Unified Cosmic Mechanics Evolution Theory (V)
Reconstruction of Dynamic Relationships of Basic Physical Dimensions

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Abstract

[**Series Information**]

This paper is one of 23 installments in the Unified Cosmic Mechanics Evolution Theory. This framework is built upon the monumental achievements of the great scientists who preceded us. Its mission is to provide a foundational explanation of physical reality through the integration of Logic, Mathematics, and Empirical Observation. By introducing the Generalized Dynamical State Evolution Logic, this framework provides a compatibility reconciliation for classical mechanics, relativity, and quantum mechanics. Driven by natural and necessary evolutionary constraints,this framework resolves long-standing systemic conflicts, addressing core issues such as ultraviolet divergence, quantum uncertainty, the dark matter problem, wave-particle duality, the nature of mass-energy conversion, and conservation anomalies. Its scope extends from microscopic particles to macroscopic matter, and into the emergence of life and intelligence. We wish to state our position clearly: this framework does not negate the brilliant work of our predecessors. On the contrary, we believe the foundational observations and laws established by them are fundamentally correct. Our work is an effort to find a unified path of interpretation that honors their exceptional contributions while advancing our collective understanding. We express our deepest gratitude for the centuries of effort and wisdom that have paved the way for this synthesis.

[**This article**] This paper is the fifth in the 22-paper series of the "Unified Cosmic Mechanics Evolution Theory" framework. Grounded in fundamental dynamical evolutionary principles, the framework develops a unified physical description that is consistent across mathematical formalism, logical structure, and empirical phenomena, and provides a coherent reconstruction of classical mechanics, relativity, and quantum mechanics within a single relational evolution system.

Starting from the underlying first principles, this paper introduces the "Generalized Source State Evolution System" as a preliminary framework to re-examine the underlying cosmic physical dynamical mechanisms. The core revelation is: the only fundamental reality of the universe is the Momentum unit [**?**], which possesses intrinsic light-speed evolution capability. Its quantity, directional proportion, and transfer rules determine all physical phenomena; at a single time snapshot, mass, energy, momentum, information, entropy, and the number of instantaneous space-time states are completely ontologically statically equivalent, all being the unified emergence and different representations of Momentum units. The traditional mass-energy equation $E = mc^2$ is essentially a Space-time state shaping equation, the dynamical mass-energy equation is mc (i.e., momentum = energy = force). In classical mechanics, energy and force have dimensional redundancy. In essence, whether through the perceptual cross-section $1/r^2$ or $1/(4\pi r^2)$ of the interaction process, distance, momentum, inertial velocity, or time integral, they are all integrals of momentum. In a single Evolutionary Beat or inertial state, resistance, potential energy, kinetic energy, force, etc., are completely equivalent, all being the representational quantities and potential active momentum of Momentum units. Therefore, there is no need to add separate dimensions for force and energy. This lays the basic logic for the subsequent unified mechanics.

Keywords: Problems of classical mechanics; Nature of mass-energy equation; Physical dimensions; Natural unit system; Nature of space-time; Unified mechanics; Origin of dynamics

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1 Introduction

Dynamical Confusion and Unified Reconstruction Derivation of Basic Physical Quantities

1.1 Overall Logic of This Paper

Generalized State Evolution System → Evolutionary resource → Evolutionary transition and vector cancellation capability → Emergence of resistance, force, energy → Emergence of space-time state quantity = motion cost quantity = representational quantity → Emergence of mass, energy, momentum, force, information, entropy, time, and space being instantaneously equivalent.

1.2 Dimensional Problems in Classical Mechanics

Classical mechanics, relativity, and quantum theory all have extremely high descriptive accuracy and engineering effectiveness within their respective applicable scales. However, at the level of underlying

ontology, Dynamical Emergence, and basic dimensions, there are long-standing unresolved inherent confusions: the traditional system regards time and space as independent basic physical quantities, defines basic physical quantities such as mass, energy, momentum, force, information, and entropy separately, and fails to reveal their unified dynamical origin; concepts such as force, inertia, and energy are formally derived from each other but are regarded as different entities in ontology; dimensional structures such as c^2, second squared, and square second appearing in mass-energy relations and dynamical equations are mostly regarded as natural forms without inquiring into their unified logic.

