Essay

Fundamental Reasons for the Failure of Historical Grand Unified Theories from the Perspective of the "Great Tao Model"

Jiqing Zeng *

Posted Date: 22 September 2025

doi: 10.20944/preprints202509.1756.v1

Keywords: Great Tao Model; Theory of Everything; grand unified theory; existence field; elementary particles; classical physics

 doi:10.20944/preprints202509.1756.v1

Essay

Fundamental Reasons for the Failure of Historical Grand Unified Theories from the Perspective of the "Great Tao Model"

Jiqing Zeng

South China Botanical Garden, Chinese Academy of Sciences, Guangzhou 510650, China; zengjq@scib.ac.cn

Abstract

Based on the "Great Tao Model" proposed by the Jiqing Zeng's team—a framework rooted in classical physics, with the Yin-Yang model of elementary particles and the theory of existence fields at its core, and embodying the essential characteristics of a Theory of Everything (TOE)—this paper conducts a systematic analysis of numerous important attempts to pursue grand unified theories in the history of science (such as the Standard Model of particle physics, superstring theory, and loop quantum gravity). The study reveals that the fundamental reasons for the failure of historical grand unified theories lie in the following aspects: deviation from first principles, mistaking derivative phenomena in quantum mechanics (such as counterintuitive probabilistic interpretations and wave-particle duality) for essential laws; succumbing to mathematical formalism, where redundant assumptions (e.g., supersymmetry, extra dimensions) are added to cover up the lack of physical essence; and severing the intrinsic connection between fundamental physical quantities (charge and mass) and elementary particles, leading to fragmentation of the theoretical framework. In contrast, starting from the essential definition of elementary particles (electrons, positrons, and substons) and the inherent properties of the two fundamental physical quantities (charge and mass), the "Great Tao Model" uniformly describes all physical interactions and cosmic evolution through the theory of existence fields. It achieves a true grand unification that is logically consistent, formally concise, and highly consistent with experimental observations, providing a new path to resolve the dilemmas of historical theories.

Keywords: Great Tao Model; Theory of Everything; grand unified theory; existence field; elementary particles; classical physics

1. Introduction: A Century of Exploration and Core Dilemmas of Grand Unified Theories

Since the establishment of relativity and quantum mechanics in the early 20th century, constructing a "Theory of Everything" (grand unified theory) capable of uniformly describing all fundamental interactions (electromagnetic force, gravitational force, strong interaction, weak interaction) and micro-macro physical phenomena has always been the ultimate goal of physics. Over the past century, many theories, from Einstein's later "Unified Field Theory"[1] and the Standard Model of Particle Physics (SMPP)[2] to superstring theory (M-theory) [3,4] and loop quantum gravity [5], have made breakthroughs in specific fields (e.g., the Standard Model unifying the electromagnetic force and the weak interaction). However, none of them have achieved true universal unification.

The common dilemmas of these theories can be summarized in three points: First, the theoretical foundation is disconnected from physical reality. For instance, the Standard Model introduces 61 types of "elementary particles", over 90% of which (such as Z bosons and top quarks) have extremely short lifespans (10^{-25} seconds), failing to meet the essential definition that "elementary particles should exist stably". Second, mathematical complexity takes precedence over physical intuition. Superstring theory assumes "10/11-dimensional spacetime" and "string vibration modes", yet the extra

 doi:10.20944/preprints202509.1756.v1

dimensions are too small (10^{-35} meters) to be verified through experiments, reducing it to a purely mathematical construct. Third, philosophical confusion in quantum interpretation. From "wave-particle duality" to the "uncertainty principle", historical theories have mistaken the probabilistic description of micro-phenomena for the essence of nature, leading to the passive situation of "shut up and calculate" and losing the ability to provide in-depth explanations of physical mechanisms.

The "Great Tao Model" [6] proposed by the Jiqing Zeng's team, centered on the "Yin-Yang model of elementary particles" and the "theory of existence fields", completely avoids the aforementioned dilemmas by starting from first principles. This paper will use this model as a reference to systematically analyze the fundamental reasons for the failure of historical grand unified theories and clarify the core logic through which the "Great Tao Model" achieves unification.

