The theory of concomitant forces

Dipeng Li
Xi'an, Shaanxi Province, China; E-mail: 843465977@qq.com

Abstract

This paper studies the relationship between the Coulomb force and the magnetic force in electromagnetism, and proposes the inference that the magnetic force is the concomitant force of the Coulomb force. It also proposes the hypothesis that each fundamental force has a concomitant force and extends it to gravitation, suggesting that the inertial mass is the concomitant force of the gravitational mass, and explains the Higgs mechanism. Three laws of fundamental forces and concomitant forces are summarized. A model for unifying weak interactions and strong interactions is proposed, successfully explaining why magnetic monopoles cannot exist alone and the phenomenon of quark confinement. The strengths of the strong interaction and electromagnetic interaction are explained. There is a connection between fundamental forces, their concomitant forces, and space. On the basis of the theory of concomitant forces, a model of the origin of the universe is proposed. This model provides a theoretical framework to reconcile the contradictions between quantum mechanics and general relativity.

Keywords: fundamental forces, concomitant forces, weak interaction, strong interaction

1. Introduction

Modern physics holds that there are only four fundamental interactions in the universe: gravitation, electromagnetism, strong interaction and weak interaction, and that everything in nature is constructed from these four fundamental interactions. Their properties are shown in the table below

Interaction	Strength	Range (m)	Long distance behavior	Mediators
Strong	1	10^{-15}	~r	gluons
Electromagnetic	1/137	∞	$\frac{1}{r^2}$	photons
Weak	10^{-13}	10^{-18}	$\frac{1}{r}e^{-mW,Zr}$	W and Z bosons
Gravitation	10^{-39}	∞	$\frac{1}{r^2}$	gravitons

Table 1: Properties of the fundamental forces

We can observe that gravitation and electromagnetic share similarities. Both follow the inverse-square law of distance and have an infinite range of action. Moreover, strong interactions and weak interactions also have similarities. Their strengths are proportional or inversely proportional to the distance. Their ranges of interaction are very short.

In the cognitive domain of scientific exploration, nature is generally regarded as following the principle of simplicity. From the trajectories of celestial bodies to the interactions of microscopic particles, behind various phenomena, simple and harmonious laws exist. This work focuses on four fundamental interactions: gravitation, electromagnetism, strong and weak interactions. This paper analyzes and systematically studies their common properties in detail, striving to reveal the operation mechanism of nature at a deeper level and providing new perspectives and ideas for the further development of related theories.

2. Coulomb force and gravitation as well as their concomitant forces

The electromagnetic interaction can be divided into the Coulomb force and magnetic force. Coulomb force exists whenever there are charges, whether they are at rest or in motion. However, the magnetic force is generated only by moving charges, and its magnetic field is located in the plane perpendicular to the direction of the charge motion. This phenomenon can be compared with the water waves generated when a drop of water falls into the water surface in the natural world. The water drop is similar to a charge, and the generated water waves are similar to the magnetic force. From this, we can infer that the Coulomb force is a fundamental force, whereas the magnetic force is a type of secondary force that arises in conjunction with the Coulomb force. A special form of the Biot–Savart law can describe the phenomenon of a moving charge generating a magnetic field. The formula is as follows:

$$B = \frac{\mu_0}{4\pi}\frac{qv \times r}{r^3} \tag{1}$$

Here, B is the magnetic induction intensity generated by the moving charge q at a certain point in space, μ_0 is the vacuum magnetic permeability, v is the velocity of the charge's motion, and r is the distance between the charge and the observation point.

By observing this formula, we find that the magnetic induction intensity is proportional to the velocity of the charge. Under certain conditions, the magnetic induction intensity B is equivalent to the magnetic force F. Therefore, the formula for the magnetic force exerted by the moving charge is equivalent to

$$F = qv \tag{2}$$

During this process, the magnetic force intensity is directly proportional to the velocity of the charge's movement, and the magnetic force is generated in the plane perpendicular to the direction of the charge's movement.

We know that the magnetic force is the concomitant force of Coulomb's force. Thus, we can speculate that other fundamental forces also exhibit the phenomenon of concomitant forces. Now, we extend this hypothesis to gravitation and study the concomitant force of gravitation. According to Newton's second law, the external force applied to an object is equal to the product of its mass and acceleration, also known as the law of acceleration, and the formula is as follows.

$$F = ma \tag{3}$$

Here, F represents the external force, m represents the mass, and a represents the acceleration. The law of acceleration states that an object not only possesses a gravitational mass but also has an inertial mass. The inertial mass refers to the object's ability to resist changes in its state of motion and is also known as the inertial force. The inertial force can be triggered only when the object's state of motion changes, and it is proportional to the object's acceleration.

