as the increase of orbital eccentricity of moon. The movement of earth's circulation around the sun primarily depends on gravitational interaction, in which there is the interaction of cosmoscopic field because the mass of sun, actually, including "cosmoscopic mass". There is a certain difference between gravitational and cosmoscopic force interactions, so it is for sure to have some errors in the calculation of astronomical unit only using Newtonian gravitational law. With the accumulation of time, this error evolves to long term increase of astronomical unit.

8.3.3.4 Earth flyby anomaly

The measurements of several spacecraft has shown that the energy of spacecraft's orbit had

abnormally increase with geocentric reference system when it went a the earth flyby. From our point of view, it is also the result of the interaction of cosmoscopic field: People tend to use Newton's gravitational law to ensure mass of objects. Mass of spacecraft and earth is obtained according to gravitation on the surface of earth; while other celestial bodies' mass is ensured by distant orbit movement. Because cosmoscopic mass is just proportional to distance between two objects, mass of spacecraft and earth are more pure gravitational mass while other celestial bodies include more cosmoscopic mass. it is more correct to calculate by gravitational law when the spacecraft is only acted by sun and other planets, because here it actually includes the function of cosmoscopic field. When the spacecraft went a the earth flyby, people can regard it as the movement just under the function of gravitation, in regardless of cosmoscopic field. Thus, it appears the abnormal incidental increase of energy.

8.4 Discussion

The analysis above indicates that "mass discrepancy" phenomenon is the evidence of the existence of cosmoscopic field. The cosmoscopic force has the similar classic expressional method with gravitational, electric or magnetic forces and so on. The cosmoscopic charge is closely related to gravitational potential. One of its characteristics is that its distribution has definite effective radius.

The cosmoscopic force between two celestial bodies is divided into three situation: a, b and c. That means the cosmoscopic force can vary jumpily with the distance between two bodies, which would cause particular effect to the forming of galactic nuclei or stellar clusters. It is possible to examine it through theoretical analysis and astronomical observation. Of course, this jumping shows that our theory is rudimental, approximate and the actual curve of change should be smooth.

The interactive theory of cosmoscopic field is the initial plan of a new substitutive theory of dark matter. It remains to be amended and supplemented further. For example, the theory needs new observation data and theoretical analysis to ensure the value of H , p , c , b , h , L , as well as pure gravitational mass of celestial bodies, etc.. It is identical with MOND theory that the interactive theory of cosmoscopic field is a theory based on the observation data, thus some

conclusion drawn from the theory is in congruity with observation data, which is not enough to prove that it is true. However, it not only includes the MOND theory, but also explains the phenomena beyond MOND's ken, and yet can explain the four astrometric anomalies in solar system, which shows that it is reasonable.

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Chapter 9 Smarandache geometrical model of cosmos

As mentioned earlier, the macroscopic ether composes the gravitational field, cosmoscopic field and causes the relativistic phenomena; while microscopic etherons could be excited into virtual photon or virtual gluon, and thus electromagnetic or color field appear; the virtual photon or virtual gluon could further be split into leptons or quarks to compose various objects, so that the ether is indeed the origin of things in our known world. However, the material world is always unified as well as not uniform and so-called "the origin of things" is only relative to a local physical world generally. For example, any organism is made up of cells, therefore, cells were "the origin of things" in biology field; But biology represented only a portion of material world. Further research made people to discover that all organic and inorganic substances made of atoms, so that atoms would be considered to be "the origin of things"; However, it was only a short phase of human understanding history; After that, people gradually understood that leptons and quarks should be "the origin of things"; Now, we have understood that ether is "source of all things" of known material phenomena, or all objects and field phenomena. Similarly, what we have known so far about the material world could not be treated as the whole things in the universe as well. There will be more comprehensive material world for us to discover.

9.1 The historical track of cosmology

Our species have always attached to thinking about the universe：how the universe created, what is its structure, and how it was evolved?

There were a large number of myths about cosmic creation in ancients, where there was a known Chinese story "Pan Gu Separates the Sky from the Earth". In this story, the cosmos began as a giant egg. the giant slept inside the egg for thousands of years before he awoke and broke free,shattering the egg in the process. Some parts of the egg (the lighter and purer bits) rose up to form the heavens while the heavier, impure parts formed the earth. Pan Gu held up the heavens with his hands while his feet rested on the earth. As the heavens drifted higher, the giant grew taller to keep them in contact with the earth. Eventually, Pan Gu died, but his left eye became the sun, his right eye the moon. His sweat became the rain, his hair the plants of the earth, and his bones the rocks[1].

On the structure and evolution of universe, peoples were only to reasonable description for visible things between heavens and earth at the very start, then tried to establish calculable mathematical models. Aristotle believed that the stars are moving with the ideal circular motion around the earth. Ptolemy, in second century, further proposed a mathematical model according with observed data at that time.

In sixteenth century, Nicolaus Copernicus succeeded in displacing the earth from the cosmic center so that it promoted the development of cosmology silenced 14th century. Johannes Kepler replaced Aristotle's divine circular orbits with ellipses further.

The next great development on the road to modern cosmological thinking was the arrival on the scene of Isaac Newton. According to the mechanical system established by him, the universe is like a giant machine and can operate regularly and eternally.

Entering 20th century, astronomical observation and physical theory advanced rapidly and drove the cosmological unprecedented development. With the expansion of the scope of astronomical observations, people discovered the phenomena that stars are gathered into a group generally: the planets move around the sun into a solar system; out of count solar systems form a galaxy; many galaxies compose a cluster of galaxies and so on. Then Swedish astronomer Charles Charliar proposed a "hierarchical model of the universe", which describes the universe as a the Russian dolls that one includes other, and gather step by step into more and more structure, and is extended until infinite[2]. The hierarchical phenomena are rather general, but this model only thinks over the object structure and does not refer to the interaction of field.

It is generally considered that the general theory of relativity published by Einstein in 1915 replaces Newtonian gravitational theory, which marks the beginning of modern cosmology because it is probable that makes a mathematical expression to describe entire cosmos. Where the space and time are no longer thought of as absolute and independent of material bodies, but as participants in the evolution of the universe. Therefore what modern cosmology tells us is not the origin of the cosmos in space and time, but the origin of space and time themselves. Is it real so, or does the cosmology start from myths and return the myths at last?

9.2 The origin of cosmological problems

To understand the whole universe is human dream and ideal generation after generation. The further development of research on physics stimulates people the desire to know the universe on the whole. The high technology based on physics helps to create giant telescope with wider and wider caliber, space X-ray and infrared telescopes, the antenna array radio telescope covering large regional. All these invention benefit people from not only observing cosmic window from the infrared, visible light, to the entire band of the X-ray, gamma-ray, but also extending spatial and temporal scales to more than 10 billion light year. Nowadays, a vivid and spectacular universal picture is presented to human beings.

In 1917, Einstein published his famous paper *Inspection of the Entire Universe By General Relativity*, which created the research on universe. According to his general relativity theory, Einstein thinks the metric of any point in four-dimensional space-time continuum should be decided by material and its distribution. Due to material's uneven distribution on restrict region, space-time continuum is rather complicate. Nevertheless, judging from large range, the distribution of material and its status is uniform. Therefore, the metric is bending slowly, behaving like Spherical space. In order to make substance to have Quasi-static distribution, Einstein added a $\Lambda > 0$ add-ons in gravitational field equations. In 1927, Lemaitre from Belgium put forward prediction of Large-scale Expansion of the universe. Is the universe expanse or static? Hubble gave us an answer as seems convincing.

In 1929, Hubble got the velocity-distance relation based on the evidence of observation data of mere 24 galaxies, whose distance from earth is known to us. That is Hubble Law , $v_r=H_0r$, r is distance, v_r is the velocity galaxy posing to Milky Way, H_0 is Hubble constant. This result proves that not only the whole universe is in expansion, but also the expansion speed is proportional to the distance r, therefore it is correct to say the universe has center or has no center. Since the universe is expending, pushing the time backward, it is natural to think that the universe originated from a big-bang, which seems to be like a myth at first, however, this reasoning has the general relative theory as its theory basis and observational support from Hubble Law. Later, people gradually discovered cosmic background radiation as "Dust of big-bang" and cosmic abundances in congruity with big-bang theory, etc. Therefore, big-bang theory has been becoming a standard

model. However, modern cosmology has been possessed by the problems since its birth[3], and there were always new problems replacing old ones in its development procedure.

There exists three major problems when using big-bang Theory to discuss original universe:

First is the horizon problem. The horizon is the area of causal relation. Due to the timing restriction of effective broadcast, in early universe, it is impossible to communicate by thermal or optical signal between horizons. Therefore, the universal causal link in current universe can not be explained clearly. For example, in all-sky, the cosmic background radiation temperature is uniform until $1/10^5$ degree, which is a strong evidence to prove the existence of universal causal relation in the universe.

Second is the flatness problem, which is related to density parameter. Currently, the density parameter is approximately 1, meaning the universe is flat which requires early density parameter tend to 1 more precisely, because if the early density parameter was away from the value 1, the error would become larger dramatically, so that it would damage the flatness of universe. But if original cosmic material density was very large and the radius was very small, according to the general relative theory, the curvature should be rather large, why was it flat?

Third is the magnetic monopole problem. According to related theory, after the big-bang, the energy gradually reduces, which will cause "symmetry spontaneous breaking", and thus magnetic monopoles appear in the intersection of different horizon. Because the mass of magnetic monopoles are fairly large, about 10^{14} times than that of baryons. That is a catastrophic prediction, because since the magnetic monopoles are so many, they should have been discovered. But in reality, even one of them has not been discovered!

In order to eliminate these problems, there appeared "inflation" theory in the 80's of the 20th century, whose basic assumption is that the universe experienced an unimaginable dramatic expansion in grand unified symmetry breaking, causing volume of one horizon to expand to the whole universe known to us. As a result, the three problems above could be solved easily: Because our universe is inflated from a horizon, the horizon problem no longer exists; magnetic monopoles phenomenon become rare, which is not surprising that it has not been discovered by now; In inflation, the radius of cosmic curvature increased to about 10^{43} times, so that it does not matter how the original universe bended, it has already become flat after inflation. Then, How the deuce

so-called inflation? That is, in far less than one second, something, size of an atom, suddenly becomes a huge thing larger than the Galaxy, even in myths, it is hard to depict such a picture, is that possible? It is an even difficult problem to answer. In addition, the speed of inflation is over 10^{30} times faster than the speed of light, which is incompatible with the relativity at all. Some people thinks that the inflation is a space- time inflation, which is different from material inflation so that the speed is possible. Actually, it is sophistry, because the so-called space-time is just the ether, which is a kind of matter, not the real space.

Inflation theory predicts density parameter is 1, while the baryon matter is produced far more slowly than the speed of inflation. Therefore, the main component of universe should be non-baryon matter, namely dark matter, of which people are not aware. Most of the matter in the universe are not known to human being now. What are they after all? That becomes another great problem.

Our universe is the result of inflation of an original horizon. Does the inflation happen in other original horizon? It is probable of course. Then such a cosmology is downgraded actually into a local cosmology. Now there are many multiple cosmology, one of them is the theory of universe cell proposed by Tu Run-Sheng, who considered that a universe cell is composed of one feminine sub-cosmos (a world of negative energy) and another masculine sub-cosmos (a world of positive energy), and innumerable universe cells compose the infinite cosmos[4].

After the inflation, the universe should have reduced the speed of expansion. However, when the astronomical observation data is analyzed with modern cosmological method, it is found that the universe is still accelerating its expansion! This abnormality once again stimulated cosmologists' imagination. They think that there exist "dark energy" in the universe, and its quantity is even larger than dark matter. The cosmological constant, which had been invented and discarded by Einstein, was picked up as treasure to be the representative of dark energy. Usually energy always has some kind of relation with mass, an object with energy, it must necessarily has mass. The energy represents repulsion and the mass represents gravitation; The dark energy, however, only has the function of repulsion instead of the function of gravitation. Such a dark energy is even more mysterious than dark material. Is it possible that the dark energy exists? What on earth is it? This is another even more difficult problem!

To replace the older problem with new ones is just an expedient method, which could not be regarded as a scientific style. It is time for reflection! Then, what is the root of constant problems coming from cosmology? In order to answer this question, we should do some research in the basis of modern cosmology. The basic theory of modern cosmology is the general relativity; its experimental basis is cosmological redshift, cosmic microwave background radiation, the cosmic abundance, etc. We shall analyze these things.

The general relativity has its own limitation. Einstein himself once said: " For the large field density and the material density, field equations and the field variables in these equations would not have the true meaning…the equations can not be extended to these regions." Hawking also said: "The general relativity itself has caused its failure, because it predicted the universe that is not predictable by itself." In 1970, Penrose and Hawking proved that if the general relativity is correct, there is singular point in the space. The singular point here is the point where the field density and the material density tends to infinity. This conclusion is one of the manifestation of the restriction of the general relativity. However, people, include Einstein and Hawking, only repaired the gravitational equation, or bypassed the singular point by using quantum effect. On the whole, they described the whole universe based on general relativity.

Modern cosmology treats the mathematic model of general relativity---Riemannian space as the real curved space, considering that the universe is a limited four-dimension space without boundary. Actually, the so-called space-time bending is only a mathematic description of the uneven distribution of the ether. The real space-time does not bend. Mathematic model is the necessity for scientific theory, but mathematic model often confuses people. Standing on the frontier, the cosmologists are the elites in the scientific community, with their abundant imagination and deep command of mathematics. When their inspiration sparks, they will construct new mathematic model. After setting and adjusting several parameters, they will get some datas in accordance with actual phenomenon. Then, they tend to equal the mathematic model with actual physical mechanism, and the problems would occur follow on.

The general relativity is just a gravitational theory while the gravitational field is only a macroscopic field. However, modern cosmology considers the gravitational field as a "cosmic field", which dominates the whole universe. Thus it is not strange to produce problems based on such erring theory.

The big-bang cosmology is based on an unreliable theoretical basis; Much content of the three convincing evidences are also far-fetching. The modern cosmology theory says that the helium has been the production since the temperature was low enough after the big-bang; the cosmic microwave background radiation is the “left dust” of big-bang; cosmological redshift is Doppler redshift. However, many reasons could result in one particular phenomenon. Modern cosmology has regarded them as the only explanation so that it becomes a big mistake.

All the young planets contain the abundant helium with the same amount of density. So the modern cosmology treats these helium as the production after the big-bang. If we think in another way other than big-bang cosmology, we could conclude that the so-called young planets exist only a very short period of time compared to the infinite repetition of live and death. The helium is produced from the nuclear burning of hydrogen in the body of planets, and the density of helium is the result of infinite evolution of celestial changes. So it is no wonder that the helium in all the celestial bodies in the same phase of evolution have the same density.

The cosmic background radiation is a electromagnetic radiation full of the entire universe, its characteristic is identical with a black-body radiation of absolute temperature scale 2.725K, while the black-body radiation is a heat radiation of ideal body, namely a radiation of thermal equilibrium state, which is regarded as a product of cosmic big-bang is worth to be doubted. Any planet is constantly radiating, reflecting and absorbing the electromagnetic waves. In the space, these electromagnetic waves have been experiencing unlimited period of time. So it is natural to have formed the cosmic background radiation. It can be regarded as the macro vacuum fluctuation in the space. It seems to be like sea waves without wind in the “space sea”. This happened before, and will continue to happen in the future. However, in terms of left dust of Big Bang, it seems like a myth.

Prof. Tsco. Chang said: "The cosmic background radiation was the exploded product of compact dark stars, which included gamma ray and the afterglow of supernova, they were absorbed, emitted, reabsorbed, reemitted and so on, finally it is into the thermal equilibrium state, which is just the cosmic background radiation[5]."

As for the redshift of spectral lines, there are Doppler redshift, gravitational redshift and the redshift of energy attenuation of photon. Among them, the redshift of energy attenuation of photon does not have obvious demonstration in the macroscopic world because of the extremely fast speed

of light, but in the cosmoscopic world its function is displayed. Actually, the existence of cosmic background radiation shows that ether in the space is not completely superfluidity, which indicates that it has a little viscosity. Therefore, the light will consume energy during the long distant and long period of time. If we think in another way other than big-bang cosmology, that is to say, the universe is infinity, then redshift and blueshift of heavenly bodies caused by the Doppler effect will be equal, and the cosmological redshift will be the redshift of energy attenuation of photon other than the Doppler redshift.

Prof. Tsao Zhang considered that cosmological red shift results from the very weak interaction between photon and ether background field. He derived a equation: $\omega' = \omega(1 - H_0 t)$, which shows that the light's frequency ω' is a linear function of traveling time t, when the t tends to the H_0^{-1}, the energy of the photon decreases to the zero, or the H_0^{-1} can represent the life of photon traveling in cosmos[5.6].

Prof. Yu Benlih proved by strict mathematical inference that if a light is a genuine plane wave, then its spectrogram will appear no phenomenon of red shift, but generally the lights sent by heavenly bodies are not the plane wave, their wavelength are not constant but gradually lengthen very slowly along with the extension of the propagating distance, namely the red shift[3].

It is a big mistake to consider the cosmological redshift as the Doppler redshift. It is a key point to determine whether or not the universe is expanding and doing accelerating expanding. Eliminating this mistake, so-called the universe expansion, the dark energy, even the whole big-bang cosmology are all untenable.

Another reason for the prevalence of modern cosmology is the formal judgment of a theory. People tend to think that as long as the premise is simple and the calculation is easy, the theory is a good one. Modern cosmology uses a gravitational equation to depict the whole universe. How simple it is! Adjust the parameter such as cosmic constant or Hubble constant, etc. to present a logical explanation to the whole universe. How neat it is! However, logic is just the law of thinking, not necessarily the law of natural. The reliability of physical meaning is more important than the simplicity and logicality.

The universe is infinity. Every part of it is moving, evolving. But the universe will not be created or destroyed. It is to some extent reasonable that the cosmology is discipline about

evolution of part of universe; If it was thought that the cosmology should describe the evolution of universe on the whole, they make a mistake on the premise. It should be the religion who prefers to explain cosmic creation or destruction on the whole, not the science.

Actually, more and more scientists have been aware of absurdity of modern cosmology. For example, on 22 May, 2004, New Scientists of England published “An Open Letter to the science field” signed by 34 scientists and engineers (After it was posted on the web, there were 185 more scientists signing the web signature). This article doubted and criticized the Big Bang theory. They cogently pointed that “More important is the fact that the big bang theory never has the quantized theoretical prediction to be proved by practical observation. The claimed successes that the Big Bang defenders have made are all contributed to its catering to the results of actual observations. It is constantly adding the adjustable parameters, like what Ptolemy’s geocentric theory did.”[2] Indeed, current cosmology has three major elements: inflationary, dark matter and dark energy, which are the imaginary things like modern deferents and epicycles system.

Various assumptions occur in front of absurdity of modern cosmology. For instance, Prof. Wang Ping proposed "space-time philosophy", which believes that the universe is a entity of real and virtual space, the real space is the finite, and the virtual space is the infinite[9]. Mr.Luo Zheng-Da proposed the theory of the natural force of the universe that there exists the natural external force which contracts universe; also exists the natural repulsive force which expands universe; the interrelation and interaction between them make the cosmos filled with vitality[10].

9.3 The ether theory of interval field

It is generally known that there are four kinds of interactions, namely strong interaction, week interaction, electromagnetic interaction and gravitational interaction. However, the electro-weak unified theory means that the week interaction could be regarded as affiliation with the electromagnetic interaction, so there are three major kinds of interaction. These three kinds of interaction are corresponded to three kinds of major force field: color field, electromagnetic field and gravitational field, with the cosmoscopic field added here, there are four kinds of force field in all. It is obvious that they play role on their own special interval space (some **field interval**). If we think that the universe is infinity, then we will believe that it exists a series of interval field, which dominate their range of space respectively, or above ether is only the ether of gravitational field, it

is just one member of a series of interval field ethers. In addition, like conventional known field, the interval field is also a state of continuity distribution of a physical quantity rather than represent a basic existential matter. Therefore, just as gravitational field caused by the ether of gravitational field, the interval field is caused by the ether of respective interval field.

It seems that the Interval field ether theory juxtaposes various kinds of interval field in their materiality, actually, the gravitational field has its special position. For example, there always exists gravitational field on the coordinate system which is stationary with acceleration, whatever force like electric force, electromagnetic force to advocate the acceleration of the object. What happens to this phenomenon? The situation is that because the ancients who were living on the earth did not know appearance of other planets, they regarded the earth as the center of the universe and the sun, moon and other stars as decorations of universe; Similarly, because people are living in the gravitational field, they are not aware of existence of other fields, therefore, they unintentionally regard the gravitational field ether as the only one interval field ether, which is called **some field ether property** in our book, it means what people now possessing physical conceptions are all the conceptions of **gravitational field ether property**, or what we could understand about material phenomena are all the manifestation of gravitational field ether. The color field, electric field and cosmoscopic field mentioned in this book are all not the real interval field, they are just the representations that the gravitational field ether suffered action of other interval field. In reality, similarly, the phenomena of quantum, wave-particle duality etc.,are all the phenomena when the gravitational field ether is influenced by microscopic interval field. We can understand the relationship between interval field ethers in this way: The intervals among ether particles are replete with continuous distributed microscopic interval field ether and so on.

There was one question which had puzzled people: Why substances phenomenon is so clear and intuitive at the macroscopic world, while at the microscopic and cosmoscopic systems the situation is totally different, where there are much phenomena such as wave-particle duality, the uncertainty principle and Quasars etc. Is this because the nature is good to people? Now, we have answer to this question: the particular phenomena in microscopic and cosmoscopic systems are caused by the interaction among interval fields, which means people are able to use gravitational field ether property to describe substance phenomenon in an adjoined field interval. Obviously, the farther away from local field interval this method of describing reaches, the more distorted material

form described, and finally this distortion tends to a limit. It is also easy to understand from the essential of quantitative description of gravitational field ether theory: our knowledges are all the gravitational field ether property so as to possess the gravitational field ether with spacial position. the light as ether's wave, whose velocity is a limit speed, is invariable in a vacuum. This fact become a basis for the space-time theory of quantitative description of gravitational field ether property, namely relativistic space-time theory. Here, the standard of time and length is decided by the gravitational field ether density, which is the interval among etheron. Therefore, the gauge bosons (etheron etc.) as a "molecular" of gravitational field ether, whose size can not be determined, thus the even smaller fermions composing the bosons can only be considered as point particle. However, if we observe them with the perspective of micro interval field ether, they are not point particles, they have the interior structure and can be divided. Therefore, if we string these "objects" together, this a serial of generalized objects will be infinite.

Here physicist D. Brown's idea about "explicate order and implicate order"[11] can be explained and extended: in microscopic world, explicate order is composed of various physical particles, electromagnetic field and color field etc which are familiar to us, while the implicate order, a interaction of microscopic interval field, which is difficult to be sensed directly by us, and always leads micro-particles with imaginary wave form, and thus resulting in some property such as wave-particle duality and quantum. Similarly, in the cosmoscopic system, as the explicate order, the celestial bodies are sure to be acted by implicate order caused by cosmoscopic interval field. Many particular phenomenon such as cosmological redshift and Quasars phenomenon can be regarded as the results of it.

The relativistic space-time theory is a space-time theory of quantitative description of gravitational field ether property. When people describe the microscopic system with the gravitational field ether property, the special relationship caused by microscopic implicate order should use quantum mechanics to deal. The quantum mechanics cooperated with the relativity could describe microscopic phenomenon quite well. Similarly, cosmoscopic implicate order would cause some quantitative relationship which is hard to understand intuitively in cosmoscopic system. Therefore, we believe in gravitational field ether property, that just as the quantum mechanics is used with relativity to make quantitative description in the microscopic system, it is also necessary

to establish a special “cosmoscopic mechanics system” to cooperate with relativity to reveal the puzzles of the cosmoscopic system.

For the sake of clarity, some related intervals are named as follow: shown as figure 9.1, the interval of gravitational field is macroscopic interval; the interval which is larger than macroscopic interval and could be described by gravitational field ether property is called cosmoscopic interval; the interval which is less than macroscopic interval, but could be described by gravitational field ether property, is called microscopic interval; The super-cosmoscopic interval is larger than cosmoscopic interval and the super-microscopic interval is even less than microscopic interval. The super-cosmoscopic and super-microscopic intervals is unknown to people currently.

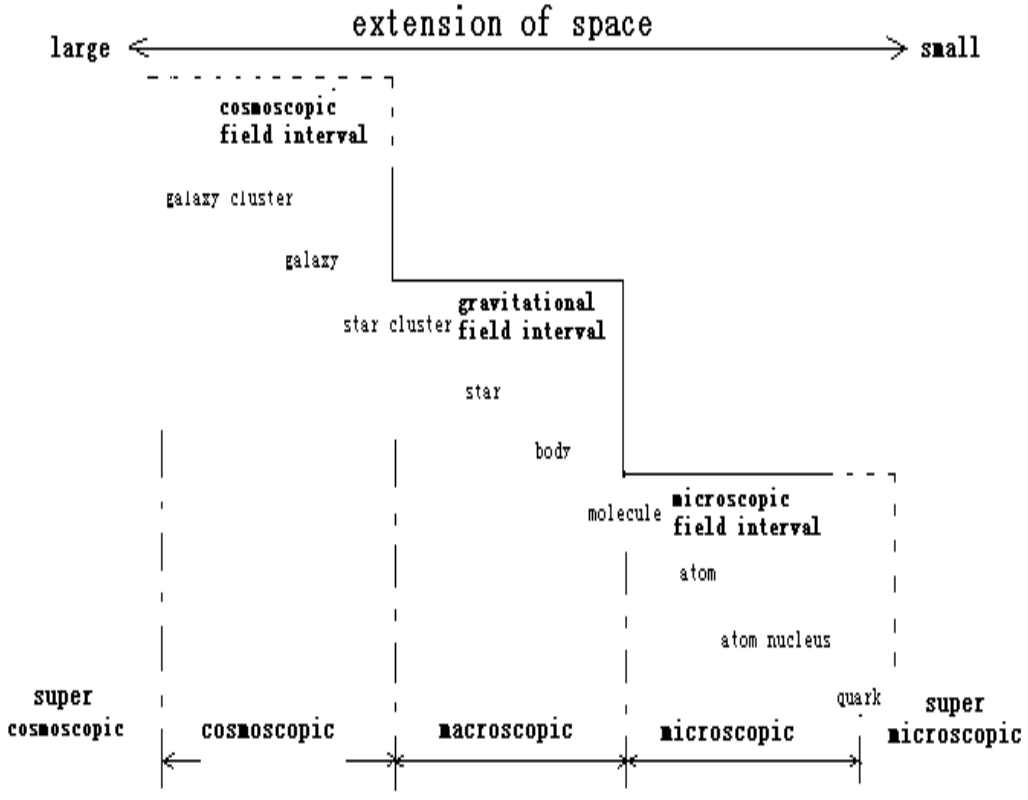

Figure 9.1 The sketch map of relationship between the object and filed ether layers

The Figure 9.1 could be regarded as the profile along a radius OP in Figure 9.2

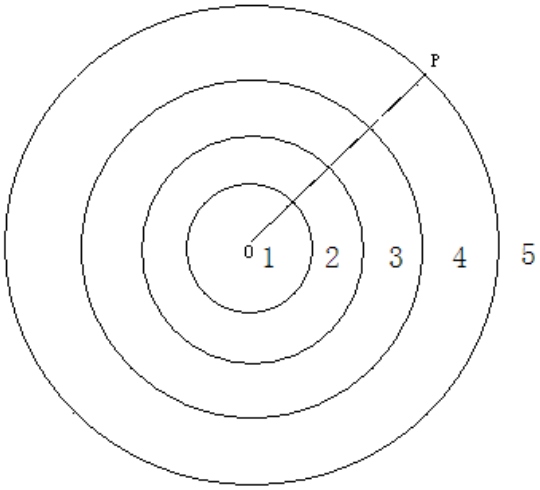

Figure 9.2 The cosmic space interval: 1 super-microscopic interval; 2 microscopic interval; 3 macroscopic interval; 4 comoscopic interval; 5 super-cosmoscopic interval.

Different interval field ether property, whose separate material basis is different, there would be different vacuum theory, object theory and quantitative space-time theory respectively. What we think as particle (for example photon) is not necessarily correspondent to object in microscopic interval field ether property and the electron image we know is totally different from that in microscopic interval field Ether property; The quasar, which is very peculiar to us , is possible to be very ordinary phenomenon in cosmoscopic interval field ether property.

Gravitational field ether leads to the relativistic space-time theory. In Chapter Three, we use a semi-ellipse to represent Smarandache geometry of relativistic space-time in macroscopic physics (Figure 3.3). The interval field ether leads to respectively independent space-time of physics. Therefore, each of the space-time of interval field ether property can be represented by a semi-ellipse, thus the physical space-time of whole universe can be represented by a series of semi-ellipse, such as A、B、C. Moreover, the microscopic space is effected by both the gravitational field ether and microscopic interval field ether, similarly the cosmoscopic space is also effected by both gravitational field ether and cosmoscopic interval field ether, all these indicates that the series of semi-ellipse should be interlaced partly with each other one by one. This is the Smarandache geometry of interval field ether theory, as shown in Figure 9.3.

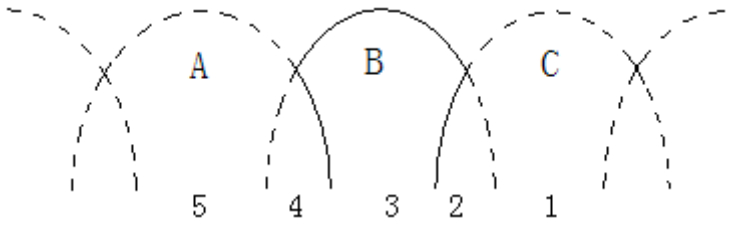

Figure 9.3 The Smarandache geometry of interval field ether theory, the meaning of 1,2,3,4,5 is the same of that of figure 9.2; A is the Smarandache geometry of Cosmoscopic field ether interval; B is the Smatandache geometry of gravitational field ether interval; C is the Smarandache geometry of microscopic field Ether interval; Microscopic interval 2=C∩B; Cosmo interval 4=B∩A etc.

9.4 Smarandache geometry model of hierarchical and Infinite order universe

We have mentioned earlier that if we string these generalized objects together in all interval field object, it would form a infinite serial of generalized objects, which is called the "first-order hierarchy model of the universe".

The contradictory universality also decides the variety of existent form of matter. In this book, we believe that not only the existent form of matter, but its basic existent form such as object and interval field ether are all infinite. Interval field ether is the basic existent form matter which is higher by one order than that of the object. There will be basic existent form matter which are higher by one order, two order, until infinite order than interval field ether. The basic existential form of matter above interval field ether are all vacuum state maters, therefore the physical vacuum is a material existent form which is more abundant and extensive than object.

The assumption above makes us have a general material structure about the whole cosmic: The generalized object forms a infinite series; the interval field ether divides this series into countless field intervals with different property; this infinite field ether series can be divided further into material layer of more higher order. The division could be done again until infinity. As for this cosmic substantial structure, it is called "Cosmic model of hierarchical and Infinite order ".

The cosmic model of one order hierarchical is the object distribution model of universe, while the cosmic model of two order hierarchical shows the space-time structure of interval field ether theory, whose SmarandacheIn geometry is shown in Figure 9.3, the whole universal physical space-time is infinite order hierarchical Smarandache geometry, as shown in Figure 9.4.

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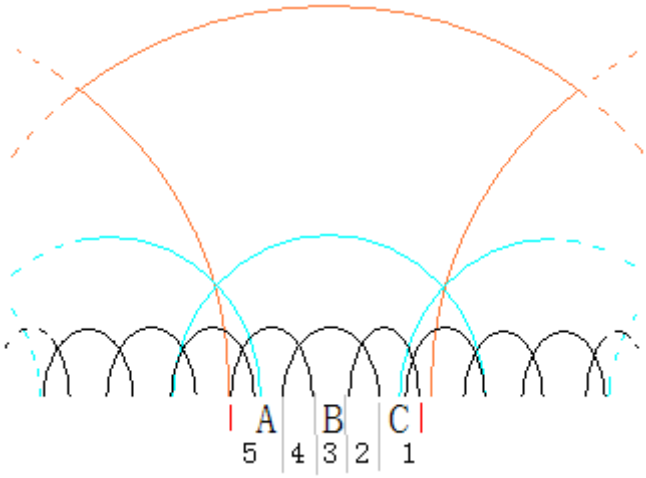

Figure 9.4 The cosmic Smarandache geometry model of infinite order hierarchical, the meaning of 1,2,3,4,5 and A,B,C are the same as in Figure 9.2 and 9.3; The black series is the layer of interval field ether; The green series is the material layer which is higher by one order than interval field ether; The brown series is the material layer which is higher by two order than interval field ether; etc.

In local material world, there generally exists “multiple hierarchical” phenomenon. Take the plants for example, in the long period time of evolution, thousands of species have been formed in the world. They could be characterized as genus ; Follow “genus”, they are divided as “order”, ”class” and “phylum” etc. These “species”, “genus”, “order”, “class” and “phylum” represent some basic characteristic of plants. The local world is finite, but the universe is infinite, and the material structure of the whole world is certainly “infinite order hierarchical”. Among the infinite order material layer, except the first order material layer, the rest are all the vacuum state matter. How mysterious and profound the vacuum is!

The past mainstream cosmologies always regard some material form as the cosmic nucleus, and thus we can conclude them as “the center cosmic theory”. Aristotle’s point of view is “geocentric theory”; Copernicus’s is “heliocentric theory”; The hierarchical cosmology is the center theory of object ; The cosmology based on Newton’s law or general relativity is a center theory of gravitational field, etc. They have the common flaws that each of them is only just one-side of the whole picture. Each partial material world will move and evolve endlessly, but the all-inclusive world is impossible to be created or destroyed on the whole.