2. Core Defects of Historical Grand Unified Theories: Deviation from First Principles and Classical Reality

2.1. Confusion in the Definition of Elementary Particles: Abandoning the Core Attributes of "Stability, Simplicity, and Substantiality"

As the ultimate unit of cosmic matter, elementary particles should essentially be "indivisible, stably existing, and possess fixed fundamental physical quantities (charge/mass)". However, all historical attempts at grand unified theories have violated this principle, resulting in chaotic theoretical foundations:

The "particle zoo" of the Standard Model: Classifying 61 types of particles, including quarks, leptons, and gauge bosons, as "elementary particles". Most of these particles (e.g., π mesons, W bosons) have extremely short lifespans, and their masses are acquired through the hypothetical "Higgs field" rather than being inherent properties. For example, although the Higgs boson has been detected, the mechanism of its coupling with other particles still lacks a physical explanation; it is essentially a mathematical tool added to fit experimental data.

The "non-substantial" misunderstanding of superstring theory: By regarding elementary particles as "vibration modes of one-dimensional strings", this perspective completely negates the substantive nature of particles. The vibrations of strings cannot explain "why electrons carry a fixed negative charge" or "why certain particles (such as neutrons) have mass but no charge". Instead, physical quantities can only be arbitrarily correspondingly assigned through "vibration frequency assignment", which deviates from the first principle that "elementary particles are substantial entities".

Misjudgment of "transient particles" in early quantum field theory: In the 1930s, Hideki Yukawa proposed the hypothesis that "π mesons transmit the nuclear force" to explain the nuclear force, classifying π mesons (with a lifespan of 10^{-8} seconds) as elementary particles. However, he failed to recognize that the nuclear force is actually the short-range electrostatic attraction between protons (positrons + substons) and neutrons (electrons + protons) (with an intensity of 10^{22} N when the distance is less than 10^{-15} meters). This led subsequent nuclear force theories to fall into the wrong path of "force transmission by virtual particles".

In contrast, the "Great Tao Model" strictly adheres to the essential definition of elementary particles: there are only three types of elementary particles—electrons (negatively charged), positrons (positively charged), and substons (uncharged, mass-dominant)—all with infinite lifespans and fixed physical quantities. Composite particles such as protons and neutrons are formed by the combination of these three (e.g., proton = positron + subston, neutron = electron + proton + subston). This fundamentally achieves simplicity and stability in the particle system, laying a clear material foundation for unification.

2.2. Fragmentation of Physical Fields and Interactions: Ignoring the Fact That "Charge and Mass Are the Only Fundamental Physical Quantities"

The essence of all physical interactions stems from the mutual influence of the fundamental physical quantities (charge and mass) of elementary particles. However, historical grand unified

 doi:10.20944/preprints202509.1756.v1

theories have fragmented this connection, creating obstacles to unification by adding "new forces" and "new physical quantities":

Redundant classification of forces: The Standard Model classifies interactions into four categories—electromagnetic force, strong interaction, weak interaction, and gravitational force. To unify the first three, it constructs the "gauge field theory" and introduces non-fundamental physical quantities such as "color charge" and "flavor charge". "Color charge" is only used to explain quark confinement and lacks direct experimental evidence; the weak interaction relies on "W/Z bosons for transmission", yet it cannot explain why the mass of bosons is much greater than that of protons.

Incompatibility between gravity and quantum forces: General relativity attributes gravity to "spacetime curvature", while quantum mechanics attributes forces such as the electromagnetic force to "transmission by virtual particles". The two have fundamental contradictions in the nature of spacetime (absolute reference frame vs. relative spacetime) and causality (determinism vs. probabilism). Superstring theory attempts to reconcile them through "11-dimensional spacetime", but due to the undetectable nature of extra dimensions, it has never been able to establish a physical connection between gravity and quantum forces.

Misunderstanding of the nature of fields: Although Maxwell's electromagnetism unifies electricity and magnetism, it fails to recognize that "magnetic fields are the dynamic form of electric momentum fields"; Einstein's "Unified Field Theory" attempts to incorporate gravity into the electromagnetic framework but ignores that "charge and mass are independent fundamental physical quantities". The theory of existence fields in the "Great Tao Model" clearly states that although the existence field of charge (electric field) and the existence field of mass (gravitational field) both propagate at the speed of light c, their field constants are different (the charge field constant is $1/\varepsilon_0$, and the mass field constant is $4\pi G$). Only "existence fields of the same physical quantity can interact with each other"; they have a unified form but exist independently and do not need to be forced into reduction.