1.3 Analysis of Dimensional Problems and Reconstruction Based on This Evolution Theory

On this basis, taking the Unified Cosmic Mechanics Evolution Theory as the overall framework, this paper introduces the Generalized Source State Evolution System as the preliminary logic, takes the Evolutionary carrier (Momentum unit) as the necessary physical reality for the underlying representational quantity (Occupation), and takes State transition, Vector Composition, and directional proportion as the real evolutionary mechanisms. It re-sorts out the emergence mechanisms and dimensional origins of mass, energy, momentum, force, space-time, information, and entropy, reconstructs the traditional physical dimensions dynamically, clarifies the homology and instantaneous equivalence (ontological equivalence) of various basic quantities, and provides a foundation for the mechanism reduction and expression of unified mechanics and underlying dynamics.

2 Preliminary Derivation: Joint Derivation of Physical Dimensions by Generalized Source State Evolution System and Cosmic System

2.1 Core Definition of Generalized Source Inertial State Evolution System

The Generalized Source Inertial State Evolution System is the preliminary framework for the emergence of all physical quantities in the universe, defined as: an underlying system with independent evolution capability and self-driven characteristics. Even if there is external drive, it core follows five conservation principles — Evolutionary resource conservation, non-dissipation of driving capability, invariance of evolutionary rules, self-maintenance of causal inertia, and no independent change of inertial state. The core physical properties contained in the evolutionary carrier of the system are the representational quantity m_0 and the inertial driving capability v_0, which are collectively called the Momentum unit. It is the smallest physical unit with intrinsic evolution capability and the only underlying reality of all inertial state evolution systems. All physical phenomena originate from the quantity, directional proportion, and transfer rules of Momentum units.

2.2 State Evolution and Dynamical Emergence

The core emergence condition of space-time is the "single transition event of Momentum units", that is, the evolutionary carrier m_0 performs discrete-continuous state transitions based on the driving capability v_0. Each transition corresponds to a space-time unit $(l_{\mathrm{p}} \times t_{\mathrm{p}})$. The following three transition modes all follow this core condition, only differing in form, and can be uniformly encapsulated as the "self-inertial scale" as the basic measure of space-time evolution:

1. Each time the Momentum unit performs a state transition based on its own inertial scale l_{p} in a free dimension. This transition event corresponds to a time unit t_{p}, and l_{p} (space unit) and t_{p}

(time unit) emerge synchronously, that is, the space-time unit $l_{\mathrm{p}} \times t_{\mathrm{p}}$ is generated synchronously with the transition event, reflecting the "one-to-one correspondence between scale and time".

2. The Momentum unit can be in any scale from 0 to l_{p}, but within each time unit t_{p}, it will inevitably jump out of the space scale l_{p}, and the space-time unit $l_{\mathrm{p}} \times t_{\mathrm{p}}$ also emerges. It core solves the compatibility of "multiples of self-inertial scale transitions", and is essentially "l_{p} scale transition within t_{p}", which is homologous and equivalent to Mode A.

3. The scale of the Momentum unit can be l_{p}, but within a single t_{p}, the l_{p} transition scale xl_{p} driven by the driving capability (energy unit) e_{p} is $xl_{\mathrm{p}} < l_{\mathrm{p}}$. This mode cannot package l_{p} and xl_{p} into a unified representational scale equivalently to Modes A and B. However, this mode does not have stable and complex causal relationship shaping, nor does it conform to the verification based on relativistic effects in subsequent chapters, that is, relativity requires that both the transition frequency and the perceptual interaction frequency are stable c. Because a unique space-time state quantity can be locked during each state transition [2], instead of having multiple driving quantities within a single $t_{\mathrm{p}}/l_{\mathrm{p}}$ space-time scale, that is, the statistical quantity of l_{p} cannot be logically packaged to be equivalent to t_{p} and e_{p}. Therefore, Mode C is not valid in the cosmic system, nor does it conform to the stable evolution requiring a standard quantum system derived in the preliminary chapters [3].

Supplementary explanation: Based on the discrete-continuous evolution, v_0 essentially requires determining a "static and single" space-time state before the interaction between evolutionary carriers in the relational state evolution system, and the space-time state shaped by the causal relationship after the interaction.