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真空、时空、物质和 Smarandache 几何模型

胡昌伟

在本书中，如果中、英文的意思有差异，以中文为准。

献给我的外婆张玉莲

是她给了我第二次生命和幸福的童年

目　　录

出版前对本书的评论

在此之前，人们多从微观的量子场的角度对物理真空进行探讨。本书作者把物理真空称为以太，他不但描述了以太与粒子之间的相互联系和相互转化；也阐述了以太的宏观效应和宇观作用，为现代以太论奠定了一个基础。尤其可贵的是，他指出，是以太造就了物理学的定量描述的时空观。他还运用了 Smarandache 的有关概念和方法，描述了相对论性空间乃至整个宇宙的 Smarandache 几何模型。这些是开创性的和有益的探索，值得我们去阅读与推介。

——吴水清教授， 前“现代物理知识”主编

在洛伦兹变换的流体力学导出的基础上，胡昌伟经过分析后认为：牛顿的绝对时空观，是最基本的时空观，在这里，物理真空是一种可压缩的超流体，它的密度的变化，会引起现实的时空标准的变化，从而导致了偏离绝对时空观的定量效应。相对论性和量子性效应都是定量效应；相对论和量子物理学的时空是被定量效应所“扭曲”的时空。对于这样的描述，他称之为“带着定量效应回归经典”。这一说法既有趣，也很有意义。

——胡素辉教授，原“中国科学”与“科学通报”的特邀编辑

有人认为，真空里存在以太或超光速是不可能的，因为这将破坏真空的洛伦兹不变性。胡昌伟则指出：这样的看法是本末倒置了，因为，以太是相对论的物质基础。他指出，相对论是以光和光速不变作为时空衡量工具的一种定量描述理论，它把现实的，由以太引起的时空标准的变化，当作了时空本身的变化，这只是一种可行的数学模型。既然，相对论把光作为时空的衡量工具，它显然描述不了超光速。这些看法应该引起重视。

——杨文熊教授，上海交通大学

序　　言

在物理学中，许多基本概念仍旧未得到解决：

什么是时间？它纯粹是相对的吗？

什么是真空？它是指“空的空间”，还是指空间中的介质呢？

什么是质量？它能否被创建出来？

我相信，物理学家们对上述问题没有得到明确的答案。

牛顿说过：真理就像大海一样，我不过就象是一个在海边玩耍的小孩，不时发现一块异常光滑的卵石，而对于展现在我面前的浩瀚的真理海洋，我却全然无知。牛顿的这段话，不仅是他的谦虚，也是客观事实。

举例来说，人们仍然不知道在物理学中时间的明确的定义是什么。

由于受到相对论的影响，人们过分地批评牛顿的绝对时间的观点，从而忽视了其中正确的精华。其实，绝对时间是各种物质运动的相对时间的科学的抽象和提升。在牛顿的绝对时间的表述中，正确的内容是：

1. 绝对时间具有客观性，与个人的感觉无关；

2. 绝对时间具有单向性，历史不可能倒演；

3. 绝对时间均匀地流逝着，与个别物体的运动状态无关。

例如，相对论的先驱者洛仑兹认为，除了相对论时间外，还应该存在一种“真实”的时间（True Time）。作为洛仑兹时间观的表述，一种推广伽利略变换的时间，它对应于宇宙的格林尼治时间。当采用这种时间定义时，同时性是绝对的，其时间箭头都是正向的，超光速运动也不会引起时间的倒演。

所以，出现超光速时，仅仅说明狭义相对论定义的相对时间不再有效，可是并不会破坏因果律。

物理学应该确定一条定理：“时间机器”是不可能的。

关于“真空”，大多数物理学家认为它是特殊的介质，而不是虚空。

由于“真空”这个术语很容易被人误解为虚空，为了避免混淆，我们主张最好是引进术语“以太场”以取代术语“真空”。

胡昌伟先生研究“以太场”这个主题已经有 30 多年。在胡昌伟的研究论文以及本书中，他在伽利略变换的基础上，通过一个流体力学的代换，简单地导出了洛伦兹变换。这表明，

“以太场”是一种可压缩的超流体;“以太场”的密度对应于引力势;“以太场”密度的变化导致了时空几何结构的变化。因此,“以太场”是相对论的物质基础。

胡先生也把 Dr. Florentin Smarandache 的一些概念，如 Smarandache 重空间、Smarandache 几何，应用到基本物理学和宇宙学。这在时空物理学的研究上是一个尝试。

物理学是一门发展中的科学。胡昌伟先生对物理现象的新探索，值得引起人们的关注。

张操（美籍物理学家）

2012 年元月

特殊名词说明

1、**以太：**一种真空态的物质，即物理真空，它本身无所谓质量，是它的密度的不均匀分布造就了相对论性质量。

2、**以太子：**最小或最基本的以太流体质点。

3、**元气：**中国古代对真空态物质的称呼。

4、**实物：**有质量的物质，以太密度波包的核心。

5、**绝对描述：**是以绝对时空观为基础的物理描述，即牛顿描述。

6、**定量描述：**以实验数据为基础的物理描述。因为现实的衡量时空的标准工具或多或少地会随着环境而变化，因此，它与绝对描述之间会有一定的差异。

7、**定量效应：**由绝对描述和定量描述之间的差异造成的效应，或者说，由现实的时空标准的可变性造成的效应。

8、**Smarandache 否定公理：**一个公理在同一空间中同时表现出成立或不成立，或至少以两种以上方式表现不成立，这个公理就被称之为 Smarandache 否定公理。

9、**Smarandache 几何：**至少含有一个 Smarandache 否定公理的几何被称为 Smarandache 几何。

10、**宇观：**星系和星系团的空间区域，它比宏观大一级，正如宏观比微观大一级一样。

11、**区间场以太：**比实物高一阶的一系列基本存在形式的物质，它们在各自的场区间里存在，并起主导作用。

作者前言

本书探讨的是有关物理学基本理论方面的一系列问题。不过，作者不是专业的物理学工作者，这有弱势，也有优势。

弱势是相当明显的。在本书中，尤其是第六章以后，数学模型欠缺，许多问题没有深入展开，有的还只是一些思辩性的设想。因此，本书不是成熟或完美的。中国有句成语：抛砖引玉，作者就是将本书作为一块砖抛出，希望能引起对有关问题的进一步探讨，从而促进对新的科学宝玉的发掘。

至于优势，那是潜在的。古诗云：“不识庐山真面目，只缘身在此山中。”物理学家们深入一个个具体的物理细节，身处数学符号的海洋之中，难免会眼花缭乱，并往往把数学模型当作了客观真相。比如，物理学家认为，引力场里的时空弯曲了。这在我们看来只是真空态物质分布不均匀的一种数学描述，真正的时空不会弯曲。另外，人人都会有某种偏见，科学家也不例外。一种新的理论往往需要冲破各种各样偏见的层层阻绕，才能逐步成长；但随着它被越来越多的人的认可，它又会造成阻碍别的新理论发展的某些偏见。相对论就是这样，在它的发展过程中，始终存在着阻碍它发展的偏见；而现在，它又是阻碍超光速研究等的偏见的源头。

本书提出并引起了一系列的问题，限于作者的水平，对这些问题，有的作了比较具体的解答；有的只作了初步的解答，有的则避而不谈。下面是若干问题及其简单的回答。

1、以太是什么？答：真空不空，这已经被大量的客观现象和实验所证实。以太就是对真空态物质的一种称呼。洛伦兹变换的流体力学导出，在理论上显示了以太的存在。

2、物理学的时空就是真正的时空吗？答：不一定。伽利略变换所表达的绝对时空是真正的时空，它的时空标准是不变的。但是，由于实际的时空衡量标准的可变性，造成了现实的定量关系总会或多或少地偏离绝对时空观，这就是我们所说的定量效应。物理学是实验科学，它的理论要与实际测量出来的数据一致，就不可避免地与标准衡量工具的行为相联系，因此，物理学的时空不一定是真正的时空。

3、相对论的实质是什么？答：相对论是以光作为时空衡量工具的一种定量描述理论，它把现实的时空标准的变化当作了时空本身的变化，这在绝对时空观看来只是一种可行的数学模型。

4、质量是代表物质多少的量吗？答：物质的基本存在形式是多种多样的，质量只是代表实物多少的量。以太是不同于实物的另一种物质基本存在形式，它是无所谓质量的。当然，

以太与实物有着紧密的联系。

5、以太的具体形象如何？答：以太是一种占据整个空间的可压缩的超流体；它与实物是紧密联系的，引力场是以太密度场，实物是以太密度波包的核心，实物的质心就是以太密度的极大值点。微观地说，以太和实物粒子都由中微子和电荷构成：中微子加整份电荷是荷电轻子；中微子加分数电荷成为夸克，而以太是由正、反费米子对构成的，最低能态的玻色-爱因斯坦凝聚。其中，最基本的以太流体质点是正、反中微子对，它被称为以太子。一个以太子内部的正、反中微子之间转移整份电荷，或者说一个得到正电荷，另一个得到负电荷，它就变成了由正、反荷电轻子构成的光子，其中不形成独立以太密度波包的是虚光子，这是电磁激发的以太，形成独立以太密度波包的是实光子。以太子或光子内部的正、反轻子之间转移分数电荷，就变成了正、反夸克对，其中不形成独立的以太波包，且带色的是胶子，这是色激发的以太；形成独立的以太波包的是介子，它必然无色。

6、以太与场哪一个享有本体论地位？答：是以太，因为以太是与实物一样的物理实在，而相互作用的场只是以太的一种状态，它们是不同性质的以太密度波包，强相互作用、电磁相互作用和引力相互作用的强度分别对应虚胶子、虚光子和以太子的密度梯度。

7、怎样描述相对论的物理机制？答：这里的要点是：以太密度决定相对论的时空标准，即以太密度较大的地方，量杆较短；时钟走得较慢。其实质是：相对论的长度标准与以太流体的质点间距成正比；时间标准与光通过一个质点间距的时间成正比。于是，以太变成了相对论中的处处均匀、各向一致的四维时空连续体，光速当然恒定了。

8、连续性的以太用来说明不连续的实物之间的作用不是“超距作用”，现在以太由以太子组成，这是一种逻辑循环吗？答：不！首先，在定量描述上，因为长度标准与以太流体的质点间距成正比，而以太子是最小的以太质点（再分割就不是以太了），它的大小无法确定，或者说，它是无所谓大小的。另外，在绝对时空观看来，以太子也是有大小的，但区间场以太观认为，我们所认识的只是引力场以太，在引力场以太子之间，会存在着微观区间场以太，如此等等。

9、光速恒定是怎么回事？答：光速恒定是一种定量效应，在绝对描述中，光速是可变的，在这里，光速较慢的地方，现实的量尺较短，时钟走得较快，因此，直接测量出来的光速总是不变的。因为相对论是以光作为时空衡量工具的一种定量描述理论，所以它鞭长莫及，无法描述超光速。超光速好比超声速，超声速不会使我们清楚地听到过去的声音；超光速也不会使我们回到过去。

10、引力场是能够支配整个宇宙的宇宙场吗？答：引力场的作用不是无限的，它只是一

种宏观场；到了星系、星系团的宇观世界，引力场的作用只有宇观场作用的十分之一左右。宇观场的作用是一种以太的宇观作用，是它造成了宇观世界的质量缺失现象，而不是存在所谓的“暗物质”。如果引力场不是宇宙场，那么，以广义相对论为基础的各种宇宙论都毫无意义了。

11、Smarandacheh 几何有什么意义？答：真正的时空只有绝对时空一种，但定量描述的时空有很多种，它们随着以太的分布状态和存在形式的不同而变化。因此，现实的定量描述的时空是 Smarandacheh 重空间，即在同一个空间内，存在着一些不同性质的子空间，这用 Smarandacheh 几何来表达，相当直观，一目了然。

……

我对物理学问题的思索始于上世纪的 60 年代；在 70 年代，我曾与好友陈志良一起讨论过区间场论。在 80 年代，我用流体力学的方法导出了洛伦兹变换，认识到光是超流体以太中的第二声，并在《潜科学》上发表了处女作“区间场以太观”。

在 2005 年前，我的物理学探索与外界没有什么联系。我于 2004 年才发现了网上世界的精彩，并于 2005 年先后加入了北京相对论研究联谊会和上海的科学沙龙，这让我有一种如鱼得水的感觉。我的物理思想，在与形形色色见解的交流、碰撞中得到了提炼和升华。

本书的出版，首先要感谢 Dr. Florentin Smarandacheh 和他们协会的秘书的提议和大力帮助。从 2005 年以来，我一直受到北京相对论研究联谊会总部的吴水清、付昱华和科学沙龙里的胡素辉、张操、殷业等的关心、支持、鼓励，这对我在学术上的进展帮助很大，对他们我是非常感恩的。也感谢季灏、朱永强、毛明义和江正杰给我的热情帮助。我与曹盛林、杨文熊、孙福民、庄一龙等进行过有益的讨论，获益匪浅。许多人帮我对书稿进行翻译和检查，他们是：胡杰、方菲菲和上海师范大学信息与机电工程学院的研究生梁琛、孙凯旻、彭涛、刘念等，均深表感谢。

第一章 导论

宏观的万有引力、电磁作用等是真空现象；微观的自发对称性破缺、夸克囚禁等是真空现象；现代宇宙学中的微波背景辐射和暗能量等也是真空现象。因此，许多物理学家意识到：21 世纪将是真空的世纪[1,2]。本文想要展示的就是有关真空、时空、物质及它们之间内在联系的一系列新的看法。本书的视野，小到轻子夸克，大到整个宇宙，内容庞杂，但最基本的关键词是 3 个：物理真空（以太）、定量效应和 Smarandache 的有关概念。

1.1、物理真空（以太）

鉴古而知今，把历史这面镜子擦亮了，才能更好地把握今天，展望明天。

真空的本意是一无所有的虚空。最早，人们认为，世界由实物和真空构成。后来，人们渐渐地意识到，实和虚是相对的。两个人站在地面上，他们之间的空间看起来好象没有什么东西，但如果仔细观察，空中弥漫着尘埃；进一步用仪器探测的话，尘埃之间又充斥着空气分子，如此等等。现代物理学显示，没有任何粒子的真空态中，也存在着真空起伏、真空隧道效应、真空相变等等，说明真空类似于介质[3]，是一种特殊的物质状态。本书的真空，指的就是真空态的物质，或物理真空。

真空不空的观点并不是始于现代物理学，在古代就已初见端倪，中国古代的元气说[4,5]就是这方面的一个代表。在西方，17-19 世纪的以太论[5,6]也是一种真空不空理论，它曾作为物理学的一个重要的组成部分，盛极一时，但在相对论诞生后，以太论没落了，这些将在第二章里进一步介绍。

美籍资深物理学家张操教授说：“‘真空’这个术语很容易被人误解为虚空，所以作者宁愿采用 19 世纪物理学中的术语‘以太’来取代‘真空’这个术语。”[1]这句话相当实际，下面，我们就把物理真空叫作“以太”。

以太概念贯穿了全书。其中，第二章介绍中国古代的元气说及以太论的历史，并澄清有关问题，为以太正名。第四和第五章阐述以太的宏观效应，其中将说明宏观以太是一种特殊的可压缩的超流体，它的可压缩性，即密度可变性，造就了引力场和相对论性效应。第六章指出电磁激发是以太的最基本的激发，并进一步提出了动能的电磁量子假设，这有可能被用于解释一些疑难的电磁现象。第七章描述了以太的微观表现，微观以太以虚玻色子的形式存在，它与实粒子只是能态的不同，能够参与相互作用以及粒子之间的相互转换。第八章提出了宇观场作用论，宇观场作用就是以太的宇观作用，指出引力场只是宏观场，在星系、星系团的宇观世界里，宇观场的作用已经超过引力场的作用，并且是引力场作用的 10 倍左右，这是造成星系世界质量缺失的原因，而并不是存在着所谓的“暗物质”。第九章指出，前面所说的以太，其实只是无数区间场以太中的一分子——引力场以太，我们已知的一切物质现

象都可看成是引力场以太的种种表现，微观世界的特殊性是由微观区间场以太对引力场以太的作用引起的，宇观世界的特殊性是由宇观区间场以太对引力场以太的作用引起的；进一步说，区间场以太是比实物高一阶的物质基本存在形式，在区间场以太之上，还会有更高阶的物质基本存在形式存在。

以太不同于空间，它是物质。为明确起见，这里对物理学的物质作这样的定义：物质是存在于时空之中，可以运动、变化，转换形式，但不会创生或灭亡的客观实在。对照这个定义，空间和时间是客观实在，但不是物质；实物是具有质量的离散性的物质，每一个实物只占居了有限的空间；而以太是无所谓质量的连续性的物质，它占居了整个空间。实物与以太密切相关，质量是太不均匀分布的表现，实物是以太密度波包的核心。对于单纯的实物介质，一般把它看作由质量相同的质点构成，因此，实物的密度可以用单位体积的质量来表示；以太无所谓质量，它的密度可以用单位体积的质点数来表示。

上述的物质定义建立在具有普适性的时空观念的基础上，这种具有普适性的时空观念是经典的绝对时空观，而不是其他的物理学时空观。物理学的时空观是不统一的，相对论时空观不同于绝对时空观，它没有普适性的时空标准；量子论的时空观又不同于相对论或绝对时空观，它的时空观念被不确定性原理搞得很模糊了。相对论或量子论的时空观与绝对时空观之间的差异都可归结为“定量效应”。

1.2、定量效应

物理学本来附属于自然哲学，是牛顿的辉煌成果使物理学成了一门独立的基础科学。牛顿站在哥白尼、伽利略、开普勒等等巨人们的肩膀上，以空间、时间、质量等为最基本的“砖瓦”，并以微积分等数学方法为“水泥沙浆”，建立起了壮观的牛顿力学体系。这是一个立足于实验和观察的基础之上，结构严谨、逻辑严密的科学体系，并为经典物理学的进一步发展奠定了扎实的基础。

牛顿的科学贡献无与伦比,18 世纪英国的随笔作家、评论家、讽刺作家和最伟大之一的启蒙主义诗人亚历山大·蒲柏曾写道：自然和自然法则隐藏在黑暗里，上帝说：“让牛顿来。”于是一切都被照亮。

牛顿时空观，空间是平直、均匀、无限的；时间均匀流逝，没有开始和结束；物质在时空中运动、变化；时间与空间各自独立，它们都与物质无关，而且时空标准始终不变。这些都与人们的直觉相吻合，给人一目了然的感觉。

19 世纪末，经典物理学发展到了顶峰。正当人们在赞美它的完美无缺的时候，有两朵“乌云”悄然升起,第一朵乌云主要是指迈克耳逊－莫雷实验结果与当时以太论之间的矛盾；第二朵乌云主要是指经典物理学理论在黑体辐射问题上的失败。这两朵乌云在 20 世纪初很快地演变成了一场暴风骤雨。量子理论和相对论在这场物理学的急风骤雨中形成、发展，而且成为了 20 世纪物理学的两大基础。

相对论的时空观完全不同于牛顿时空观，它的时间和空间是纠缠在一起的，并共同构成了四维时空连续体;而这四维时空连续体又与物质有着不可分割的联系,有实物必有引力场，而引力场使这四维时空连续体弯曲了,从而,实物的运动必然伴随着四维时空连续体的蠕动，这对于非物理专业的人来说，简直是莫名其妙。至于量子理论，它的波函数的统计诠释和不确定性关系等，模糊了时空的观念，对微观粒子已经难以作时空描述。为什么会这样呢？我们的回答是：物理学的时空不一定等于真正的时空。

绝对时空观是科学的抽象，它用一个不变的时空标准去描述世界。然而，物理学是实验科学，它的理论要与实际测量到的数据相一致，因此，物理学的时空是一种可以测量的相对时空，它不一定是真正的时空，因为，衡量时间和长度的工具，如尺、钟、特定的光等等，多多少少都会随着环境而变化，因此，在牛顿描述与现实的定量关系之间必然会有一定的差异，由这种差异引起的效应，或者说，由现实的时空标准的可变性造成的效应被称之为**定量效应**。

一般的尺和钟会随着温度而变化，对此，人们不会认为时空在变化，因为，人们可以用更精确的时空衡量工具来证明这只是尺和钟本身的变化。如果物理学的最标准的衡量工具会变，那么，科学家就会把时空标准的变化当作时空本身的变化。相对论性时空观就是这样的一种物理学的时空观，因为，现在最新的长度和时间单位的标准是以光以及光速不变来定义的。比如，米是 299,792,458 分之 1 秒的时间间隔内光在真空中行程的长度[7]，在这里，无论光走得快还是慢，它在一秒钟内所经过的路程都是 299,792,458 米，光速成了一种不变的定义速度，而这正是相对论的一个前提，以至我们可以把相对论看成是以光作为时空衡量工具的一种定量描述理论，它把时空标准的变化当作了时空本身的变化，这在绝对时空观看来只是一种可行的数学模型。为了表达的方便和明确，以绝对时空观为基础的描述被称为**绝对描述**，即牛顿描述；以实验数据为基础的描述被称为**定量描述**，那么，相对论，或者说爱因斯坦描述是一种定量描述，而相对论性效应是一种定量效应，它由爱因斯坦描述和绝对描述之间的差异所造成。

相对论没有普适的时空标准，爱因斯坦描述颠覆了牛顿描述，使人感到难以理解。于是，就有人在亚历山大·蒲柏所写的句子后，续写了一句：“爱因斯坦走来了，物理世界又变得朦胧。”这种“朦胧”是由于对定量效应的认识不足引起的。

在宏观、低速的环境里，定量效应很弱，可以忽略不计。在这样的情况下，牛顿描述与定量描述一致，它既是绝对描述，又是定量描述，它以长度、时间、质量等为最基本的物理量，描述的物理图象相当直观、清晰。爱因斯坦描述认为，光速不变，但时间、长度标准和质量等会随着运动速度和引力势的改变而变化，因此，它与绝对描述有着一定的错位，我们

看高速、强引力场中的世界，就会有一种照哈哈镜的感觉；在微观世界，物质密度大，运动速度高，时空标准将会瞬息万变，它与牛顿描述之间就有着巨大的错位。在量子物理中，时间、长度、质量等物理量已是变幻莫测，而被算符所取代，描述物理现象只能靠波函数、几率和态，这被有些人认为：时间、空间和质量等概念已经没有必要了。

物理学家们，一般都认为，物理学的时空是真正的时空，而没有意识到相对论和量子物理学的时空不是真正的时空，从而，不少人对世界的实在性也产生了怀疑。但无论宏观还是微观；低能还是高能，我们都可寻求到一定的物理规律性，它不随着人们的意志而改变，这是物理世界实在性的一种表现。因此，在时空观问题上，我们应该逆向思维，转变观念：把绝对时空观看作是真正的时空观，而相对论的时空观是被定量效应扭曲了的时空观；同样地，量子物理学的时空也被定量效应扭曲了。

对于一种物理现象，人们可以提出许多合乎逻辑的设想。然而，逻辑只是思维的规律，凡是客观存在的，都是符合逻辑的，但合乎逻辑的不一定是客观存在的。比如，我们人的器官功能并不是最好的，从逻辑上来说，可以有许多更合理的设想，比如说，在人体上长出翅膀，这样，人类的活动能力可以更强，但这是不现实的。因此，物理学离不开实验和数学，它需要根据实验数据建立数学模型，进行严谨的数学演绎，用数学公式表达物理规律，这样才能定量地与科学实验进行比较和鉴别，并预言新现象。

但是，有人把数学的作用放大了，认为："凡是数学上为真的，在现实中也必然是真的。"这样的认识包含了数学模型反映了事物的真相的意思，显然，它没有考虑到定量效应的存在。更有甚者，有人将希望寄托于精心设计的数学模型，想以此来描绘物理世界的全景。比如，超弦理论等把物理学中的点模型扩展为弦、圈等，运用数学的对称关系，将时空的维数提高到了 11 维，甚至 25 维，使其中包含了许许多多可以任意调节的参数，以此扩大选择的余地，企图从中来寻找物理学的"终极理论"。实际上，现实世界没有真正的直线和对称，依靠数学的对称性等去大海捞针般地寻找物理学的"终极理论"是行不通的。正如万花筒，它运用镜面对称，可以变幻出形形色色美妙的图案，但它绝不可能变化出真实的田园景色，这就是说，最精美的数学模型也难以描绘出逼真的物理实在。

物理学离不开数学，但它在本质上又不同于数学。它的数学模型必须以物理实验为基础，并说明它的物理机制。相对论和量子论导出了一系列的定量关系，建立了数学模型，但在对它们的物理诠释上一直存在着某种不确定性。众所周知，在量子力学基本概念和原理的诠释方面，如波函数的几率解释等，从其出现至今，一直存在着持续的争论。至于相对论，也始终争论不断；就连爱因斯坦本人，在其 70 岁生日时，给老友索洛文的信中写道："你一定想象我在此时此刻一定是以满意的心情来回顾我一生的成就。但是仔细分析一下，却完全不是这么一回事。我感到在我的工作中没有任何一个概念会很牢靠地站得住的，我也不能肯定我所走的道路一般是正确的。"[8]这段话，既显示了爱因斯坦坦诚的科学精神，也表明相对论确实存在着一定的困惑。量子物理和相对论的困惑是由于它们都只是定量描述的数学模型，

而缺失对其物理机制的理解。本书将用以太的可压缩性来诠释相对论的物理机制，这是对相对论的一种必要的补充。

1.3、定量效应由以太造就

科学的发展往往是由简单到复杂，然后在新的高度上化繁为简，再由简单到复杂，不断循环向前的过程。当然，不同的学科，不同的阶段，“循环”的形式会有所不同，有的好比平原上公路的弯曲；有的恰如山区里公路的盘旋。我们认为，物理学理论已经到了化繁为简的时候了。

定量描述中的复杂性，是由定量效应造成的。因此，要化繁为简，应该从定量效应入手，找出导致定量效应的根本原因。由上可知，定量效应是由于现实的时空标准的可变性引起的。那么，现实的时空标准的可变性又是怎样造成的呢？是以太。以太与时空观密切相关，这由洛伦兹变换的流体力学导出（见 4.1）所显示，是本文真空观的一大亮点。

在流体力学里，有一个把可压缩的流体转换成不可压缩的流体的变换式，它可以简化运算，在实践中，比如设计飞机等，常被运用。若将这一变换式代入表达绝对时空观的伽利略变换，可以很简单地导出表达相对论时空观的洛伦兹变换。这个推导过程显示，有一种特殊的超流体，它把绝对时空观与相对论时空观联系起来了；它在空间里无限分布，而且其中的声速就是真空中的光速。显然，满足这种条件的特殊流体只能是宏观以太，这从一个侧面显示了以太的存在。

洛伦兹变换的导出过程显示，在绝对时空观中，宏观以太是一种可压缩的超流体，即它的密度是可以变化的，以至作为一种以太波的光，它的速度应该是可变的；而在相对论时空观里，以太是不可压缩的，即它的密度是处处均匀，各向一致的，光速就当然恒定了。于是，在绝对描述的以太密度比较大的地方，出现了相对论性的长度标准变得较短，而时间标准变得较慢，这就是相对论性效应的由来。进一步的分析表明（4.2、4.3），引力场是以太密度场，每一个实物都有以它为核心的以太密度波包；狭义相对论效应是由以太的可压缩性引起的；广义相对论的引力效应则是由于引力势绝对值对应以太密度。可见，相对论不是一种超物质的存在，它的物质基础是以太，是以太造就了相对论性定量效应。

以太造就了引力场和相对论性定量效应，也决定着时空的性质。狭义相对论的时空对应以太均匀分布的情况，在同一个惯性参照系里，时空标准处处相同；而在不同的惯性参照系之间，时空标准各不相同；广义相对论的时空对应以太不均匀分布的情况，从而引力势不同的地方，时空标准不同。另外，牛顿时空观与以太是否存在无关，它也可以被看成是没有以太或它的作用可以忽略的情况下的一种定量描述的时空观。

微观物理学与宏观物理学有着显著的差异，其中的概念、原理、公式等等，都是在大量的实验资料基础上逐步建立起来的，完全是一些定量描述，诸如二象性和量子性之类的现象，都是微观的定量效应，它们是否也是以太引起的呢？这看来是顺理成章的，且有一个事实可

以印证：在非相对论性的薛定谔方程中，自旋是作为一个外加的自由度放入理论框架内的；而在相对论性的狄拉克方程里，自动地包含了自旋量子数。这意味着，量子性是相对论的定量效应在微观世界的一种表现。

上述表明，相对论时空标准取决于以太密度，它的可变性造就了定量效应。显然，这样的描述是在绝对时空观的基础上进行的。在相对论时空观中，以太被描述成了不可压缩的，因而也就成了无所谓密度变化的“四维时空连续体”，它已失去了一种实体的形象。因此，只有在绝对时空观的基础上，我们才能够借助于以太，对相对论的物理机制进行描述，这是对相对论的一种必要的补充。在这里，我们可以进一步意识到：绝对时空是真正意义上的时空，绝对描述反映了事物的真相；相对论时空，即四维时空连续体，不是真正的时空，它其实是“物”，是被相对论时空观折射出来的以太的变态形象，因此，它只是一种数学模型，它能够比较正确地描述事物之间的量方面的关系，但不一定能反映事物的真相。比如，广义相对论所谓的时空弯曲，其实是对以太分布不均匀的一种数学描述，真正的时空不会弯曲。绝对时空观和爱因斯坦时空观是两种本质上完全不同的时空观，它们不是一个否定另一个的关系，而应该具有一定的互补性。这将在第五章里有具体的描述。

现代物理学否定了绝对时空观，而将数学模型当作了客观的真相，使物理世界变得诡谲怪异。如果我们重新站到牛顿时空观的立场上，用以太的作用来描述定量效应，或者说，带着定量效应回归经典，这样就能在新的高度上化繁为简，使物理世界阳光灿烂。

自然法则隐藏在黑暗之中，
上帝说：让牛顿降生。
于是物质世界一派光明。
爱因斯坦带着相对论走来，
还有掷骰子的量子理论，
他们使世界又显得朦朦胧胧。
如果认识到以太处处存在，
是它造就了诡谲的定量效应，
物理世界又将会是万里晴空。

以上，我们着重对绝对时空观、以太和相对论时空观之间的关系作了简单的介绍，说明物理学的时空不一定是真正的时空。以太在绝对时空中的可压缩性，引起了现实的时空标准的可变性，从而导致了相对论性的定量效应，是它扭曲了高速和强引力场世界的物理图象，这是本书前 5 章的基本内容，其中对绝对描述和定量描述作了大量的对比、分析，内容比较成熟。

以太和定量效应的表现形式在不同的时空体系里是不同的。在本书的后四章中，我们分别对对微观、宇观和整个宇宙的物质存在的形式和规律作了一些探讨，提出了若干设想，它们主要还是一些初步的想法，有待进一步鉴别、深化。

1.4、若干 Smarandache 概念

物理学的发展不是孤立进行的，它是实验、哲学、数学、逻辑等等共同合力助推的结果。

F. Smarandache 教授，一位多才多艺的人，他既是一个科学家，又是一位文学家。在科学方面，他提出了许多新颖而有用的概念，如：Smarandache 函数、Smarandache 序列、Smarandache 几何和中智学等等[9]。其中的有些概念在本书中得到了运用。

中智学由 Smarandache 教授创立于 1995 年，是哲学的一个新分支。它研究中性（中间状态）的起源、本质以及与不同思想观念范畴的相互作用；它是中智逻辑、中智集合、中智概率论、中智物理学等的基础[10]。

中智逻辑将所考察的逻辑判断在一个三维的中智空间刻画出来，该空间的三个维度分别表示所考察判断的真（T）、假（F）和不确定（I），在这里，T、F、I 是独立的量，这为不完全信息，矛盾信息及完全信息的选择留下了余地。

在相对论的发展过程中，可以发现中智逻辑的智慧。爱因斯坦年代，麦克斯韦方程所导出的光速不变性和符合相对性原理的速度合成法则相矛盾。一般看来，这两者是对立的，不可能都正确。而爱因斯坦却作了另一种选择：相对性原理和光速恒定都成立，是牛顿时空观有问题，从而导致了定量描述的时空观的诞生。

实际上，我们前面所阐述的思路与爱因斯坦的中智逻辑有异曲同工之妙：一般认为，牛顿与爱因斯坦的时空观是相互对立的；而我们认为，这两种时空观不是一个否定另一个的关系，而是具有互补性，二者之间的差异是以太引起的。

几何是表达时空的一种数学方式。欧几里得几何建立在一些公理之上，它的平行公理是：过已知直线外的一点，有且只有一条直线与已知的直线平行；在非欧双曲几何中，这条公理被否定为：过已知直线外的一点，至少有二条直线与已知的直线平行；而在非欧椭圆几何里，平行公理又被否定成：过已知直线外的一点，没有直线与已知的直线平行。一个公理在同一空间中同时表现出成立或不成立，或至少以两种以上方式表现不成立，这个公理就被称之为 Smarandache 否定公理。含有 Smarandache 否定公理的几何被称为 Smarandache 几何。

狭义相对论的时空不同于牛顿时空，它不但把时间当作一维特殊的空间，而且将空间和时间交织在一起而形成了四维空间连续区，但这四维空间连续区是平直的，可以当作欧几里得连续区；而广义相对论的时空连续区是弯曲的，是一种非欧几里得连续区，这也就是说，几何学的平行线公理在狭义相对论的时空中是成立的，而在广义相对论的时空中被否定了。因此，在包括狭义和广义的相对论空间里，平行线公理是一条 Smarandache 否定公理，而相对论的时空几何就是一种 Smarandache 几何。

另外，在牛顿时空观里，时间和空间各自独立，这对绝大多数人来说，是一个常识，我们可以把它当作一条时空公理。那么，这条公理在牛顿时空中成立，在相对论里不成立。从而，包括牛顿时空和相对论时空的宏观物理学的时空几何是一种 Smarandache 几何，它包含了二个 Smarandache 否定公理。

宏观物理学的 Smarandache 几何有三个子空间：牛顿空间、狭义相对论空间和广义相对论空间。由上所述，是以太的存在方式决定了物理学时空的性质：不存在以太或它的作用可以被忽略的空间是牛顿的三维欧氏几何；在均匀分布的以太作用下的空间是狭义相对论的四维欧氏几何；在不均匀分布的以太作用下的空间是广义相对论的四维非欧几何。

物理学的空间特性由以太决定，而以太是比实物高一阶的物质基本存在形式，因此，我们可进一步用不同的高阶物质形式来表达 Smarandache 几何，那么，我们将指出：宇宙空间是一种无穷阶等级式的 Smarandache 几何。在本书中，我们描绘了宏观物理学、区间场以太论和宇宙的 Smarandache 几何模型。

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第二章 真空不空

真空是相对于实物来说的，它所占的空间比实物所占的空间多，其中的奥秘也比实物丰富。

最早，人们认为，在自然界，除了物质就是真空。后来，人们对物质的认识逐步深入，由可以直接看得见、摸得到的天体、物体，到需要仪器探测的分子、原子、基本粒子，由有形状、大小的实物到没有形状大小的以太、场，物质观发生了巨大的变化，最后，认识到，一无所有的真空是不存在的，所谓的真空，其实是一类不同于实物的物质存在形式。关于真空的物质性，古人就有了一定的认识，中国古代的元气说，是其中的一个代表。

2.1、中国古代元气说[1.2]

探讨物质的本原，是古代朴素唯物主义思想的一个重要方面。开始，人们往往把一个或几个具体的物质作为万物的本原。这在世界上的几个文明古国中都有所记载。在中国，早在3000多年前，就有了五行学说——《国语·郑语》中，太史官史伯说："……故先王以土与金、木、水、火杂以成百物"。至今，这五行学说仍是中医学的一个基础；稍后的《管子·水地篇》中有"水之何也，万物之本原也，诸生之宗室也。"这是水一行说；《庄子·在宥》中则有"今夫百昌皆生于土，而反于土。"这是土一行说。在这方面，古希腊的泰勒斯（约2600年前）认为水是万物的本原；后来的阿那克西美尼认为空气是万物的本原；赫拉克利特认为万物的本原是火；恩培多克勒认为万物由土、水、气、火四种元素组成；亚里士多德认为地上的物体由土、水、气、火四种元素组成，天体则由第五种元素"以太"构成。

将一个或几个具体的物质作为万物的本原，往往难圆其说。于是，人们就从事物的更深层次去探求解答。古希腊的毕达哥拉斯学派，他们跳出了物质的范畴，主张"数即万物"，这促进了数学的发展，也"预言"了物理学和数学的结合，但物是实质，数只是表象，毕达哥拉斯学派颠倒了"物"与"数"的关系；古希腊的德谟克利特等，从聚沙成塔，众树成林的现象中，意识到看得见的物质应该由更小的看不见的物质所构成，于是，提出了实物性的原子学说，这是近代原子理论的先导，被认为是古希腊最伟大的科学猜想；在中国，人们由液体的汽化，人体的气感等，逐步感悟到真空里应该充斥着不同于实物的物质——元气，它与实物可以相互转化.这种超实物性的元气说，是一个古代的"真空不空论"的杰作。

元气说的思想萌芽可追溯到公元前800年，《国语·周语》上记载，伯阳父曾用"天地之气"的失序来解释地震。

约 1800 年前，王充等在前人思想的基础上，提出了一个比较系统的“元气自然论”。他们认为，元气是万物的本原，“天地，含气之自然也。”后来，有不少人对元气说作了进一步的发展和完善，使元气说形成了一个比较完整的体系。

元气被认为是一种真空态的连续性的流体。元气论的集大成者张载说:“太虚即气。”“太虚不能无气，气不能不聚而为万物，万物不能不散而为太虚。”在这里，元气说从统一的物质本原，来认识物质世界，并且从事物的内部关系来说明连续性的“气”与间断性的实物之间的转化，蕴含着物质循环发展，生生不息，不可创造，不可消灭的思想。