Through the theory of existence fields, the "Great Tao Model" unifies all interactions into "interactions between the existence fields of fundamental physical quantities and their derived fields":

Static state: The force form is $\vec{F} = Q\vec{E}$ (Coulomb force corresponds to the charge existence field, and gravitational force corresponds to the mass existence field).

Dynamic state: The force form is $\vec{F} = \vec{P} \times \vec{E}_p$ (Lorentz force corresponds to the electric momentum field, and mass momentum force corresponds to the mass momentum field).

Spin state: The force form is $\vec{F} = Q_s\vec{E}_s$ (spin magnetic force corresponds to the charge spin field).

The field intensity formulas in the three states all follow a unified form of "being proportional to the fundamental physical quantity and inversely proportional to the square of the distance" (e.g., $\vec{E}_Q \propto Q/r^2$, $\vec{E}_P \propto (\vec{P} \times \vec{r})/r^3$), with a clear physical image and no redundant assumptions.

2.3. Misinterpretation of Quantum Phenomena: Treating Derivative Phenomena as Essential Laws

The deepest dilemma of historical grand unified theories lies in mistaking derivative phenomena in quantum mechanics, such as "probabilistic interpretation" and "wave-particle duality", for the essential laws of the microcosm, leading to the separation of the theoretical framework from classical reality:

Misunderstanding of the nature of quantization: The Bohr model introduces the assumption of "orbital quantization" but cannot explain why electron transitions are "instant jumps"; the Standard Model attributes "discrete energy levels" to "wavefunction boundary conditions" but ignores that "quantization is the continuous energy accumulation effect of charged particles in accelerated motion". The "Great Tao Model" clearly states that electron transition is the continuous motion of electrons accelerating/decelerating around the nucleus, and the discreteness of radiant energy

 doi:10.20944/preprints202509.1756.v1

originates from the "minimum energy unit $\varepsilon=h$" (each additional orbit of electron accelerated motion corresponds to an electromagnetic wave of a specific frequency)[7,8], without the need to introduce "quantum jumps".

Philosophical trap of wave-particle duality: De Broglie's "matter wave" hypothesis attributes the diffraction-like phenomena of electrons to the "wave nature of particles", and quantum mechanics further develops the "probabilistic interpretation of wavefunctions". However, the "Great Tao Model" proves through the "particle flow diffraction-like mechanism"[9] that the interference-like/diffraction-like phenomena of electrons are the statistical scattering effects between particles and the detection screen, rather than the particles themselves having wave nature. Historical theories have mistaken "observation effects" for "particle essence", leading subsequent unified theories (such as quantum field theory) to be based on the non-realistic foundation of "probability waves".

Fallacy of spin as an "intrinsic property": Quantum mechanics treats electron spin as an "intrinsic property," assigning it a "spin quantum number of ±1/2" without being able to explain its physical origin. In contrast, the "Great Tao Model" reveals that spin is the classical rotation of an electron around its own axis, with its angular velocity synchronized with the angular velocity of its orbital motion around the nucleus (ω_rotation = ω_revolution)[10]. This approach eliminates the need to introduce the ad hoc concept of "intrinsic properties," demonstrating that the so-called spin quantum number is actually a fitting correction parameter resulting from a conceptual error regarding magnetic moment.

Historical theories have treated the "descriptive laws" of quantum phenomena (such as probability distribution) as "explanatory essence", leading to the theoretical misunderstanding that "mathematical fitting takes precedence over physical mechanisms". The Standard Model corrects infinities through "renormalization", and superstring theory eliminates divergences through "supersymmetry"; essentially, they all use mathematical techniques to cover up the lack of physical essence rather than fundamentally explaining phenomena.

3. The Unification Logic of the Great Tao Model: Successful Practice of Returning to First Principles

The reason why the "Great Tao Model" can achieve true grand unification lies in its adherence to the first principle of "starting from the definition of elementary particles and the facts of fundamental physical quantities" and its abandonment of the mathematical formalism and quantum misunderstandings of historical theories.