2.3 Emergence of Statistical Quantities from Different Perspectives

Unified logic encapsulation of the remaining two modes: that is, regardless of the AB transition mode, the statistical quantity, active momentum, or evolutionary quantity of m_0 within a single t_{p} time (event) can be regarded as: single transition scale = self-inertial state quantity = quantity of motion driving itself = self-representational state quantity = quantity of space shaping driving itself = number of transitions driving itself = $l_{\mathrm{p}} = t_{\mathrm{p}} = 1$. If expressed strictly mathematically, the space eigenquantity:

$$\Delta x_0 = 1 \cdot l_{\mathrm{p}}$$

time eigenquantity:

$$\Delta t_0 = 1 \cdot t_{\mathrm{p}}$$

state eigenquantity:

$$\Delta S_0 = 1 \cdot u_{\mathrm{state}}$$

Note that even if the evolutionary carrier is performing l_{p} state transitions within a single time snapshot relying on Mode B, we logically package it into a static quantity, collectively called the "self-inertial scale", which are all synchronously emerging state quantities [1].

2.4 Emergence of Space-Time Shaping Capability

In the state evolution system, time emerges from the number of events of the evolutionary carrier m_0, $m_0 t t_{\mathrm{p}}$, and space emerges from the state transition quantity of the evolutionary carrier based on free dimensions, $m_0 l l_{\mathrm{p}}$, both of which are single-dimensional active statistical quantities; in an inertial

state evolution system, we can count the emergence capability of the evolutionary carrier m_0 in the time dimension based on the inertial state evolution frequency v_0 as m_0v_0, in the space dimension as m_0v_0, and in the space-time dimension as $m_0v_0v_0$. Time t growth rate = space l growth rate = evolutionary momentum = m_0v_0, and space-time shaping capability is $m_0v_0v_0$. Therefore, in the cosmic evolution system, mc^2 is essentially a Space-time state shaping equation, not an active equation. The active equation is the self-state quantity and the relational shaping quantity (evolutionary combined velocity capability).

Emergence of Continuous Space-Time

When the evolutionary carrier has stability, causal inertia maintenance, and rule stability, discrete-continuous space naturally emerges through multiple state evolutions based on the "self-inertial scale"; when the evolutionary carrier performs multiple state evolutions based on its own inertial scale l_{p}, discrete-continuous time naturally emerges. Because compared with the external system, no matter how long the interval between two state evolutions in the generalized source system is, there is no any perception capability in the source system, such as pausing and resuming a video, which does not affect the time continuity of the video.

Therefore, when a single evolutionary carrier without cancellation state performs multiple t_{p} (corresponding to Planck time) state transitions based on its own inertial scale l_{p} (corresponding to Planck scale), the speed of light c and continuous space-time in the cosmic system naturally emerge. For its detailed mathematical derivation, verification, and physical mechanism, see the preliminary chapter on evolutionary resources in this framework [3].

2.5 Introduction of the Smallest Space-Time Unit in the Universe and c for Verification

In the cosmic system, the smallest evolutionary event t_{p} and scale l_{p} of the evolutionary carrier m_0 correspond to the mass unit, Planck time, and Planck scale respectively. When continuous inertial state evolution occurs, the speed of light c emerges. Therefore, they satisfy the discrete integral relationship or the natural growth reciprocal relationship, and their algebraic relationship follows [1,4]:

$$c = \frac{l_P}{t_P} \iff \frac{1}{c} = \frac{t_P}{l_P}$$

The following verification is carried out through mathematical derivation:

Correlation Verification between the Smallest Space-Time Unit of the Universe and the Speed of Light c

In the cosmic system, the smallest evolutionary event of the evolutionary carrier m_0 corresponds to Planck time t_P, and the smallest evolutionary scale corresponds to Planck length l_P. As independent postulates, both are determined by quantization and gravitational constraints:

$$l_P = \sqrt{\frac{\hbar G}{c^3}}, \qquad t_P = \sqrt{\frac{\hbar G}{c^5}}$$

Here, c is temporarily stored as a dimensional balance parameter, and its physical meaning emerges through the ratio.

Emergence of Eigenvelocity

Taking the ratio of the two directly derives the physical meaning of the speed of light c:

$$\frac{l_P}{t_P} = \sqrt{\frac{\hbar G/c^3}{\hbar G/c^5}} = \sqrt{c^2} = c$$

Equivalently, the reciprocal is:

$$\frac{1}{c} = \frac{t_P}{l_P}$$

This formula indicates that $1/c$ is the "minimum time cost required for unit space evolution", which locks the strict corresponding relationship between the space grid l_P and the time snapshot t_P — for each generation of a space displacement of l_P, the system exactly consumes an evolution step of t_P [2].