元气说包含三个基本观点：万物以气为本原和元素的观点；气化，也就是运动变化的观点；感应，即相互作用的观点。它从萌芽期起，就被广泛地运用。在中医理论中，元气是关键词之一，例如，元气在人体中的经络里运行，运行通畅身体就好，运行不畅就会有病痛。元气被用来解释由场引起的现象，如磁力、潮汐、天体运行等等，比如，宣夜说，一种中国古代的宇宙说，认为:“日月众星，自然浮生虚空之中，其行其止皆须气焉。”另外，当时人们还不知道空气的存在，因此，由空气造成的现象，如乐器的共振共鸣，在古人看来也是一种真空现象，也可以用元气来解释。

程宜山先生认为:“西方形形色色的朴素唯物主义之间，呈现出一种后浪推前浪的形势，最后归结到原子论；中国形形色色的朴素唯物主义，则呈现出一种百川归海的形势，开始时有多种朴素唯物主义形式并存，后来都归结为元气论。”对此，张岱年先生指出：西方唯物主义的基本范畴是“物质”或 “原子”；中国古代唯物主义的基本范畴是“元气”。可见，元气说是中国历史上科学文化遗产中的瑰宝。

2.2、以太论的兴衰[1-6.12]

在西方，以太论是真空不空的代表作。

以太这个名词最早出现在古希腊，亚里士多德认为天体由被称为以太的第五种元素构成。

在 17 世纪，笛卡尔主张没有真正的真空或虚空，最先将以太引入了科学。他认为，连续性的以太，完全充满了没有被固态物体占据的空间，并以旋涡系统的方式传递它们的相互作用；整个宇宙是一个连锁的涡旋体系，比如，行星被以旋涡形式运动着的以太海洋所带动绕行，产生了我们所说的引力效应。

后来，惠更斯，一个笛卡尔的追随者，他也认为引力无异于以太的作用，它环绕地心，对抗着脱离地心的运动；他相信光是一种波，而经典物理学认为，波必须通过介质传播，所

以，他认为，光波是在静止不动的以太中纵向传播的波；以太传递冲力但不转移自己的位置。

牛顿认同以太观，但不同意光的波动学说，他认为，光线是直线运动着的粒子流，光粒子是被激发的或伴随着的无所不在的以太中的振动。牛顿假定，以太密度是可变的，它在虚空中的密度比在重物体附近的空间里的密度要密一些，从而提供了一种引力机制：在以太的压力下，地球向着太阳运动，就像一个软木塞从深海里升起来一样。

在 18 世纪，由于光的波动说受到排挤等原因，以太论曾一度没落。19 世纪初，托马斯·杨的著名的双缝干涉式实验，使他能够精确地测量光的波长，以致与光的波动理论有关的以太论再度复兴。后来，光的偏振被发现，这确立了光是横波的事实，于是，菲涅耳在以太论的基础上引入了光的横波理论，它能够说明已知的所有光学现象。后来，麦克斯韦推出了“光是由引起电磁现象的同一介质的横波构成”的结论，从而把光和电磁两者同时还原为单一以太的作用机制。另外，在得知 1858 年亥姆霍兹关于旋涡运动的工作（这项工作表明，一定的旋涡运动具有某种永恒性）时，威廉.汤姆孙论证说，假设以太是穿过空间的完美流体，这些永恒的流体旋涡环可以等同于普通的原子。这是第一个把离散的原子与连续的充实物联系起来，用以太解释物质，避免粒子的超距作用或接触作用的模型。从而，以太论确立了它在物理学中的重要地位。

曾来到中国的传教士丁韪良将元气说与笛卡尔的以太旋涡说进行了具体的比较，指出二者之间存在着惊人的类似[1]。因此，他推断：笛卡尔在构思他的以太旋涡学说时，受到了中国元气说的直接影响。以太和元气一样，代表的都是物理真空。将真空看成是一种特殊的物质存在形式，中国远早于西方；而诸如电磁场理论、光的波动说之类的近代科学，诞生在西方。近代科学给以太论以活力，所以，可以把西方 19 世纪的以太论，看成是中国古代的元气说和西方近代科学相结合的产物。

19 世纪以太论认为，以太是绝对静止的，任何物体都在与它相对运动。由此产生了一个问题：地球以每秒 30 公里的速度绕太阳运动，在地球上就应该会存在每秒 30 公里的“以太风”，它是否真的存在呢？

1881 年，迈克尔逊首先进行了测量以太风的实验，但没有发现以太风。1887 年迈克尔逊与莫雷合作，再次进行了测量以太风的高精度的实验，但仍然是零结果。这被开尔文称为经典物理学晴空中的两朵乌云之一。

在以太论的基础上，迈克尔逊-莫雷实验由菲茨杰拉德首次进行了解释：固体的分子凝聚力会随着固体通过以太的速度而改变，在这样的方式中，干涉仪的岩石基础的尺寸将在运动的方向上收缩，这种收缩抵消了迈克尔逊-莫雷以太实验中的光学效应。洛伦兹等人发展

了菲茨杰拉德的假设，并导出了一个著名的洛伦兹变换。

是相对论的兴起，使以太论没落了。

爱因斯坦曾为一个事实所困惑：在电磁定律中，光速是常数，而经典力学却不可能得出这样的结论。他对此苦思冥想，最后，在时空观方面找到了突破口。

1905 年，爱因斯坦发表了 5 篇科学论文，其中的一篇“论运动媒质的电动力学”，创立了狭义相对论。他的理论，好比欧几里德几何的公理体系，在两个原理的基础上，不必借助于其他假设，就可通过数学演绎而导出许多包括洛伦兹变换在内的结果，这从数理逻辑的角度看来，非常漂亮。因此，主流物理学家认为，物理学不需要以太的假设了。其实情况并非如此。

2.3、现代物理学并没有否定以太

现代物理学建筑在相对论和量子论这二大基础之上，它们以不同的形式描述了“真空不空”，因此，它们都没有否定以太.

一般认为，以太论已被相对论否定了，其实,爱因斯坦对以太论的心态是很矛盾的[3]，他既意识到以太的存在，又搞不清它的真面目。1920 年，他在专题演讲“以太和相对论”中曾指出:“依照广义相对论，空间被赋予了物理性质，从这个意义上来说，以太是存在的。根据广义相对论，一个没有以太的空间是不可思议的。因为，在这样一种空间里，不但光不能传播，而且量杆和时钟也不可能存在，因此，也就没有物理意义上的空间-时间间隔。但是，又不可认为，这种以太会具有那些为重媒质所特有的性质，也不可认为，它是那些能够随时间追踪下去的粒子所组成的，而且也不可把运动概念用于以太。”在这里，爱因斯坦既指出以太的存在性，又对以太的性质提出了看法：1、以太是光的传播媒介。2、长度和时间的标准由以太决定（这点很重要，但他无法把握）。3、以太不同于一般的有质量的实物（重媒质）。4、以太不能用相对论时空观进行描述。这些陈述相当正确，不过，他实际上是把以太（物理真空）描述成了四维时空连续体，而用相对论的时空观去描述相对论的四维时空连续体，好比一个人抓住自己的头发，要把自己提起来一样，不可能。由于这种不可能，爱因斯坦对以太只能回避。

在 1938 年，他与英费尔德合著的《物理学的进化》中有一段话：“我们力图发现以太的性质，但一切努力都引起了困难和矛盾。经过这么多的失败之后，现在应该是完全丢开以太的时候了，以后再也不要提起它的名字了。我们说空间有传播波的物理性质，这样便不必再用我们已决定避免的这个名字。在我们的字典中勾销一个字自然是无补于事的，这方面我们

要解决的困难实在太多了!”在这字里行间，流露了他内心的无奈。为了应对这一无奈，他搬出了“场”的观念。在“相对论和空间问题”一文中，他说“因此，当笛卡尔相信他必须排除空虚空间的存在时，他离开真理并不怎么远。如果仅仅从有质物体来理解物理实在，这个看法确实显得有些荒谬。为了揭示笛卡尔观念的真正的内核，就要求把场的观念作为实在的代表，并同广义相对性原理结合在一起；‘没有场’的空间是不存在的。”爱因斯坦把场描述成弯曲的时空，这有点像古希腊的毕达哥拉斯学派，以致将时空的几何结构当作了物理实在。

真空中存在着电、磁、引力场等，这些都是真空不空的表现，但是，囿于“质量是代表物质多少的量”的成见，人们不敢贸然地把场当作一种特殊的物质。是量子场论所反映的事实，才使人们认识到：场是不同于实物的另一种物质表现形式。量子场论认为，物理世界由各种量子场系统组成，量子场的激发表示粒子的产生，量子场的退激，表示粒子的消失，这些量子场的能量的最低状态，即量子场的基态就是真空。在这样的量子真空里，存在着量子运动，即“零点振荡”，以至带有零点能量。比如，局限于一定体积内的量子场，当该体积发生变化时，其中的零点振荡能量会有相应的改变，从而产生可以观察的“卡西米尔效应”[7.8]； 在这样的量子真空里，也存在着真空极化，这也会产生可观察的效应，如氢原子的兰姆移位、电子的反常磁矩。另外，量子场论还显示了真空隧通效应、真空相变、真空凝聚、真空畴结构等等[9]，这些都说明真空类似于介质，是种物理实在。可见，以太是“物”，而不是一无所有的虚空。不过，量子场论把以太的物质性，算到了场的头上。

实际上，场只是物理量连续分布的一种状态。比如，空气密度场，它是空气密度在空间里连续分布的一种状态；温度场是温度在介质中连续分布的一种状态。空气密度场的物质基础是空气；温度场的物质基础是吸收能量的介质，等等。那么引力场、电场等真空场的物质基础是什么呢？是物理真空，即以太，它才是不同于实物的另一种物质的基本存在形式。现代物理学抛弃了作为物质本体的以太，而把场，一种以太的状态当作了物的代表。类似地，它也把数学描述，一种形式上的描述当作了本质性的描述。这也就是说，现代物理学过分依赖数学的形式描述在一定程度上造成了对实质性认识的错位。

以太是本体，场只是以太的一个状态，这有实验上的证明，那就是 A-B 效应[10.11]。在经典电动力学中，电、磁场强 E、B 是物理实在，而标量和矢量势 φ、A 只是辅助量，并无实质的物理意义。虽然，在量子场论中，出现在粒子运动方程中的场量是 φ、A，但经过规范变换，粒子的波函数仅有一相位因子的改变，不影响物理过程的实质，因而，通常认为，即使在量子力学中势 φ、A 也没有实质意义。1959 年，Y. Aharonov 和 D. Bohm 探讨了荷电

粒子通过场强 B（E）为零，而势 A(φ)不为零的电磁势场的情况，发现这也会引起量子干涉现象，这被称为 A-B 效应，后来被 Chambers 等人用实验证实，它显示：场（E、B）不足以表征电磁连续统，而势 φ、A 可以表征，。后面(4.2, 7.4)，我们将指出：引力势对应以太密度，势 φ 和 A 对应电磁激发的以太密度。可见，A-B 效应表明了以太是本体，场只是以太的一个状态。

曹天予的著作《20世纪场论概念的发展》[12]好评如潮，比如，格拉肖的评论是：“他对经典场论和量子场论的发展和诠释作出了清晰的论述，在对所有自然力的规范场论的创立中，这一论述达到了登峰造极的地步。”不过，曹天予认为，场具有本体论的地位，而且，这本体论地位的获得，始于洛伦兹的工作。他说：“洛伦兹的以太摈弃了所有机械的性质，因而，完全从物质中分离出来。在这个框架中，电磁场被当作是以太的状态。既然以太没有机械性质，其性质只是如同构成电磁场与物质之基础的虚空一样，那么电磁场就享有与物质一样的本体论地位。即它代表着独立于物质的一种物理实在，而不是物质的一种状态，像物质一样具有能量，因而具备非机械实体的资格。” 这样的分析是值得商榷的。一般说来，有形状大小、有质量的实物才具有机械性，作为真空态的以太不应该有明显的机械性质。如果没有机械性质就没有本体论地位，那么，这一点更适用于场。实际上，以太的实体性是洛伦兹的收缩假设所要求的。洛伦兹假设，当物体在以太中运动时，除了电磁力，决定物体大小的分子力也受到影响，因而物体尺度的收缩将消除以太风的效应。

洛伦兹收缩要求以太是实体。他的以太之所以被误解为“虚空”，如我们在第一章中所说，是因为牛顿描述与定量描述之间存在着错位，这是定量效应造成的；洛伦兹关于运动物体在以太作用下长度收缩的假设，相当于考虑了定量效应，已经突破了牛顿描述，而接近于定量描述；从而，洛伦兹的以太被误解成了“虚空”，这正如相对论性定量描述中的以太成了“四维时空连续体”一样。

另外，曹天予教授认为，从洛伦兹的电动力学开始，物理学研究中出现了一种建立在场本体基础上的“场纲领”，这条纲领后来逐步发展成广义相对论的几何纲领、量子场纲领、规范场纲领等。他以独特的视角和方式整合出了一幅场论的演化、发展的图景，其观点既新颖，又很有条理。把场看作是一种本体，是出于对本体的一种认识。正如曹教授自己所说：“在最后一章涉及理论术语的本体论地位时，我将捍卫的是结构实在论的立场。简单地说，这种立场坚持认为，在成功理论中的结构关系（经常直接用数学结构来表达，但也能用模型与类比来间接表达）应当被视为是真的，不可观察实体的实在性被逐渐建构，而且在一种理想的情况下，最后被这些结构关系以唯一的方式决定。”在这里，曹教授认为不可观察实体

的实在性被逐渐建构成了确定的数学模型，这无疑是很确切的，说明正确的物理学数学模型来自实在，反映实在。但是，这种反映，好比照哈哈镜，往往被定量效应扭曲了。场的几何纲领、量子场纲领、规范场纲领等是一条场的数学模型的发展纲领，这些数学模型在一定程度上反映了物理规律的客观实在性，但它们所描绘的事物的形象与现实之间总会有一定的错位。

当然，19 世纪以太论的没落有它自身的原因[13]，一种历史的局限性。经典物理学具有明显的机械论色彩，作为当时经典物理学一分子的以太论，难免染上了浓重的机械论色彩。一方面，它只认定绝对时空观，而没有也不可能意识到现实的长度和时间的标准会随着以太密度变化；另一方面，它把以太当作实物那样来对待，而实际上，真空是不存在实物粒子的状态，以太无所谓质量，它与一般的实物性流体有着本质上的不同。19 世纪的以太被当作了一般的流体，而光就是其中的机械弹性波。于是出现了这样的尴尬局面：因为光的极大的传播速度，以太在离开平衡位置时，应产生极强的恢复力，这要求以太是一种非常硬的东西；而另一方面，任何物体都可以在以太中毫无阻力地运动，这又显示以太是极为稀薄的流体。实际上，任何物体，无论它的表面是光滑还是粗糙，无论它的内部是否布满了缝隙，都能在真空里毫无阻力地运动，这充分显示以太是一种超流体。在一般的实物性超流体中，存在着两种基本的声音：“第一声”是一般的密度波，即普通的声音；“第二声”则是传播热激发量的“温度波”[14]。真空中热量的传播方式是热辐射，即电磁波。可见，包括光在内的电磁波就是以太中的第二声，而以太的电磁激发相当于它的“热激发”。

另外，现在有人将以太当作了所谓的暗物质，暗物质是具有质量的东西，把以太看成由具有质量的微粒所组成，这与以太是一种真空态物质的本来意义不符，会带来很大的矛盾。在星系世界，如果不假定存在有质量的暗物质，那么，天体的运动轨迹极大地偏离了牛顿定律。如果假设中的暗物质就是以太，而它不仅存在于星系世界，也存在于太阳系中，那么，太阳系里也会存在大量的暗物质，它们也会使行星的运动轨迹偏离牛顿定律，但是，行星的运动轨迹完全符合牛顿定律，太阳系里的以太质量的巨大作用到那里去了呢？

实际上，质量只是代表实物多少的量，以太本身是无所谓质量的。当然，质量与以太有密切的关系，在第一章里已经提到，实物是以太密度波包的核心，这意味着质量是以太分布不均匀的一种表现。人们囿于“质量是代表物质多少的量”的观念，开始并不认为真空态的场是一种物质，直到场的量子性被发现，才承认了它的物质性，因为量子性意味着有能量，而能量必然伴随着质量。不过，这里有个问题：引力场至今无法量子化，难道它不是物？其实，场的量子性是以太密度波动性的反映，是以太与实物相互联系，相互转化的表现，这在

第七章里将有进一步的说明。

另外，有些物理学家认为，真空是洛伦兹对称的，因此它不可能是以太。洛伦兹对称性就是相对论时空的对称性，实际上，我们可以用以太来说明洛伦兹对称性的实质，我们在第一章已经指出，在相对论时空观中，以太的分布是处处均匀，各向一致的，这就是洛伦兹对称性的物理图象，在这里，以太是本，洛伦兹对称性是末，以洛伦兹对称性否定以太，是本末倒置了。

以太的概念是随着历史的发展而变化的：笛卡尔的以太不同于亚里士多德的以太；19 世纪的以太又与笛卡尔的以太有所区别；而我们的以太观将摈弃 19 世纪以太论的机械性，吸收现代物理学，尤其是相对论、量子场论的精华，它是对 19 世纪以太论的现代演绎，是 19 世纪以太论的否定之否定。

现在，越来越多的人意识到为以太正名的必要性。在北京相对论研究联谊会里，认同以太或类似以太物质存在的有几十人，他们有不少专论，如熊承坤、刘良俊的太极子论[15]；江正杰的Φ量子说[16]；陈果仁的以太旋子学[17]；周江华的游离磁能观[18]；齐绩的无形态物质论[19]；庄一龙的斥力子论[20]和陈有恒的新以太介质说[21]等等，肖钦羡和窦剑文的“量子天文学”也把以太请了回来，并委以重任[22]。

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第三章 时空观的沿革

空间和时间的概念有狭义和广义之分。狭义的空间和时间的概念是指它们的本来意义：空间是物质的存在、发展、变化的舞台；时间是事物的前后次序和持续性的表现。广义的空间不但包含了时间，也被广泛地用来表示一些事物的表现形式，而其中的某种独立的参数则被当作“空间”的维。比如，数学里有希尔伯达空间、向量空间；物理学中有动量空间、同位旋空间；其他的有社会空间、想象空间等等。陈伟在他的“11/30 地震周期律”的基础上提出了“11/30 二维时间坐标系”[1]，也有一定的意义。不过，本书中的时空只是狭义的，指它们的本来意义。

古人眼见日、月、星辰东起西落，循环往复，事物发生、变化，生生不息，逐渐形成了时间和空间的概念，并设法对它们进行衡量。最初，最方便、简单的衡量工具是人体，比如，用脉搏来衡量时间，用手掌、脚步来计算长度。对于较长的时间来说，循环往复的天文现象是最好的时间单位，如年、月、日等等。后来，又逐步发明了沙漏、量尺、钟表等各种各样的时空计量工具。

时间和空间可以被衡量，于是人们就尝试对它们作进一步的描述，而这种描述与宇宙观有关。中文的宇宙二字，宇代表空间，宙代表时间。

3.1、宇宙和时空

人类是用感觉器官和仪器来感知世界的。在古代，宇宙就是人们眼睛所能看到的一切事物。

中国古代的宇宙学说主要有三种[2],它们是盖天说、浑天说和宣夜说。

盖天说出现于 3000 年前，最初，它被描述为“天圆如张盖，地方如棋局”。当然，这只是一种直观的比喻，圆的难以与方的相合，于是，后来逐步演变成天、地都是拱形的，北极星是天的中心，在那里天、地相距 8 万里；地不动，日月星辰在天球上，并随着天球绕中心旋转，其中，太阳轨道会随着季节而变化。盖天说认为大地是平的，因此只描述了人们头顶的半个天球。

在公元前 300-400 年间，人们逐步意识到：天、地都是球形的，地球也会运动，由此产生了浑天说。被称为东方亚里士多德的张衡，是浑天说的代表人物，他对浑天说作了这样的描述：“浑天如鸡子，天体圆如蛋丸，地如鸡子中黄，孤居于天内，天大而地小。天表里有

水，天之包地，犹壳之裹黄。天地各乘气而立，载水而浮……”他曾相当精巧地设计制造了一架浑天仪，在水流的推动下，一天刚好转一圈，仪器上的星星起落和实际天象几乎完全吻合。

以上两种宇宙说都认为人们看到的蓝天有个外壳，因此，人类能够观察到的宇宙是有限的。另外一种宇宙说，宣夜说，它的产生时期与浑天说差不多，则明确地否定了天壳的存在。它认为：人们看到的天壳并不是真的，天色苍茫，是由于我们看得非常遥远的缘故，犹如远山色青，深谷色黑，青与黑都不是它们的本色；日月众星自然地存在于虚空之中，它们的运行靠的是气的作用。在这里，引力被看成是元气的作用，而元气是一种真空态的物质，这样的描述与现代人的认识比较接近。不过，它没有描述日月星辰的运动规律，因此，应用价值不大，流传不广。

在西方，比张衡小 7 岁的托勒密，在总结古希腊天文学成就的基础上，提出了托勒密地心体系，它能对当时观察所及的天体运动，特别是行星运动作出比较精确的计算，因而在长达 1500 年的时期内被认为是真理。托勒密认为复杂的行星运动可以用简单的圆周运动合成，其中，每个行星按两个或两个以上的圆形轨道系统运行：一种叫它的均轮，另一种是它的本轮。

随着天文观察精确度的提高，到了哥白尼时代，本轮和均轮的圆圈数竟然多达 80 个左右。出生于 15 世纪的哥白尼信奉自然的简单、和谐，意识到托勒密地心体系肯定存在问题，而且，只在原有体系的基础上修修补补解决不了问题，应该要有重大的突破。他经过多年的悉心研究，发现每个行星都有三种共同的周期运动，即一天，一年和相当于岁差的周期运动，如果将这些分别归为地球的自转、公转和地轴回旋，就可以使行星的运动一下子简化很多，因此，将宇宙中心让位给太阳更为合理，从而提出了太阳中心说，冲破了地球是宇宙中心并固定不动的陈旧理念。

哥白尼对地心说的突破，引发了其他方面的新突破。他去世后不久，有三颗耀眼的新星在科学界相继升起。他们是伽利略、开普勒和笛卡尔。

伽利略，一位开启近代科学的大师，是他开创了实验和数学相结合的物理学研究方法；他提出了显示时空均匀性的相对性原理；他发现的摆的等时性原理，为钟表的发明提供了理论依据；他研制和运用天文望远镜，看清了行星的真面貌，为将宇宙空间扩展到无限创造了条件。

开普勒，被誉为天空立法者，他发现行星的运动轨道是椭圆形，终结了行星轨道由圆周运动合成的本轮和均轮系统，并总结出了行星运动三大定律，为牛顿发现万有引力定律打下

了基础。

笛卡尔，一位近代西方哲学的开创者，他最早将以太引入科学，是真空不空论的近代奠基人；他把本来互不联系的两个研究领域，几何与代数，结合起来，引进了坐标系，建立起平面上的点与数对的对应关系，从而可以用代数方程来表示几何曲线，同时也使数学从常量进入变量时代，这让时空描述变得形象、方便。

到了牛顿时代，人们已经形成了这样的时空观念：时空是万物生存、运动、发展和变化的所在，它们与物质无关；空间被用来描述物质的位置、形状，它是无限的；时间被用来描述事物的前后次序，它均匀流逝，没有开始和终结，是物质存在、运动和变化的持续性的表现。这样的时空观念是诞生牛顿物理的温床。

3.2、牛顿时空观

牛顿时空观也叫绝对时空观。牛顿在“自然哲学之数学原理”[3]中写道：“绝对空间的自身特性与一切外在事物无关，处处均匀，永不移动。相对空间是一些可以在绝对空间中运动的结构，或是对绝对空间的量度。”“绝对的、真实的和数学的时间由其特性决定，自身均匀地流逝，与一切外在事物无关。相对的表象的和普通的时间是可感知和外在的对运动之延续的量度，它常被用以代替真实的时间，如 1 小时、1 天、1 个月、1 年。”“与时间间隔的顺序不可互易一样，空间部分的次序也不可互易……所有事物置于时间中以列出顺序，置于空间中以排出位置。”

在牛顿看来，空间、时间分别代表物质存在的广延性和顺序性，这是两个直观的，由人类经验得出的概念，简单、易懂，无须定义，以上只是一些说明[4]。

牛顿对空间和时间的说明相当确切。绝对的空间和时间是科学的抽象，人们总是通过相对的空间和时间来认识它们的。例如，一节车厢内的空间，它是相对空间，可以运动，也可以度量，人们通过对许许多多这样的相对空间的认识，而抽象出了绝对空间，它总是相对静止的，不会随着车厢运动。同样，人们通过对 1 天、1 月、1 年等等相对时间的认识，抽象出了绝对时间，它均匀地流逝着。

抽象概念在人类的思维中有着重要的作用，它是我们描述世界所不可缺少的。例如，人是个抽象概念，它是从无数的，具体的你、我、他中抽象出来的，它不代表具体的一个人，但代表了我们整个群体。一个具体的人，可能会出现非人类共性的怪态、怪脾气和怪动作，他的生命是很短暂的；而人所代表的是人类的共性，其存在是长久的。因此，抽象是一种对某方面的信息进行综合、分析，由表及里地把共同的，本质的属性浓缩出来的过程或结果。

它来自具体，高于具体，比具体更全面、更普遍、更能反映事物的本质。同样，抽象的绝对时空比一些具体的相对时空更具普遍性和真实性。

空间和时间是经典物理学中最最基本的物理量。时空观就是物质在运动中的时空关系，这是一种最基本的物理学关系。伽利略变换是人们根据当时对时空的普遍性的常识得出的，它表达了绝对时空观。

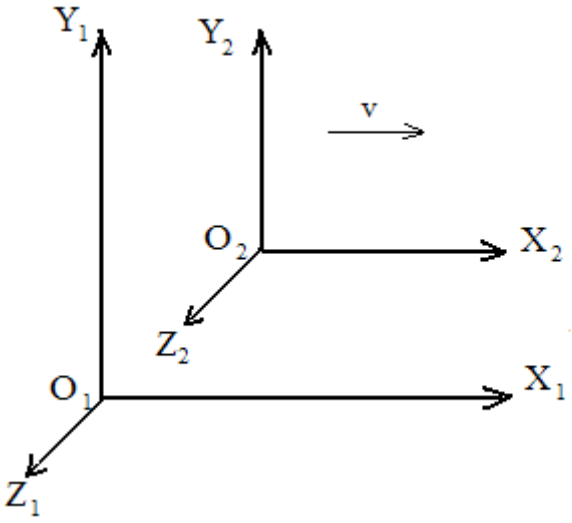

图 3.1：两个平行的惯性坐标系

如图 3.1 所示，在两个不同的惯性参照系上，建立二个平行的直角坐标系$O_1(x_1,y_1,z_1)$、$O_2(x_2,y_2,z_2)$，它们的 X 轴互相平行，O_2相对于 O_1以速度v沿 X 轴正方向匀速直线运动。那么，在牛顿时空观中，它们之间存在着伽利略变换关系：

$$\begin{cases} x_2 = x_1 - vt_1 \\ y_2 = y_1 \\ z_2 = z_1 \\ t_2 = t_1 \end{cases} \qquad (3.1)$$

3.1 式是两个不同的惯性参照系之间的时空关系，我们可以由此分析牛顿时空观的基本特性，其主要是三点：

一是空间和时间都与物质无关，因为在伽利略变换式中没有与物质性质相关的参数。

二是时间与空间各自独立，因为$t_1 = t_2$告诉我们，时间是普适的，它不会因空间的变更而改变。

三是时空标准不变。时空标准，即时间和长度的单位的值，是特定的时间间隔和长度间

隔，而时间间隔和长度间隔在伽利略变换中是不变的。

关于时间，两个给定的事件 P 和 Q，由于$t_1 = t_2$，它们发生的时间间隔，对 O_2 和 O_1 上的观察者来说都是相同的：$t_{2p} - t_{2q} = t_{1p} - t_{1q}$，即在伽利略变换中，时间间隔不变。

关于长度，设 A 和 B 是一根刚体棒的两个端点。在 O_1 中，它静止且与 X 轴平行地放着，其两个端点的位置是x_{1B}和x_{1A}。在 O_2 上的观察者看来，它在以-v的速度相对运动，他测得的棒的端点的位置是 x_{2B} 和 x_{2A}，运用伽利略变换得：$x_{2B} = x_{1B} - vt_B$ 和 $x_{2A} = x_{1A} - vt_A$，因为棒的两个端点是在同时运动着的，所以 $t_B = t_A$，从而 $x_{2B} - x_{2A} = x_{1B} - x_{1A}$， 即在伽利略变换中，空间间隔不变。另外，空间间隔不变性也说明空间不会随时间变化。

站在地上的人看到火车在轨道上奔驰；而火车上的人看到地面上的树木等在窗外迅速掠过，因此，从形式上来说，运动总是相对的。有不少人（包括牛顿）认为，绝对时空观意味着存在一个绝对静止的空间，这是一种误解，在伽利略变换中，没有绝对静止空间的存在余地。一个相对的空间可以被度量和描述它的运动，但具有普遍意义的空间是指抽象的空间，它无所谓形状大小，是被用来表达物质运动的，因此，空间本身无所谓运动。不过，“物质在空间中运动”的说法，又总是给人一种空间相对静止的感觉。众所周知，物质的运动是相对于所取的参照系来说的，因此，对于静止的空间，可以理解为：对于任何参照系，我们都可以认为存在着一个相对静止的绝对空间，它们在牛顿物理中是完全等价的。实际上，所谓静止的空间，就是一个进行物理描述的空间参考体系，因为牛顿的空间标准与物质环境无关，所以它可以任意确定。我们可以在任一参照系上确定一个刚性坐标系，以对事物进行时空描述，这个相对于参照系静止的坐标系就是一个抽象的绝对空间的数学表达。

时空可分为绝对时空和相对时空，由伽利略变换所表达的，以上述三大特征为代表的绝对时空观，它所描述的不只是经典物理学的时空，更是具有普遍意义的客观时空，真正的时空。物理学的时空，严格地说，都是可测量的相对时空，不是真正的时空。有人认为，没有物质，哪来时空？因此，时空与物质是不可分的，绝对时空与物质无关就是错误的。这里存在着对“无关”和“有关”的界定问题。时空是用来衡量物质运动的，没有物质，当然也就无所谓时空。而绝对时空与物质无关，指的是时空与物质各自独立，物质的运动、变化不会影响时空的衡量标准。一个标准会变化的时空能算得上是具有普遍意义的真正的时空吗？由于存在定量效应，绝对描述与定量描述之间存在着一定的错位；但是，在绝对描述的基础上，可以揭示定量描述的物理机制，这是绝对描述的意义所在。

3.3、相对论时空观

牛顿时空观是人类的长期经验积累的结果，而相对论时空观则是爱因斯坦个人天才的产物。爱因斯坦从小就对时空现象比较敏感。据说，5 岁时，他父亲给了他一只指南针，这触动了他的好奇心：为什么这指针总是指着一个方向呢？从此，一个又一个的“为什么”在他的头脑里出现，并常常陷入沉思之中。他在 16 岁时曾考虑过这样一个问题：如果一个人跟着光线跑，并企图抓住它，会发生什么现象？最后，他的思绪聚焦在相对性原理和光的传播定律之间的关系上。

相对性原理最早由伽利略提出，它认为力学定律在一切惯性参考系中具有相同的形式，任何力学实验都不能区分静止和匀速运动的惯性参考系。这意味着时空是处处均匀，各向一致的，没有一个惯性参考系空间是特别的。根据这一原理，如果一束光相对于参照系 O_1 的速度是 c，而 O_2 相对于 O_1 的速度是 v，那么，光相对于 O_2 的速度是 c+v，即光速不恒定。然而，在电磁学里，真空中的光速是个常量。据说，爱因斯坦曾长时间被这一矛盾所困惑，后来，在一次与朋友的讨论过程中，他终于顿悟到问题原来出在一个最不容易被人怀疑的基本思想观念，即同时性的问题上。他说：“时间这个概念本来是不能给一个绝对的定义的，但是在时间和信号速度之间有着不可分割的关系。有了这个新的概念，前面所说的困难就全部迎刃而解。5 个星期之后，狭义相对论就完成了。”[5]在这里，他指出了建立相对论的关键是：时间和信号速度之间有着不可分割的关系。其中的信号速度是指光速，因为它是已知的最快的信号速度。于是，他把时间标准和长度标准都与光速联系起来了，因为光速是光在单位时间中传播的路程长度。这再次印证了我们前面说过的观点：相对论是以光作为时空衡量标准的一种时空理论。

在爱因斯坦以前，洛伦兹等人已经提出了洛伦兹变换。他们的解释是：运动物体在以太的作用下，运动方向上的长度会收缩。而爱因斯坦在相对性原理和光速恒定的基础上进行数学演绎，得到了洛伦兹变换。他认为，洛伦兹变换显示了一种不同与牛顿的时空观，它在运动速度为零时化为牛顿时空观，即牛顿时空观只是一种近似的时空观。

如果二坐标系的关系如图 3.1 一那样，那么，洛伦兹变换为：

$$\begin{cases} x_2 = \beta(x_1 - vt_1) \\ y_2 = y_1 \\ z_2 = z_1 \\ t_2 = \beta(t_1 - vx_1/c^2) \end{cases} \qquad \left(\beta = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \right) \tag{3.2}$$

从（3.2）式，我们可以得出狭义相对论时空观的几个特性：

一是长度标准会随着运动速度而变化。设想一两端为A、B的量尺，静止且与X轴平行地放O_2上，它在O_2中的静止长度是$x_{2B}-x_{2A}$；在O_1上的观察者看来，AB是运动着的，而且，A、B二点总是同时运动着的，它的长度，由3.2式可得：$x_{1B}-x_{1A}=(x_{2B}-x_{2A})\sqrt{1-v^2/c^2}$。可见，运动棒长度的测量值$x_{1B}-x_{1A}$是其静止长度$x_{2B}-x_{2A}$的$\sqrt{1-v^2/c^2}$倍，即长度间隔收缩了。设该量尺运动时的单位长度为$dr$，静止的单位长度为$dr_0$，那么

$$dr=\sqrt{1-v^2/c^2}\,dr_0 \tag{3.3}$$

二是时间标准会随着运动速度而变化。设想有一只放在O_2坐标系的原点（x_2=0）的钟，它前后记录了相隔1秒钟的两个事件发生的时刻t_{21}=0和t_{22}=1，而在O_1坐标系上的观察者看来，根据洛伦兹变换计算，这两个事件发生的时刻分别为$t_{11}=0$，$t_{12}=\dfrac{1}{\sqrt{1-v^2/c^2}}$，这显示，运动物体上的时间间隔，或者说时间标准变长了，即时间膨胀了。设时钟运动时的单位时间为dt，静止时的单位时间为dt_0，那么

$$dt=\frac{dt_0}{\sqrt{1-v^2/c^2}} \tag{3.4}$$

三是长度和时间纠缠在一起，不再互相独立，这由洛伦兹变换的第4式很清楚地表示着。

四是长度和时间与实物有关。牛顿时空观中的速度与实物没有实质上的联系；而相对论中的实物质量与速度相关：

$$m=\frac{m_0}{\sqrt{1-v^2/c^2}} \tag{3.5}$$

因此，与速度有关的长度和时间就与实物的质量有了联系。

由上可知，狭义相对论时空观的基本特性与牛顿时空观恰恰相反。

狭义相对论描述的是惯性参照系之间的时空关系。如果一个人乘坐在加速运动的火箭上，时空关系又会出现怎样的情况呢？这是广义相对论所讨论的问题。爱因斯坦通过惯性质量与引力质量相等的假设，建立了广义相对论[6]。