In the acceleration formula, acceleration $a = \frac{v - v_0}{t}$, when we take the position of the object itself as the observation point at any point in time, (the reason why we take the position of the object itself as the observation point is that the inertial mass is excited along the direction of the object's motion. Therefore, our observation point should also be located at the position of the object itself.) The initial velocity of the object $v_0 = 0$; in the case of time $t = 1$, the acceleration formula can be rewritten as

$$F = mv \tag{4}$$

In this situation, the inertial force is proportional to the velocity of the object, and it is generated along the direction of the object's motion. On the basis of the relationship between the Coulomb force and magnetic force, we can infer that the inertial mass is the concomitant force of the gravitational mass.

According to general relativity, the inertial mass and gravitational mass are equivalent, but this equivalence principle does not explain the intrinsic connection between the inertial mass and gravitational mass. We know that the quantum field theory predicts that the gravitational field gives fundamental particles gravitational mass, while the Higgs mechanism gives fundamental particles inertial mass. When fundamental particles move in the Higgs field, the Higgs field excites the inertial mass of that fundamental particle. We know that the inertial mass is the concomitant forces of gravitational mass, so the relationship between gravitational mass and inertial mass can be compared to the relationship between the Coulomb force and magnetic force, and the relationship between the gravitational field and Higgs field can be compared to the relationship between electric field and magnetic field. This equivalent relationship better explains the intrinsic connection between inertial mass and gravitational mass.

Now, based on the existing inference, we can obtain a summary. The fundamental interactions can be divided into two type forces: fundamental forces, such as the Coulomb force and gravitation forces. The other is concomitant forces, such as magnetic force and inertial force. According to existing research, the rules of concomitant forces can be summarized as follows.

Rule 1: Any attribute object (mass or charge) can generate a fundamental force regardless of whether it is at rest or in motion, and only the attribute object (mass or charge) in motion can excite concomitant forces.

Rule 2: The magnitude of the concomitant force is directly proportional to the speed of the motion of the object (mass or charge).

The inertial force is the concomitant force of gravitation, which is generated along the direction of the object's motion, and the magnetic force is the concomitant force of Coulomb force, which is generated in the plane perpendicular to the direction of the charge's motion. We address the following a question: Why do the manifestations of the concomitant forces stimulated by different fundamental forces exhibit variation? From this, we obtain the following inference.

Rule 3: The manifestation forms of the fundamental force and the concomitant force it triggers are in a symmetrical relationship.

Because the gravitational mass has only one attribute, the concomitant force it excites also has only one attribute, inertial mass, which is generated along the direction of the object's motion. The Coulomb force has two charges, positive charge and negative charge, and the concomitant force it excites also has two attributes, the south pole and north pole, which are generated in the plane perpendicular to the direction of the charge motion.

3. Model of unifying weak interactions and strong interactions

We know that fermions are classified into two types: leptons and quarks. All the fermions are involved in weak interactions, whereas only quarks are involved in strong interactions. The characteristics of the fermions are shown in the following table.

	First-generation fermions	Second-generation fermions	Third-generation fermions	Charge quantity
quarks	Up (u)	Charm (c)	Top (t)	2/3
	Down (d)	Strange (s)	Bottom (b)	-1/3
leptons	Electron neutrino (ν_e)	Muon neutrino (ν_μ)	Tau neutrino (ν_τ)	0
	Electron (e)	Muon (μ)	Tau (τ)	-1

Table 2: The characteristics of fermions

On the basis of the discussion in the previous chapter, we can conclude that: all fundamental forces should trigger concomitant forces. We can conjecture that the strong interaction and the weak interaction are different manifestations of the same fundamental interaction.

According to the rule of concomitant force 1, any attribute object can generate fundamental forces regardless of whether it is in a stationary or moving state, and only the attribute object in a moving state can trigger concomitant forces. We know that all fermions participate in weak interactions, and fermions will probability generate weak interactions regardless of whether they are stationary or moving. Thus, weak interactions conform to the characteristics of the fundamental forces. In strong interactions, the gluon responsible for transmitting strong interactions carries color charge and has a speed of light, so strong interactions conform to the characteristics of concomitant forces. Therefore, we propose that strong interaction is the concomitant force of weak interaction. We verify this conjecture next.

We know that the leptons that participate in weak interactions have three generations: electron, muon, and tau (electron neutrino, muon neutrino, and tau neutrino). In the weak interaction process, leptons change the charge or neutral flow of leptons by exchanging charged W bosons or neutral Z bosons with charge. Correspondingly, the quarks participating in strong interactions have three color charges: red, green, and blue (anti-red, anti-green, and anti-blue). In the strong interaction process, quarks change the color charge of quarks by exchanging colored gluons.