Emergence from Discrete Transition to Continuous Speed of Light

Let a single transition satisfy $|\Delta\vec{x}_k| = l_P$, $\Delta t_k = t_P$. After N accumulations:

$$X(N) = \sum_{k=1}^{N} |\Delta\vec{x}_k| = N \cdot l_P, \qquad T(N) = \sum_{k=1}^{N} \Delta t_k = N \cdot t_P$$

The macro velocity is defined as the ratio of total displacement to total time:

$$v_{\text{obs}}(N) = \frac{X(N)}{T(N)} = \frac{l_P}{t_P} = c$$

This result is independent of N, indicating that the speed of light c is the exact invariant rate of the discrete unit ratio l_P/t_P at any accumulation scale. The macro "continuous uniform motion" is essentially a linear superposition effect of the micro discrete "transition-accumulation" process, thus breaking the circular logic of "defining c first and then deriving the Planck scale".

Note: 1. The above mathematical expressions have also been derived many times in traditional theories, but there are essential differences in ontological logic. This framework aims to verify an inverted unit logic relationship: the speed of light c is not a preset physical constant, but a constant ratio c emerging in the standard quantized inertial state evolution system when the evolutionary carrier m_0 undergoes multiple discrete t_P transition events and performs continuous l_P steps based on free dimensions, and can emerge space-time and basic physical dimensions. 2. This derivation does not preset the underlying derivation process of the Planck scale, such as its relational quantities established with G, $\hbar$ bar, etc., but only verifies its space-time relationship. The unit logic of its energy, etc., shall be subject to the independent derivation of this framework. 3. The above derivation is based on the free inertial transition of the evolutionary carrier, without introducing vector superposition cancellation states.

3 Dimensional Analysis of Dynamical Relationships

In Chapter 2 above, the main analysis is the emergence relationship of the evolutionary carrier (Momentum unit $m_0 v_0$) based on the generalized state evolution system or free state evolution in the cosmic system, which can be understood as the analysis of state quantities. This chapter mainly derives the emergence mode of its dynamical relationship shaping quantities.

State Evolution and Emergence of Core Physical Quantities (Combined Explanation of Force, Energy, and Momentum)

The emergence of dynamical relationship dimensions originates from the evolution and relationship shaping of Momentum units. The derivation logic revolves around "(carrier evolution $\Leftrightarrow$ state change $\Leftrightarrow$ relationship shaping) $\rightarrow$ dimensional emergence" in the cosmic system. The core logic chain is as follows:

1. When the Momentum unit m_0 performs state transitions based on the constant c, the dynamical active momentum of mc emerges (inertia does not require secondary integration), that is, there are no concepts of force and energy in the traditional theory at this time. In essence, it is the momentum mc, that is, the intrinsic conserved quantity: energy = momentum = force = mc [5].

2. When the Momentum unit m_0 performs state transitions based on the constant c and establishes a vector superposition relationship with other evolutionary carriers, the directional proportion s and macro evolutionary frequency (inertial state) $v = cs$ and conserved driving capability c emerge.

In this process, the cancellation and broken states formed before and after vector superposition give rise to macro statistical quantities such as resistance, force, and potential energy, which are the motion trend quantities and cost quantities of the self-evolution capability c and the influence on other evolutionary carriers (vector resultant force) [6]; that is, the relational state shaping quantity: number of evolutionary carriers * evolutionary frequency = $m_0sc = mv$, which is the macro Apparent statistical result and the vector superposition projection of mc.

Core Preliminary Conclusions

1. Dynamical quantities such as force and resistance originate from the vector superposition and cancellation of Momentum units, not independent entities. In essence, during the interaction process, they are the motion trend cost of breaking the inertial state, belonging to the relationship shaping capability (divided into repulsion, attraction, and active force three types), which are homologous and equivalent to energy (scalar potential perspective) and momentum (vector motion perspective), without time integral correlation; this is the source of the action at a distance [7], instantaneity, non-attenuation, vector superposition, cancellation, and penetrability of force in the cosmic system. Note that the instantaneous and action-at-a-distance of force application are not equal to the instantaneous and action-at-a-distance of evolutionary carrier transition capability, such as quantum entanglement.

2. Mass, energy, momentum, information, entropy, force, time, and space have homology, showing an instantaneous eight-state equivalence relationship at a single time snapshot, all originating from the state representation of Momentum units [8];

4 Core Premise of the Momentum Unit Evolution Theory: Evidence Based on Typical Physical Phenomena

The following typical physical phenomena verify the core characteristics of Momentum units, strengthen the logic of "no time integral, eight-state equivalence", and do not involve explanations related to traditional time integrals:

4.1 Speed Increase Effect: Direct Correlation between Momentum Deviation and Velocity Change

The speed increase effect shows that when matter obtains a momentum breaking deviation, the macro velocity change is directly related to the momentum deviation ($\Delta v = \Delta p/m \cdot c$), suggesting that there are Momentum units with light-speed evolution capability inside. The velocity change is essentially the accumulation of momentum deviation, independent of time (see Particle Encapsulation and Speed Increase Effect for the core formula) [9].