在牛顿力学中有两种不同意义的质量：

力=惯性质量×加速度

力=引力质量×引力场强度

如果惯性质量与引力质量相等，那么，加速度就相当于引力场强度。加速度是速度的时间变化率；而引力场强度是引力势的空间变化率，于是，时空与引力势发生了关系。

在广义相对论中，时间和长度的标准会随着引力势而变化，对此，可以通过等效原理和能量守恒定律来导出一个简单的表达式：设在一个孤立的星球引力场中，一物体从无限远处向这星球自由降落，初速为0，在离星球r远处时，速度达到v，当地的引力势是φ（以无限远处为零点），那么它的动能与势能之和始终为零：$\frac{1}{2}mv^2+m\varphi=0$,即:

$$\varphi=-\frac{1}{2}v^2 \tag{3.6}$$

把（3.6）代入（3.3）和（3.4），得:

$$dr=\sqrt{1+2\varphi/c^2}\,dr_0 \tag{3.7}$$

$$dt=\frac{dt_0}{\sqrt{1+2\varphi/c^2}} \tag{3.8}$$

（3.7）、（3.8）与广义相对论中的史瓦西（Schwarzschild）解的结果完全一致[7]，其中的dt_0、dr_0，是指远离引力场的参照系上的固有的单位时间和单位长度。

在引力场里，引力势的分布是不均匀的，而时空标准会随着引力势变化，这被广义相对论描述为“引力场使时空弯曲了”。

广义相对论用存在局部惯性系的黎曼几何来描述引力场，其方程为：

$$R_{\mu\nu}-\frac{1}{2}g_{\mu\nu}R=kT_{\mu\nu} \tag{3.9}$$

（3.9）式的左边是表征引力场时空属性的爱因斯坦张量，右边是作为引力场源的物质能量动量张量，在这里，时空的结构和性质取决于物质的分布，物质周围的引力场使四维时空弯曲了。其意思是：当没有任何物质或能量存在时，空间应该是平直光滑的，当一个大质量物体进入空间后,平直的空间就发生了弯曲,这好比一条在席梦思上铺得很平很直的床单，当放进一个保龄球时，床单就凹陷下去，而放在床单上的东西会因床单凹陷而受力运动，所谓引力就是因为这样的空间弯曲所造成。

爱因斯坦于1916年建立了广义相对论，第二年就提出了一个宇宙学模型。他认为宇宙应该是静态的，“有限无边”的，其意思是，宇宙的四维时空好比是一种高维空间中的的球面，这球面的面积是有限的，但它没有边界。为了得到静态的宇宙解，他还在方程3.9中加

了一个宇宙常数Λ项。

后来，有人指出，作为3.9式场方程的解的宇宙模型是不稳定的，它要么膨胀，要么收缩。接着，1929 年，哈勃发现：河外星系的光谱线红移量与它们离开地球的距离大体上成正比。如果假设这种红移是星系视向运动的多普勒效应，那么，红移-距离关系就意味着宇宙在膨胀。既然宇宙在膨胀，它就必然有一个起点，从而导致了大爆炸宇宙学的兴起，它认为：物质、时间、空间都在大爆炸的一瞬间产生。这看起来非常荒诞，开始，相信的人不多。后来，被看成是大爆炸余热的宇宙微波背景辐射发现了；宇宙中氦元素的丰度与大爆炸理论的预言也基本相符等等，于是，大爆炸宇宙学渐渐成了标准的宇宙学模型。膨胀宇宙模型得到认可后，爱因斯坦曾感慨地说：引入宇宙常数是他毕生最大的错误。不过，现在有许多人认为：宇宙常数的引入并不违背任何基本原理，它可能代表了宇宙真空场的能量-动量张量或所谓的暗能量。

大爆炸宇宙学的证据是确实可信的，还是一些牵强附会或巧合？这留待第八章里讨论。

3.4、其他时空理论

相对论没有终结对时空观的探讨。相反，相对论时空观引起了孪生子佯谬、潜水艇悖论、车库悖论[8-10]等等，这促使人们去探讨新的时空理论。

3.4.1、弦理论的高维时空观[11, 12]

相对论在时空观方面有二大变革：一是把时间当作一维特殊的空间，从而扩大了空间的维数；二是将引力几何化了。

弦理论沿着相对论形式上变革的思路，进一步扩大了空间的维数：弦理论的数学方程要求空间是9维的，再加上时间维度，总共是10维时空；而由M理论给出的空间维度，理论上最大为11维，甚至25维。

弦理论家们普遍相信标准模型中的基本粒子实际上都是一些小而又小的振动的弦的闭合圈(称为闭合弦或闭弦)，所有粒子都可由闭弦的不同振动和运动得到。弦并不是在平常的三维空间运动，而是在我们无法想象的高维空间运动。在这里，我们过去关于空间的观念都是错误的，空间正在以一种陌生得令人惊讶的方式活动着。从本质上讲，所有的粒子都是质地相同的弦的不同的振动，它们实际上是在相同的弦上弹奏着不同的“音调”。弦理论也统一了四种基本力：开弦的端点为带荷的粒子，弦的振动描述了它们之间传递的力，引力是闭弦的振动。

然而，在人们的感觉中，空间总是三维的。对此，弦理论认为，高维空间的存在是合理的，可以举一个水管的例子来说明：水管的表面是二维的，但是当我们从远处看它时，它却像是一维的直线。这是为什么呢？原来，水管的那两维很不一样，沿着管子伸展方向的一维很长，容易看到；而绕着管子的那一个圆圈维很短，“卷缩起来了”，不容易发现。你必须走近水管，才能看清绕着圆圈的那一维。同样道理，在弦理论的 11 维空间中，3 维空间和 1 维时间是可以很容易探测到的宏观维，其他 7 维是难以探测到的微观的空间维。据说，弦微小到只有 10^{-33} 厘米，这个长度比我们今天能达到的最小尺度低 17 个量级，用今天的技术，要银河系那么大的加速器才能直接看见一根一根的弦。

弦理论家们认为，在我们的三维空间里，相对论和量子理论就像两块互不相干的碎片，永远也拼合不到一起。但把空间的维数向上抬高为十维，这两块看似互不相干的碎片就会令人震惊地结合得天衣无缝，成为一个更完整的理论大厦的两根互相依存的支柱！虽然我们在三维空间中无法想象和描述一个 10 维的空间，但我们却能通过复杂的数学方程推导出它的存在。

在弦理论中存在着许多可调节的参数，弦理论家们深信，只要适当调节这些参数，一定可以找到物理学的终极理论。然而，这种理论既很难证伪，也很难取得正果。比如说，弦理论预言了一个新粒子，它在某一高能加速器的探测范围内，但结果探测不到，那么，超弦理论家只要修改一下某个参数，就可以改口说：新粒子的质量超过了这个高能加速器的探测范围。另一方面，如果我们要求一个负的或零的宇宙学常数，那么就有无限多个不同的理论；如果要有一个正的宇宙学常数，理论的数量是有限的，大概为 10^{500} 个！要在这里找出一个终极理论来，比大海捞针还难。

实际上，物理学的终极理论是不存在的。一位物理学家说：我曾为那些思想的现代方法着迷了：超对称、超弦、隐藏的额外维的空间……可是，几年前，也许因为我更深刻认识了科学思想的历史和文化过程，事情突然变了。我开始怀疑统一，觉得它不过是实在的一神论在科学的翻版，是在方程里寻找神的存在。

相对论是一种把现实的时空标准的变化当作时空本身变化的物理学的数学模型；而弦理论，与其说它是一种物理理论，不如说它是一种数学理论，它激发了数学的进步，有多位弦理论家获得了有数学诺贝尔奖之称的菲尔茨奖，但这不能证明它是正确的物理理论。托勒密的均轮-本轮理论曾刺激了三角和数论的发展，但它并不因此而正确。如一个老科学家所说：“归根结底，数学只是我们的，而不是宇宙的。”

3.4.2、推广的伽利略变换（GGT)[13.14]

洛伦兹变换表达相对论时空观，于是，有人从修正洛伦兹变换式入手来探索新的时空理论。F. R. Tangherlini 和张操教授提出和发展了“推广的伽利略变换（GGT）”，就是这方面的一种尝试。

设 $O_0(X,Y,Z)$ 为特殊惯性系，$O(x,y,z)$ 是以常速 v，沿 X 方向运动的惯性系，那么，GGT 为：

$$\begin{cases} x = \beta(X - vT) \\ y = Y \\ z = Z \\ t = \beta^{-1}T \end{cases} \tag{3.10}$$

由 3.10 可知，GGT 既有伽利略变换的性质，即在两个惯性系之间，时间变换与空间坐标无关，同时性是绝对的；也有洛伦兹变换的特性，即在时间变换中有个钟慢因子 β^{-1}，在空间变换中有个尺缩因子 β。

张操教授指出：当描述亚光速粒子以及光子运动时，GGT 理论与狭义相对论同样地与实验相一致，只是狭义相对论的表述更为简单。可是在描述超光速的快子时，GGT 理论定义的时间要比狭义相对论具有优越性，因为，在 GGT 的框架中，在不同参考系中观察到的超光速粒子总是在时间中正向运动，不会出现时间的“反演”。

张操教授对时间概念有精辟的见解。他认为，在物理学中可以有多种时间定义，各种时间定义可以用确定的数学公式相联系；爱因斯坦的时间定义只是一种可取的方案，不能代替全部。例如，Atlanta 采用美国东部时间，Huntsville 采用美国中部时间，这两地的地方时间之间有 1 小时的时差，有人某天于当地时间的上午 10:00 从 Atlanta 乘飞机出发，到达 Huntsville 时，当地时间是 9:45，所以，他要把手表指针倒转 15 分钟。显然，这不意味着时间倒转了，而是由于他采用的都是当地时间之故。如果他采用统一的格林尼治时间的话，就不用调整手表了。同样，相对论的时间是一种地方时，不同的地方，时间标准是不同的，如果存在超光速运动，就将造成时间读数的倒退；而 GGT 时间好比一种格林尼治时间，在超光速运动中不会出现时间的反转。

3.4.3、物质空间理论

物质空间的观念源于笛卡尔的思想。笛卡尔认为不存在一无所有的空间，真空中充斥着

以太。我们已经指出，相对论的四维时空连续体，其实是以太在相对论时空观中的形象，所以，相对论的空间是一种物质空间。不过，爱因斯坦和当代物理学家很少意识到这一点。张操教授则明确指出：“既然以太（或真空）作为背景场是一种客观的物质，以太与运动物体的相互作用应是一个研究课题，相对论的基础应该受到再考察。”

上海师范大学信息与机电工程学院的殷业博士明确主张物质空间的观念，他提出了“物质空间层次宇宙模型”[15]，其要点如下:

(1) 所有存在的空间都是物质空间。

(2) 物质空间具有层次结构,由稠密向稀薄,从低级到高级递进. 最稠密的空间是宇宙爆炸时的“奇点”,最稀薄的空间是“无”空间.“无”空间是假设的一无所有的空间,但“奇点”和“无”空间都是作为极限空间而存在。

(3) 地球周围能看到的空间是:固态空间、液态空间、气态空间、真空空间,它们都是物质空间,人类生活在气态空间中,鱼生活在液态空间中。

(4) 真空是一种物质空间,本宇宙为一个真空物质组成的有限封闭空间,在它的最外端的膨胀界面之外假设存在比真空更稀薄的物质空间,定义它为:“YIN 空间”。

(5) 低层次空间相对于高层次空间,在物质形态上表现为不连续的量子化. 如:鱼是一条一条的固态,水是连续的液态；气态的恒星在真空中是一颗一颗的,真空是连续的； 同理,YIN空间是连续的,本宇宙真空球和其他宇宙真空球是一个一个分布其中的. 物质空间层次宇宙模型示意图如图 3.2 所示.

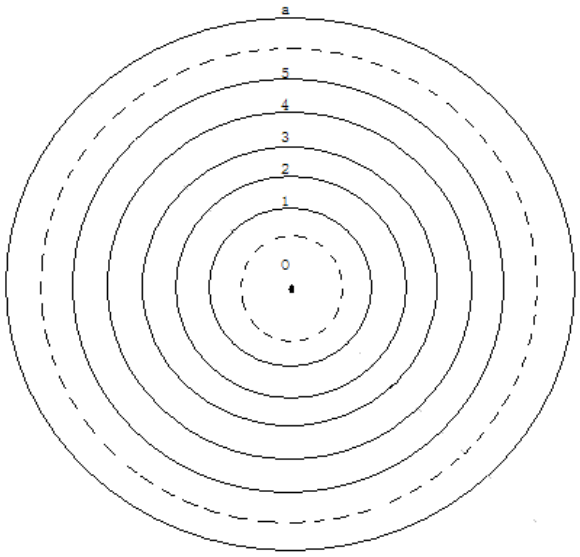

图 3.2 物质空间层次宇宙模型示意图：中心 0 为奇点；1 是固态空间；2 是液态空间；3 是气态空间；4 是真空空间；5 为 Yin 空间；a 为无空间。

在物质空间的基础上，殷业博士进一步提出：质量和真空空间能可以相互转化,在等能量密度膨胀时,遵循质空积守恒,这样将能量守恒定律的适用范围扩展到了包含真空空间能。在这里，殷业博士提出了一个新的概念：质空积，即运动物体的体积与它质量的乘积[16]。注意，其中的运动物体的体积的变化，仅仅是指狭义相对论性效应引起的体积变化。

殷业博士对相对论的悖论深有研究，他认为：“因为不存在绝对惯性系，所以伽利略相对性原理是一条近似原理，爱因斯坦将伽利略相对性原理绝对化了，这既是爱因斯坦出彩的地方，也是爱因斯坦出错的地方，将相对性原理绝对化加上光速不变公理使爱因斯坦得到了对称的狭义相对论，但同时对称的理论和不对称的真实之间隐含了偏差，当这种偏差不能忽略时就产生了悖论。”“相对论是忽略了参照系的差异才导致时钟快慢的相对性，通过对相对论的修正，由相对性引起的悖论就全部自然消失了。”[17]

3.5、宏观物理学的 Smarandache 几何模型

牛顿时空观和相对论时空观，它们所描述的时空都是宏观物理学的时空，其中有 3 种不同的时空几何。

牛顿时空是三维欧几里德空间加一维时间。欧几里德空间是一种刚性几何体,所谓刚性，就是不会变形，其具体的表现是：任意二点之间的距离 s 与参照系的选取无关，即：

$$ds^2 = dx_1^{\ 2} + dx_2^{\ 2} + dx_3^{\ 2} = \text{不变量} \qquad (3.11)$$

这对于牛顿空间来说是很显然的，因为牛顿的长度标准处处相同。另外，由于牛顿的时间标准处处相同，因此，任何一个时间间隔与参照系的选取无关，也是刚性的。

在狭义相对论中，时空标准会随着参照系的不同而变化，(3.11）式就不再是不变量了。这意味着狭义相对论的时空不是欧几里德的刚性空间了吗？不是。狭义相对论的空间和时间是纠缠在一起的，闵可夫斯基将时间当作一维特殊的空间，并用 $x_4 = \sqrt{-1}ct$ 来替换通常的时间坐标，那么，这四维时空中任意二点间的距离也与参照系的选取无关：

$$ds^2 = dx_1^{\ 2} + dx_2^{\ 2} + dx_3^{\ 2} + dx_4 = \text{不变量} \qquad (3.12)$$

因此，狭义相对论的四维时空连续体也是欧几里德几何体。

在广义相对论中，时空几何由物质及其运动所决定。在这里，时空失去了刚性，而变得跟软体动物一样，会随着物质的运动而“蠕动”，(3.12）式就不能成立。这就是说，广义相对论的时空成了一种非欧几里德几何体。在欧几里德几何里，二点之间直线最短，而在非欧

几里德几何里，二点之间弯曲的测地线最短。

在欧几里德几何中，坐标轴是直线，三维空间 3 条轴，四维空间 4 条轴。对空间中的任何一点 p，我们可以过这一点作 n（维数）条与坐标轴平行的直线，就可确定这一点的位置 p（$x_1, x_2 \cdots x_n$）。在非欧几里德几何中，确定一个点的是 n（维数）条曲线。广义相对论将无限小的曲面看作欧几里德平面，无限接近的二点之间的距离 ds 作为平面线段处理，四维时空线元表示为：

$$ds^2 = g_{\mu\nu} dx_\mu dx_\nu \quad （\mu，\ \nu =1、2、3、4） \qquad （3.13）$$

其中 $g_{\mu\nu}$ 是表示该点时空性质的度规张量。

宏观物理学有 3 种不同的空间：牛顿空间、狭义相对论空间和广义相对论空间，对此可以直观、简单地构作一个 Smarandache 几何模型。

如图 3.3 所示，半椭圆形 ACB 外，是一般的牛顿空间，直线、平行线就是通常的直线、平行线，适用于三维欧几里德几何。半椭圆形 ACB 内是相对论空间，它被直线 AC 分成二部分，其中 S_1 表示狭义相对论空间，在这里，我们定义：从其中任何一点出发的，可以无限延长的射线为 Smarandache 直线，记为 S_1-直线，代表被时间牵连的狭义相对论四维空间中的直线；两条不相交的 S_1-直线为平行线。那么，过 S_1 内任何一点 P，只能够在 AB 方向上作 S_1-直线，有且仅有一条 S_1-直线与给定的 S_1-直线 CA 平行，这表示 S_1 是一种四维欧几里德几何。S_2 表示广义相对论空间，在这里，我们定义：连接边上二点的线段为 Smarandache 直线，记为 S_2-直线，代表广义相对论的局域化的四维空间中的直线，如果两条 S_2-直线不相交，就为二线平行，那么，过 S_2 内任何一点 Q（不包括 AC 上的点），将有无数条 S_2-直线与给定的 S_2-直线 AC 平行，所以，S_2 可以表示四维非欧几里德几何空间。在这里，我们可以看到，半椭圆形 ACB 外的几何空间是最基本的空间，S_1 和 S_2 这两个几何空间，是在这基本空间的基础上设置边界，并重新定义直线和平行线的结果。这种情况与牛顿时空、狭义和广义相对论四维空间之间的物理实质有密切的关系在这三者中，牛顿时空是最基本的，它有二重意义，一它是真正的时空；二是它不存在以太或以太的作用可以忽略情况下的定量描述的时空；而狭义和广义相对论的四维空间都是由存在于牛顿时空中的可压缩性以太的作用引起的定量描述的空间，只是前者中的以太分布是均匀的；后者中的以太分布是不均匀的。

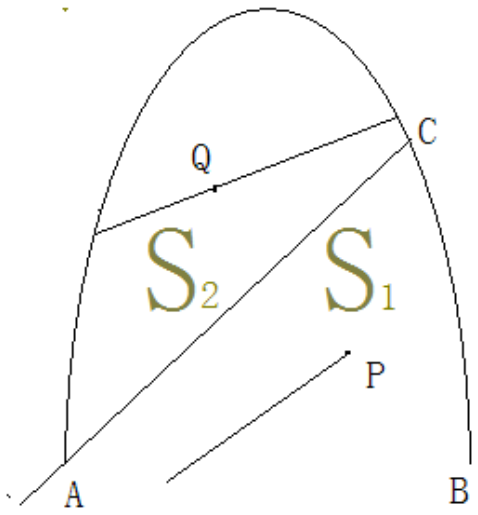

图 3.3 宏观物理学的 Smarandache 几何模型

图 3.3 的宏观物理学的 Smarandache 几何模型可以用少一条边的长方形或三角形等等来表示，我们选择了半椭圆形，这是为了在后面构建区间场论和整个宇宙的 Smarandache 几何模型打好基础，这样可以使图形更清晰、美观。

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第四章 宏观以太与时空观

迈克尔逊-莫雷实验不能探测出地球相对于以太的绝对运动。为了解释这一结果，G. F. FitzGerald 在历史上首次提出：以太能够如相对论所说，在运动方向上收缩物体的尺寸，并且与通过以太的速度成比例。接着，洛伦兹变换被 J. Larmor、H. A. Lorentz 等逐步完善，是 Poincare 给了它现代形式，并命名它为洛伦兹变换[1-5]。最后，爱因斯坦在发展他的狭义相对论的过程中显示，洛伦兹变换涉及空间和时间的本质[6]。洛伦兹变换的不同的导出方法可以导致对它的不同的解释。我们在伽利略变换的基础上，用流体力学的方法导出了洛伦兹变换，这一过程，把绝对时空观、宏观以太和相对论时空观之间的内在联系充分显示出来了。

4.1、洛伦兹变换的流体力学导出

在流体力学中，不可压缩流体的运动，速度势 Φ 满足方程:

$$\Delta\phi\left(x.y.z\right)=0 \qquad (4.1)$$

如果有一个运动物体在无限大的可压缩流体中运动，这将在它周围的流体中引起速度（包括大小、方向）密度和压力等的扰动。如果可以假设这些扰动为一阶无穷小量，则可得一线性化的方程[7]：

$$\left(1-\frac{v^2}{c^2}\right)\frac{\partial^2\phi}{\partial x^2}+\frac{\partial^2\phi}{\partial y^2}+\frac{\partial^2\phi}{\partial z^2}=0 \quad (v<c) \qquad (4.2)$$

其中c、v为该流体中的声速、流速

对(4.2)式作变换：

$$\begin{cases} x^{'}=\beta x \\ y^{'}=y \\ z^{'}=z \end{cases} \qquad \left(\beta=\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}\right) \qquad (4.3)$$

（4.2）就成了（4.1）的方程形式：$\Delta\phi\left(x^{'}.y^{'}.z^{'}\right)=0$。即（4.3）是将可压缩的流体变换成不可压缩流体的变换式。

如果存在一种特殊的流体，它能满足（4.2）式成立的有关条件。那么，我们在这种特殊流体上，建立二个平行的直角坐标系 $O_1(x_1,y_1,z_1)$、$O_2(x_2,y_2,z_2)$，它们的 X 轴互相重叠，O_2 相对于 O_1 以速度v沿 X 轴正方向匀速直线运动，那么，在绝对时空观中，它们之间存在着伽利略变换关系：

$$\begin{cases} x_2 = x_1 - vt_1 \\ y_2 = y_1 \\ z_2 = z_1 \\ t_2 = t_1 \end{cases} \tag{4.4}$$

$$\text{和}\begin{cases} x_1 = x_2 + vt_2 \\ y_1 = y_2 \\ z_1 = z_2 \\ t_1 = t_2 \end{cases} \tag{4.5}$$

将（4.3）代入（4.4）和（4.5）[（4.4）中的x_1是相对静止的固有长度，保持不变；同理，（4.5）中的x_2不变。]并且去掉$t_1 = t_2$，得：

$$\begin{cases} x_2' = \beta\left(x_1' - vt_1\right) \\ y_2' = y_1' \\ z_2' = z_1' \end{cases} \tag{4.6}$$

$$\text{和}\begin{cases} x_1' = \beta(x_2' + vt_2) \\ y_1' = y_2' \\ z_1' = z_2' \end{cases} \tag{4.7}$$

把（4.6）中的第一式代入（4.7）中的第一式，可得：$t_2 = \dfrac{1}{v\beta}\left(x_1' - \beta^2 x_1' + \beta^2 v t_1\right) = \beta\left(t_1 - \dfrac{x_1'\left(\beta^2 - 1\right)}{v\beta^2}\right)$，将$\beta^2 = \dfrac{c^2}{c^2 - v^2}$代入，得：

$$t_2 = \beta\left(t_1 - \frac{vx_1'}{c^2}\right) \tag{4.8}$$

如果特殊流体的声速就是光速，那么，形式上，（4.6）和（4.8）二式合起来就是洛伦兹变换！

上述洛伦兹变换的流体力学导出，作者曾以“月弓”为笔名发表在《潜科学》杂志1989年第4期上[8]，同期，廖铭声先生也发表了一篇关于流体力学与相对论密切相关的论文[9]。现在，已经有越来越多的学者,如杨新铁、刘卫平等认识到了流体力学与相对论之间的内在联系，取得了许多研究成果[10.11]。

以上的推导过程中的特殊流体,在真空里无限分布,而且其中的声速就是真空中的光速，所以它不可能是一般的实物流体，只能是宏观以太，而且，超流动性的以太完全可以满足（4.2）式的要求。这就从另一个角度印证了作为光的传播媒介的以太的存在。

量子场论认为，物理真空是量子场的基态，这只是一种微观描述。同一种物质，宏观地看和微观地看，形象会有巨大的差异。比如，对于水，如果我们只从微观的角度去研究它，就只能发现它由一个个分子组成，每个水分子都在进行着杂乱无章的运动，很难发现它们作为一种连续性流体的最基本的性质。另外，在微观世界，以太不但与引力场有关，而且还受到电磁场、色场等的强烈牵连，因此，以太的形象显得相当复杂。洛伦兹变换的流体力学导出清晰地表明，宏观以太是一种连续性流体，这为研究以太开辟了新的视野，而且，在宏观世界，以太主要与引力场相关，这更能显示以太的真相。

4.2、两种描述之间的对应关系

洛伦兹变换的流体力学导出，是把绝对时空观中的可压缩性以太转化为相对论时空观中的不可压缩以太的过程。在这里，绝对时空观是基本的，第一性的，绝对描述是一种基本的描述，它用统一的时空标准衡量世界；相对论时空观是在绝对时空观的基础上，通过一个流体力学的代换后得到的，是第二性的，相对论是一种定量描述，它用可变的时空标准衡量世界；这两种描述之间存在着错位，那是很显然的，但也会有一定的对应关系。

以太遍布宇宙，它应满足连续性方程：$\frac{\partial \rho}{\partial t}+div\rho\vec{u}=0$，使该方程对洛伦兹变换协变，可得一组变换式:

$$\begin{cases} \rho^{'}=\beta\rho\left(1-\dfrac{vu_x}{c^2}\right) \\ \rho^{'}u_x^{'}=\beta\left(\rho u_x-v\rho\right) \\ \rho^{'}u_y^{'}=\rho u_y \\ \rho^{'}u_z^{'}=\rho u_z \end{cases} \qquad (4.9)$$

在（4.9）中，若把密度ρ换成质量m，就同相对论中的质量、动量变换式完全一致了。可见，以太密度与质量有着某种对应关系。因为质量是实物的属性，无空间广延性，再考虑到质量与万有引力场之间的联系，以太、引力场、实物三者之间的内在联系就显现出来了：在宇宙的统一的以太海洋里，以太密度的分布与实物密切相关——实物是以太密度波包的核心，实物的质心就是以太密度的极大值点。在这里，定量描述的概念与绝对描述的概念之间的对应关系是：引力势的绝对值对应以太密度；引力场强度对应以太密度梯度；质量对应实物的以太波包的密度的变化量（相对于平均值，它与以太波包的密度极大值相关，）。声学中，密度的变化量ρ和压力的变化量P之间的关系是：$P=\rho c^2$（c是声速）。由于以太的声速就是光速，那么，根据质能关系$E=mc^2$，能量对应以太波包的压力的变化量。

实物是以太包的核心，这意味着，以太密度的平滑分布（无极大值点）表示“无”，即真空，以太密度的起伏分布（有极大值点）表示“有”，有实物。任何一个实物都会有自己的万有引力以太波包。实物运动时，它本身在实实在在地运动，但它周围的以太只是在波动，即以太本身不作宏观的移动；因此，实物的相对运动，例如地球相对于太阳的运动，不会产生所谓的“以太风”，迈克尔逊-莫雷实验的否定结果是很自然的。实际上，即使地球表面存在以太风，迈克尔逊-莫雷实验仍然会是否定的结果，刘卫平等人已通过数值模拟实验和实际声干涉实验证明：可压缩流动具有回路声干涉条纹不随风速变化而变化的效应[11]。

古人云：以太其大无边；其小无内。因为以太充斥宇宙，所以“其大无边”；由于无论以太密度是疏还是密，在定量上，以太质点的间距是不变的，是最基本的长度单位，以太质点本身的大小就难以确定，这是对“其小无内”的一个注释。实际上，定量上以太质点间距的固定不变，也是量子性的起源，这将在后面显示。

实物运动时，虽然它周围的以太只是在波动，但由于以太的密度中心在随着实物移动，因此，从效果上说，直线运动的实物部分地带动了以太；对于轴对称转动的物体来说，它的转动不改变周围以太密度的分布，因此，从效果上看，它不带动以太。另外，当二个实物作相对运动时，如果实物之间不发生碰撞，伴随它们的二个以太包之间的相互穿插，不会影响他们之间的速度关系，（4.2）式就能成立；洛伦兹变换的流体力学导出就完全可以进行。

由于以太的可压缩性，运动物体质量（能量）的增加，可看成是其以太波包的密度（压力）的变化量比静止时有所增加的缘故。这就是说，狭义相对论的质速关系 $m=\dfrac{m_0}{\sqrt{1-u^2/c^2}}$，可以看成是以太流体的密度（压力）的变化量与速度之间的关系：

$$\rho=\frac{\rho_0}{\sqrt{1-u^2/c^2}} \tag{4.10}$$

（ρ 是相对运动的以太波包的密度的变化量，ρ_0 是相对静止的以太波包的密度的变化量）和

$$p=\frac{p_0}{\sqrt{1-u^2/c^2}} \tag{4.11}$$

（p 是相对运动的以太波包的压力的变化量，p_0 是相对静止的以太波包的压力的变化量）

上述显示，动能是物体的以太压力相对于静止时的增加量，而势能则是同一物体在引力

势不同的二点之间的以太压力差。

不过，请注意，这里的以太压力的增加，并不意味着存在一般的力学效应，它对应的只是能量的变化。另外，这里也意味着，运动不完全是相对的，而是与物体所在处的以太场有关，这将在后面进一步说明。

时间和长度是最最基本的物理量，时空观的不同必然引起其他物理量的变化。经典物理学中的物质只是实物，与真空无关；相对论中的物质，与真空有关，质量（或能量）会随着运动速度和外界引力势而变化，它对应实物的以太密度的变化量，即质量是以太密度分布不均匀的产物，或者说，惯性起源于以太密度的变化。实物运动时，它周围的以太分布将随之变化。显然，以太不能作为“绝对参照系”。

下表是对两种描述之间的对应关系的一个综合。

绝对描述和定量描述之间的对应关系表

绝对描述	定量描述
以太可压缩	以太（四维时空连续体）不可压缩
以太密度	引力势的绝对值
以太密度场	引力场
以太密度梯度	引力场强度
以太波包的密度增加量（相对于平均值）	质量
以太波包的压力增加量（相对于平均值）	能量
以太密度均匀分布（无实物）	平直时空
以太密度不均匀分布（有实物）	弯曲时空
以太密度变化率	时空曲率
时空标准不变	时空标准可变
以太密度的增加	空间收缩，时间膨胀
光速会随着以太密度变化	光速恒定
光线向以太密度增加的方向弯曲	光沿短程线传播
每一个实物都有以它自己为核心的以太密度波包，它们的叠加构成了宇宙	实物的存在使时空弯曲，宇宙有限而无界

定量描述与绝对描述，由于所持的时空观不同，对同一事物就会有不同的反映。在绝对描述看来，引力场是以太密度场；以太是可压缩的超流体；光线在引力场中的偏转，就是向介质密度较大的方向弯曲，这同普通声音的传播方式完全相同。而定量描述认为，引力场是时空曲率场；以太是均匀的四维时空连续体；光线是在弯曲的时空中沿着短程线传播；等等。

绝对描述和定量描述之间存在着错位，这解答了 19 世纪以太论中的一个困惑：菲涅尔等直观的以太力学模型（绝对描述），总无法完全符合定量关系；而洛伦兹的满足定量关系的以太模型又失去了直观的力学性质。对于这二种不同描述之间的“错位”，应该准确地把握。绝对描述的图象是比较直观的，它反映了事物的本来面貌，但不一定能完全符合定量关系；定量描述能比较正确地符合实际的量方面的关系，但它往往扭曲了事物的本来面貌；我们应该把这二种描述有机地结合起来，它们是相辅相成的。

4.3、相对论的物理机制

相对论性现象包括狭义相对论的运动学效应和广义相对论的引力效应，它们都由现实的时空测量标准的可变性造成。那么，现实的时空标准为什么会变呢？由上可知，那是由于以太密度会变。因此，我们可进一步把时空标准的变化归结为以太密度变化效应：以太密度较大的地方，量杆较短，时钟也走得较慢。由此可知，狭义相对论的运动学效应是由以太可压缩性造成的——实物在以太中运动时，它自身的可压缩的以太波包的密度提高了，因此其中的量杆收缩了，时钟变慢了；广义相对论的引力效应是由于引力势对应以太密度，引力势绝对值较大的地方，以太密度较大，于是量杆较短，时钟较慢。

进一步，按照流体力学的方法，将以太流体看成由无数的“以太质点”构成，那么，情况是这样的：现实的长度和时间的标准由实质性描述中的以太密度决定——单位长度同以太质点的间距成正比；单位时间同光通过以太质点间距的时间间隔成正比。用这样的长度和时间的标准来衡量以太，定量描述的以太就成了处处均匀，各向一致的“四维时空连续体”，光在这均匀的媒介里，速度当然恒定了。同时，由于长度和时间的标准都与以太质点间距有关，于是，相对论性的空间和时间就纠缠在一起了。

洛伦兹等认为，运动物体的洛伦兹收缩，是在以太的作用下，物体本身的收缩，这把运动物体的长度收缩绝对化了，是不确切的。洛伦兹变换的流体力学导出表明，洛伦兹变换所反映的长度收缩、时间膨胀都只是真空效应，即以太密度的变化效应。目前，最精确的时空衡量工具是光，在绝对描述中，光在不均匀的以太中传播时，它的速度会有变化，而这在定量描述中，相应的情况是：光速不变，光的波长、频率变了，从而，长度标准和时间标准都

变了，即绝对描述中光速比较慢的地方，定量描述的长度标准缩短了，时间标准变长了。

下面，我们用一维以太分布线来作进一步的说明。

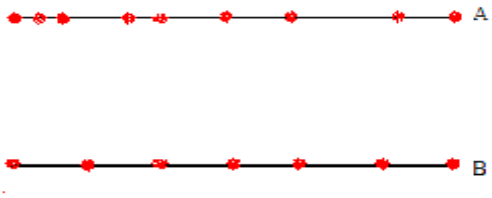

图 4.1　绝对时空观中的一维以太分布线

如图 4.1 所示，在绝对时空观里，时空是平直的，以太是可压缩的，所以，在其一维直线上，以太的分布可以是均匀的，也可以是不均匀的。我们以红点代表以太质点，直线 A 上的以太分布是不均匀的，直线 B 上的以太分布是均匀的。

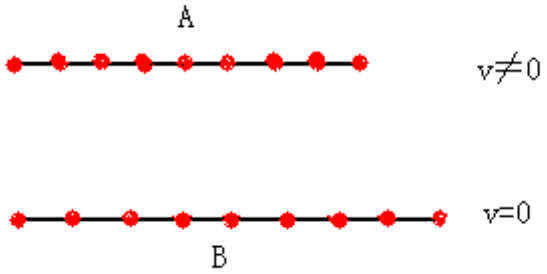

图 4.2　狭义相对论时空中的一维以太分布线

在狭义相对论里，一维以太分布线也是直线，因为它对应的是以太密度均匀分布的状态，但是，由于以太的可压缩性，在不同的参照系中，以太质点的密度是不同的。如图 4.2 所示。