We find that the particles participating in weak interactions and strong interactions have symmetry. In weak interactions, the three generations of leptons: electron, muon, and tau (electron neutrino, muon neutrino, and tau neutrino) and the three color charges in strong interactions: red, green, and blue (anti-red, anti-green, and anti-blue) have a symmetrical relationship.

There are three kinds of bosons that mediate weak interactions: Z^0, W^+, W^-. There are also three types of π mesons that mediate the strong interaction between baryons: π^0, π^+, π^-. By observing the decay types of these two types of particles, it is quite easy for us to conjecture that they might essentially be the same particle in different manifestations under weak and strong interactions.

The symmetry relationship between the weak interaction and the strong interaction can be analogized to the relationship between the positive and negative poles of electric charges and the north and south poles of magnetic forces in the Coulomb force. Their relationships are shown in the following table (in this work, for the convenience of observation, some irrelevant decay types were removed from some fundamental interaction processes, not limited to this place)

Interaction	Weak interaction	Strong interaction
Fermions	electron, muon, tau (e, μ, τ)	red, green, blue (r, g, b)
	electron neutrino, muon neutrino, and tau neutrino (ν_e, ν_μ, ν_τ)	anti-red, anti-green, anti-blue ($\bar{r}$, $\bar{g}$, $\bar{b}$)
bosons	Z^0 ($u+\bar{u}$, $d+\bar{d}$) W^+ ($u+\bar{d}$, $\mu^+ + \nu_\mu$, $e^+ + \nu_e$) W^- ($d+\bar{u}$, $\mu^- + \bar{\nu}_\mu$, $e^- + \bar{\nu}_e$)	π^0 ($u+\bar{u}$, $d+\bar{d}$) π^+ ($u+\bar{d}$, $\mu^+ + \nu_\mu$, $e^+ + \nu_e$) π^- ($d+\bar{u}$, $\mu^- + \bar{\nu}_\mu$, $e^- + \bar{\nu}_e$)
Interaction	Coulomb force	Magnetic force
Fermions	Positive charge, Negative charge	South pole, North pole
bosons	Electromagnetic waves	Electromagnetic waves

Table 3: Comparative analysis of properties for weak and strong interactions

The strong interaction and the weak interaction are to some extent in accordance with the rule of concomitant forces 3: The manifestation forms of the fundamental force and the concomitant force it triggers are in a symmetrical relationship. On the other hand, the strengths of the two forces are quite different, their symmetries are broken.

The process of lepton participating in the weak interaction is shown in the following figure.