4.2 Bremsstrahlung: Vector Distribution Characteristics of Momentum Units

Bremsstrahlung is essentially a sudden change in the vector distribution of Momentum units — the directional Momentum units of incident particles and the Momentum units of atomic nuclei undergo vector cancellation, and the excess directional Momentum units are released in the form of photons. Photons are essentially pure directional Momentum units without vector cancellation (intrinsic light-speed evolution), confirming the vector distribution characteristics of Momentum units [10].

4.3 Annihilation of Matter and Antimatter: Transformation and Conservation of Momentum Units

After the annihilation of matter and antimatter, all mass is converted into photons. In essence, the Momentum units of matter and antimatter undergo complete vector cancellation, and the Momentum units in the cancellation state (static state) are all converted into the directional state (light-speed evolution), which conforms to the principle of evolutionary resource conservation (the total number of Momentum units remains unchanged). It confirms that Momentum units are the unified foundation of the reality of matter, and photons are the pure directional evolution form of Momentum units ($E = mc$, no redundant c^2) [11].

4.4 Fundamental Particle Coupling: Participation Mechanism of Momentum Units

Fundamental particle coupling is essentially the vector superposition and cooperative evolution of Momentum units — different Momentum units form stable coupling states by adjusting directional proportions. The breaking of coupling states (particle decay) is the imbalance of directional proportions, and excess Momentum units are released in the form of other particles, following evolutionary rules [12].

4.5 Traditional Mass-Energy Equation: The Essential Nature of Light-Speed Evolution of Momentum Units (Core Correction)

The traditional mass-energy equation $E = mc^2$ is not a dynamical essential equation. Its core nature is a Space-time state shaping equation, not an intrinsic equation describing the inertial motion or energy potential of particles, and even cannot be regarded as a redundant dimensional projection, but a macro description of the space-time evolution characteristics of Momentum units. From the perspective of dynamical essence, energy (scalar potential perspective) is equal to the product of the total number of Momentum units (mass m) and their intrinsic evolution amplitude (speed of light c), that is,

$$E = mc$$

(natural unit system), which is the intrinsic form of the dynamical mass-energy equation [13].

Key explanation: The realization of integration is the macro evolutionary frequency or the number of evolutionary carriers in the interaction process, that is, appearing in the form of "traditional force", while the constant inertial motion process cannot be integrated. Therefore, the dynamical state quantity or capability quantity describing photons can only use mc, which is the limit state of all directional evolution of Momentum units inside the particle [14]. mc^2 describes that the interaction environment under relativity is non-radial, because the space-time path integral condition needs to follow the Space-time state shaping equation mc^2, and can emerge the Pythagorean theorem distribution formula and Lorentz factor. However, this equation can confirm that any particle is composed of internal structures with light-speed evolution capability. [15],[16],[17].

4.6 Other Verifications

In addition to the above verifications, it also includes quantum entanglement, wave-particle duality, and the electron collapse state being a supersymmetric spherical structure [18,19,20], etc., which represent that particles have internal structures, that is, multi-layer Encapsulation methods, forming an overall (particle) cooperative evolution through quantum entanglement [10].

4.7 Core Evidence Conclusion

Momentum units are the unified foundation of the reality of matter and dynamical evolution. The Momentum unit m_0 has intrinsic inertia c evolution capability. Its quantity and directional proportion directly determine all core physical quantities. When the broken or cancellation state changes, the "energy" and "rest mass" in the traditional theory emerge. Its high-speed motion is affected by the distribution of the space-time state shaping equation, leading to a reduction in the number of perceptual space-time windows, emerging special relativity. Based on a high-density environment, the previous state interaction affects the next space-time path integral, emerging general relativity. Based on radial interaction, classical mechanics emerges.

Verification Based on Cosmic System Mechanical Interaction

Because the cosmic system is not a simple state quantity statistics or relational shaping quantity statistics as in Chapters 3 and 4 above, but a statistics of the complex interaction integral process formed based on particle encapsulation states. Its verification shows that all mechanical integrals are integrals of momentum formed by the number of evolutionary carriers m_0 and the number of driving capabilities v or c. The following introduces basic principles such as gravity and electromagnetic force for verification.