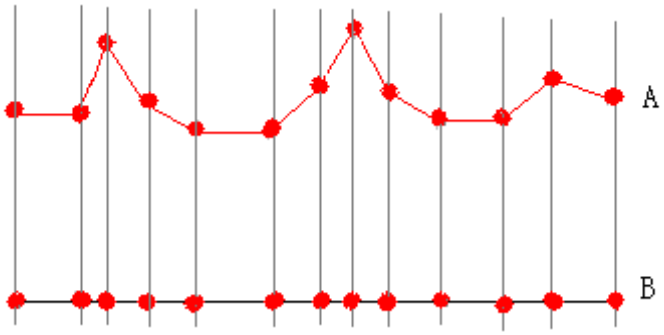

图 4.3　广义相对论时空中的一维以太分布线及其与绝对时空观中的一维以太分布线的对比

广义相对论研究的是存在加速度或引力场时的时空情况。以太密度的分布，在绝对时空观看来是不均匀的；在狭义相对论看来是均匀的。在广义相对论中，光速不变原理仍然成立，因此，以太密度的分布也是均匀的，只是由均匀分布的以太构成的四维时空连续体变得“弯曲”了。其中所谓的“时空曲率”，其实只是时空标准的变化率——甲、乙两地的标准的钟和标准的量尺，如果它们的快慢和长度不一样，那么，广义相对论就认为这两地的时空曲率不相同。于是，出现了这样的情况：在广义相对论时空中的一维以太分布线上，相邻二以太质点的间距都相同，但这条一维以太分布线弯曲了。如图 4.3 所示，同一条一维以太分布线，在绝对时空观看来，它是一条直线 B，而在广义相对论的时空观里，它成了一条曲线 A，A、B 两条一维以太分布线上的以太质点是一一对应的，图上以竖线连接。可以发现，曲线 A 上，以太密度越大的地方，相邻的两个以太质点连线的斜率的绝对值越大，斜率的正、负根据以太密度是增加还是减少来确定。广义相对论时空中的一维以太分布线是曲线，这就是所谓的广义相对论时空弯曲了。真正的时空不会弯曲，这种所谓的弯曲，其实只是对以太不均匀分布的一种数学描述。

总的说来，时空观可以分为二大类型：一类是科学抽象性的时空观，它同实物没有实质性的联系，那就是绝对时空观，这是真正意义上的时空观。另一类是物质依托性的时空观，它通过测量方式同一定的物质世界相关联。比如，古人将太阳起、落的方向定为东、西，与地面的垂直方向为上、下，太阳二次升起的间隔为一天等等，这是人们根据地面上的观察而得到的一种时空观，可称之为“地面性时空观”；而相对论时空观由以太造就，是一种“以太性时空观”。这类时空观同实物性的衡量工具相联系，可以建立数学模型，进行具体的定量描述和检验，但具有一定的局限性。比如，地面性时空观只在特定的地面上有效，即使在同一个地球上，不同的地面，其上下的方向，一天的时间长短等都各不相同。这与相对论中，运动速度或引力势不同的地方，时空标准不同，在性质上是类似的。

绝对时空观比物质依托性的时空观更基本，更抽象，它能说明物质依托性时空观的物理机制，并指出它们的局限性。

4.4、相对论的局限性和近似性

狭义相对论认为，任何相对运动都会引起相对论性效应，这其实并不一定。比如，由地球自转引起的恒星绕地球转，这不会引起相对论性效应，否则，离地球 1 光年远的天体，它们绕地球转的速度已大大超过光速。

狭义相对论讨论的是关于以太密度分布均匀时，即没有引力场时的情况。它忽视了以太

这个基础，于是，产生了一些难以破解的佯谬。实际上，相对论把以太当作了一种“时空物质”，它所谓的时空均匀性，就是定量描述中的以太分布的均匀性。这意味着，如果 A、B 二人以速度 v 相对运动，那么，A 认为自己是静止的，周围的以太密度处处为 p；B 是在这种环境中运动着的；而 B 认为自己是静止的，周围的以太密度处处为 q；A 是在这种环境下运动着的。然而，由于以太的可压缩性，即由于存在运动学效应，p≠q，即 A 与 B 不平权，这是产生佯缪的根本原因。图 4.2 所示的，是观察者在 B 上，因此认为，B 不动，A 动时的一维以太分布线。

根据相对论性现象是由以太密度变化引起的，可以把相对运动分为形式上的运动和实质性的运动二种类型：运动物体自身的以太波包密度不发生变化的运动，是形式上的运动，只会产生观察效应，相对论公式无效；运动物体自身的以太波包密度会发生变化的运动，是实质性的运动，会产生实实在在的效应，相对论公式有效。由地球自转引起的恒星绕地球转，因为地球的以太波包与遥远恒星的以太波包之间，基本上互不影响，这只是观察效应，是形式上的运动，相对论公式无效。当然，纯粹的实质性的运动或纯粹的形式上的运动是不存在的，相对运动的双方，有可能一方是实质性运动为主；而另一方是形式上的运动为主。比如，粒子在地球以太场里的运动，基本上是实质性的运动；而地球相对于该粒子的运动是形式上的运动为主，因为，从整体上说，地球的以太波包不会受到某一粒子运动的影响；地球和太阳之间的相对运动，比较起来，地球绕日运动是实质性的运动，而太阳绕地运动是形式上的运动，所以，日心说要比地心说伟大。可见，运动的相对性在形式上总是成立的，但相对运动的双方在实质上不一定平权。

实物运动时，它周围的以太分布将随之变化，因此，以太不能成为“绝对参照系”。由于实质性的运动学效应是以太的可压缩性造成的，这是外界的以太场对运动物体自身的以太波包的作用的结果，因此，描述物体的运动时，应该以物体所在处的外界基本以太场作为参照物。研究银河系内天体的运动时，所有河外星系的以太波包之和，可看成是种均匀的宇宙背景场，而应该以银河系的以太波包作为参照物；研究太阳系内行星的运动时，因为银河系的以太波包对各行星的作用几乎相等（各行星与银心之间的距离几乎一样），成了均匀的宇宙背景场的一部分，所以，应该以太阳系的以太波包作为参照物；在地面上，太阳系的以太波包也成了均匀的宇宙背景场的一部分，应该以地球的以太波包作参照物。1971 年 Hafele 和 Keating 进行的铯原子钟环球飞行实验[12-13]的结果证明了这一点。该实验显示，向东环球飞行后，飞行钟比地面钟平均慢了 59×10^{-9} 秒；向西环球飞行后，飞行钟比地面钟平均快

了273×10^{-9}秒。显然，这实验的结果与相对论的“动钟必慢”的观点大不吻合，因为，相对于地面来说，向东环球飞行和向西环球飞行一样都是在运动。在这里必须取地心坐标系，这样才能以相对论的公式来计算，并获得与实验基本相同的结果[14]。这里的地心坐标系，实际上就是把地球的引力场以太波包作为参照物的坐标系。

如果有一个带电体静止在地面上，它不会产生磁场，这早已经被实验证实。如果它在地面上运动，那么，根据相对性原理，在地面参照系看来，它会产生磁场，而在与这个带电体相对静止的参照系看来，它不会产生磁场。情况是否真的如此呢？带着这个问题，上海市东方电磁波研究所的朱永强、季灏和郝建宇研制了一个新的能测定一个弱磁场（10^{-7}G）的仪器“电容和感应线圈相互正交的联合体，”，并用它于 2007 年 10 月进行了一次“带电体运动产生磁场的跟踪观察实验”，结果发现，当运动方向平行于电容板方向时，仪器感受到了和仪器一起运动的带电体即平板电容器所产生的弱磁场，这就是说在地球上带电体运动产生磁场的“运动”，必须以地球为参考系[15]。他们还认为：地球是一个实验参考系统，但是它的成立仅仅是在地球相邻区域。在宇宙中不同的区域有无数的不同的实验参考系统，例如，在月球上应该取月球为实验参考系统，而在太阳上必须以太阳为实验参考系统。这与本书的观点一致。

关于相对论的局限性，有人认为：由宇宙微波辐射各向异性所显示的“新的以太漂移”，即地球相对于宇宙微波辐射的运动速度约为 390 公里/秒[16]，清楚地证明了绝对运动的存在，这表明绝对坐标系将会以某种新的形式重返物理学。这种看法是值得商榷的。局部的绝对运动是存在的，但总会有一定的范围。如上所述，在地面上，相对于地球的运动是绝对运动；在太阳系里，相对于太阳的运动是绝对运动；在银河系中，相对于银心的运动是绝对运动。那么，宇宙微波辐射各向异性所显示的绝对运动对应什么范围呢？可能是本星系团，因为，太阳系绕银心的速度是 220 公里/秒，银河系绕本超星系团的速度是 600 公里/秒，而宇宙微波辐射各向异性所显示的地球运动速度是 390 公里/秒。宇宙微波辐射也是以太的波动，由此，我们来分析一下以太密度，即引力势的分布：把天体的质量看成集中在质心上，天体产生的引力势的数量级为 GM/r（G 是万有引力常数，M 为天体质量，r 是离开天体质心的距离），那么，通过简单的计算，可以发现：在地面的某固定点上，地球的引力势<太阳的引力势<银河系的引力势。从理论上说，天体的等级越大，其引力势也就越大。但宇宙微波辐射各向异性所显示的绝对运动意味着引力势将在本星团群达到一个极大值。即在地面上，本超星系团的引力势将小于本星系团。

另外，相对论带有一定的近似性。已往，在推导洛伦兹变换时，都有意或无意地运用了宇宙学原理，即宇宙空间是均匀和各向同性的。这一原理保证了洛伦兹变换是线性的[17]，但也导致了后者的近似性。因为，在相对论中，时空与物质密切相关，宇宙学原理只能是一种大范围的统计性的近似，由此推导出来的洛伦兹变换式也只能是近似的。其实，本书中的洛伦兹变换的流体力学的导出过程，也反映了相对论公式的近似性。因为，（1.2）式是经过了线性化处理的，线性化就意味着是有条件的，近似的，它只有当以太处于完全超流动性时才成立。超流体都有一定的“临界速度”、“临界密度”和“临界压力”等等，以太密度会随着物体的运动速度而提高，达到一定程度时，以太将失去超流动性，相对论公式就将不再有效。实际上，爱因斯坦自己也说过：“对于很大的场的密度和物质的密度，场方程以及这些方程中的场变量，都不会有真实意义……总之，需要认清方程不得推广到这样的区域去。”[18]

上海市东方电磁波研究所季灏老师，在 2006-2009 年期间，发表了一系列与相对论有关的实验报告[19-22]，被称为“季灏实验”，其实验数据介于经典和相对论的理论值之间，但趋势上更接近于经典理论，这很发人深思。

4.5、关于光障

有许多关于超光速的理论研究、观察和实验的成果，比如，类星体的超光速膨胀，量子隧道效应中的超光速效应等等[23-25]。

根据我们的以太观，可以将超光速与超声速作个类比。大家知道，物体在空气中运动时，会使前进路上的空气受到压缩而产生阻力。当物体的运动速度接近声速时，它前方（运动方向上）的空气密度及其对物体的压力极大提高，从而形成了声障。同样，一个物体在真空中运动时，随着运动速度的提高，它的质量和能量，即它自身以太波包的密度和压力随之增加，当速度接近光速时，这以太的密度和压力将趋向无穷大而成为“光障”。

人类早就征服了声障。这一般是将运动物体（如飞机等）的前部尖锐化，让它不断地推开迎面而来的空气，使之不能形成声障而超过声速。另外，小体积的东西，比如说，线度小于空气分子间隙的东西，它能很容易地推开碰到的空气分子而达到超声速。实际上，微观粒子大多数都在进行超声速运动。这可供我们理解超光速的参考。

我们可以将中微子的超光速比作小体积东西的超声速。根据相对论公式，任何有静止质量的东西，无论它的静止质量是多么的小，当它的速度接近光速时，它的总质量也会趋向无穷大。因此，如果中微子的质量为零，那么，它的超光速就不足为奇。另外，上面指出：以太密度会随着物体的运动速度而提高，达到一定程度时，以太将失去超流动性，相对论公式

就将不再有效，即相对论的质-速关系有一定的适用范围，当实物的速度达到光速时不能成立。所以，如果中微子有质量，它也可以超光速。关于中微子的质量问题，后面 7.4 节中将有进一步的探讨。

根据以上的类比，一般有静止质量的物体，伴随着一个以太的密度波包，当它的速度接近光速时，会形成光障。如果我们想要超光速，就必须搅动以太，使其不凝结成光障。然而，以太是完全超流动性的，用一般的方法难以搅动以太。但办法总会有的。后面我们将指出，电磁场中的以太被电磁激发了，而这好比超流体的热激发，使其具有了一定的粘滞性，这就是说，让以太电磁化，使它具有粘滞性，就有可能搅动以太。因此，特殊的电磁装置，比如说超高速旋转的电磁场，有可能激发并驱动以太，为超光速开路。

我们相信，随着科学技术的发展，人类总有一天会突破光障。

现在，有人认为超光速是不可能的，他们的一个理由是：超光速将破坏洛伦兹对称性。洛伦兹对称性就是相对论的时空对称性，这是一种数学模型，它的物理诠释就是定量描述中的以太分布是处处均匀，各向一致的。这是相对论以光作为时空的衡量工具而描绘出来的结果。当物体的运动速度达到或超过光速时，相对论的时空衡量工具鞭长莫及，失效了。用洛伦兹对称性否定超光速，是用一种数学模型去否定它适用范围外的一种物理实在，是站不住脚的。

上海交通大学的杨文熊教授提出：可以用罗朗级数来统一地描述亚光速和超光速，罗朗级数的正幂次展开描述亚光速；罗朗级数的负幂次展开描述超光速，而且，超光速粒子的质量仍然为正[26]，这是人们真正所向往的超光速。

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第五章 相对论的定量效应

时间和空间是物理学中两个最基本的物理量。绝对时空观是用理想的，绝对不变的标准来描述时空的；而相对论是用现实的，可变的标准来描述时空的，因此，相对论中的时间、空间观念不等同于牛顿的时间、空间，但他们之间又会有一定的关系。

实际上，相对论离不开牛顿时空观。因为，它要说明时空标准如何变化，必须借助于相对不变的量，也就是绝对描述的量。根据 3.2 节对绝对时空的理解，相对论中的固有量其实就是特定的绝对描述的量。

5.1、相对论的定量效应方程组

牛顿时空观和相对论时空观都认为任何惯性参照系相互等价。实际上，它们有着本质上的区别。绝对时空观认为，任何惯性参照系上的时空标准都是一致的；而相对论时空观显示，不同惯性参照系上的时空标准不相同。

狭义相对论指出，在某一惯性参照系中，单位时间 dt 和单位长度 dr 与速度 u 之间的关系由公式（3.3）、（3.4）表示，为：

$$dr = \sqrt{1 - v^2 / c^2}\, dr_0 \tag{5.1}$$

$$dt = \frac{dt_0}{\sqrt{1 - v^2 / c^2}} \tag{5.2}$$

dt_0和dr_0 为该惯性参照系中的单位固有时间和单位固有长度，它们不随速度变化，用来衡量以任何速度相对运动的物体上的时空标准的变化。因此，他们就是这一惯性参照系中的绝对描述的单位时间和单位长度。（5.1）、（5.2）就是在这一惯性参照系里，定量描述的时空标准与绝对描述的时空标准之间的关系，是狭义相对论对绝对时空观进行定量修正的“定量效应方程组”。

同样，广义相对论认为，单位时间和单位长度会随着引力势而变化。方程（3.6）、（3.7）和（3.8）就是这方面的表示，现在将它们编号为（5.3）、（5.4）和（5.5）：

$$\varphi = -\frac{1}{2}u^2 \tag{5.3}$$

$$dt = \frac{dt_0}{\sqrt{1 + 2\varphi / c^2}} \tag{5.4}$$

$$dr = \sqrt{1 + 2\varphi / c^2}\, dr_0 \tag{5.5}$$

（5.4）、（5.5）与广义相对论中的史瓦西（Schwarzschild）解的结果完全一致[1]。

（5.4）、（5.5）中的dt_0、dr_0，是指远离引力场的参照系上的单位时间、单位长度，它们不随引力势变化，也就是绝对时空观中的单位时间、单位长度。于是，（5.4）、（5.5）是广义相对论的“定量效应方程组”。

定量效应方程组可以用来很简单地说明相对论性现象

5.2、定量效应方程组的应用

相对论定量效应是由现实的时空标准的可变性造成的。它象个“魔术师”，可以把本质上（即在绝对时空观中）可变的描述成定量上不变的；把本质上不变的描述成定量上可变的；下面是二个例子。

5.2.1、雷达回波延迟

关于雷达回波延迟[2][3]，“引力与时空”一书有明确的分析和解答[4]，它指出，延迟的原因是：光线在引力场中的偏折和光速变慢。其中，由光线偏折造成的路程增加极小，是一个可以忽略的二阶修正；因此，雷达回波延迟的主要的原因是：引力场中的光速变慢了。该书运用线性化近似的引力场方程，经过好几个步骤，求得引力场中的光速为：

$$c_0 = 1 - \frac{2GM}{c^2 r} \qquad (5.6)$$

其中，取$c=1$；G是引力恒量；M是天体的质量；r是离该天体质心的距离。

其实，这可以用（5.4）和（5.5）简捷地来求：定量描述的速度单位（dr/dt）和绝对描述的速度单位（dr_0/dt_0）之间的关系是：

$$dr/dt = \frac{\sqrt{1+2\varphi/c^2}\,dr_0}{dt_0/\sqrt{1+2\varphi/c^2}} = (1+2\varphi/c^2)dr_0/dt_0 \qquad (5.7)$$

设无引力场时光速为c，绝对描述（即以dr_0/dt_0为速度单位）中的引力场里的光速是：

$$c_0 = (1+2\varphi/c^2)c = (1-\frac{2GM}{c^2 r})c \quad (\text{unit}\, dr_0/dt_0) \qquad (5.8)$$

这与（5.6）式完全一致。

至于光的引力延迟时间，根据（5.8）式，运用微积分即可求出。在下面的计算中，为方便起见，取光速为1，c不代表光速，而是坐标值。

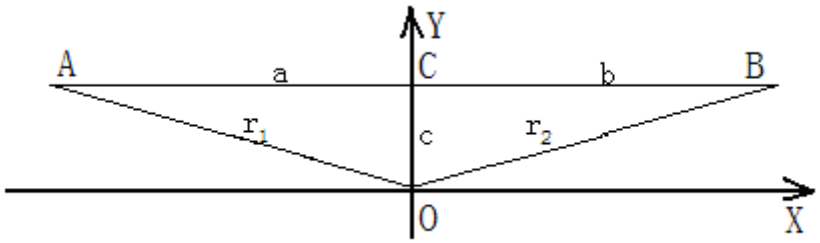

图 5.1 在太阳(0)引力场中，地球（A）与行星（B）之间的光线路径示意图

如图 5.1，在太阳引力场中，从地球 A (-a, c)发出的光或雷达信号，沿着近似直线 ACB 到达目标行星 B (b, c)，其传播时间是：

$$\Delta t=\int_{-a}^{b}\frac{dx}{dx/dt}=\int_{-a}^{b}\frac{dx}{1-2GM/r}\approx\int_{-a}^{b}(1+\frac{2GM}{r})dx=\int_{-a}^{b}(1+\frac{2GM}{\sqrt{x^2+c^2}})dx$$

$$=b+a+2GM\ln\frac{\sqrt{b^2+c^2}+b}{\sqrt{a^2+c^2}-a} \qquad (5.9)$$

（5.9）左边第三项代表单程引力延迟时间。当地球与目标行星处于太阳二边的相反位置（“上合”）时，引力延迟时间最大。这时，$\frac{c}{a},\frac{c}{b}$ 都很小，它们的平方项都可略去不计，于是，经过分母有理化，可得单程引力延迟时间近似地为：

$$\Delta t\approx 2GM\ln\frac{4ab}{c^2} \qquad (5.10)$$

（5.10）式中的时间 t 不是地球上的时间，地球上的时间近似地为固有时 t_0。根据（5.4），

$$\Delta t_0=\sqrt{1+2\varphi/c^2}\,\Delta t\approx(1-\frac{GM}{r})\Delta t=2GM(1-\frac{GM}{r})\ln\frac{4ab}{c^2} \qquad (5.11)$$

这方面的实验，不但通过水星[2]、金星[5]进行过，也通过水手号宇宙飞船[6]和海盗号火星探测器[7]等进行过，实验值与理论符合得很好[4]。

显然，引力场中的光速变慢的结论，是一种绝对描述，这是用一个不变的时空标准去衡量整个太阳引力场中的光速的结果。定量地说，光速不变原理在广义相对论中仍旧成立，因为引力场中的长度和时间的标准会随着引力势变化，如果用每一点定量的时间和长度的标准去衡量经过该点的光速，那么，运用（5.7）式，把（5.8）式中绝对描述的速度单位 dr_0/dt_0，换成定量描述的速度单位 dr/dt，结果将恒为 c：

$$c_0 = (1+2\varphi/c^2)\ c/\left(1+2\varphi/c^2\right) = c \quad （单位\ dr/dt）\qquad (5.12)$$

于是，绝对描述上可变的光速被定量描述成了不变的。

绝对描述上的引力场中的光速变慢，导致了光的引力延迟。延迟的时间可观察，可计算，这一事实表明，绝对描述的确反映了事物的客观情况，同时也显示了两种描述之间的互补性。

5.2.2、光谱线的引力红移

在绝对描述看来，真空中，光的固有频率v_0是不变的。但是，在定量描述中，时空标准会随着引力势而变化，引力场里的时钟走的快慢不一样，这样，用两只快慢不一的钟去衡量同一束光的频率，就导致了定量上的光谱线的红移。

对同一束光，测量的时钟走得慢（标准长），光的频率就较高，即光的频率与当地定量描述的单位时间的大小成正比，所以，根据（5.4），光子的频率。

$$v = \frac{kv_0}{\sqrt{1+2\varphi/c^2}} = \frac{kv_0}{\sqrt{1-2GM/c^2r}} \approx k\left(1+\frac{GM}{c^2r}\right)v_0 \qquad (5.13)$$

其中k为比例系数。

（5.13）式显示，光的频率会随着引力势变化。当1个光子从引力势绝对值大的地方（时间标准较长）往引力势绝对值小（时间标准较短）的方向运动时，用经过处的当地时间标准来衡量，它的频率在降低，即光谱线在红移。对于同一个光子，若前后处于径向位置r_1和r_2，那么，二者的频率之比是:

$$\frac{v_1}{v_2} = \frac{\sqrt{1-2GM/c^2r_2}}{\sqrt{1-2GM/c^2r_1}} \qquad (5.14)$$

(5.14)就是光在 Schwarzschild 几何中的引力红移公式[4]。这样，本质上不变的光的频率被定量地描述成了可变的。

5.3、效应能量分析法及其应用

5.2.1和5.2.2节是运用定量效应方程（5.4）和（5.5）来简捷地解答雷达回波延迟和光谱线的引力红移问题。下面，根据定量效应方程，进一步提出一个“效应能量分析法”，用它可简捷地解答行星近日点的进动和光线的引力偏折问题等。

5.3.1、效应能量分析法

把（5.3）式代入狭义相对论的质速关系式 $m=\frac{m_0}{\sqrt{1-u^2/c^2}}\approx(1+\frac{u^2}{2c^2})m_0$ 可得：

$$m=\frac{m_0}{\sqrt{1+2\varphi/c^2}}\approx(1-\frac{\varphi}{c^2})m_0=\left(1+\frac{GM}{c^2r}\right)m_0 \qquad (5.15)$$

（5.15）式是质量-引力势关系式。质、能相当，可以把(5.15)式写成能量-引力势关系式：

$$E=\frac{E_0}{\sqrt{1+2\varphi/c^2}}\approx(1-\frac{\varphi}{c^2})E_0=\left(1+\frac{GM}{c^2r}\right)E_0 \qquad (5.16)$$

（5.15）和（5.16）式，也是广义相对论的定量效应方程。（5.16）式显示，近似地说，引力场中的物体带有二种能量： “固有能量” E_0 和“效应能量” $\frac{GM}{c^2r}E_0$。因此，我们可以把广义相对论性问题转化成经典问题：在绝对时空观的基础上，把引力场中一个物体的运动，看成是由固有能量引起的的“固有运动”与效应能量引起的“效应运动”之和。这效应运动将不改变固有运动的系统，而只是使固有运动系统作整体的变动。比如，行星的固有运动系统是椭圆，行星效应能量的存在，不改变这椭圆的形状，而是使这整个椭圆缓缓地旋转，即进动。

一个物体的固有能量和效应能量之间的关系，不同于一般的总能量与分能量；二者之间的大小比例是一定的，而且相互之间不可转换；它们处于相同的引力作用下,是在这种情况下做功的能力，因此，这二种能量运动的位移（或角位移）之比，就等于这二种能量之比。这就称之为效应能量分析法，简述如下。

效应能量分析法：引力场中的一个物体的相对论性运动，可在绝对时空中分解成固有能量引起的固有运动和效应能量引起的效应运动； 效应运动一般不改变固有运动系统，而只改变整个固有运动系统的运动状态；效应运动的位移（或角位移）与固有运动的位移（或角位移）的比值等于这二种能量之比，约为 $\frac{GM}{c^2r}$。

当然，效应能量分析法还只是一种假设，它是否成立，要看它能否与事实相符。下面，我们运用这一方法来计算行星的进动和光线的引力偏折问题，结果将与广义相对论一般方法导出的公式完全一致，但相当简捷，这从一个侧面反映了它的合理性和优越性。

5.3.2、行星近日点进动

关于行星的近日点进动，上面已经指出，效应运动只与进动有关。在这里，效应能量表现为额外的角向动能，它使行星在完成一个周期的椭圆运动时，矢径转过的角度不是2π，而是$2\pi+\alpha$，α即进动角。这种额外的角向动能与固有运动中的角向动能二者的作用，始终是同向、同步的，因此，这进动角可以这样简单地来求：计算进动的角向动能与固有运动的角向动能之间的比值，那么，运用效应能量分析法，当行星完成一个周期的椭圆运动时，它的进动的角位移就可以按比例求出。

不考虑效应运动时，行星的角向运动由行星的固有运动的角向动能造成。我们先来计算行星的角向动能与总能量的比值。

对圆形轨道，动能都是角向动能，其值是势能绝对值的$\frac{1}{2}$，因为引力加速度$a=\frac{v^2}{r}=\frac{GM}{r^2}$，所以动能$\frac{1}{2}mv^2=\frac{1}{2}m\frac{GM}{r}$，而$m\frac{GM}{r}$为势能，于是，行星的角向动能是总能量的$\frac{1}{3}$。对于椭圆形轨道，动能中有一部分成了径向动能，这与角向运动无关。当行星处于远日点时，它的动能为$\frac{GMm}{2(a+c)}$（G是引力常量，M是太阳质量，m是行星质量，a是半长轴，c是半焦距），当行星处于近日点时，它的动能为$\frac{GMm}{2(a-c)}$，因此，行星椭圆运动的平均动能是$\frac{1}{4}GMm\left(\frac{1}{a-c}+\frac{1}{a+c}\right)=\frac{GMm}{2a\left(1-e^2\right)}$（$e$是偏心率）；而半径为$a$的圆周运动的动能是$\frac{GMm}{2a}$，因为，长轴一样的椭圆运动的总能量是一样的，于是，角向动能是椭圆运动平均动能的（$1-e^2$）倍。因此，行星固有运动的角向动能约是$\frac{1-e^2}{3}E$（E是固有运动系统总能量）。

根据效应能量分析法,行星进动的角向动能是效应运动的能量，其值为$\frac{\varphi}{c^2}E$，它与固有运动的角向动能的比值是$\frac{3\varphi}{c^2\left(1-e^2\right)}$。所以，当椭圆运动的角向动能完成一个周期（$2\pi$）运动时，进动的角度按弧度计为：

$$\alpha=\frac{2\pi\times 3\varphi}{c^2\left(1-e^2\right)}=\frac{6\pi\left(2\pi a/T\right)^2}{c^2\left(1-e^2\right)}=\frac{24\pi^3a^2}{\left(1-e^2\right)c^2T^2} \qquad (5.17)$$

式中 T 为行星运动一周的时间。

（5.17）式与广义相对论一般方法导出的公式完全一致[8]。

5.3.3、光的引力偏转

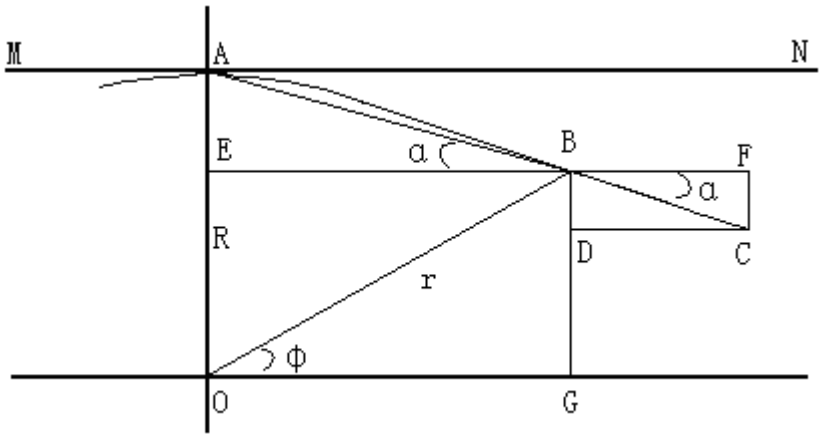

图 5.2 光的引力偏转

如图 5.2，没有引力场时，光子沿水平直线 MAN 运动，而实际上，光子沿曲线 ABC（实际上这是一条与 MAN 偏角极小的近似直线）运动，O 是天体的质量中心，AO=R 是天体的半径，MN∥EF∥DC∥OG。

光子从 A 运动到曲线 ABC 上任意一点 B 处时，∠FBC=α 是光子从 A 点运动到 B 点时的累计偏转角。因为曲线 ABC 近似于一条直线，而且，光线的偏折主要发生在 A 点附近，所以，当 B 点离开 A 点相当远时，直线 AB 与 B 点处的切线和曲线 BC 就几乎在一条直线上，于是，∠ABE=∠FBC=α，$tg\alpha=\frac{AE}{BE}=\frac{R-r\sin\phi}{r\cos\phi}$，即$r\sin\phi=\frac{R}{1+ctg\phi tg\alpha}$。因为光线的偏转角非常小，所以，当$\phi=\alpha$时，$\alpha$就足够精确地等于光从 A 点出发到穿越引力场后的总偏转角。这时，

$$r\sin\phi=\frac{R}{2} \qquad (5.18)$$

光子的固有运动系统是以恒定速度作直线运动；它的效应运动不改变固有运动的系统，

只是使其直线系统缓慢地平行位移，这在 B 点可以被分解为垂直的效应运动位移 BD 和水平的固有运动位移 BF，这两种位移之比为 $\frac{GM}{c^2 r}$（M 是该天体的质量；r 为矢径长度，是个变量），这是一种瞬时值。我们要求的是 B 点处的累计偏转角α，为此，我们来考虑另外一种情况：设想同一质量的天体的质量中心在 G 点，BG 是其半径，光子在 B 处水平掠过，于是，BF 表示光的固有运动的瞬时水平位移，FC 表示效应运动的瞬时垂直位移，这时的瞬时偏转角就是α，也就是光从 A 点出发到达 B 点时的累计偏转角，这样，就可以直接运用效应能量分析法来计算：$\frac{FC}{BF}=\frac{GM}{c^2 BG}$。结合（5.18）式，光从 A 点出发到穿越引力场后的总偏转角是：

$$\alpha \approx tg\alpha = \frac{FC}{BF} = \frac{GM}{c^2 r\sin\phi} = \frac{2GM}{c^2 R} \qquad (5.19)$$

光子到达 A 点的前、后运动轨迹是对称的，所以，它在引力场中的总偏转角是$\frac{4GM}{c^2 R}$，这也与一般方法导出的公式完全一致[9]。

5.4、光速不变的条件

17 世纪前，人们以为光速无限大，伽利略首先对此提出了质疑；后来，天文学家通过木星卫星食和光行差等现象，在 18 世纪就确认了光速是有限的；20 世纪初，爱因斯坦把光速不变当作了一条基本的原理；而我们指出，光速不变只是一种定量效应，这是有条件的。

在相对论的原始论文“论动体的电动力学”里，爱因斯坦对光速不变原理是这样定义的：“任何光线在‘静止的’坐标系中都以确定的速度 c 运动着，不管这道光线是由静止的物体还是由运动的物体发射出来。”可见，爱因斯坦明确表示，光速不变是对静止坐标系来说的。

他进一步设想，一根二端为 A、B 的棒，它的轴与 x 轴平行，并以均匀的速度 v 沿 X 轴的正方向运动，让一束光在时刻t_A从 A 发出，于时刻t_B在 B 处被反射，并在时刻$t_A^{'}$回到 A 点，时刻t_A、t_B、$t_A^{'}$和运动着的棒的长度r_{AB}都是用静系中的工具测量的，于是，爱因斯坦说：“考虑到光速不变原理，我们发现$t_B - t_A = \frac{r_{AB}}{c-v} and t_A^{'} - t_B = \frac{r_{AB}}{c+v}$。”[10]

如上所述，如果有二个参照物 A、B，它们以速度 v 相对运动，那么，按照爱因斯坦的观点，A 上的观察者认为光相对他的速度是c；相对于 B 的速度是$c \pm v$，即与v同方向的光速是$c-v$；反方向的光速是$c+v$。而 B 上的观察者也认为光相对于他的速度是c；相对于 A

的速度是$c \pm v$，这是因为，A 和 B 的时空标准是不同的，如果只用一种时空标准，光速是可变的。推广的萨涅克效应实验结果也显示了这一点。

1913 年法国科学家萨涅克（Georges Sagnac）做了一个实验，发现了一种新的物理效应，这个效应现在以他的名字命名，称为萨涅克效应[11]：在一个以顺时针方向旋转的圆盘上的两束光，一束以顺时针方向走闭合回路，另一束以逆时针方向走闭合回路，它们会以不同的时间走完这二个形状完全相同的回路，前者会多花一些时间。两者的时间差一般以 $\Delta t = 4A\Omega / c^2$ 表示,式中 A 是回路所包围的面积，Ω 是旋转角速度。

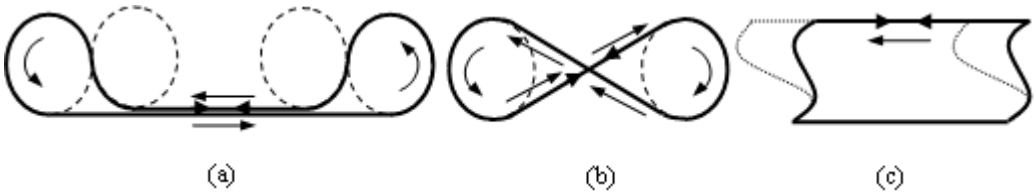

图 5.3 推广的萨涅克效应实验

最近几年，美籍科学家王汝涌教授等，在实验中，用光纤的“传送带”来替代旋转圆盘（如图 5.3），从而使光的传播媒介不但可以作匀速圆周运动，也可以部分地进行匀速直线运动如（a）、（b）；另外，他们还做了“剪切”平行四边形（c 上面动、下面不动）等等实验。大量实验证明了，任一线段对回路中两个相反方向传播的光束的总的传播时间差都有贡献。对传播时间差的这一贡献正比于运动速度矢量V 和线段长度矢量 L 的点积：

$$\Delta t = (2/c^2) V \cdot \Delta L \qquad (5.20)$$

这里运动无论是直线运动还是圆周运动都是如此，时间差也与光传导介质的折射率无关。这一结果把旋转运动的萨涅克效应作为一个特例包括进来，因此，他们称之为“推广的萨涅克效应”[12.13]，并且指出：推广的 萨涅克效应的本质並不是一般认为的转动和回路面积，而是线段的速度和长度。

在推广的萨涅克效应装置中，取一段长Δl，以速度v相对于实验室参考系作匀速直线运动的光缆,用相对于实验室参考系静止的时间和长度的标准来测量,按照爱因斯坦的观点，与 v 同方向的光速是 c-v，与 v 反方向的光速是 c+v，于是，二束反方向传播的光，通过这段光缆的时间差$\Delta t = \dfrac{\Delta l}{c - v} - \dfrac{\Delta l}{c + v} = \dfrac{2v\Delta l}{c^2 - v^2}$。由于光缆的运动速度远远小于光速，因此，$c^2 - v^2 \approx c^2$，$\Delta t \approx \dfrac{2v}{c^2}\Delta l$，这与实验公式(5.20)一致。可见，推广的萨涅克效应支持了爱因斯坦对光速不变原理的表述。