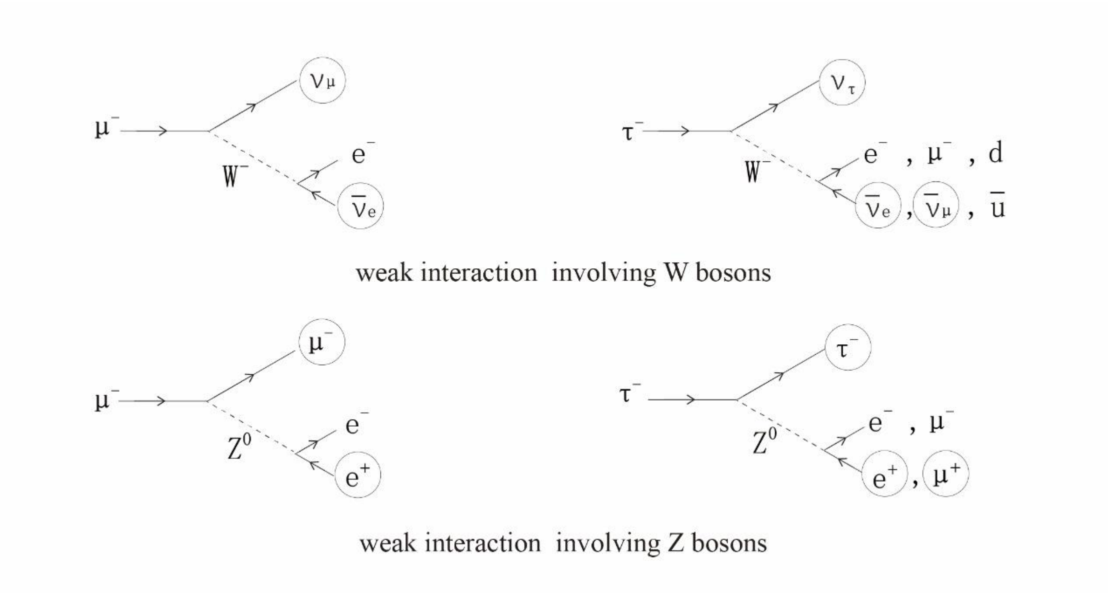


Figure 1: The process of leptonic weak interactions involving W and Z bosons

The difference between W and Z bosons lies in that during the leptonic decay process, the electron neutrinos and muon neutrinos (electrons and muons) respectively transform into electrons and muons (electron neutrinos and muon neutrinos). Although W and Z bosons have different charges, their essence should be the same particle. We know that the tau lepton is the only lepton that can decay into hadrons through the weak interaction. The tau lepton has a 64.8% probability of decaying into tau neutrino and anti-pi mesons. The weak interaction can couple with the strong interaction under high-energy conditions. Then, what is the reason that breaks the symmetry between them in low-energy conditions?

The main feature of the strong interaction is that the gluon, which carries a color charge, transmits the strong interaction and has a mass of 0 and a speed of light. The main feature of the weak interaction is that the W and Z bosons, which transmit the weak interaction, have mass that makes it difficult to reach the speed of light.

The properties of the particles involved in the weak interaction are charge or neutral current (W and Z bosons), and the properties of the particles involved in the strong interaction are color charge (gluons). Because W and Z bosons have masses and speeds that make it difficult to reach the speed of light, while the mass of the gluon is 0, once the gluon is generated, its speed immediately becomes the speed of light. This is precisely because the mass gap between the two types of force-carrying bosons causes the strengths of the two types of forces to differ greatly. This is also the reason why although the two types of forces conform to the rule of concomitant forces 2: the magnitude of the concomitant forces is proportional to the speed of the object with that property. However, owing to the asymmetry in the mass of the bosons that transmit their interactions, this rule cannot be manifested in low-energy conditions.

During the weak interaction process, leptons change the charge (neutral current) of leptons by exchanging charged W bosons (Z bosons carrying a neutral current). When the lepton (carrying charge, such as the tau lepton) or W boson (Z boson) undergoes relative motion, theoretically, it will excite a concomitant force, namely the strong interaction. However, because the speed of the gluon transmitting the strong interaction is the speed of light, while the speed of the lepton or W boson (Z boson) has difficulty to reaching the speed of light, there is no opportunity to exhibit strong interaction. Only when the energy of the lepton or W boson (Z boson) reaches a certain threshold, the strong interaction will immediately excite the color charge property of the lepton or W boson (Z boson), transform into particles composed of quarks, achieve quark confinement and asymptotic freedom, and excite the gluon that transmits the strong interaction and has a speed of light.

We know that when an electron moves, it will excite a magnetic field. At this time, the moving electron is equivalent to a magnet, and a magnet only acts on other magnets, not directly on stationary charges. Similarly, we can conclude that quarks only have strong interaction with quarks and do not have strong interaction with leptons.

Through the above verification, it is possible that the strong interaction is the concomitant force of the weak interaction in theory. We find that the symmetry between the two interactions is not harmonious. We construct a model of weak interaction with perfect symmetry to the strong interaction in the next chapter.

The theory of concomitant forces can successfully explain the strength of the strong interaction and electromagnetic interaction. The electroweak unified theory unifies the weak interaction and the electromagnetic interaction into one kind of interaction with different manifestations. The strong interaction is the concomitant force of the weak interaction. Because the gluon transmits strong interactions and carries color charge, and its speed is the speed of light, while the speed of the electron in the first Bohr orbit is 1/137 of the speed of light. According to the magnitude of the concomitant force is directly proportional to the speed of motion of the object, the strength of the strong interaction is 137 times greater than that of the electromagnetic interaction.

We know that the range of the strong interaction is not directional in space, meaning that the strong interaction that is stimulated when fermions move in space is located in the three-dimensional space in the direction of the fermion's motion.

We know that quarks cannot exist alone, which is the phenomenon of quark confinement. Moreover, in electromagnetic interactions, magnetic monopoles cannot exist alone either. Magnetic monopoles can be compared to quarks, and they are both particle attributes assumed by the concomitant forces that fundamental forces stimulate. Quarks and magnetic monopoles can only attach to their respective concomitant forces.

4. A model of weak interaction which is symmetrical to strong interaction

In the previous section, we concluded that the strong interaction is the concomitant force of the weak interaction. At low energy levels, the strengths of the strong interaction and the weak interaction are quite different, and the symmetry of the two interactions is broken. In this chapter, we construct a model of the weak interaction that is symmetrical to the strong interaction (referred to as the symmetrical weak interaction).