5 Three Types of Evolutionary Changes Caused by Force Interaction

In the cosmic system, the essence of all force interactions is the establishment of causal state change relationships between the motion of particles and other evolutionary particles. In this process, there are still only changes in evolutionary frequency and the number of evolutionary carriers, leading to three types of changes: changes in the evolution distribution of Momentum units inside particles, changes in internal structure, and changes in the combined velocity between particles.

1. Changes in the distribution of Momentum units inside particles

   Such as electromagnetic force, gravity, and strong force, all of which are non-dissipative forces. When the distance between particles changes, particles A and B respectively and jointly produce

a reverse state distribution of part of the Momentum units Nm_0c inside. The joint inward state evolution distribution forms attraction, and the joint outward evolution distribution forms repulsion. They are all non-dissipative action and reaction forces, that is, they jointly change Δp, $-\Delta p$. The total space-time state shaping capability of them is still zero, that is, the interaction process does not change the cosmic momentum conservation. In this process, they jointly obtain the macro momentum deviation m_1v_1 (i.e., Δp) $= -m_2v_2$ (i.e., $-\Delta p$) [12].

2. Changes in internal structure

   After the interaction between particles A and B, the internal structure of the particles changes, which can change from the cancellation state to the broken state, emerging the huge energy statistically in the traditional theory, such as the original particle encapsulation state emerging partial breakage after decay and fission [21,22].

$$v = \frac{N_+ - N_-}{N_+ + N_-} \cdot c$$

$$v = \frac{P_+ - P_-}{P_+ + P_-} c$$

3. Changes in the combined velocity between particles

   Due to attraction or collision, particles A and B evolve from original independent evolution to cooperative evolution. They jointly distribute the original evolution capability, form a vector resultant force, and emerge a macro evolution capability of 0-c [23,12].

$$\vec{v} = \frac{\vec{p}_1 + \vec{p}_2}{P_1 + P_2} c$$

$$\left[\vec{v} = \frac{m_1\vec{v}_1 + m_2\vec{v}_2}{m_1 + m_2} \right]$$

Summary: The state changes formed by causal interaction between particles. Types 1 and 2 can be understood as changes in the distribution of Momentum units inside particles, which seem to only represent the self-evolution driving capability, and can be understood as "state quantities", which cannot reflect the mutual "relational cost quantities". However, Type 3 is to contribute its own driving capability to the other party. Both are completely linear vector superposition, equivalent, and conserved relationships. Therefore, it fully indicates that all cost quantities in the cosmic system are only momentum, and there are no other cost quantities. From different perspectives, it can be reflected as resistance cost, motion cost, kinetic energy cost, potential energy cost, thrust cost, attraction cost, repulsion cost, etc., and all come from the number of evolutionary carriers m and the combined velocity cost v. Therefore, the underlying cost quantity = state quantity = number of evolutionary carriers * evolutionary driving capability = mv.

6 Force Interaction Integration Methods

6.1 Force interaction process in the cosmic system

In the cosmic system, force interaction is based on the evolutionary carriers (particle states) generating corresponding changes in interaction size through changes in distance in three-dimensional space

through the perceptual attenuation radiation mechanism. Therefore, the interaction changes with the increase or decrease of the Perceptual cross-section.

For example, in the gravity [24] interaction process, when a stone is hung by a rope, it shows a macro static state. At this time, there are no countless molecular motions inside that replace potential energy as traditionally understood. In this process, although the rope seems to have no upward evolution trend, in fact, the mv of the electromagnetic force inside the rope provides the cancellation capability; when the rope is cut, the stone moves downward because it loses the combined velocity of the rope's upward evolution. In the movement process, the closer to the ground, the larger the Perceptual cross-section $1/(4\pi r^2)$ of gravity, the larger the momentum deviation state quantity generated by the interaction, leading to greater evolution capability in the next round of integration, thus forming the acceleration in classical mechanics. The integral result is

$$\frac{1}{2}mv^2 = mgh$$

which is the potential energy in the traditional theory.

6.2 The essence of integration is related to the final state

Similarly, in the gravitational potential, no matter how a stone reaches the ground and is stationary in any form, the gravitational interaction between the stone and the Earth is constantly $m_1 m_2 \cdot 4\pi G/(4\pi r^2)$, so it has no essential relationship with the movement process, but only with the finally stabilized state function. In this process, whether it comes to the Earth from thousands of miles away, accelerates to the Earth, or moves horizontally to the Earth, the integral result is only related to the static Perceptual cross-section $1/(4\pi r^2)$ state. Therefore, it is proved that $\frac{1}{2}mv^2$ and mgh are essentially the gravitational force F in the final state.