3.1. Starting Point Unification: Yin-Yang Classification and Minimalist System of Elementary Particles

Based on the ancient Chinese philosophical thought of "Tao generates one, one generates two, two generates three, and three generates all things" and combined with classical physical realism, the "Great Tao Model" classifies elementary particles into three categories:

Yin particles (electrons): Carry a unit negative charge (-e), have a fixed mass, and are the ultimate carriers of negative electrical properties.

Yang particles (positrons): Carry a unit positive charge (+e), have the same mass as electrons, and are the ultimate carriers of positive electrical properties.

Neutral particles (substons): Have no charge, a mass much larger than that of electrons (approximately 1836 times that of electrons), are the dominant carriers of mass properties, and are also the essence of dark matter.

Through "Yin-Yang combination", these three types of elementary particles form five types of composite particles (protons, antiprotons, neutrons, antineutrons, neutrinos), which further constitute atoms, molecules, celestial bodies, and even the universe. For example, protons are formed by positrons rotating around substons, neutrons by electrons rotating around protons, and neutrinos by the combination of electrons and positrons. This system fully conforms to the definition of

 doi:10.20944/preprints202509.1756.v1

"elementary particles being minimalist, stable, and substantial", avoiding the "particle redundancy" problem of historical theories from the very beginning.

3.2. Framework Unification: Global Coverage of the Theory of Existence Fields

The theory of existence fields is the core framework for the "Great Tao Model" to achieve unification. Its core idea is that the fundamental physical quantity (Q) of an elementary particle has the inherent property of "continuously and uniformly diffusing physical information to the surrounding space", and this property is called the "existence field" ($\vec{E}_Q$); elementary particles transmit physical information through existence fields and interact by receiving existence field information from other particles.

The mathematical form of this theory is highly unified:

Existence field intensity: $\vec{E}_Q = k_Q\, Q/r^2$ (where k_Q is the field constant, Q is the fundamental physical quantity, and r is the distance).

Interaction force: $\vec{F} = Q \cdot \vec{E}$ (static state), $\vec{F} = \vec{P} \times \vec{E}_p$ (dynamic state, where $\vec{P} = Q\vec{v}$ is the momentum).

Spin interaction: $\vec{F} = Q_s \cdot \vec{E}_s$ (where $Q_s = Q\omega$ is the spin quantity and $\vec{E}_s$ is the spin field).

This framework not only unifies the electromagnetic force and gravitational force but also incorporates nuclear forces, spin magnetic forces, and others. For example, the nuclear force is essentially the electrostatic attraction between protons and neutrons at short distances (<10^{-15} meters), without the need to introduce the "strong interaction"; spin magnetic force is the interaction of the electron spin field, explaining the directionality of chemical bonds (such as the tetrahedral configuration of methane).

3.3. Phenomenon Unification: Coherent Explanation from Micro-Particles to Cosmic Evolution

Based on the "Yin-Yang model of elementary particles" and the "theory of existence fields", the "Great Tao Model" can logically and consistently explain all physical phenomena from the microcosm to the macrocosm without adding any ad hoc assumptions:

Atomic and molecular structure: Through the "dynamic entity model of electron orbits", the orbital motion of electrons around the nucleus is regarded as a "spatiotemporally accumulated dynamic entity" (such as a sphere or ellipsoid). The "expansion/contraction" of the orbit corresponds to energy level transitions, and spin pairing (synchronized angular velocity) explains the essence of chemical bonds (α/β bonds)[10], correcting contradictions such as "d-orbital filling exceptions" in quantum mechanics.

Nuclear physics and nuclear radiation: The binding force between protons and neutrons is short-range electrostatic attraction, and atomic nuclei have a spatial structure similar to ionic crystals; β decay is essentially the "radiation and combination reaction (RC reaction)" of electrons and positrons in neutrons, without the need to introduce the "weak interaction".

Cosmic evolution: Primordial celestial bodies are composed of hydrogen molecules and antihydrogen molecules. Through the RC reaction (hydrogen molecules + antihydrogen molecules → substons + neutrinos + radiant energy), a "big bang" occurs. The remaining substons form dark matter (accounting for 84% of the cosmic mass), and the multi-level celestial explosion explains the accelerated expansion of the universe without introducing "dark energy".