The symmetrical weak interaction model that assumes that in high-energy conditions, the bosons that transmit the symmetrical weak interaction are X and Y bosons. The X and Y bosons are electrically neutral and have a mass of zero. The attribute comparison table of the symmetrical weak interaction and the strong interaction is as follows:

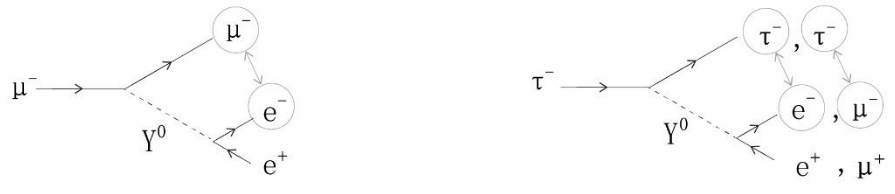
Interaction	Symmetrical weak interaction	Strong interaction
Fermions	e, μ, τ	r, g, b
	$\bar{e}$, $\bar{\mu}$, $\bar{\tau}$	$\bar{r}$, $\bar{g}$, $\bar{b}$
bosons	$e+\bar{e}$, $\mu+\bar{\mu}$, $\tau+\bar{\tau}$ (Y Boson) $e+\bar{\mu}$, $e+\bar{\tau}$, $\mu+\bar{\tau}$ $\bar{e}+\mu$, $\bar{e}+\tau$, $\bar{\mu}+\tau$ (X Boson)	$r\bar{r}$, $g\bar{g}$, $b\bar{b}$ $r\bar{b}$, $r\bar{g}$, $b\bar{g}$ $\bar{r}b$, $\bar{r}g$, $\bar{b}g$ (Gluon)

Table 4: Comparative analysis of properties for symmetrical weak and strong interactions

In Quantum Chromodynamics, gluons are supposed to exist in eight types. This is not in contradiction with the content of this article. It is merely for the convenience of the research. The X and Y bosons that transmit weak interactions can also be set as eight types based on the principle of gluons.

The above figure shows that the properties of the weak interaction and the strong interaction maintain perfect symmetry. The combination patterns of fermions and bosons that transfer the two types of interactions are consistent.

The participation of X and Y bosons in the process of weak interactions with symmetry at high energy is shown in the following figure.



symmetric weak interaction involving Y bosons

symmetric weak interaction involving X bosons

Figure 2: The process of leptonic symmetrical weak interactions involving X and Y boson

By observation, the participation of the Y boson in the symmetric weak interaction process and that of the Z boson in the weak interaction process are the same. Therefore, although their masses are different, they should essentially be the same kind of particle. The difference between the participation of the X and Y bosons in the symmetry weak interaction process lies in the exchange of leptons and bosons, as shown in the above figure.

Gluons transfer strong interactions. Under high-energy conditions, the X and Y bosons transfer the symmetric weak interaction, as shown in the following figure.