At the same time, when we push an object to move on the Earth, due to gravitational traction, the object cannot maintain continuous inertial motion, and needs to continuously apply pushing force, that is, momentum deviation. Because the integral of gravity is exactly the same as the integral method of the pushing process, the result obtained is still $\frac{1}{2}mv^2$.

Therefore, the $F = ma$ in our traditional theory is essentially the statistics of the Δp size per unit time or single interaction, which can be understood as the (Dynamical Pressure) size per unit time; while E is the interval integral statistics of Δp, which can be understood as the total interaction size. The comprehensive result leads us to invent an independent physical entity "kinetic energy", "energy", "potential energy", and also an independent "field force".

6.3 Summary of Force Integration:

1. In this process, although energy seems to grow by the square multiple, in essence, the smaller r is, the larger the interactive inertial momentum is, and the underlying conservation relationship still follows the linear requirement, such as Zhang San + Li Si = two people, not four people.

2. The integral of force interaction also represents the "cost quantity" and "state quantity" in the process of driving evolution and establishing mutual relationships.

3. Whether we use the integral of distance, time, Perceptual cross-section, momentum, or inertia, it is the integral of the Dynamical Potency (momentum) of evolution, not the integral of independent energy or independent force, but the integral of the number of evolutionary carriers (conserved quantity is Nm_0, macro m) and driving capability (conserved quantity is c, macro v).

4. The final state of integration is only related to the final state, not strictly related to the process quantity, except for mass decay dissipation and cooperative evolution, such as only particle A evolving independently originally, and particles A and B forming cooperative evolution due to attraction during the integration process. If the integral is completely related to the process quantity, infinite interaction will lead to infinite energy divergence.

5. Therefore, the $F = ma$ in the traditional theory can be redefined as the Rate of Momentum Deviation, and $\frac{1}{2}mv^2$ as the interval integral under the rate of momentum deviation change. Both are macro statistical quantities, not the underlying dynamical state representational quantities and the foundation of driving capability [22].

7 Derivation, Verification of Core Dynamical Relationships and Reconstruction of Classical Mechanics Equations

Based on the redefinition of physical quantities above, the core dynamical relationships are derived and verified in combination with actual scenarios, eliminating mathematical projections and time integrals, restoring the physical intrinsic mechanism, and clarifying the differences between the underlying mechanism and the approximation of traditional statistical methods; at the same time, the core equations of classical mechanics are reconstructed to adapt to the discretization and eight-state statistical equivalence logic of the Momentum unit evolution theory, and the traditional equations containing time integrals are abandoned.

7.1 Homologous Relationship between Momentum-Energy-Force

Derivation: Based on momentum $p = smc$ and energy $E = mc$, we can get $p = sE$, that is, momentum (vector motion perspective) is the directional component of energy (scalar potential perspective); as a statistical quantity, force F (relationship shaping perspective) is equivalent to E and p in the limit state (all are mc). The three are homologous, without redundant dimensions and time integral correlation.

Verification: During the annihilation of matter and antimatter, the Momentum units are all converted into the directional state ($s = 1$). At this time, $p = E = mc$, which is completely consistent with the photon energy observed in experiments; for a static particle ($s = 0$), the momentum $p = 0$, the energy $E = mc$ (the total evolution capability of the Momentum units in the cancellation state), and the statistical value of force is 0, which conforms to the eight-state equivalence and conservation relationship, explaining the essence of "static particles still have energy" — the intrinsic evolution capability of Momentum units always exists, independent of the state.

Supplementary: The traditional momentum-energy relationship

$$E^2 = p^2c^2 + m^2c^4$$

is essentially a mathematical projection after introducing c^2 and time integral in traditional dimensions. Under the natural unit system ($c = 1$), it is simplified to

$$E^2 = p^2 + m^2$$

It cannot be integrated in the inertial state, so it is essentially wrong, and even cannot be regarded as redundant. Therefore, this framework is corrected to the representational quantity of the inertial state and the upper limit of the relational shaping active momentum mc, the vector superposition state is mv, and only the representational quantity m exists macroscopically in the static state.