现实的时空标准，随着环境而变化。在同一惯性参照系里，时空标准不变，伽利略的速度合成定律是完全成立的；而相对论的速度合成定律其实是不同参照系之间的速度变换。比如，在上述例子中，一束光从 A 发出，射向 B，那么，站在 A 上的观察者（他所持的是 A 上的时空标准）可以用伽利略速度合成定律计算：这束光相对于 A 的速度是 c，相对于 B 的速度是 c-V；如果要问在 B 上观察这束光的速度，即将观察者从 A 转移到 B，就要用相对论的速度合成定律了，计算的结果仍为 c。

综上所述，在牛顿时空观看来，光速是可变的，相对论的光速不变是由于现实的时空衡量标准发生变化而产生的一种定量效应。由于光速是一种不变的定义速度，在绝对描述中光速较慢的地方，现实的最精确的“光尺”收缩了；最精确的“光钟”变慢了，所以，直接测量到的光速总是不变的。这里的直接测量，指的是测量仪、记录器和测量地点处于同一位置上的测量。如果不是直接测量，那么光速是可变的值。在推广的萨涅克效应中，用静系的时空衡量工具去测量动系中的光速，光速变了。因此，在自然界，存在超光速现象，它们不能被直接测量到，但可以用对比等方法间接地探测到。比如，光速在引力场中的变慢是一种间接测量的结果；在量子隧道效应中和类星体上存在超光速，也是间接推测出来的结果。

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第六章 有关电磁现象的进一步探讨

电磁相互作用是原子世界的主宰，它又是长程的，在宏观世界也是常客；作为电磁波的光子是一种微观粒子，它又是连续性以太中的宏观波；因此，电磁现象是联系宏观和微观的纽带，我们在探究微观世界前，先来对它作下进一步的探讨。

6. 1、电磁是以太的最基本激发

前面，我们已经指出，光是超流动性以太中的第二声，这只是问题的一个方面

在实物性的超流体中，第一声和第二声的传播速度是不同的。当温度趋于绝对零度时，两者的比值趋于$\sqrt{3}$[1]。这是根据以分子运动论为基础的热力学公式求得的，显然，这种方法不适用于以太。以太中的第一声是密度变化量的传播，以太的密度变化量对应质量，因此，这是一种质量波；以太中的第二声是“温度波”，即热传播，是种能量波。质量与能量是紧密联系的，有质必有能，有能必有质，因此，以太中的二种声音是合二为一的。不过，由于电磁相互作用比引力相互作用强得多，所以，光主要表现出电磁波的特征。

任何温度大于绝对零度的物体,都在进行着电磁辐射。可见，在以太的各种激发中，电磁激发的起点能量最小，它应该是以太的最基本的激发，这好比处于绝对零度的超流动性分子，获得动能，就激发成了热运动分子。至于这种电磁激发的物理机制，将在第七章里作具体的描述。

大家知道，带有电、磁性的物体的运动，会辐射电磁波，那么，不带电、磁的中性物体的运动是否会扰动真空态以太呢？下面是一个回答。

6. 2、动能的电磁量子假设

一般认为，物体的动能与电、磁没有必然的联系。然而，情况未必如此。

光子的能量，既是纯粹的动能，也是纯粹的电磁能，它的能流密度矢量S与电场强度E、磁场强度H之间存在着矢量关系：

$$S = E \times H \qquad (6.1)$$

大家知道，光子的波粒二象性关系适用于一般的实物。那么，其矢量关系（6.1）是否也适用于一般的实物呢？这个问题很值得深究。拿导线切割磁力线产生感应电动势来说，导线的运动方向、磁场方向和感应电动势的方向，这三个方向(不包括数值)之间的关系，符合（6.1）式。其他有关动能的电磁感应，也存在着类似的情况。对此，本文提出如下的假设。

动能量子假设：光子的矢量关系（6.1）适用于一般实物的动能量子，即每一个动能量子都满足关系式

$$S_0 = E_0 \times H_0 \qquad (6.2)$$

一个运动物体包含无数动能量子，它们的S_0的方向一致，其矢量和S为该实物的动能流密度矢量，而E_0和H_0的分布，在与S垂直的平面上各向同性，不呈现明显的电磁性；当存在外界电、磁场时，E_0和H_0的分布将发生变化。这意味着，实物的动能是隐性的电磁能。这可以进一步用以太来描述：实物的相对论性动能与实物本身的以太波包的以太压力有关，当以太受到扰动，其中就会产生电磁激发，每一个动能量子是一个以太质点，它满足(6.2)式，其矢量方向会随着外界电、磁而变化。当无电磁性的中性物体运动时，就形成隐性的，不向外传播的动能量子；而一般带电或磁的物体运动时，既发出电磁波，又具有动能。

6. 3、实例分析

运用以上假设，我们可以对一些电磁效应作出新的解释和描述，下面分析几个实例。

6.3.1、洛伦兹力

洛伦兹力的成因可以这样描述：带有电荷 q 的粒子，以速度v运动时，形成了一定数量的动能量子，它们都满足关系式$S_0 = E_0 \times H_0$，且所有S_0的方向一致，其矢量和S为该粒子的动能流密度矢量；而E_0和H_0的方向，在与S垂直的平面上各向均匀分布，矢量和都为零。当存在外界磁场H时，H_0的方向重新分布，使其和为$-H$，于是，在与S和H垂直的方向上出现了电场E，$E \times (-H) = S'$（$S' \le S$，且只有光子取等号），根据已知的结果，可得：

$$E = S' \times H = v \times B \qquad (6.3)$$

E作用于电荷，于是产生了洛伦兹力$F = qE = qv \times B$。

公式(6.3)可看作是动能量子假设的一个宏观上的计算公式。当v为光速c时，由(6.3)可推出电磁波的关系式$\sqrt{\varepsilon_0}E = \sqrt{\mu_0}H$。

6.3.2、单极效应

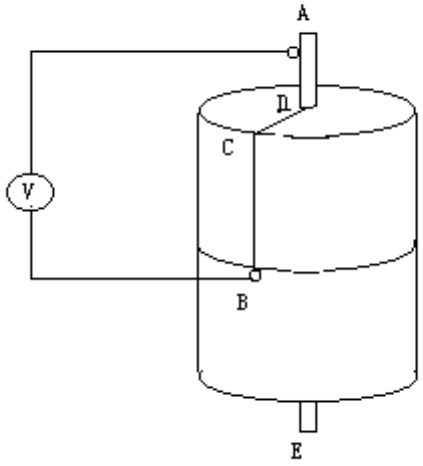


图 6.1 单极效应示意图

所谓单极效应是指运动磁体的电感应现象。如图 6.1，当一个轴对称（半径 r）的磁体，以等角速度ω转动起来后，在与磁体滑动接触的静止导线回路 AVBCDA 内，就有一个稳定的电流通过。怎样解释这单极效应，历史上曾有过争论。法拉弟认为，磁体转动时，磁力线不随之运动，这样，磁体上的 CD 切割磁力线产生感应电动势，造成了回路中的稳定电流；韦伯的观点则相反，他认为磁体转动时，磁力线也随之运动，运动的磁力线切割静止的导线 AVB，导至稳定电流的产生。对这二种不同的观点，历史上没有作出判断，并认为经典电动力学不能解释单极效应[2]。根据动能量子假设，只要导线的方向、运动速度与磁场三者相互垂直，就会产生感应电动势，而与导线是否切割磁力线无必然联系，即磁体转动时，磁力线是否随之运动，与结果无关。因此，单极效应与法拉弟圆盘的原理是等效的，回路 AVBCDA 的电流取决于 C、D 二点间的感应电动势：$U_{CD}=\frac{1}{2}B\omega r^2$。

实际上，地球本身就是一个巨大的单极效应装置：地球的磁场、自转方向和大致上垂直地面的电场三者构成了正交的矢量关系。

6.3.3、威尔逊-威尔逊实验

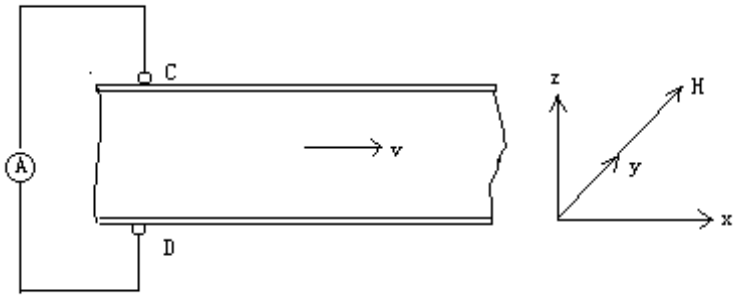


图 6.2 威尔逊-威尔逊实验示意图

1913 年，M. Wilson 和 H. A. Wilson 进行了一个运动电磁介质的电磁感应实验。这个实验的原理如图 6.2 所示，有一无限大的平板电容器，其中充满了电、磁介质（ε,μ）；整个电容器沿正 X 轴方向以速度 v 运动；有一冲击式电流计 A 与电容器的二平板活动接触；整个空间有均匀磁场 H 指向 Y 轴正方向；当改变 H 的方向时$\left(H\to -H\right)$，电流计测到有电流出现。

一般认为，该实验结果要用麦克斯韦-闵柯夫斯基电动力学来分析。其实，这一实验用动能量子假设来说明十分简单。因为，整个电容器沿正 X 轴方向以速度 v 运动，而整个空间有均匀磁场 H 指向 Y 轴正方向，因此，在电容器内的 Z 轴方向必有感应电场产生。根据（2），$E=v\times B$。于是，$D=\varepsilon E=\varepsilon\mu v\times H$，这个电位移使电容器充电。当改变 H 的方向时$\left(H\to -H\right)$，充电的方向也将反向，这样，图 2 中的电路 CAD 中将出现冲击电流，其大小将正比于因子$\varepsilon\mu$。这个因子比用麦克斯韦-闵柯夫斯基电动力学方法得到的因子$\left(\varepsilon\mu -1\right)$更接近实验结果[2]。

6.3.4、雷电的起电机制[3][4]

雷电的能量非常大，它的一次闪光的时间约为 40 微秒，电流高达 10^4-10^5 安倍；强起电过程能使雷电云中的电场强度达到 4×10^5 伏/米，空间电荷大于 2×10^{-8} 库伦/米 ^{3}。关于雷电的起电机制，已经有好几种理论，比如，降水粒子与云的构成物碰撞，分离了电荷；云的对流运动反抗电场力，输送和聚集了电荷等等，但都不尽人意。运用我们的假设，可将雷电的巨大电能看成是：剧烈运动的大气的部分动能，转化成了显性电能。雷云有条件实现起电过程。

a、动能转化为显性电磁能，需要存在外界的电、磁场。在一般情况下，地面带负电，而大气带正电，大气中随时都存在着大气电场，它会随着气象条件而变化。晴天，陆地上的垂直的大气电场，平均为 120 伏/米，海洋上是 130 伏/米；雷雨云已经历了一定的起电过程，一般情况下，它形成了电偶极子模式：上部高 6 公里处为正电区域；下部高 3 公里处为负电区域；底部高 1.5 公里处为正电区域。另外，大气中存在着地球磁场。大气电、磁场的存在，为雷电的起电创造了外部条件。

b、雷暴中存在着强对流，其瞬时风速一般为 15-25 米/秒，有时可达 40 米/秒。它的巨大的动能是雷电能量的来源。

c、强起电云层的厚度至少为 3-4 公里，而且，存在冰晶的云层容易起电，这些涉及起电的具体机制，它可能与“动电效应”有关。

动电效应：流体通过多孔塞，在多孔塞的前后会产生一定的电压差。流体通过多孔塞后会产生湍流，看来，它在电磁能的隐性转显性中发挥了一定的作用。因此，雷电的起电体系好比是一个庞大、复杂的动电效应系统，云层好比是运动的、可变的、无数层叠加的多孔塞，强对流的气体与云层的相互作用，激发了起电机制。另外，极大湿度的云层的存在也为放电创造了条件。

6.3.5、天体基本磁场的成因

关于天体的磁场的成因，目前，正统的观点把它归因于自转天体内部的自激发电流。但是，这种假设性的电流自激发机制，需要满足一定的条件，带有相当复杂性，这同天体磁场的普遍性有矛盾。

从地球本身是一个巨大的单极效应装置这个角度来看，地球的自转和垂直地面的电场的存在，能够激发出南北向的磁场来。那么，天体的运动状态与它的电、磁场之间有何关系呢？为此，我们将比较熟悉的六大行星的有关物理量作了一些分析、比较（见下表）。

六大行星有关物理量之间的联系表（有关数据取自[5]）

物理量	水星	金星	地球	火星	木星	土星
轨道运动平均速度v	1.6076	1.176	1	0.81	0.4384	0.3236
质量m	0.0558	0.8150	1	0.1074	317.893	95.147

自旋周期t	58.81	243.675	1	1.03	0.41	0.43
磁矩 p	上限 5×10^{-5}	上限 5×10^{-5}	1	0.004	19000	550
$\left(\frac{mv^2}{t}\right)^2$	6×10^{-6}	2×10^{-5}	1	0.0047	22206.31	536.89

从表中可知：$p\approx\left(\frac{mv^2}{t}\right)^2$。这显示天体的磁矩与轨道动能的平方成正比；与自旋周期的平方成反比，即

$$p=k\left(\frac{mv^2}{t}\right)^2 \quad（k\text{ 是常系数}）\qquad（6.4）$$

行星磁矩是受多种因素影响的，如太阳风、自旋矢量与轨道速度或磁矩的交角，剩磁体的分布，及可能产生的自激发电流等等。但是，（6.4）式显示，天体的基本磁场由其自身的运动方式造成，当然，这还需要进一步设计实验加以检验和修正。

6.4、实验构想

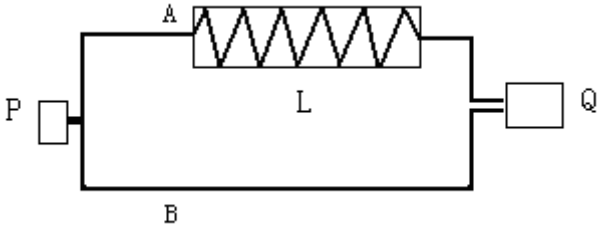
6.4.1、电、磁场中的光速

雷达回波延迟表明：引力场能影响光速。光是电磁波，那么，电、磁场更应该能够影响光速（如果在电、磁场内部真空的每一点上去直接测量，光速也都将是不变的值）。

大家知道，光在实物介质内的速度小于真空中的光速，人们一般把这归因于光与实粒子的相互作用。实际上，构成实物的原子内部是空空然的，比如氢原子，它的半径至少是 0.53 $\times10^{-10}$m，而其原子核（质子）的半径小于 1×10^{-15}m，原子核的体积在原子中所占的比率远小于太阳的体积在太阳系中所占的比率。而电子更被认为是点粒子；可见，原子内部绝大多数是真空，但其中充斥着电磁场。因此，光与实物之间的作用，在很大程度上是光与电、磁场之间的作用。这表明光在介质内速度的减小，与电、磁场的作用有关。

当然，电、磁场究竟能否对光速起作用，应由实验来回答。下面提出一个实验构想。

a、实验原理：运用迈克尔逊干涉仪的原理，在迈克尔逊干涉仪的一条光路中加入一个强大的磁（电）场，通过观察磁（电）场的加入或变化，可否引起干涉条纹的变化，来判别磁（电）场对光速是否有影响。



6.3 光缆型迈克尔逊干涉仪：P 是光源；Q 是干涉屏；A、B 是光缆；L 为磁（电）场发生器。

b、实验装置：引力场对光速的影响是非常微弱的，人们将地球、太阳、行星作为实验平台，才探测到了光速的变慢。电、磁场对光速的影响应该比引力场强得多，但要在实验室里发现这方面的效应，也必须将可能存在的效应放大。这可从二方面入手：一、增长通过磁（电）场的光程。一般实验室用的迈克尔逊干涉仪的光程太短，估计至少要有几十米、上百米才行。也可以将迈克尔逊干涉仪中的光路用光缆替代，构成如图 6.3 那样的光缆型迈克尔逊干涉仪，并使电磁场发生器 L 内的光缆，在不致于漏光的前提下，盘得越长越好。二、提高 L 中的磁（电）场的强度，而且，L 中的磁（电）场的强度、方向等最好能够调节，以便作定量分析。当然，也可分步进行，如逐步更换不同强度的磁（电）场；分别使磁（电）场的方向与光线垂直、平行等等。

c、实验步骤：对于光缆型迈克尔逊干涉仪来说，首先，在不开启 L 的情况下，将一束激光同时打入二条光缆 A、B，调节干涉屏，使出现清晰的干涉图象；接着，开启 L，如果干涉条纹发生变化，再观察、分析干涉条纹与磁（电）场的强度、方向之间的关系；另外，还可以测验一下交变电磁场的强度和频率与干涉条纹的关系。由于光缆内不是真空，这要求用不同折射率的光缆进行重复试验，以证明干涉条纹的变化与光传导介质的折射率无关，。

光缆型迈克尔逊干涉仪会存在磁光效应（法拉第效应、磁双折射效应等）和光电现象等，这对干涉条纹有一定的影响，使实验的分析复杂化。对此，可以使 A、B 两条光缆的长度一样，摆放的形式也一样。当然，最好是增长通过磁（电）场的光程，而不用光缆。

6.4.2、以太旋涡的时空效应

a、实验目的

我们的以太观认为，相对论性现象是由以太密度的变化造成的定量效应：以太密度较大

的地方，量杆较短，时钟也走得较慢。这是有实验证据的：光的频率会随着引力势变化，而引力势对应以太密度，这表明，时间标准会随以太密度变化。我们的实验目的是要用新的方法进一步验证这一点。

b、实验原理

设想在以太中有一个旋涡，那么，由于其中的以太密度分布的不均匀，它将具有“时空突变”效应。由于以太的超流动性，中性物体的旋转，难以带动周围以太；而在电、磁场中，存在着电磁激发了的以太，它们会随着电、磁场的变化而运动。因此，我们的实验原理就是用高速度旋转的强电、磁场，造就一个伴有时空突变的以太旋涡。

c、实验装置

这是一个功率强大的，可转动的电（或磁）场，它的强度、转速、方向和形状等都可以适当调节，以便进行定量分析（当然，也可以分别进行）；在场内不同的地方，安置一些特殊的光源作为“时空计量仪”，用光谱分析等手段来检测其中是否存在着“时空突变”效应；实验装置应该遥控。

d、有关以太旋涡的联想

具有时空突变的以太旋涡会伴随着强烈的电磁异常。在以太旋涡内部，以太密度中心小，边缘大，是一种负引力场结构，从而，它会与外界的引力场发生特殊的作用。这些特性令人与传说中的“飞碟”联系起来。因为，飞碟具有强烈的电磁异常，会引起时空突变，能够反引力运动等。许多人认为，飞碟可能不存在，所谓的飞碟其实是实在的飞行物，如火箭、流星、飞机等等被大气折射后的产物。我们认为，飞碟即以太旋涡是存在的，不过，它们的形成往往同飞行物体有关。即火箭、流星、飞机等等及其相关行为（如部件的脱落、爆炸、尾气喷射等等）与大气运动、磁暴等相互作用有可能造成以太旋涡。

至于所谓的遭遇飞碟，与外星人接触的传言，那是以太旋涡对人的大脑作用而产生的幻觉——心理学家已多次指出，遭遇飞碟与濒死体验和吸食麻醉品等引起的幻觉有相似的模式。所以，实验装置必须遥控。

以太旋涡是扰动着的以太，因此，它有可能被用来阻止光障的形成，在超光速中发挥作用。

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第七章 微观以太和粒子

微观现象是人类无法直接感觉到的，人们借助于各种仪器进行科学实验和理论分析，发现在那里存在着量子性、二象性等等有别于宏观世界的特殊性。这些特殊性是怎样造成的，它们与宏观现象是否有联系？让我们来作些探讨。

7.1、量子性是相对论量方面的关系在微观世界的表现

狭义相对论中的质速关系是：

$$m=\frac{m_0}{\sqrt{1-u^2/c^2}}\approx(1+\frac{u^2}{2c^2})m_0 \qquad (7.1)$$

广义相对论中的质量和引力势之间的关系是：

$$m=\frac{m_0}{\sqrt{1+2\varphi/c^2}}\approx(1-\frac{\varphi}{c^2})m_0=\left(1+\frac{GM}{c^2r}\right)m_0 \qquad (7.2)$$

（7.1）式是(7.2)式中的引力场强度（或加速度）为零，即引力势φ为常数时的一个特例，它适用于匀速直线运动。这时运用效应能量分析法将出现什么现象呢？效应能量分析法指出：效应运动一般不改变固有运动系统，而只改变整个固有运动系统的运动状态。如果固有运动和效应运动合起来总体上仍是匀速直线运动，那么效应运动只能是横向的振动或矢量方向与系统运动方向平行的自旋，而且，这种自旋的矢量方向只能是二个：与系统运动的方向相同或相反。这种效应运动存在吗？宏观上看，这似乎不可能，但从微观的角度来说，这是千真万确的——微观粒子都具有波-粒二象性，都有内禀自旋。事实上，把二象性和自旋的角频率联系起来，自旋量子数就会出现。

根据牛顿力学，旋转物体的能量E_1和角动量L之间的关系是：

$$E_1\propto L\omega \quad (\omega \text{ 是角频率}) \qquad (7.3)$$

在二象性中，能量E_2和角频率ω之间的关系是：

$$E_2=h\nu=\frac{h}{2\pi}\omega \qquad (7.4)$$

如果$E_1\propto E_2$，我们得：

$$L\propto\frac{h}{2\pi} \qquad (7.5)$$

（7.5）式与自旋量子数公式相似。

当然，将自旋当作绕固定轴的转动，只是一种粗劣的、形象化的描述和说明，实际上，电子的内禀自旋是种定量效应,不完全等同于绕固定轴的转动。量子力学也明确指出：电子自旋是一个新的自由度，与电子的空间运动无关。因此，以上的估算是大体上的，并且由定量效应导致的物质波的波函数不能只取实数，而应该取复数形式。值得注意的是：薛定谔方程是一种半定性，半定量的非相对论性的理论，它可以导出某些物理量的量子化，但自旋是作为一个外加的自由度放入理论框架内的;而具有狭义相对论不变性的量子力学方程——狄拉克方程，自动地包含了粒子的自旋量子数。这进一步显示了：粒子的内禀自旋是狭义相对论的定量效应在微观世界的反映!

其实，不但粒子的内禀自旋是狭义相对论的定量效应在微观世界的反映，光的量子性也可以看成是狭义相对论的定量效应在微观世界的反映。光子是电磁激发了的以太，而相对论的一个最基本的定量效应是光速不变，这意味着每个光子模型在量方面会具有一定的共性。对于这种共性，我们可以作两种设想：

其一，设想光子是由电磁激发了的以太构成的波包，构成光子的每一个电磁激发元都具有最基本的电矩、磁矩、自旋及能量值h（普朗克常数），因此，如果我们将光速与声速进行类比，由于声速与空气分子的平均运动速度同级，那么，光速将与以太粒子的运动速度同级；由于定量上真空中的光速恒为c，因此，从定量描述的角度来看，以太粒子要么静止不动（未激发），要么以光速运动（电磁激发）——运动的以太粒子必然伴随着电磁激发而成为一个电磁元；一个电磁元代表一个波峰，电磁元的线密度越大，其频率越高，于是，相应的光子的能量（或质量）也就越大，$E=hv$（E代表光子的能量，v为频率）。从绝对描述看来，光子中的电磁激发了的以太粒子的能量有大有小，一般是中心处的能量较大；而从定量描述的角度看来,每一个电磁元的能量一样大。

另外，“声速与空气分子的平均运动速度同级”也意味着：实际上，光速是一种统计性的结果。由于这种统计性和量子性、二象性，加上微观世界里物质密度高，运动速度大，时空标准的可变性被放大，于是，在微观世界，就出现了几率性、不确定性原理之类的定量效应。

这样的设想，把光子看成是由电磁激发元构成的波包，一个电磁激发元代表一个波峰。这带来了一个问题：宏观电磁波，如无线电波，它的一个波峰应该有许多电磁激发元构成，即它的一个波峰是一个电磁激发元的波包，或者说它的一个波峰就是一个光子。于是，如图7.1所示，低能电磁波的频率由单位时间内的波峰数确定，而高能光子的频率由单位时间内的电磁激发元的数量确定，那么，在低能电磁波中应该存在着高频率的光子的电磁波，这在

频率的确定上显然是矛盾的。

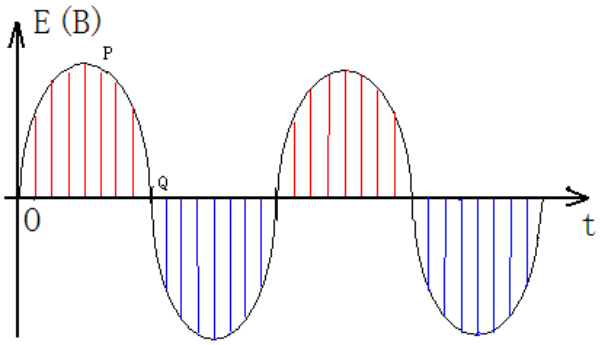

图 7.1 设想一：低能电磁波的一个波峰，是一个光子，它是由许多电磁激发元构成的波包。一条红线表示一个正向电磁激发元；一条蓝线代表一个负向电磁激发元。

第二种设想是这样的：光子是有质量的实物，一个光子就是以一个电磁激发元为核心的以太波包，定量地说，每一个电磁激发元的电（磁）振幅是一致的，其波峰曲线的斜率的绝对值越大，频率越高，能量也就越大，如图 7.2 所示。这与图 4.3 所描述的，广义相对论时空中的一维以太分布线是一致的：以太密度越大的地方，相邻的两个以太质点连线的斜率越大。这是合乎事实的：光子本身的以太波包的密度越大，它的质量越大，能量也就越大。由此可见，图 7.2 所示的光子波形线，反映了光子在绝对时空观中的以太密度分布情况，这印证了我们关于超流体以太中的第一声与第二声是合二为一的观点，即以太中的电磁起伏与以太密度的起伏是同步的。

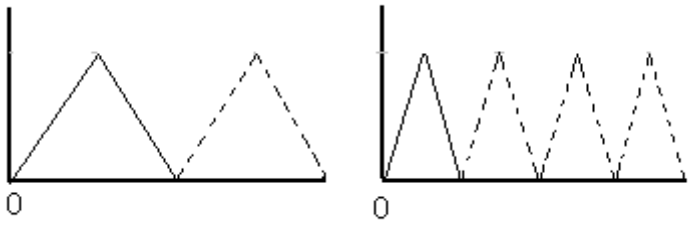

图 7.2 纵坐标表示电（磁）振幅，每一个电磁激发元的电（磁）振幅是一致的。横坐标表示单位时间里光子通过的路程。波峰的斜率绝对值越大，频率越高，能量也就越大。

从上述分析看来，第二种设想比较合理。在这里，定量地说，每一个电磁激发元的电（磁）振幅是一致的，能量只与频率有关，而与振幅无关。至于宏观电磁波，它的振幅是由许许多多电磁激发元叠加而成的，因此，宏观电磁波的能量既与频率有关，也与振幅有关。

同光的量子性相类似的，还有电荷的基量性。电荷是定量描述的概念，根据位错与电荷在照片形象和数学描述形式上都很相似[1]的事实，我们认为，电荷的绝对描述的意义是以太中的位错。定量描述中，以太的分布是处处均匀，各向一致的，电荷就是其中的位错。四维时空的均匀性，造就了全位错柏氏矢量的基量性，这就是电荷基量性的根本原因。进一步说，分数电荷可看成是以太中的全位错扩展成了不全位错的结果。不全位错是全位错中的部分结构，不能单独存在，这就是带分数电荷的夸克不能独立存在的原因。

那么，是否有空间和时间的量子呢？定量上来说，回答是肯定的。我们将最基本的以太质点称为以太子，它好比以太流体的的“分子”，再进一步分割就不是以太了。因此，相邻的 2 个以太子的间距就是最基本的长度量子；而光通过这以太子间距的时间间隔就是最基本的时间量子。但就绝对描述来说，这些长度和时间量子都是随以太密度的不同而变化的，强子内的长度量子比原子空间中的短；而原子空间中的长度量子又比地面上的长度量子短；如此等等，因此，在绝对时空观看来，不存在什么时、空量子。这里也清楚地表明，量子现象只是一种定量效应。

7.2、关于二象性

实物是以太密度波包的核心，这包含了二象性现象的基本要素：实物本身是粒子性的；而伴随着它的以太波包是波动性的。

实物粒子可分为二大类：没有静止质量的光子和有静止质量的轻子、强子。光子之所以没有静止质量，是因为它纯粹是一种以太波，即构成光子的以太子并没有作宏观的移动，只是不断地进行着电磁激发的传递，而呈现出波动性；但光子又具有以太密度的极大值，是个以光速前进的以太密度波包，而表现出粒子性。至于有静止质量的轻子、强子，其中的剥离了以太波包的“裸轻子”、“裸强子”，它们的运动是实实在在的运动，并始终处于以太密度波包的核心；但伴随着它们的以太密度波包中的以太粒子，并没有作宏观的移动，而只是进行波动。这些就是我们对二象性的描述。

绝对描述与定量描述之间存在着错位，这在微观世界比在宏观世界表现得更为明显。在宏观世界，绝对描述的景象是：在宇宙的以太海洋中，以太密度的分布是不均匀的，一个个实物的质心，就是一个个以太密度的极大值点，引力场是以太密度场；而定量描述的景象是：在宇宙的以太海洋中，以太密度的分布是时时处处都均匀的，这就是所谓的四维时空连续体，而实物的存在使这均匀的时空连续体发生了“弯曲”，引力场就是这时空的“曲率场”。在微观世界，绝对描述指出：一个实物粒子不但是一个以太密度的极大值点，也是一个以太中的

位错，原子核外的电子和原子核内的质子等是一个个全位错，而各种强子都由具有不全位错的夸克组成；微观的定量描述，由于电荷的出现，四维时空连续体变得支离破碎，只能用量子性和二象性进行模糊的描述。

7.3、粒子物理学的标准模型

粒子物理学的标准模型是目前物理学家对宇宙的物质基元的最基本的描述。它认为，构成宇宙的最基本的实物粒子是三代轻子和三代夸克，如下表所示：

表 7.1 费米子的代和电荷（上标）

	中微子	荷 电 轻 子	夸 克
第一代	$\nu_e^{\ 0}$	e^{-1}	$d^{-\frac{1}{3}}$ $u^{+\frac{2}{3}}$
第二代	$\nu_\mu^{\ 0}$	μ^{-1}	$s^{-\frac{1}{3}}$ $c^{+\frac{2}{3}}$
第三代	$\nu_\tau^{\ 0}$	τ^{-1}	$b^{-\frac{1}{3}}$ $t^{+\frac{2}{3}}$

表 7.1 中有 6 种轻子和 6 种夸克。轻子和夸克都是自旋为 1/2 的费米子，它们都有自己的反粒子，因此，共有 24 种最基本的费米子。微观粒子之间的相互作用是通过交换规范粒子进行的，这些规范粒子都是自旋为整数的玻色子，它们是电磁相互作用中的光子；弱相互作用中的中间矢量玻色子 $W^{\pm}$、Z^0和强相互作用中的胶子。

标准模型中的弱电统一理论认为：弱作用和电磁作用是统一的，正如电作用与磁作用是同一种电磁作用的两种不同表现一样，弱作用与电磁作用也只不过是同一种作用的两种不同表现而已。中间矢量玻色子本来与光子一样也是质量为零的规范粒子，由于真空对称性自发破缺，通过 Higgs 机制，中间矢量玻色子获得了很大的质量，而光子仍保持它原有的零静止质量。

标准模型中的量子色动力学认为：强子之间的强相互作用归结为组成强子的夸克和胶子之间的相互作用。夸克有味和色两种自由度，夸克之间的电磁作用和弱作用是通过味自由度进行的，而强作用则是通过色自由度进行的。每味夸克都带有 3 种色荷，不同色、味的胶子有 8 种。

粒子物理学的标准模型，正确地描述了迄今为止的所有电弱作用和高能强作用的实验现

象，取得了巨大的成功。但其中的 Higgs 场，在这一理论体系里，既是不可缺少，又显得不大协调，因为，它给标准模型带来了理论上的缺陷，即所谓的平庸性和不自然性问题；而且，迄今还未找到它所预言的 Higgs 粒子。另外，在标准模型里，最基本的粒子有轻子、夸克和规范玻色子等，多达几十种，这有悖于“最基本”的意义。可见，探索超出标准模型的新物理势在必行[2]。在这方面，已经有人工色（technicolor）、超对称(supersymmetery)、小黑格斯粒子、额外空间维度(extra dimension)等等，它们从建立新的数学模型入手，来进行探索。而我们的新思路，着重于事物的内在联系，尤其在以太和粒子的关系上，其主要是二点：找出构成所有粒子的基本要素；赋予真空态的虚粒子更实在的意义。

7.4、以太与粒子的内在联系

表 7.1 显示了费米子的代和电荷的对称性，这意味着什么呢？我们提出如下看法：

假设 1：中微子和电荷是构成轻子和夸克的二大要素。

根据表 7.1，我们认为：中微子和电荷是构成轻子和夸克的二大要素：中微子加上整份电荷构成了荷电轻子；中微子加上分数电荷构成了夸克；中微子有三种，这是粒子分为三代的基础：v_e 加上 -1 份电荷构成了 e，加上 $-\frac{1}{3}$ 份电荷构成了 d，加上 $+\frac{2}{3}$ 份电荷构成了 u；v_μ 加上 -1 份电荷构成了 μ，加上 $-\frac{1}{3}$ 份电荷构成了 s，加上 $+\frac{2}{3}$ 份电荷构成了 c；v_τ 加上 -1 份电荷构成了 τ，加上 $-\frac{1}{3}$ 份电荷构成了 b，加上 $+\frac{2}{3}$ 份电荷构成了 t；费米子可以具有，并且相互转移 0、$\pm\frac{1}{3}$、$\pm\frac{2}{3}$、±1 份电荷；这三种中微子应是同一物质的三种不同状态，正如同一种物质会有固态、液态、气态一样。由于三种轻子数各自守恒，这三种中微子不可相互转化，但三种正、反中微子对之间可以相互转化，这应该是实现中微子振荡的一种途径。

在微观世界，粒子与以太有着密切的关系。量子场论认为，真空是量子场的基态，量子场的激发或退激，代表粒子的产生或消失。这意味着粒子与以太可以相互转化。不过，以太不可能单纯由费米子组成，因为，由于泡利不相容原理，费米子不可能全部集中在最低能态。

至于波色子，它的自旋是整数，可以看成是二个或偶数个费米子的耦合。玻色子原则上可以全部凝聚在最低能态[3]，这意味着以太应该由玻色子构成。另外，狄拉克方程是描写费米子的，它有正、负能态两个解，正能态中的粒子是正粒子，负能态中的空穴是反粒子，以太是既无正粒子，也无反粒子的状态，这就是说以太是正、反粒子刚好一一配对的状态。实际上，各种正、反费米子对都能在真空中成对地产生或湮灭，这些充分表明以太是由处于最

低能态的正、反费米子对的集合。由此，我们提出：

假设二：以太是由正、反费米子构成的虚波色子的集合，是种最基本、最普遍的玻色-爱因斯坦凝聚；真空态的玻色子是无所谓质量，也无形状、大小的“虚粒子”。由于质量对应以太波包的密度的变化量，能量对应以太波包的压力的变化量，那么，其“虚”的实质就是不形成以它为中心的以太波包，或没有以太压力变化量的最低能态。