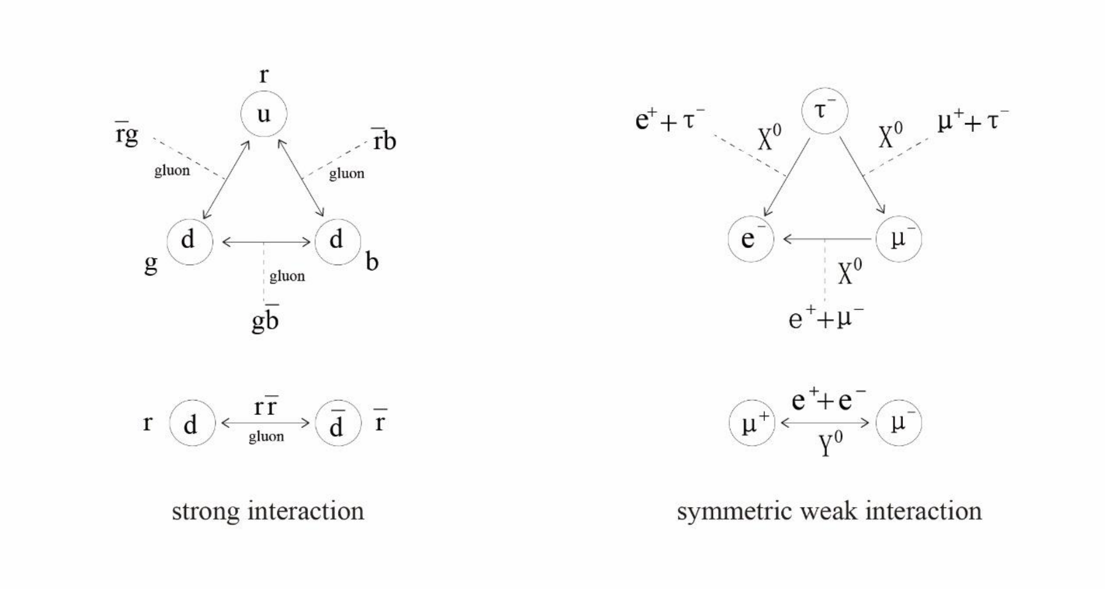


Figure 3: The process of strong interaction and symmetrical weak interaction

The above figure shows that the three quarks (two quarks) generate strong interaction through the exchange of gluons. Muons and anti-muons generate symmetric weak interaction through the exchange of Y bosons. Electrons, muons and tau generate symmetric weak interaction through the exchange of X bosons. Among them, after tau emit X bosons, they transform into electrons or muons, and after electrons or muons absorb X bosons, they transform into tau; on the other hand, muons emit X bosons and transform into electrons, and electrons absorb X bosons and transform into muons. This process is very similar to the strong interaction process. As shown in the above figure.

The strengths of the symmetry weak interaction and strong interaction are consistent. The two interactions have achieved perfect symmetry. The two interactions overlap and cancel each other out, thus achieving unity. This model has demonstrated that the strong interaction is the concomitant force of the weak interaction, which is theoretically valid.

After the symmetry of the weak interaction is broken, the X and Y bosons acquire mass. The Y boson decays into the W or Z boson. The X_m boson with mass participates in the weak interaction process as predicted as follows

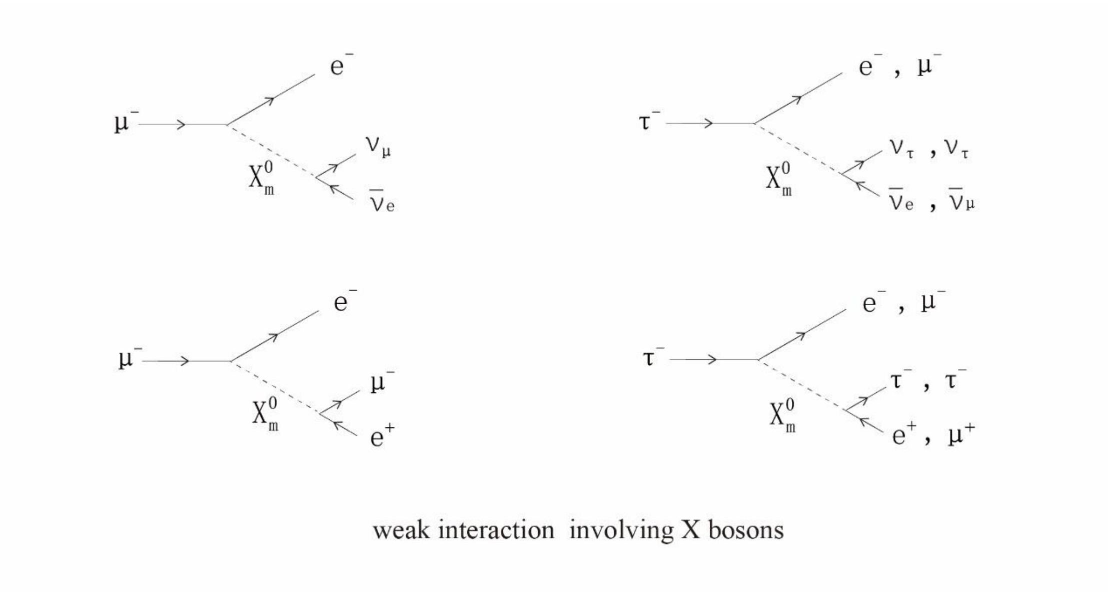


Figure 4: Prediction of the process of leptonic weak interactions involving X boson with mass

The decay products of leptonic weak interactions involving X_m bosons with W bosons or Z bosons are consistent. For instance, muon undergoing weak interaction, it will eventually decay into an electron, an electron neutrino (anti-electron) and a muon neutrino (muon). Can we make assume that the X_m boson exists in the real world as it has a same mass to the W boson or Z boson, and the decay products of the leptonic weak interaction in which they participate are the same, so they are not found? If the X_m boson can be found, it will be strong evidence that the strong interaction is a concomitant force of the weak interaction.