Resolution of unsolved mysteries: Neutrinos are composite particles of electrons and positrons (not elementary particles), and their "oscillation" originates from changes in the energy state of the composite structure; black holes are actually "dark stars" (subston condensates), without "singularities" or "event horizons". The gravitational field and electromagnetic field act independently, allowing light to escape.

These explanations are all based on classical physical mechanisms (electromagnetic interaction, energy conservation), without any counterintuitive assumptions, and are highly consistent with

 doi:10.20944/preprints202509.1756.v1

existing experimental data (such as hydrogen atomic spectra, dark matter mass proportion, and neutrino mass upper limit).

4. Conclusions: The Root Cause of Historical Failures and the Implications of the Great Tao Model

The failure of historical grand unified theories is not due to the inherent complexity of cosmic laws, but rather the fundamental deviation of their research paths from "first principles" and "classical physical realism":

Wrong starting point: Classifying transient particles and non-substantial mathematical objects (such as string vibrations) as elementary particles, violating the essential definition of "elementary particles being stable and substantial".

Fragmented framework: Adding redundant "forces" and "physical quantities" (such as strong/weak interactions and color charge), severing the independent properties of charge and mass, and leading to theoretical fragmentation.

Misinterpretation of essence: Treating the probabilistic descriptions and observation effects of quantum phenomena as the essence of nature, abandoning classical causality and physical reality, and falling into the trap of mathematical formalism.

The success of the "Great Tao Model" proves that the fundamental laws of the universe are concise, intuitive, and consistent with classical physical intuition. By returning to the essential definition of elementary particles, the inherent properties of fundamental physical quantities, and the interaction mechanism of existence fields, this model abandons the redundant assumptions of quantum mechanics and ultimately establishes a universally unified framework covering micro-particles, atomic nuclei, celestial bodies, and even the universe. This is not only a major breakthrough in physics but also a rectification in the philosophy of science—it marks that human understanding of nature has returned to the correct path of "taking physical reality as the foundation and first principles as guidance", providing a new paradigm for the development of physics in the future.

In the future, the verification of the "Great Tao Model" should focus on key experiments (such as the direct detection of substons, the polarization measurement of mass momentum waves, and the measurement of electron spin pairing angles). If experiments further confirm its predictions, it will completely end the "mysticism" of quantum mechanics and promote physics into a new era of "classical unification".

References

1. Einstein A .The Meaning of Relativity. Physics Today, 2003.DOI:10.1063/1.3059795.
2. Cottingham, W. N. and Greenwood, D.A. “An Introduction to the Standard Model of Particle Physics”, Second Edition, Cambridge University Press (2023).
3. Polchinski J , Harvey J A . String Theory. Physics Today, 1999, 52(6):59-60. DOI:10.1063/1.882705.
4. Green M B , Schwarz J H , Witten E .Superstring Theory. Vol.1 .Cambridge University Press,2012.
5. Rovelli, C. Loop Quantum Gravity. Living Rev. Relativ. 1, 1 (1998). https://doi.org/10.12942/lrr-1998-1
6. Zeng, J.; Zeng, T. The Great Tao Model: The Theory of Elementary Particles and Their Interactions. Preprints 2025, 2025011006. https://doi.org/10.20944/preprints202501.1006.v1
7. Zeng JQ. Classical physical mechanism of quantum production and its explanation for hydrogen atom structure and photoelectric effect. Physics Essays, 2021, 34(4):529-537
8. Zeng JQ. Classical physics derivation of quantization of electron elliptical orbit in hydrogenlike atom. Physics Essays, 2022, 35: 147-151.
9. Zeng JQ, Zeng TH. Study on the diffraction-like and interference-like mechanisms of particle flow. Applied Physics Research,2023,5(2):157-172. https://doi.org/10.5539/apr.v15n2p157
10. Zeng, T.; Zeng, J. A Unified Theory of Atomic and Molecular Structure. Preprints 2025, 2025011033. https://doi.org/10.20944/preprints202501.1033.v1

 doi:10.20944/preprints202509.1756.v1