以太由正、反费米子对组成，这看起来象是 Smarandache 分别在 1995 年和 1980 年提出的中智物理和反论中说到的“unmatter”，它基于 A 与反 A 的对立统一，以及它们之间的中间状态的结合[4]。

粒子的多样性，导致了虚波色子的多样性。这造就了微观真空的简并性。单纯引力场里的以太，由正、反中微子对（$\nu_e-\overline{\nu_e},\nu_\mu-\overline{\nu_\mu},\nu_\tau-\overline{\nu_\tau}$）构成，这被称之为以太子；在电磁场中存在着虚光子，这即前面所谓的电磁激发元，它们是虚正、反荷电轻子对（$e-\bar{e},\mu-\bar{\mu},\tau-\bar{\tau}$），可以看成是以太子内部的正、反中微子之间转移一份电荷的结果；色场中还存在着虚正、反夸克对（$d-\bar{d},u-\bar{u},s-\bar{s}$等等），它们是色激发了的以太，是轻子对内部转移分数电荷的结果。所谓的胶子，就是其中带色的虚正、反夸克对；而无色的是一般所谓的“海夸克”。电磁场、色场的强度分别对应虚光子、虚胶子的密度梯度，或者说：引力场是以太子的密度场；电磁场是虚光子的密度场；色场是虚胶子的密度场。

以太子好比陈蜀乔所说的真空基态粒子，它的波函数满足$\phi_0=\phi_0^*=\phi_0\phi_0^*=1$，是质量为零的标量粒子，即哥尔斯冬玻色子。陈蜀乔对真空的动力学图象作了全面的定量描述[5]。

实物是以太密度波包的核心，这意味着以太密度的均匀分布（无引力场）和单调变化（有引力场）都是真空态；以太密度的起伏分布，即有极大值点时才有实物，这里展示了对称性破缺的含义。实物和以太二者都由中微子和电荷构成。如图 7.3 所示，虚光子、实光子、实正、反荷电轻子对的构成是一样的，只是虚光子处于最低能态，不形成独立的以太密度波包，因而无所谓形状、大小；实光子具有一个独立的以太波包，是一个单独的具有能量的粒子；而正、反荷电轻子对是二个独立的以太波包的组合。它们可看成是相同结构的不同能态。虚胶子和相应介子的构成也一样，前者是带色的虚粒子，后者是无色的实粒子。

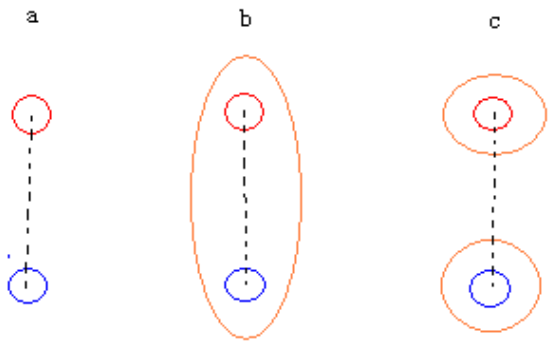

图 7.3 红圈是带正电荷的轻子；蓝圈是带负电荷的轻子；黄圈代表以太波包。a 是虚光子；b 是实光子；c 是荷电轻子对。

理论上，按极化系数划分，有三种光子：横光子、 纵光子和标量光子；另一方面，算符（如 A）与态矢$(如|a\rangle)$都没有直接的意义，有直接意义的是算符在态矢中的平均值$(如\langle a|Aa\rangle)$和态的模$(如\langle a|a)$或标积$(如\langle a|b\rangle)$，而算符在态矢中的平均值、态的模和标积都由横光子决定，纵光子和标量光子无贡献，因此，横光子是实光子，纵光子和标量光子是虚光子。对此，我们可以进一步描述：虚光子是正、反荷电轻子对，一个轻子带正电荷；另一个带负电荷；同时，这两个轻子都会有自旋，从而两个轻子都会有磁荷。当这两个轻子的正、负电荷不抵消，而它们的磁荷互相对消时，可称为纵光子，它是一个电力线元；当这两个轻子的正、负电荷抵消，而它们的磁荷没有抵消时，可称为标量光子，这是一个磁力线元。静电场是纵光子密度场；静磁场是标量光子密度场；另外，以太子也可看成是正、负电荷和磁荷都抵消了的虚光子，因此，晏成和认为引力是电磁力的外延[6]是有一定道理的。

所有的虚粒子都是真空态粒子，但其中的以太子是最基本的真空态粒子，由它构成的以太流体，完全是一种超流体；其他的虚粒子，如虚光子、虚胶子等是以太子的电磁或色激发态，它们会参与电磁或强相互作用，因此，它们会有一定的粘滞性。量子场论所研究的“物理真空”，显然不是最基本的真空态，而是电磁或色激发的真空态。另外，以太子的间距是定量描述的最基本的长度单位，因此，以太子本身的大小已经难以确定，于是，构成它的费米子的大小就只能认为是零了，这也是一种定量效应的表现。在绝对时空观看来，以太子和费米子应该也有大小和结构，有许多人提出了这方面的设想，比如，戚华明确指出：光子、电子和夸克都有结构，粒子湮灭为光子只是物质的一种相变，等等[7]。但现在对此是难以作定量描述的，因为这超越了现有的定量体系。

引力场，即以太密度波包，伴随着实物。最基本的实物粒子是费米子，其中，荷电轻子和由夸克构成的强子有明显的质量，这表明引力相互作用本身不能造就以太密度波包，它是由电磁和强相互作用，或者说是以太中的位错造成的。中微子，它不参与电磁和强相互作用，不可能形成以它为中心的以太密度波包。现在，有实验显示，中微子也有微小的质量，这反映的只是：它的存在，使处处均匀，各向一致的以太子的“晶格”稍微发生了一点小范围的变形，但不会形成位错，这也就是说，中微子没有自身的以太波包，因此，相对论的质速关系对它是不适用的，它可以比较容易地超越光速。

7.5、粒子间的相互转化

为表达方便，用 h 来表示一个费米子，于是，根据前面假设，h=中微子+电荷，其中的电荷量可以取 0、$\pm\frac{1}{3}$、$\pm\frac{2}{3}$、±1；而且，在 h 之间，能够互相转移$\pm\frac{1}{3}$、$\pm\frac{2}{3}$、±1 份电荷。根据这些法则，并结合能量守恒定律，就能够对粒子间的相互转化，进行新的绝对描述：粒子间的相互转化，一般是在能量守恒和虚粒子的参与下，h 之间转移电荷，并重新进行组合的过程。这样的描述，能于实际情况相符合，是其合理性的一种显示。下面就以部分粒子的衰变为例，来作一下描述。

符号：$\xrightarrow{h_1\cdots(a)\to h_2}$表示$h_1$向$h_2$转移 a 份电荷；用[　]括起来的表示一独立的实物粒子（中括号前的字母为该粒子的代表符号，如质子为p，中子为n等等）或中间状态（中括号前无代表符号）的 h 组成；在$\langle\ \rangle$内的为虚粒子的 h 组成；$\Rightarrow$后为符合能量守恒的衰变结果。

7.5.1、不稳定强子的衰变

强子都由夸克组成，而夸克之间存在着胶子。构成重子的是三个夸克，如质子$p[uud]$、中子$n[ddu]$；构成介子的是二个夸克，如π介子$\pi^0[u\bar{u}]$或$\pi^0[d\bar{d}]$，$\pi^-[d\bar{u}]$。就不稳定强子来说，其不稳定性在于，构成强子的夸克和虚胶子可以不通过转移电荷而直接组合成新的粒子，因此，它们很不稳定，寿命极短。如：

$\Delta^-\left[ddd\left\langle u-\bar{u}\right\rangle\right]\Rightarrow n\left[ddu\right]+\pi^-\left[d\bar{u}\right]$。

7.5.2、稳定的奇异重子的衰变

含有夸克 s 的重子为奇异重子。稳定的奇异重子的衰变，一般是在虚胶子（由于能量的制约，只能是$d-\bar{d}$、$u-\bar{u}$）的参与下，夸克 s 与 u 之间转移一份电荷后，s 变成了 u，u 变成了 d，然后重新组合。由此得出的结果，与实际上的主要衰变方式（除Σ^0以外）完全一致：

$$\Lambda^0\left[uds\left\langle u-\bar{u}\right\rangle\right]\xrightarrow{s\cdots(-1)\to u}\left[udud\bar{u}\right]\Rightarrow p\left[udu\right]+\pi^-\left[d\bar{u}\right],\text{或n}\left[\text{ddu}\right]+\pi^0\left[u\bar{u}\right]$$

$$\Lambda^0\left[uds\left\langle d-\bar{d}\right\rangle\right]\xrightarrow{s\cdots(-1)\to u}\left[ddud\bar{d}\right]\Rightarrow n\left[ddu\right]+\pi^0\left[d\bar{d}\right]$$

$$\Sigma^+\left[uus\left\langle u-\bar{u}\right\rangle\right]\xrightarrow{s\cdots(-1)\to u}\left[uuud\bar{u}\right]\Rightarrow p\left[uud\right]+\pi^0\left[u\bar{u}\right]$$

$$\Sigma^+\left[uus\left\langle d-\bar{d}\right\rangle\right]\xrightarrow{s\cdots(-1)\to u}\left[udud\bar{d}\right]\Rightarrow p\left[uud\right]+\pi^0\left[d\bar{d}\right],\text{或}n\left[dud\right]+\pi^+\left[u\bar{d}\right]$$

$$\Sigma^-\left[dds\left\langle u-\bar{u}\right\rangle\right]\xrightarrow{s\cdots(-1)\to u}\left[ddud\bar{u}\right]\Rightarrow n\left[ddu\right]+\pi^-\left[d\bar{u}\right]$$

$$\Xi^0\left[uss\left\langle u-\bar{u}\right\rangle\right]\xrightarrow{s\cdots(-1)\to u}\left[usud\bar{u}\right]\Rightarrow \Lambda\left[sud\right]+\pi^0\left[u\bar{u}\right]$$

$$\Xi^0\left[uss\left\langle d-\bar{d}\right\rangle\right]\xrightarrow{s\cdots(-1)\to u}\left[dusd\bar{d}\right]\Rightarrow \Lambda\left[dus\right]+\pi^0\left[d\bar{d}\right]$$

$$\Xi^-\left[dss\left\langle u-\bar{u}\right\rangle\right]\xrightarrow{s\cdots(-1)\to u}\left[dsud\bar{u}\right]\Rightarrow \Lambda\left[dsu\right]+\pi^-\left[d\bar{u}\right]$$

$$\Omega^0\left[sss\left\langle u-\bar{u}\right\rangle\right]\xrightarrow{s\cdots(-1)\to u}\left[ssud\bar{u}\right]\Rightarrow \Lambda\left[dsu\right]+k^-\left[s\bar{u}\right],\text{或}\Xi^0\left[ssu\right]+\pi^-\left[d\bar{u}\right]$$

$$\text{或}\Xi^-\left[dss\right]+\pi^0\left[u\bar{u}\right]$$

至于Σ^0的衰变，是其内部的胶子衰变成了光子（这是一种电磁相互作用，速度较快）：

$$\Sigma^0\left[uds\left\langle d-\bar{d}\right\rangle\right]\xrightarrow{d\cdots\left(\frac{2}{3}\right)\to\bar{d}}\left[uds\left\langle e-\bar{e}\right\rangle\right]\Rightarrow \Lambda\left[uds\right]+\gamma\left[e\bar{e}\right]$$

一些非主要的衰变方式，全是 h 间转移分数电荷的结果，如：

$$\Sigma^-\left[dds\left\langle u-\bar{u}\right\rangle\right]\xrightarrow{s\cdots\left(\frac{2}{3}\right)\to\bar{u}}\left[dde(\mu)\bar{v}_e\left(\bar{v}_\mu\right)u\right]\Rightarrow n\left[ddu\right]+e+\bar{v}_e,\text{或}n\left[ddu\right]+\mu+\bar{v}_\mu$$

7.5.3、中子和荷电轻子的衰变

由于能量的制约，中子同荷电轻子一样，在虚光子的参与下进行衰变：

$$n\left[udd\right]\left\langle e-\bar{e}\right\rangle\xrightarrow{d\cdots(-1)\to\bar{e}}p\left[udu\right]+\bar{v}_e+e$$

$$\mu\left\langle\bar{e}-e\right\rangle\xrightarrow{\mu\cdots(-1)\to\bar{e}}v_\mu+\bar{v}_e+e$$

$$\tau\left\langle \bar{e}-e\right\rangle \xrightarrow{\tau\cdots(-1)\to\bar{e}} \nu_{\tau}+\bar{\nu}_{e}+e$$

由于τ的能量巨大，在它的周围有可能存在无色的正、反夸克对，从而可以衰变出强子来。

以上的描述能与粒子表的事实相符合，这是我们设想合理性的表示。

7.5.4、衰变的分支比

关于衰变的分支比，根据上面的衰变式，通过简单的计算，可以发现，衰变的分支比与夸克之间的结合关系有关，这结合关系在$p[uud]$中是uu,ud,ud，在$n[ddu]$中是dd,ud,ud，在π^-中是$d\bar{u}$，等等。我们已经知道，分支比$\Lambda\to p\pi^-$是（64.2±0.5）%，$\Lambda\to n\pi^0$是（35.8±0.5）%，$\sum^+\to p\pi^0$是（51.6±0.7）%，$\sum^+\to n\pi^+$是（48.4±0.7）%。设结合的可能性 uu 比 dd 大 15.5%，$d\bar{u}$ 和$u\bar{d}$比$u\bar{u}$和$d\bar{d}$大 12.5%，因为$p\pi^-$的结合关系是$uu,ud,ud,d\bar{u}$，而$n\pi^0$的结合关系是$dd,ud,ud,u\bar{u}$，于是两者的分支比差为15.5%+12.5%=28%；同样，已知$\sum^+\to p\pi^0$的分支比为（51.6±0.7）%，而$\sum^+\to n\pi^+$的分支比为（48.4±0.7）%，前者比后者大 3%，这是因为$p\pi^0$的结合关系是$uu,ud,ud,u\bar{u}$，而$n\pi^+$的结合关系是$dd,ud,ud,u\bar{d}$，于是有 15.5%-12.5%=3%。

7.6、相互作用的机制

关于相互作用，目前认为，共有四种基本的相互作用，它们是：引力相互作用、电磁相互作用、强相互作用、弱相互作用。对这些相互作用进行描述的有二大互不相融的理论：描述引力相互作用的是广义相对论，它把万有引力描述成弯曲的时空对物体的作用；而描述其他三种相互作用的是量子场论，它把相互作用描述成互相交换场量子：电磁相互作用交换光子；强相互作用交换胶子；弱相互作用交换中间矢量玻色子。这里将相互作用说成是“交换”场量子，只是形象化的说法，其真正的含义是：力场都由场量子，即虚玻色子构成，场量子总是处于不停地进行虚虚实实的变化和振荡之中。从形式上看来，广义相对论和量子场论是水火不相的，其实它们有一个共同的特点，那就是不平衡。我们已经指出，所谓时空的弯曲，是对以太密度不均匀分布的一种数学表达。当物体处于不均匀的以太之中，前面有 A 个以太子对它作用，后面有 B 个以太子对它作用，A≠B，于是就出现了引力。同样，其他力场也是

由场粒子（以太子激发的产物）的分布不均匀造成的。

在下面，我们约定：不同的夸克有不同的味，不同的轻子也看成是不同的味，正、反粒子的味数相反，正、反粒子对的味数是零。

定性地说，我们可以把相互作用看成是“荷”（如电荷、磁荷和色荷等）之间的作用。荷本身不能独立地存在，只能依附在中微子上：电荷依附在中微子上成为荷电轻子；色荷，作为分数电荷的一种特性，依附在中微子上成为了夸克。电力线和磁力线是两种不同的形式的虚光子链，它们能够传递电磁相互作用；类似地，我们可以认为，胶子构成了色力线，是它在传递强相互作用，并使夸克重新组合。在静力场中，虚粒子链的分布是平滑的，其中没有实粒子；在运动的力场中，力线在波动，形成了一个个波峰，它们就是零静止质量的实量子。但是，零距离的弱相互作用不能这样描述，它的实量子有很大的质量。相互作用被描述成交换规范粒子只是一种数学模型。

根据上述分析，强相互作用就是夸克间的重新组合，它不改变每一个粒子的味，因此具有最大的味的对称性。味与电荷有关，而与色荷无关

就粒子的变换来说，电磁相互作用是正、反粒子对内部转移电荷，如Σ^0的衰变，它虽然改变了二个费米粒子（d和$\bar{d}$）的味，但总的味数不变，因此具有较好的味的对称性。

弱相互作用也是粒子间的转移电荷，但它改变了总的味数，因此味的对称性最低。定质地说，弱相互作用是正、反不对称的电荷之间的作用，因为，电荷必然依附在中微子上，所以，弱相互作用，应是带有不对称正反电荷的中微子之间的相互作用，其可观察的实的作用量子描述为中微子对（Z 子）或中微子与荷电轻子对（W 子）——它们不是独立的二个以太包对，而是一个以太包内包含了 2 个粒子，因而质量很大。

引力相互作用，则是以太质点之间的作用，所谓的引力量子就应该是由二个以太子构成，它是否能形成一个以它为核心的以太波包，是个问题。上面曾指出：电磁激发是以太的最基本的激发，以太一受到扰动，就产生了电磁激发，并向外传播。因此，引力量子可能不存在，所谓的引力波，实际上被包含在电磁波中。

以上意味着，相互作用中的虚粒子与可观察到的场量子既有联系，也有区别，前者不形成以太包，而后者是伴有以太包的实粒子。另外，以太子是正、反中微子对，而弱相互作用量子是带有不对称正反电荷的中微子对，因此，陈绍光先生认为，引力是弱相互作用力的真空极化效应的一种表现形式，有其一定的道理[8]。正如电磁场的量子理论与电子的量子理论密切相关一样，引力场的量子理论将同中微子的量子理论有某种关联。

另外，如果弱衰变过程中有强子，那么，其中将包含强相互作用，因为，粒子间转移电荷后，新的夸克之间要重新组合成强子，而这种重新组合是强相互作用。所以，一般认为的稳定的奇异重子的弱衰变，其实，在衰变的最后片刻，都存在着强相互作用。

在微观世界，实粒子和虚粒子都在不断地运动着，变化着，它们在不停地交换着能量，转移着电荷，变换着实和虚的角色。场的量子性就是以太和实物之间相互联系，相互转化的一种动态表现。

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第八章 以太的宇观作用

人类生活在宏观世界，我们日常见到的物质现象，一般都可以用经典物理学来描述，比较直观，容易理解。如上所述，在微观世界，存在着二象性、量子性、不确定性原理等等难以直观理解的物理现象。同样，在星系、星系团的宇观世界里，也存在着河外星系的普遍性红移、类星体和暗物质等等难以理解的天文现象。对这些现象，人们已经进行了长时期的研究探讨，其中有些问题，看起来已经得到了解决，实际上却是差强人意，暗物质问题就是其中之一。

8.1、暗物质问题回顾[1]

我们把星系、星系团的世界称为“宇观”。 天文学家可以通过两种方法确定宇宙中有多

少物质。第一种方法是把观察到的所有物质总合起来。第二种方法是测量可见天体的运动速度有多快，然后运用物理学定律推导出需要有多少物质才能产生约束这些天体运动的引力。令人大伤脑筋的是，这两种方法求出的结果竟是大相径庭。多数天文学家因此判断宇宙中还隐藏着某种看不见的物质，这就是天文学上著名的暗物质。

早在 1932 年，年轻的荷兰天文学家奥尔特(A. H. Oort)，在研究恒星穿越银河系银道面的运动中发现：根据这些恒星的实际运动情况，用牛顿力学公式来计算，银盘的物质总量，至少是看得见的发光体总质量的三倍；1933 年，瑞士天文学家茨维基(F. Zwicky)发现，后发星系团的动力学质量竟是光度学质量的 400 倍；1936 年，史密斯等人又发现，室女星系团的动力学质量是其光度学质量的 200 倍，等等. 当时的观察数据误差很大，现在认为，在类似的情况下，一般为 10 倍左右。这些“质量缺失”现象表明：如果宇观物体的运动规律也符合牛顿力学定律，那么，一定还存在着人们还未发现的极大量的“暗物质”。

上述的发现可能存在着一些不确定因素，而 1978 年，鲁宾(V. Rubin)等人的发现被认为很有说服力。他们发现：包括银河系在内的一些旋涡星系，在星系的发光圈外，物质的转动速度同距离无关。而按照牛顿力学定律，物质的轨道运动速度的平方与距离成反比。因此，如果牛顿力学定律始终有效，就得认为：星系外围存在着巨大的暗物质的晕。

如果暗物质真的存在，那么，它究竟是何物呢？早先，人们认为，它是难以被观察到的常见物质，如弥漫在太空中的气体、尘埃、行星，因衰老而变暗了的天体和黑洞等等。但经过观察和分析，这些常见物质，在质和量方面都远远满足不了要求。因此，它应该主要由人类尚未认识的物质所构成。暗物质是非常见物质，它的量又比常见物质大得多，这种情况十分反常。不过，现代宇宙学却如获致宝。因为，按照现代宇宙学理论，在宇宙早期，经过暴胀以后，宇宙学密度保持为 1，而在暴胀中，重子物质不可能迅速合成，它的密度远小于 1，因此，宇宙物质的绝大部分应该是非重子物质。目前，现代宇宙学家们认为：在宇宙的物质构成中，常见的重子物质只占总体的 4%左右；23%左右是暗物质；其余的 73%则是所谓的暗能量。但是，一个最实质性的问题：暗物质究竟是什么？至今毫无答案。

暗物质主要由人类尚未认识的物质所构成，于是，目前有些以太论者认为，以太就是暗物质。但这里忽略了一个基本的事实：到目前为止，暗物质的存在还仅仅表现于宇观世界，比如，在银河系里，若不考虑有质量，有引力作用的暗物质的存在，那么，天体的运动规律，已完全背离了牛顿的力学规则。而以太不只存在于宇观世界，也存在于宏观世界，但在太阳系世界，行星的运动规律完全符合牛顿的力学规则，丝毫不用考虑暗物质的作用，这里的暗物质（它们的质量总和远大于太阳与行星的质量之和）的万有引力作用到那里去了呢？实际

上，以太就是物理真空，它是无所谓质量的，与所谓的有质量的暗物质无关。

总之，暗物质问题源于宇观世界的“质量缺失”现象。它的实质是：在宇观世界里，用牛顿力学定律不足以解释常见物质的运动状态。对此，如果认为牛顿力学定律在宇观世界仍然有效的话，就得承认大量的非常见物质的暗物质的存在，这是当今物理学的主流观点；认为牛顿力学定律具有局限性，在宇观世界，对它应作适当的修正，从而避免暗物质的引入，这是以往的暗物质替代理论的基本思想。

早在 1930 年代，英国天文学家琴斯(H. Jeans)就指出，在星系尺度上，万有引力定律所表述的引力与距离的关系应当修正；1963 年，罗马大学的奋兹(A. Finzi)又提出了对万有引力定律的另一种修改方案。以色列物理学家密尔格罗姆(M. Milgrom)指出，前二位对引力-距离关系方面的修改，无法重现观察结果，并于 1983 年提出了“牛顿引力动力学修正理论”（Modified Newtonian Dynamics 简称 MOND 理论）[2]。在这里，他引入了一个常数a_0，当引力加速度远大于a_0时，牛顿第二运动定律照常适用，即引力与加速度成正比；但当引力加速度小于a_0时，牛顿第二运动定律就得修改了，这时引力与加速度的平方成正比。这一修正理论能很好地复现观察数据，如旋涡星系中的轨道速度不是随着到星系中心距离的增大而不断下降，而是逐渐趋向于一个恒定的值；这个恒定的速度值与星系质量的 4 次方根成正比，在这方面它是优于暗物质论的。因此，它被看作是最成功的暗物质替代理论。不过，这一修正理论缺乏基础性的理论依据，只是一种为了解释已知的观察数据而建立起来的“现象性理论”。而且，它对富星系团内部的“质量缺失”不能很好地进行描述，对引力透镜现象也无法进行解释。可见，这一修正理论不太理想。

那么，是否存在一个即能不借助于暗物质，又带有一定基本性的理论呢？这是有可能的。

8.2、引力场不是宇宙场

暗物质论和 MOND 理论都存在着一些欠缺，而且，它们有一个共同点，那就是都把引力场当作了可以支配万物的宇宙场。目前已知的三种基本的相互作用都有着明显的区间作用性：在原子核内部，作为强相互作用的色场起着主要作用；在原子世界，电磁场占着主导地位；引力场的作用在微观世界是微不足道的，到了太阳系世界，它才成了支配天体运动的主宰。既然，引力场不能在微观世界发挥明显的作用，怎能认为它能独霸宇宙呢？微观、宏观、宇观是人为规定的，设想在电子上有一种特殊的有智慧的生物，它们可以将原子世界称作“宏观”，而将我们的宏观当作是它们的“宇观”。如果我们的宇观场就是宏观中的引力场，那么，

它们的“宏观场”（电场），也可等同于它们的“宇观场”（引力场），但这是不成立的。可见，引力场不会是宇宙场，而只是一种宏观场。实际上，引力场强度对应以太密度梯度，意味着引力是以太连续性的一种属性，当以太密度小到一定程度，以太失去了连续性，引力也将趋于消失。因此，引力场的作用是有限的，在比宏观更大的宇观空间里，还会存在着不同于引力场的宇观场。所谓的“质量缺失”现象，应该是存在着宇观场作用的反映，而不是存在着什么“暗物质”。

8.3、宇观场作用论

宇观世界，空间尺度以十万光年、百万光年计，距离用“标准烛光”等确定；光度用谱线的“速度弥散”等指示；年龄用 Hubble 定律等估计；质量用质光关系和位力定理等计算。这些方法都有较大的误差，因此，描述宇观天体，一般用牛顿力学足够精确了。牛顿力学的表达方式简单、明了，我们就参照这一表达方式来进行尝试。

8.3.1、宇观场的基本假设

电、磁、引力等有着相同形式的力的表达式：$F = f\frac{m_1 m_2}{r^2}$。f 是恒量，对电力来说，m_1、m_2 代表二个电荷值；对引力来说，m_1、m_2 代表二个质量，即引力荷值，等等。对宇观力也可以有同样的形式。

假设 1：二个宇观荷（u_1、u_2）能相互吸引，这宇观力的大小

$$F = H\frac{u_1 u_2}{r^2} \qquad (8.1)$$

其中 H 为宇观力恒量，r 是它们中心之间的距离。

那么，如何来确定宇观力荷的值呢？大家知道，电荷、质量都是物质的属性，探讨宇观力荷也应该从天体的物质性入手。另一方面，宇观力的特点是在一定范围内，空间越大，它的作用越明显，这显示宇观力荷有一定的空间广延性。质量是没有空间广延性的，但实物的周围存在着引力势（以太密度），引力场强度就是引力势的梯度。上面曾提及，在量子理论中，场强是欠定的，而势是超定的，因此势是比场更基本的实在。引力势应该是比引力场更基本的物理实在，宇观荷应该与它有关。由此，根据有关的观察资料提出如下假设。

假设 2：在有效半径 L 内，天体的宇观荷与天体的引力势 $\frac{m}{r}$ 的体积分的正平方根成正比：

$$u = p\sqrt{\iiint_{\Omega} \frac{m}{r} dv} = p\sqrt{2\pi m r^2 + c} \qquad 0 < r \leqslant \mathrm{L} \tag{8.2}$$

其中 p 是常数；m 是天体的质量；r 是离开质心的距离；r < L；Ω 是以 r 为半径的球体积；c 为负数，是宇观效应常数——它使宇观力在宏观世界微不足道，当 r 相当大时，c 可略去不计；$L = b\sqrt{m+h}$；b 和 h 是常数；当 $r > L$ 时，宇观荷 u 不再随着 r 的增加而增加。

宇观场是有源场，当宇观荷的分布成球对称时，它的强度可以如电场那样来求：以天体的质心为球心，r 为半径作球面，将这球面内的宇观荷（有效宇观荷）看成全集中在球心，以此来计算离质心 r 处的宇观场的强度，而不必考虑球面外的宇观荷的影响。

以上二个假设是否成立，要看由它们推算出来的结果能否与观察数据相符。下面就此作下分析。

8.3.2、宇观场分析

由假设 2，在宇观世界，c 可略去不计，天体的有效宇观力荷是：

$$\begin{cases} u = pr\sqrt{2\pi m} \cdots\cdots\cdots\cdots r < L \\ u = pb\sqrt{2\pi\ \ (m m+ h)} \cdots\cdots r > L \end{cases} \tag{8.3}$$

结合假设 1，质量为 m_1、m_2 的二个天体之间的宇观力应分三种情况：

a、二者的距离都在它们的有效半径之内时：

$$F = H\frac{u_1 u_2}{r^2} = 2\pi p^2 H\sqrt{m_1 m_2}\,, \qquad r < L_1, r < L_2 \tag{8.4}$$

这时，力 F 与 r 无关。

b、二者的距离在 m_1 的有效半径之内，在 m_2 的有效半径之外时：

$$F = \frac{2\pi H p^2 b\sqrt{m_1 m_2 (m_2 + h)}}{r}, \qquad L_1 > r > L_2 \tag{8.5}$$

这时 F 与 r 成反比。

c、二者的距离都在它们的有效半径之外时：

$$F = \frac{2\pi H p^2 b^2\sqrt{m_1 (m_1 + h) m_2 (m_2 + h)}}{r^2}, \quad r > L_1, r > L_2 \tag{8.6}$$

这时力 F 与 r 平方成反比。

在星系的外围，物质作绕星系的圆周运动。在这种情况下，可设外围物质处于星系的宇观荷分布的有效半径之内，而星系的质心处于外围物质的宇观荷分布的有效半径之外，应该用（8.3）式计算，而且，因为天体的质量相当大，h 可以略去不计。于是，外围物质的向心加速度应该是引力加速度 a_1 与宇观力加速度 a_2 之和：

$$a=\frac{v^2}{r}=a_1+a_2=\frac{Gm}{r^2}+\frac{k\sqrt{m}}{r} \tag{8.7}$$

其中 $k=2\pi Hp^2b$，v 是外围物质轨道运动速度，m 是星系的有效质量。于是，

$$v=\sqrt{k\sqrt{m}+\frac{Gm}{r}} \tag{8.8}$$

因此，在星系的外围（r 已足够大），物质的轨道速度将趋向于定值 $\sqrt{k\sqrt{m}}$，这与鲁宾等人的发现相一致。

轨道速度为 $\sqrt{k\sqrt{m}}$ 时，向心加速度的平方是：

$$a^2=\frac{v^4}{r^2}=\frac{k^2m}{r^2}=q\frac{Gm}{r^2}\qquad\left(q=\frac{k^2}{G}\right) \tag{8.9}$$

这里显示了与 MOND 理论和观察数据相符的关系，即引力与加速度的平方成正比；速度的 4 次方与天体质量成正比的关系。在我们看来，MOND 理论是在这样情况下的一种近似：外围物质处于星系的宇观力荷分布的有效半径之内，而星系的质心处于外围物质的宇观力荷分布的有效半径之外，而且，宇观场的作用远大于引力场的作用，引力场的作用可以略去不计。

原来，人们以为天体的加速度都是引力加速度；现在，天体的加速度应该是引力加速度与宇观力加速度之和。这说明，以往通过引力定律计算出来的天体的质量，其实不是纯粹的引力质量，其中还包含着由宇观力造成的“宇观质量”。设天体的质量为 M，它包括引力质量 m 和宇观质量 m'，即 M=$m+m'$。天体的引力加速度，以往用 $a=\frac{G(m+m')}{r^2}$ 计算，现在应该用 $a=\frac{Gm}{r^2}+\frac{k\sqrt{m}}{r}$ 计算，由这二式可得：

$$m' = \frac{kr\sqrt{m}}{G} \qquad (8.10)$$

部分的宇观质量m'就是所谓的“暗物质”。由（8.5）可知，它与r成正比，即天体离开星系质心的距离越远，运用牛顿定律计算出来的星系的“暗物质”越多。它是由内向外逐步增加的。另外，当人们分别用一个星系内部的天体和一个星系外围的天体来计算该星系的质量时，得出了不同的值，这时，一般不怀疑前者的结果，而认为后者是受到了暗物质的作用，这样就把星系内部的m'等同于m，而将外围的m'当作是“暗物质”。这就是产生“暗物质”分布在星系外围的“假像”的缘故。

下面对银河系的有关的量作下粗略的估算（下面统一用米·千克·秒制）。

由于已知的银河系的质量包括了宇观质量，它的引力质量应该比这小得多。取它的引力质量m=4×10^{40}，$\sqrt{k\sqrt{m}}$=2×10^{5}，得$k \approx 2\times10^{-10}$。那么，银河系对离开银心 5 万光年处的天体的引力加速度和宇观力加速度之比：$\frac{Gm}{r^2} : \frac{k\sqrt{m}}{r} \approx 1:7.089$，即在该处，引力不到宇观力的 1/7。

设$\frac{G}{b^2} = 10^{-12}$，那么，$b \approx 8.1686$，于是，L $_{太阳}$=$b\sqrt{m} \approx 1.2$ 光年；L $_{银河}$$\approx 1.2\times10^{5}$ 光年，是银河系半径的 3 倍左右。这似乎显示，在星系之间的相互作用中，引力将不再发挥作用。

另外，MOND 理论不能正确地处理与引力透镜有关的运动[5]；而我们的理论可以解释引力透镜现象：光子是具有动态质量的粒子，它有引力势，就具有宇观荷，也参与宇观场的作用，所以，光线在引力场或宇观场里都会弯曲，而产生透镜现象。星系的宇观力远大于引力，宇观的“引力透镜”现象，其实主要是“宇观力透镜”现象。

8.3.3、对天体测量中的四个反常现象的解释

在当代的天体测量中，相继发现了四个反常现象，至今还没有令人满意的解释[4]。宇观场作用论有可能对它们作出合理的说明。

前面指出：以往通过引力定律计算出来的天体的质量，其实不是纯粹的引力质量，其中还包含着由宇观力造成的“宇观质量”，这将是造成四个反常现象的基本原因。

8.3.3.1 先锋号反常

20 世纪 70 年代，美国向几乎相反的方向发射了二个飞越太阳系的飞船：先锋 10 和 11 号。在整个发回讯号的存续期里，它们飞行了几十个天文单位，均测到存在一个不明原因的，向着太阳的，大小恒定为 $8.74\times10^{-10}m/s^2$ 的加速度。对这个反常，除了认为是某种系统误差外，无法用现有理论解释。而在宇观场作用论看来则很简单：这是宇观场的作用引起的，当太阳和飞船之间的距离都在它们的有效半径之内时，宇观力与距离无关，是恒定的。进一步说，我们知道的太阳的质量，是在地球上测量出来的，实际上也包含了一定的宇观质量，因此，当飞船在地球轨道附近飞行时，不会发现它的异常；当飞船远离地球轨道时，由宇观力引起的异常就明显了。同时，这里也显示，常数 h 比较大。

8.3.3.2、月球轨道偏心率的增加

2006 年 William 首先指出：月球轨道的偏心率在随时间增大，后来经由多人的验证，肯定了这个反常现象的存在，它对现有的物理学基本原理提出了挑战。在宇观场作用论看来，这个现象的存在是很自然的：以往人们认为月球的轨道完全由万有引力决定，月球的质量是纯粹的引力质量；而实际上，宇观场的作用对月球的轨道也会有小小的贡献，一般认识的月球质量里其实包含了宇观质量；引力相互作用与距离的平方成反比，而根据（2），宇观力相互作用与距离无关，是恒定的；因此，单纯由牛顿引力定律计算出来的月球轨道，必然存在误差，这种误差虽然很小，但随着时间的累积，就表现为月球轨道偏心率的增加。

8.3.3.3、天文单位长期增加

从 2005 年始，人们发现天文单位在不断增加，这使科学家们疑惑不解。而在宇观场作用论看来，导致这个现象的原因与月球轨道偏心率的增加完全相同。地球绕太阳的运动主要靠引力相互作用，但也有宇观场作用的参与，因为太阳的质量，其实包含了“宇观质量”。 引力与宇观力的相互作用方式有一定的差异，因此，单纯由牛顿引力定律计算出来的天文单位，必然存在误差，它随着时间的累积，就表现为天文单位的长期增加。

8.3.3.4、飞掠地球反常

对好几个飞船的测量都显示，当飞船掠过地球时，从地心参考系看飞船轨道能量有一个不正常的增加。在本文看来，这也是宇观场作用的结果：人们都是根据牛顿引力定律来确定物体质量的，飞船、地球的质量依据地球对地面上物体的引力来确定，其他天体的质量是依

据天体的远距离运动轨道来确定，而宇观质量与相互作用的距离成正比，因此，飞船、地球的质量是比较纯粹的引力质量，而其他天体都包含了较多的宇观质量。于是，当飞船主要是在太阳等其他天体的作用下运行时，我们用引力定律来计算是相当正常的，因为，这里其实把宇观场的作用也包含进去了；而当飞船掠过地球时，人们只认为它是在单纯引力的作用下运行，而没有考虑宇观场的作用，从而出现了能量意外增加的“反常”。

8.4、讨论

以上表明，宇观世界的“质量缺失”现象，是存在宇观场作用的表现。宇观力有着与引力、电力等相似的经典表达方式；宇观荷同引力势密切相关，它的一个特点是：其分布有确定的有效半径。

二个天体之间的宇观力分为 a、b、c 三种情况，即随着这二个天体之间的距离的变化，它们之间的宇观力会发生跳跃式的变化，这对星系核、星团等的形成等等将产生特殊的作用。对此，有可能通过理论分析和天文观察来加以检验。当然，这种跳跃性也表明我们的理论是初步的，近似的，实际的力的变化曲线应该是圆滑的。

宇观场作用论是一个新的暗物质替代理论的初步方案，它有待进一步的修正和补充,如需要新的观察数据和理论分析来确定 H 、 p 、 c 、 b 、 h 、 L 以及天体的纯粹的引力质量等等。同 MOND 理论一样，宇观场作用论的假设是根据有关的观察数据作出的，因此它能得出一些与观察数据相符的结论，这不足以证明它的正确性；不过，它不但包含了 MOND 理论，而且能解释 MOND 力所不及的现象，还可解释天体测量中的四个反常现象，这些显示了它是合理的。

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第九章 宇宙的 Smarandache 几何模型

如前所述，宏观以太构成了引力场，宇观场，引起了相对论性现象；而微观的以太粒子能激发成虚光子、虚胶子而形成电磁场、色场；高能虚光子、虚胶子又能进一步分裂成轻子和夸克而构成各种实物，如此看来，以太确实是我们已知世界的“万物之源”了。不过，物质世界总是既统一又不统一的，所谓的万物之源，一般只是对局部的物质界而言。比如，任何生物体都由细胞构成，因此，细胞是生物界的“万物之源”；但生物界只是物质界的一部分，作进一步探究，我们发现，所有的有机物和无机物都由原子组成，所以，原子可看成是所有物体的“万物之源”；但这也只是人类认识的一个阶段，接着，人们认识到轻子和夸克才是常见实物的“万物之源”；现在，我们又意识到，以太是已知的物质现象，即所有实物和场现象的“万物之源”。同样，目前我们认识的物质界，也不会是宇宙的全部，还会有更广泛的物质世界等待我们去求索。

9.1、宇宙学的历史轨迹

我们人类一直执著于对宇宙的思索:宇宙是如何创生的，它的结构怎样，如何演化？

关于宇宙的产生，在远古产生了很多神话。中国有一个著名的“盘古开天”的故事：宇宙始于一个巨大的蛋，巨人盘古在蛋中沉睡数千年，醒来后破壳而出，蛋中比较轻、纯的部分，上升形成天空；而比较重、浑的部分沉淀为大地。盘古双脚站在地上，用他的双手擎起天。当天空越升越高，盘古也越长越高以维系天地之间的联系。最终，盘古死了，他的左眼变成太阳，右眼变成月亮，汗水化成了雨，毛发成了植物，骨骼变为岩石[1].