The theory of concomitant forces suggests that neutrinos should not participate in the weak interactions and should not have three-generation property. However, in the real world, neutrinos participate in the weak interactions and have the three-generation property of electron neutrinos, muon neutrinos and tau neutrinos. The research suggests that the cause of this phenomenon is due to the symmetry breaking of the weak interaction.

The model of unifying weak and strong interactions, and the model of weak interaction which is symmetrical to strong interactions, some properties and mechanisms of the two models still need further research.

5. The fundamental forces and their concomitant forces as well as their spatial relationships

In this chapter, we explore the fundamental forces that are symmetrical and their concomitant forces as well as the spatial relationships. Owing to the symmetry breaking of the weak interaction, the discussion is limited about weak interaction. The relationship between them is shown in the following table.

Seq.	fundamental forces	Participation attribute	Conditions of concomitant force generation	Dimension of concomitant force action	Concomitant forces	Participating fermions	Fermion properties
1	Gravitation (Gravitational field)	1 quality	The direction of motion of a particle carrying the corresponding property	ego dimension	Inertial force (Higgs field)	Neutrino, electron, quark	quality
2	Coulomb force (Electrostatic field)	2 charges		Vertical plane	Magnetic force (Magnetic field)	electron, quark	quality, charge
3	symmetrical weak interaction	Three-generation attributes		Three-dimensional space	Strong interaction	quark	quality, charge, color charge

Table 5: Fundamental forces and their concomitant forces as well as their spatial relationships

Among them, the sequence of gravitation is 1, that of the Coulomb force is 2, and that of weak interaction is 3. By observing the characteristics of the three fundamental forces, we can draw the following rules.

Rule 1: The fundamental forces of the corresponding sequence have the corresponding number of properties. For example, the gravitation of sequence 1 has only one property: mass; the Coulomb force of sequence 2 has two properties: positive charge and negative charge; the strong interaction of sequence 3 has three properties: red, green, and blue color charge.

This rule indicates that gravitation is the simplest force, followed by Coulomb force, and finally strong interactions.

Rule 2: Fermions participating in fundamental forces of a higher sequence will inherit the properties of fermions participating in fundamental forces of a lower sequence. For example, neutrinos only participate in gravitation of sequence 1, and it has only one property: mass; electrons participate in Coulomb force of sequence 2, and they not only have charge but also inherit mass; quarks participate in strong interaction of sequence 3, and they not only have color charge but also inherit charge and mass.

This rule indicates that gravitation is the most fundamental force, followed by Coulomb force, and finally strong interactions.

Rule 3: The concomitant force excited by the fundamental force of the corresponding sequence acts on the corresponding number of spatial dimensions. For example, the concomitant force excited by gravitational mass is inertial mass, whose acting dimension is the direction of the object's motion, that is, its own dimension. The concomitant force excited by Coulomb force is magnetic force, whose acting dimension is the plane perpendicular to the direction of the charge's motion. The concomitant force excited by weak interactions is a strong interaction, whose acting dimension is three-dimensional space.

This rule indicates that there is a connection between the three fundamental forces and three-dimensional space.

From this, we can conclude that when an object carrying the properties of a fundamental force moves in space, the space itself will excite the concomitant force according to the spatial attribute of the fundamental force it possesses in the corresponding spatial dimension of the object, and the manifestations of the two forces are in a symmetrical relationship, and the energy conversion between them conforms to the law of conservation of energy. The concomitant force formula is shown in the following figure.

$$\mathrm{F}(x, y, z) = \mathrm{av} = \mathrm{F_c}(x, y, z) = \mathrm{a_c v} \tag{5}$$

Here, F represents the fundamental force. $\mathrm{F_c}$ represents the concomitant force. x, y, z represents the three-dimensional spatial dimensions. a represents fundamental force properties, such as gravitational mass, charge, and three-generation attributes. $\mathrm{a_c}$ represents the attribute of concomitant forces, such as inertial mass, magnetic charge, and color charge. v represents the velocity of the attribute particle.

Because the mass involved in gravitation has only one attribute, when a particle with mass moves in space, an inertial force will be excited in the direction of its motion in space, and the magnitude of this inertial force is proportional to the speed of motion. Because the charges involved in Coulomb force have two attributes, positive and negative charges, when a charged particle moves in space, a magnetic force will be excited in the plane perpendicular to the direction of its motion in space, and the magnitude of this magnetic force is proportional to the speed of motion. Because the fermions involved in weak interaction have three generations of attributes, when a particle involved in weak interaction moves in space, the strong interaction will be excited in the three-dimensional space, and the magnitude of this strong interaction is proportional to the speed of motion.

The reason why fundamental forces can excite concomitant forces is that they interact with space and generate such effects. The principle by which fundamental forces excite concomitant forces can be derived from Newton's third law. Newton's Third Law states: to every action, there is always opposed an equal reaction; or, the mutual actions of two bodies upon each other are always equal, and directed to contrary parts. Similarly, when an object carrying the attribute of fundamental force moves in space, it exerts a force on space, and space accordingly excites an opposing force to be applied to that object, and the force and the opposing force are in a symmetrical relationship.

6. A Model of the origin of the universe

From the previous chapters, we derived three fundamental force laws. On the basis of these three laws, we can draw the following conclusions: gravitation is the simplest and most fundamental force, followed by Coulomb force, and finally weak interaction. The three fundamental forces are related to the three-dimensional space. According to the above hypothesis, we can establish a model of the origin of the universe.

At the beginning of the origin of the universe, it was a singularity. Owing to quantum fluctuations, the universe underwent symmetry breaking and entered the first stage. At this time, a particle neutrino and a fundamental force gravitation were excited in the universe. The universe was in one-dimensional space.

Owing to quantum fluctuations, the universe underwent symmetry breaking and entered the second stage. At this time, some neutrinos transform into electrons and positrons, exciting the electromagnetism. The universe evolved into a two-dimensional space. At this time, the temperature of the universe was very high.

Owing to quantum fluctuations, the universe underwent symmetry breaking again and entered the third stage. At this time, some electrons transform into muons and tau, exciting the weak interaction and its concomitant force strong interaction. At this time, the manifestations of the weak interaction and the strong interaction were symmetrical. Owing to the decrease in the temperature of the universe, the weak interaction underwent symmetry breaking, and the universe evolved into the current three-dimensional space.

This model closely combines the fundamental forces and the three-dimensional space, explaining why our universe is a three-dimensional space and why there are three fundamental forces.

In the loop quantum gravity, time does not exist. However, in the proposed model of the universe's origin, the universe governed by gravitational exists in one-dimensional space, and in one-dimensional space, the motion speed and direction of the object are the same. Time has no meaning. This precisely aligns with loop quantum gravity.

The contradiction between quantum mechanics and general relativity essentially stems from the clash between discrete quantum nature and continuous space-time geometry. In one-dimensional space, the gravitational force is manifested as continuity; while in two-dimensional or three-dimensional space, electromagnetic interaction, strong interaction and weak interaction are manifested as discrete quantum properties. The hypothesis regarding fundamental forces and the relationship between three-dimensional space provides a very natural theoretical framework to reconcile this contradiction between quantum mechanics and general relativity.

7. Conclusion

The theory of concomitant forces is the core of this paper. This may cause confusion in readers, as they believe that modern physical theories are already sufficiently complete. What's the significance of the theory of concomitant forces? The author suggested that the theory of concomitant forces is a completely self-consistent hypothesis and does not conflict with existing physical theories such as relativity and quantum mechanics. It is a supplement to the existing physical theory system. The significance of the theory of concomitant forces for modern physical theories can be summarized as follows.

1. The theory of concomitant forces redefines the relationship between the inertial mass and gravitational mass, as well as the relationship between the Coulomb force and magnetic force.

2. The theory of concomitant forces successfully explains the non-existence of magnetic monopoles and the phenomenon of quark confinement.

3. The theory of concomitant forces provides a unified model for strong interaction and weak interaction, and constructs a weak interaction model that is symmetrical to the strong interaction.

4. The theory of concomitant forces explains why fermions have three generations and why quarks have three color charges.

5. The theory of concomitant forces provides a model for the origin of the universe, explaining why our universe is three-dimensional space and why there are three fundamental forces.

6. The theory of concomitant forces successfully explains the Higgs mechanism. When the gravitational mass moves in space, it triggers the Higgs field, which is the source of inertial mass.

7. The theory of concomitant forces successfully explains the strength of the strong interaction and electromagnetic interaction.

8. The theory of concomitant forces provides an explanation for the absence of time in loop quantum gravity.

9. The theory of concomitant forces provides a theoretical framework to reconcile the contradictions between quantum mechanics and general relativity.

10. Superstring theory is considered the theory that is currently most promising for unifying the four fundamental forces, but it is criticized for relying too much on mathematical techniques, being too complex and abstract, and not being closely related to the real world. The theory of concomitant forces is relatively simple, easy to understand, and closely related to the real world, providing new ideas and directions for unifying the four fundamental forces.

I hereby declare that on the New Year's Day of 2025, I had an initial idea for the framework of this thesis, refined it, and eventually completed the current version of the thesis.