在宇宙的结构和演化方面，开始，人们只是对看到的天地间的事物进行合理的描述，后来尝试去建立能够进行计算的数学模型。亚里士多德认为，星星都在围绕着地球作理想的圆周运动；公元 2 世纪的托勒密进一步提出了与当时的观察数据相符的宇宙的数学模型。

16 世纪的哥白尼，成功地将地球从宇宙的中心移开了，推动了沉寂 14 世纪的宇宙论的发展。开普勒进一步用椭圆轨道替换了亚里士多德神圣的圆形轨道。

通向现代宇宙学道路上的下一个重大发展是艾萨克.牛顿的登场，根据他建立的力学体系，宇宙如同一架巨大的机器，能够有规则地永恒运转。

进入20世纪。天文观察和物理学理论突飞猛进，带动了宇宙学的空前发展。随着天文观察范围的不断扩大，人们发现，天体普遍地存在着团集现象：行星围绕太阳组成了恒星系；无数太阳系团集成了星系；好多星系又形成了星系团，星系团之上又有超星系团等等，于是，

20世纪初，瑞典天文学家Charles Charliar提出了“等级式宇宙模型”，它认为，宇宙的物质结构象俄罗斯玩偶那样，一个套在另一个内部,逐级集聚成越来越大的结构,一直延伸到无限大[2]。等级式现象是很普遍的，但这个模型只考虑了宇宙的实物结构，没有涉及到场的作用。

一般认为，爱因斯坦1915年发表的广义相对论，取代了牛顿的引力论，标志着现代宇宙学的开始，因为，它使对整个宇宙进行一致的数学表达成为可能。在这里，时间和空间不再被认为是绝对的，独立于物质本体的，而是宇宙演化的参与者。因此，现代宇宙学告诉我们的不是宇宙在时间和空间中的起源，而是时间和空间本身的起源。真的如此吗,还是宇宙论从神话开始，最后又回到了神话？

9.2、宇宙学疑难的根源

了解宇宙的全貌是人类世世代代梦寐以求的目标。物理学研究的深入发展，激发了人们从整体上认识宇宙的欲望。而以物理学为基础的高科技，创造了口径越来越大的巨型光学望远望、空间 X 射线和红外线望远镜以及地域甚大的天线阵列射电望远镜，这不仅使人们观测宇宙的窗口从红外、可见光一直延伸到 X 射线和 γ 射线整个波段，还使观测宇宙的时空尺度伸展到了 100 亿光年以上。如今，在人类面前，已展现出一幅生动壮观的宇宙画面。

1917 年，爱因斯坦发表了著名论文《用广义相对论对整个宇宙的考察》，开创了宇宙学的研究。爱因斯坦根据广义相对论认为，任意一点的四维时空连续区的度规应由物质及其分布状态决定。由于物质分布在局域上看是不均匀的，时空连续区的局域度规也将是复杂的。然而从大的范围上看，宇宙的物质及状态的分布是均匀的，所以度规是缓慢弯曲的，呈近似球形空间。为了使物质有可能呈准静态分布，爱因斯坦在引力场方程中增补了一个 $\Lambda>0$ 的附加项。1927 年，比利时的勒梅特（Lemaitre Abbe′GeorgesEdouard1894～1966）提出大尺度宇宙空间随时间膨胀的预言。那么，宇宙究竟是静态的还是膨胀的呢？哈勃作出了似乎令人信服的回答。

1929 年，哈勃仅以 24 个已知距离星系的观测资料为依据，得出了速率-距离的关系，即哈勃定律 $v_r=H_0r$，r 为距离，v_r 为星系对银河系的视向速率，H_0 是哈勃常数。哈勃的这一结果，不仅证明了整个宇宙处于膨胀之中，而且这种膨胀速度与距离 r 成正比，因而既是处处没有中心又是处处为中心的。既然宇宙在膨胀，那么，把时间反推回去自然得出宇宙起源于一场大爆炸。这初看起来完全是一个大神话，但它有广义相对论作为它的理论基础，有哈勃定律作为它的观察支持，后来，又逐步发现了作为“大爆炸的余尘”的宇宙背景辐射、宇宙丰度也符合大爆炸理论的计算结果等等，于是，大爆炸宇宙学成了一种标准模型。然而，现

代宇宙学从其诞生之日起就疑难缠身[3]，而且，它的发展过程往往是以新的疑难来掩盖旧的疑难。

用大爆炸宇宙学来探讨初始宇宙时，存在着三大疑难。

一是视界疑难。视界是因果联系的区域，由于受到有效传播时间的限制，在早期宇宙中，不同的视界之间不能以热信号或光信号等相互联络，因此，它无法说明目前宇宙的普遍性的因果联系。比如，在全天空，宇宙背景辐射的温度，直到 10^5 分之一度都是均匀的，这是目前宇宙存在着普遍性因果联系的有力证据。

二是平直性疑难。宇宙的平直性与密度参数相关，目前的密度参数约为 1，即我们的宇宙是平直的，这要求早期的密度参数要更精确地等于 1，因为，如果早期的密度参数的值与 1 有些偏离，那么，这一偏离就将急剧增长，而破坏宇宙的平直性。但是，初始宇宙物质密度非常大，半径又相当小，按照广义相对论，其曲率应该很大，怎么会是平直的呢？

三是磁单极疑难。根据有关理论，宇宙大爆炸后，随着能量的逐步降低，会发生"对称性的自发破缺”，在不同视界的相交处将会产生磁单极。因为磁单极的质量很大，它的质量密度将是重子质量密度的 10^{14} 倍。这是一个灾难性的预言，因为，既然磁单极这么多，它早就应该被发现了，但实际上却至今没有发现一个！

为了消除这些疑难，上世纪 80 年代，出现了 “暴胀”理论，它的基本假设是：在大统一对称破缺时期，宇宙经历了一次难以想象的剧烈膨胀，它使一个视界的体积就暴胀成了我们所能探测到的整个宇宙。这样一来，以上三个疑难就迎刃而解了：因为我们的宇宙是由一个视界暴胀起来的，视界疑难自然不再存在；磁单极也成了个别现象，至今没有发现就不足为奇；在暴胀中，宇宙的曲率半径增加了大约为 10^{43} 的因子，所以，无论初始宇宙如何弯曲，暴胀后，它都将是平直的。但是，所谓的暴胀是个怎样的图景呢？那是在远不到 1 秒的时间里，一个原子大小的东西，一下子变成了比银河系还要大的庞然大物。这样的描述连神话都构思不出来，可能吗？这是一个更无法解答的大疑难。另外，这样的暴胀速度将是光速的 10^{30} 倍以上，这是在根本上与相对论过不去。有人说：宇宙的膨胀是时空的膨胀，这不同于物质的膨胀，因此可以超光速。这是个诡辩，这里所谓的时空就是以太，它也是一种物质，不是真正的空间。

暴胀理论预言密度参数为 1，而重子物质的产生速度远远跟不上时空的暴胀速度，因此，重子物质的密度远小于 1，于是，宇宙的主要成分应该是人们还未认识到过的非重子物质——暗物质。宇宙中的大部分物质竟是我们从未认识到的，它们究竟是何物，又成了一个大疑难。

我们的宇宙是一个原始视界的暴胀结果，那么其他原始视界是否也会暴胀呢？这当然也有可能。于是，这样的宇宙论实际上降格成了局部宇宙论。现在，出现了多种多样的多宇宙理论，涂润生的“宇宙细胞说”[4]是其中之一，他认为，一个阴性子宇宙（负能量世界）和一个阳性子宇宙（正能量世界）一起构成一个宇宙细胞，无数宇宙细胞构成无限的宇宙。

暴胀后的宇宙应该持续减速膨胀。然而，用现代宇宙学的理论来分析天文观察数据，却发现：宇宙还在加速膨胀！这一异常，又触发了宇宙学家们的想象空间，他们认为：宇宙空间存在着比暗物质更大量的“暗能量”。被爱因斯坦发明，后来又抛弃的宇宙学常数，又被他们当作宝贝拣了回来，成为了暗能量的代表。一般的能量总是与质量相联系的，有能量就有质量，能量代表斥力，质量代表引力；但这暗能量只有斥力作用，而没有引力作用。这样的暗能量比暗物质更神秘莫测，它有可能存在吗？它究竟是什么？这又是一个天大的疑难！

以新的疑难来取代旧的疑难，只是一种权宜之计，不是科学的作风，是到反省的时候了！那么，造成宇宙学疑难不断的根源是什么呢？这要从现代宇宙学的基础中去探究。现代宇宙学的理论基础是广义相对论；它的实验基础是宇宙学红移、宇宙背景微波辐射、宇宙丰度等等。我们就对此来作些分析。

广义相对论是有局限性的。爱因斯坦自己就说过：“对于很大的场密度和物质密度，场方程以及这些方程中的场变数，都不会有实在意义……这些方程不可扩展到这样的一些区域中去。”对此，霍金也说：“广义相对论导致了自身的失败，它预言它不能预言宇宙。”1970年，彭罗斯和霍金证明了：如果广义相对论正确，那么，时空一定存在奇点。这里所谓的奇点，就是场密度和物质密度趋向无限大的点，这是广义相对论局限性的一个表现。然而，人们，包括爱因斯坦和霍金，只是对引力方程修修补补，或者用量子效应绕开奇点，总体上还是在广义相对论的基础上描述整个宇宙。

现代宇宙学把广义相对论的数学模型——黎曼空间当作就是实在的弯曲空间，认为宇宙是一个无界而有限的四维时空。其实，所谓的时空的弯曲只是对以太分布不均匀的一种数学描述，真正的时空不会弯曲。数学模型是科学理论的必需，但数学模型也常常会迷惑人。站在前沿的宇宙学家是科学界的精英，他们想象力丰富，数学功底深厚。每当灵感闪现，他们将构建新的数学模型，经过设置和调节一定的参数，将会得到在某些方面与实际现象相符的数据。于是，他们往往会把数学模型等同于现实的物理机制，疑难也会随着而生。

广义相对论只是一种引力论。而引力场只是一种宏观场，现代宇宙学却把引力场当成了能够支配整个宇宙的“宇宙场”，以此作为理论基础，不产生疑难那才怪呢。

大爆炸宇宙学，建立在一个不可靠的理论基础之上；所谓的三大证据，也有不少是牵强附会。现代宇宙学认为氦都是在宇宙大爆炸后，温度降到一定程度时的产物；宇宙背景微波辐射就是宇宙大爆炸的“余尘”；宇宙学红移是多普勒红移。然而，一种现象可能有多种原因引起，现代宇宙学将他们的认识当作是唯一的解释，从而铸成了大错。

在所有年轻的恒星中都含有丰富的且同样丰度的氦元素。对此，现代宇宙学认为：这些氦是在宇宙大爆炸后的产物。如果跳出大爆炸宇宙学的思路，所谓的年轻恒星，只是天体生生死死无穷次反复演变的一瞬间，而氦是由星体内氢的核燃烧产生的，氦的丰度是天体无穷次反复演变处于平衡状态的结果。因此，相同演变阶段的天体有同样的氦丰度不足为奇。

宇宙微波背景辐射是一种充满整个宇宙的电磁辐射，它的特征和绝对温标 2.725K 的黑体辐射相同。而黑体辐射是一种理想物体的热辐射，是一种热平衡状态的辐射，把它看成是宇宙大爆炸的产物，是很值得怀疑的。任何天体都在不停地辐射、反射、折射、吸收着电磁波。在太空中，这些电磁波经历了无限长时期的捣腾，形成了宇宙背景辐射是很自然的。它可看成是太空中的宏观的真空起伏，是以太海洋里“无风三尺浪”的表现，本来如此，以后也会如此。把它当作“大爆炸”的余尘，倒象是种神话。

张操教授说“宇宙背景辐射是宇宙中致密暗星体爆炸的产物，这包括伽马射线和超新星的余辉，它们被星际的尘埃、暗星体吸收、发射、再吸收，最终达到了热平衡态，形成了现在观察到的宇宙背景辐射[5]。”

关于光谱线的红移，有多普勒红移、引力红移、光子的能量衰减红移等等。其中，由于光速的巨大，光子的能量衰减红移在宏观世界不会有明显的表现，但在宇观世界就会显示出来了。实际上，宇宙背静辐射的存在，表示太空中的以太不是完全超流动性的，这意味着它会有那么一点点的粘滞性，于是，光在星系间的远距离、长时间的传播中，会消耗能量。如果跳出大爆炸宇宙学的思路，认为宇宙是无限的，那么，由多普勒效应所产生的天体的红移和蓝移应该是均等的，宇宙学红移就不是多普勒红移，而主要是光子的能量衰减红移。

张操教授认为，宇宙学红移是光子与以太背景场之间存在非常微弱的相互作用造成的。他导出了一个关系式：$\omega' = \omega(1 - H_0 t)$， 这表示光的频率 ω' 是传播时间 t 的线性函数，当传播时间趋向 H_0^{-1} 时，光子能量减少到零，即 H_0^{-1} 可表征光子在宇宙中传播的寿命[5.6]。

余本立教授用严格的数学推理证明：如果光是真正的平面波，它不会有红移，但一般天体发出的光不是真正的平面波，它们的波长会缓慢变长，即红移[3]。

把宇宙学红移当作多普勒红移，是现代宇宙学的一大要害。它是确定宇宙在膨胀，而且

是在加速膨胀的一个关键。消除了这个要害，所谓的宇宙膨胀、暗能量，乃至整个大爆炸宇宙学就无立足之地了。

使现代宇宙学盛行的还有一个因素是对理论的一种形式化的评判标准，认为只要前提简单，可以计算的就是好理论。现代宇宙学用一个引力场方程来描述整个宇宙，多么简单！调节宇宙学常数、哈勃常数等等参数，能够对宇宙现象作出合乎逻辑的解释，又是多么的漂亮！然而，逻辑只是思维的规律，不一定是自然界的规律。物理内涵的可靠性比形式上的简单性和逻辑性更重要。

宇宙是无限的，它的每一个局部都在运动着，演化着，但宇宙不会整体创生或毁灭。如果宇宙学是有关局部宇宙演化的学问，这有一定的合理性；如果认为宇宙学应该描述宇宙整体的演化，那么，它的大前提错了！解释宇宙的整体创生或毁灭，是宗教的专利，科学不应该夺其所爱。

实际上，已经有越来越多的科学家意识到了现代宇宙学的荒诞性。比如，2004 年 5 月 22 日，英国的《新科学家》杂志发表了 34 位科学家和工程师签名的《致科学界的公开信》（上网后，又很快获得了 185 位科学家的网络签名），对大爆炸理论进行了口诛笔伐。他们尖锐地指出：“更重要的是，大爆炸理论从来没有任何量化的预言得到过实际观察的验证。该理论捍卫者们所宣称的成功，统统归功于它擅长在事后迎合实际观察的结果：它不断地在增补可调整的参数，就象托勒玫的地心说总是需要借助本轮和均轮来自圆其说一样。”[8]确实，目前宇宙学中的三大要素：暴胀、暗物质和暗能量，好比现代的本轮、均轮，是臆造出来的东西。

面对现代宇宙学的荒诞性，出现了各种各样的对真实宇宙的设想。比如，王平教授提出了“时空哲学”，他认为，宇宙是实空间与虚空间的统一体，实空间是有限的，而虚空间是无限的[9]。罗正大提出了宇宙自然力理论，它认为宇宙中既存在自然外力，它使宇宙收缩；也存在自然斥力，它使宇宙膨胀，二者之间的相互联系和相互作用，使宇宙充满了活力[10]。

9.3、区间场以太观

一般认为有四大相互作用：强相互作用、弱相互作用、电磁相互作用和引力相互作用，而电弱统一理论意味着弱相互作用可以被看成附属于电磁相互作用，因此，已知的是三大相互作用。这三大相互作用对应三大力场：色场、电磁场和引力场，加上本文引入的宇观场，共四大力场，它们的作用范围都有着明显的区间性。如果认为宇宙是无限的，那么，我们认为：宇宙中存在着一系列区间场，它们分别在一定的空间尺度范围（某场区间）中占主导地

位。这意味着，以上所述的以太只是引力场以太，它是无数种区间场以太中的一分子。另外，区间场与一般的已知的场一样，也是一种物理量连续分布的状态，而不代表某种基本存在的物质。因此，正如引力场由引力场以太所造成一样，我们进一步认为，各区间场也应该由各自的区间场以太所造就。

区间场以太观把各种区间场在物质性上平列起来了。但实际上，在我们的认识范围里，引力场有着特殊的地位。比如，无论引起物体加速运动的是电力、磁力或其他什么力，在与加速物体相对静止的坐标系上，总是表现为存在着引力场。这是怎么回事呢？情况是这样的：生活在地球上的古人，因为不了解其他星球的真面貌，于是，把地球看成是宇宙的主体，太阳、月亮、星星只是宇宙的装饰物；同样，由于人类生活在引力场区间中，还未意识到其他区间场的存在，无意中就把引力场以太当作了唯一的区间场以太了。将某一区间场以太当作是唯一的区间场以太的看法，本文称之为“某场以太性”。即人类现在所持的是引力场以太性的物质观，人们所能认识到的一切物质现象，都可看成是引力场以太的种种表现。色场、电场和本文所说的宇观场，它们都不是真正的区间场，而是引力场以太受相应的区间场的作用而表现出来的现象。类似地，量子性、二象性及以太的粒子性等等都是引力场以太受微观区间场的作用而表现出来的现象，可以这样来理解区间场以太之间的关系：以太粒子之间充斥着连续分布的微观区间场以太，如此等等。

有一个问题曾使人疑惑：为什么在人类生活的宏观世界里，物质现象是那么的清晰、直观，而在微观世界和宇观世界中，情况却不是这样，那里存在着难以直观理解的二象性、不确定性原理、类星体等等现象，难道这是大自然对人类的青睐？现在，对此有了答案：微观和宇观世界的特殊现象是由于人们用引力场以太性来描述相邻场区间中的物质现象的缘故，是区间场之间的相互作用造成的。显然，这种描述离开本场区间越远，物质被“扭曲”的程度就越厉害，最终必有一个极限。这从引力场以太性中的定量描述的实质来看也很显然：我们的认识都是引力场以太性的，这使引力场以太拥有特殊地位，在真空中，由引力场以太传播的光的波速被当作了极限速度，它是不变的，并以此为基础形成了引力场以太性的定量描述的时空观——相对论时空观。在这里，时间和长度的标准取决于引力场以太的密度，即引力场以太粒子的间距。于是，作为引力场以太“分子”的玻色子（以太粒子等）的大小已经无法确定，对于构成这种玻色子的轻子及夸克，就只能认为是“点”粒子了。不过，如果用微观区间场以太性的“眼光”去观察，那些实物不是点粒子，它们都是有内部结构的，是可分的。因此，若把所有场以太性中的“实物”串联起来，这种广义的实物系列是无限的。

物理学家 D.博姆，关于“显析序”和“隐缠序”的思想[11]，在这里可以获得明确和拓展：

在微观世界，我们熟悉的各种实物粒子和电磁场、色场等等构成了显析序；它们时时刻刻地受到微观区间场的作用，这种作用我们难以直接感知，它们作为隐缠序，以虚数波的形式对微观粒子进行导引，从而产生了二象性、量子性等微观世界的特性。同样，在宇观世界，作为显析序的天体，必定也会受到由宇观区间场所造成的隐缠序的作用。河外星系的普遍性红移，类星体现象等等宇观世界的特殊现象，就可看作是这方面的一些表现。

相对论时空观是引力场以太性的定量描述的时空观。当人们用引力场以太性来描述微观世界时，由微观世界的隐缠序引起的特殊关系，要用量子力学来处理，量子力学与相对论相配合能够很好地描述微观的物质现象。同样，在宇观世界，宇观的隐缠序也会造成一些难以直观理解的定量关系。因此，本文认为：在引力场以太性中，正如要用量子力学来配合相对论对微观世界作定量描述一样，应该建立一种“宇观力学”的特殊体系，来定量地配合相对论去揭示宇观世界之谜。

为明确起见，对有关的区间作如下命名：如图 9.1 所示，引力场区间为“宏观”；比宏观大，但能用引力场以太性加以描述的区间为“宇观”；小于宏观，但能用引力场以太性加以描述的区间为“微观”；大于宇观的叫“超宇观”，小于微观的叫“超微观”。超宇观和超微观是人类目前无法认识的。

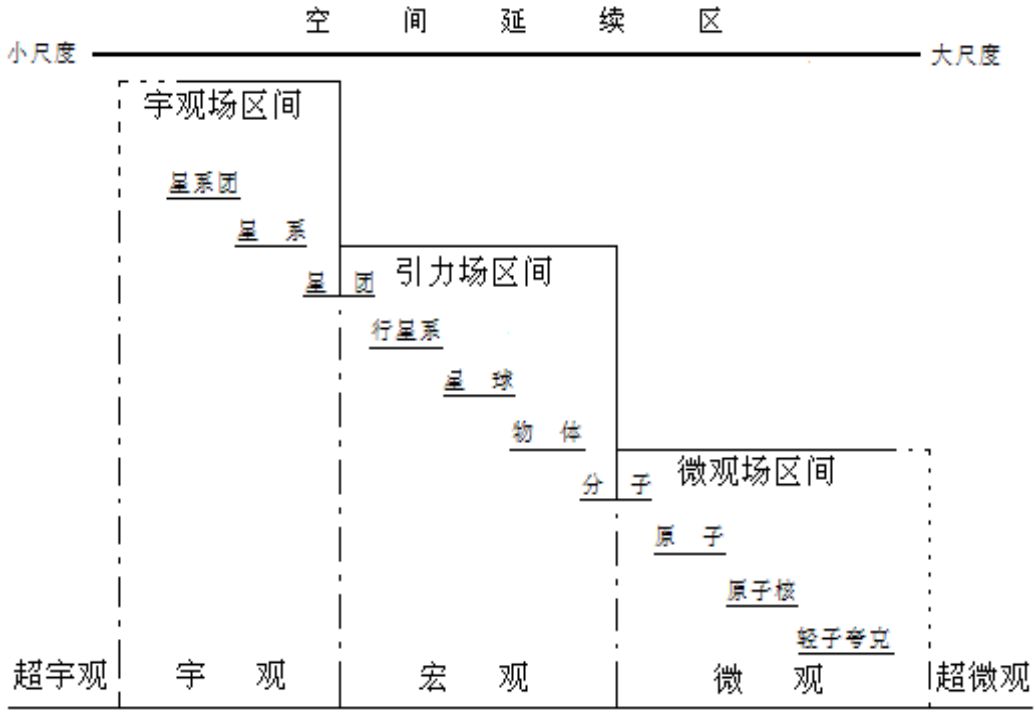

图 9.1 实物分割阶层与场以太区间阶层之间的关系示意图

图 9.1 可以被看成是图 9.2 的宇宙空间图沿某条半径 OP 的剖面图

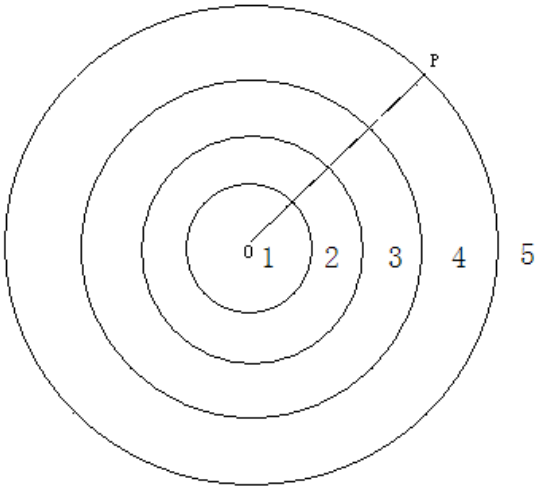

图 9.2 宇宙空间区间图，1、超微观区间；2、微观区间；3、宏观区间；4、宇观区间；5、超宇观区间。

不同的区间场以太性，由于各自立足的物质观不同，就会有各自独立的真空观、实物观、定量性的时空观。我们认为是粒子的东西（如光子），不一定对应微观区间场以太性中的实物；而我们所认识的电子形象，在微观区间场以太性中定将面目全非；我们看来是十分奇特的类星体，在宇观区间场以太性中倒可能是很普通的物质现象。

引力场以太造就了相对论性时空观，在第三章里，我们用一个半椭圆形表示宏观物理学中的相对论性时空的 Smarandache 几何（图 3.3）。区间场以太造就了各自独特的物理学时空观，因此，每个区间场以太性的时空，都可以用一个半椭圆形表示，于是，整个宇宙的物理学时空可以用一系列的半椭圆形 A、B、C……表示，而且，因为微观空间受引力场以太和微观的区间场以太双重作用；宇观空间受引力场以太和宇观的区间场以太双重作用等等，所以这一系列半椭圆形应该前后部分重叠。这就是区间场以太观的 Smarandache 几何，如图 9.3 所示。

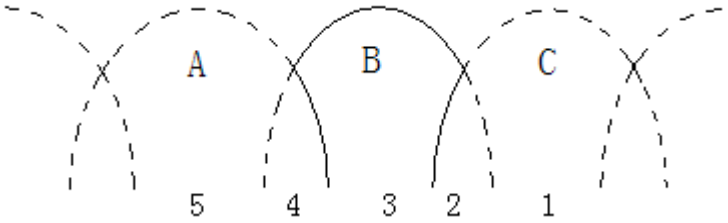

图 9.3 区间场以太观的 Smarandache 几何，1、2、3、4、5 的含义与图 9.2 相同；A 是宇观场以太区间的 Smarandache 几何；B 是引力场以太区间的 Smarandache 几何；C 是微观场以太区间的 Smarandache 几何；微观区间 2=C∩B；宇观区间 4=B∩A 等等。

9.4、宇宙的无穷阶等级式的 Smarandache 几何模型

前面已经说过，若把各区间场以太性中的实物串联起来，这广义的实物系列就形成一无穷的阶层。本文称这无限的实物系列为“一阶等级式宇宙模型”。

事物的矛盾普遍性，也决定了物质存在形式的无限多样性。本文认为，不但实物、区间场以太的存在形式是无限的，物质的基本存在形式也是无限的。区间场以太是比实物高一阶的物质基本存在形式，在区间场以太之上，还会有更高一阶、高二阶……及至高无穷阶的物质基本存在形式存在。区间场以太和比它更高阶的物质基本存在形式都是真空态物质，因此，物理真空是比实物更丰富，更广泛的物质存在形式。

以上的设想，使我们对整个宇宙的物质构架有了一个大概的轮廓：广义的实物是无限可分的；区间场以太把广义实物分割的无穷系列，划分成了具有区间场以太之间性质差异的一个个场区间；在这无限的场以太系列中，又可进一步划分成比区间场以太更高一阶的物质基本存在形式的物质阶层；如此等等，以至无穷。对于这样的宇宙物质构架，我们就称之为“无穷阶等级式宇宙模型”。

一阶等级式宇宙模型是宇宙的实物分布模型。而二阶等级式宇宙模型表示区间场以太观的时空几何结构。它的 Smarandache 几何如图 9.3 所示。整个宇宙的物理时空是无穷阶等级式 Smarandache 几何，如图 9.4 所示

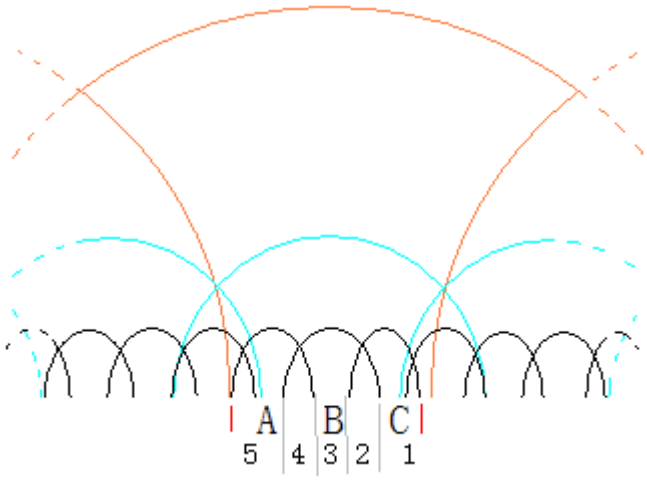

图 9.4 宇宙的无穷阶等级式 Smarandache 几何，1、2、3、4、5 和 A、B、C 的含义如图 9.2、9.3；黑色系列是区间场以太阶层；绿色系列是比区间场以太高一阶的物质阶层；棕色系列是比区间场以太高二阶的物质阶层；如此等等。

在局部的物质界里，普遍存在着“多阶等级式”现象。拿植物界来说，植物在长期的进化

过程中，形成了成千上万个物种，在种之上可分成属；在属之又上可分为科；而在科之上还可以依次地分出目、纲、门等等，这些“种”、“属”、“科”、“目”、“纲”、“门”等等就代表了植物的一些基本特征。局部的物质界是有限的，宇宙是无限的，整个宇宙的物质构架当然是“无穷阶等级式”的。在这无穷阶的物质阶层中，除了第一阶的实物阶层外，其余的都是真空态物质，真空可是奥妙无穷呀。

以往的主流宇宙说，总是把某种物质形式放到宇宙的中心地位，从而都可归结为“中心宇宙说”：亚里士多德的宇宙观是地球中心说；哥白尼的原则观是太阳中心说；等级式宇宙学是实物中心说；牛顿和以广义相对论为基础的宇宙论是引力场中心说等等。它们都是十分片面的。每个局部的物质界都会生生不息地运动、演化，但包罗万象的宇宙不可能整体创生或毁灭。

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内容提要

真空不空，奥妙无穷。真空态物质被称为以太，它好比 Smarandache 教授所说的 Unmatter 或 Unparticles。对以太的宏观效应，微观表现和宇观作用进行了探讨。在绝对时空观中，以太是可压缩的超流体，它的密度的极大值点是实物的质心。以太密度的变化，会引起现实的时空标准的变化，从而导致了定量效应，这包括相对论性效应和量子效应等等。相对论是以光作为时空衡量标准的一种定量描述理论，在这里，以太的分布永远是处处均匀，各向一致的，这就是所谓的洛伦兹对称性，它只是一种可行的数学模型，对超光速是无效的。引力场是以太密度波包，它的作用不是无限的。在星系、星系团的世界里，以太的宇观作用，将超过并达到引力作用的 10 倍左右。因此，不能只用引力场方程来描述宇宙。书中运用了 Smarandache 教授提出的方法论和有关概念，描绘了相对论、宏观物理学、区间场以太论和无穷阶等级式宇宙学的 Smarandache 几何模型。

Abstract

The vacuum is not void, in which there is infinite mysteries. The matter in vacuum state is called the ether, whose macroscopic effects, microscopic representation and cosmoscopic interaction are researched and discussed, is like the unmatter or unparticles called by Prof. Smarandache. In the absolute space-time theory, the ether is a compressible superfluid, a point of maximal value of its density is the mass center of an object. A change in the ether density causes a change in the actual space-time standard, and thus leads up to quantitative effects which include the effects of relativity and quantum etc.. The theory of relativity is a quantitative theory with light as the measure of space-time, where the distribution of ether is always homogeneous and isotropic everywhere, which is just so-called Lorentz symmetry, it is only a practicable mathematical model, and is not applicable to faster than light velocity. The gravitational field is a ether density wave-packet, whose interaction is not infinite. The cosmoscopic interaction of ether will surpass gravitational interaction and is about its ten times in cosmoscopic system of galaxies and galaxy clusters, so that describing cosmos can not use only the gravitational field equation. The methodology and related concepts proposed by Prof. Smarandache are applied, and Smarandache geometry models of relativity, macro-physics, interval field ether theory and infinite order and hierarchical cosmology are described in this book.