7.2 Multi-Scale Dynamical Definition of Force: From Interaction Quantum to Deviation Flux

Under this evolution theory framework, force is redefined as the emergent performance of momentum deviation at different observation scales. Its essence is not an independently existing physical entity, but shows the dual attributes of "state settlement" and "rate statistics" according to the different Observation Windows.

1. Microscopic level: Single Interaction Quantum (at $t = t_P$)

   At the bottom layer of the Universal Temporal Beat, force manifests as an instantaneous switching event of the direction of Momentum units inside the evolutionary carrier.

   Ontological description: Force is the causal state quantity of the state interaction of the directional proportion of Momentum units in a single interaction event or Planck step.

   Mathematical expression:

   $$F_{\text{step}} \equiv \Delta p = m_0 \cdot \Delta s \cdot c$$

   Physical reality: At this space-time limit magnitude, force and momentum state quantity show Ontological Isomorphism. It represents the number of momentum bits "written" by the causal Protocol in this frame. At this level, force has no time accumulation attribute.

2. Macroscopic level: Momentum Deviation Flux

   When the observation scale spans a large number of evolution steps, force emerges as the flux density of system state update.

   Ontological description: Force is the total momentum deviation accumulated by the system within a unit evolution time ($\Delta t = \sum t_P$), that is, the Rate of Momentum Deviation.

   Mathematical expression:

   $$F = \frac{dp}{dt} = \frac{\sum \Delta p_i}{\sum t_{P,i}}$$

   Dynamical analogy: Macroscopic force can be analogous to "Dynamical Pressure". It describes the density and execution intensity of the interaction Protocol toggling Momentum units within a unit space-time window.

3. Causal Reconstruction and Dimensional Re-Calibration of $F = ma$

   Based on the above dual definitions, this framework gives the following explanation for Newton's second law:

   Physical essence of ma: The formula ma measures not the "generated force", but the total amount of momentum deviation (mv) superimposed on the carrier m per unit time.

   Elimination of redundant dimensions: The introduction of "square second (s^{-2})" in traditional theory is to fit acceleration as the second derivative of a continuous trajectory. In this framework, acceleration a is restored to the "directional proportion bias rate per unit refresh cycle".

   Conclusion: Although the application of force manifests as the issuance of instantaneous instructions (microscopic attribute), the change of macro velocity v must rely on the superposition of momentum flow under continuous beats (macroscopic attribute). Since ma per second is ultimately settled as the increment of the momentum state quantity mv, force, like kinetic energy and potential energy, does not need to add independent dimensions, and should be uniformly calibrated as the time-sharing settlement value of intrinsic Dynamical Potency.

7.3 Correlation between Energy and Force: Energy is the Interval Integral of Force

Under this framework, energy is reconstructed as a secondary statistical quantity of dynamical relationships. Its core logic is to clarify that energy is not a primary entity, but the Interval Integration of force along the path.

1. Hierarchical Reduction of Integration:

   First layer: Force (F). Force represents the momentum bias intensity of the system in a single evolution beat, that is, the instantaneous momentum change rate $F = dp/dt$. It describes the current relationship shaping trend of the system.

   Second layer: Energy (E). Energy is another interval integral of force, that is,

   $$E = \int F \cdot dr$$

   It statistics the total amount of relationship shaping accumulated by the system in a section of physical path or evolution process.

2. Mathematical Root of Dimensional Redundancy:

   Since force F essentially already contains the information of momentum deviation (mv), and the integral variable dr (displacement) implicitly contains the dimension of evolutionary frequency $v \cdot dt$ in the underlying logic. Therefore, when integrating force over the space interval, the quadratic superposition of the velocity term is inevitably introduced mathematically:

   $$E = \int (ma) \cdot dr \rightarrow \text{emerges}[M][L]^2[T]^{-2}(\text{Joule})$$

   The square dimension (v^2) generated in this process is actually a secondary statistical projection of the same evolution rate. In the intrinsic dynamical settlement, the integral result should return to its linear essence, that is, the total increment of momentum state Δmv.

3. Statistical Validity vs. Ontological Non-independence:

   It must be clarified that energy, as the "interval integral of force", is an extremely effective statistical tool in macro engineering because it accurately describes the total power consumption of the interaction process. However, regarding this "interval accumulated quantity" as an independent physical entity parallel to momentum is the root cause of the unresolved unification of traditional physical dimensions. Energy is essentially only a historical accumulation record of momentum bias on the three-dimensional perceptual path, and its intrinsic attribute is still anchored on the count and direction distribution of Momentum units [25].

7.4 Dynamical Emergence of Combined Velocity and Resistance: Manifestation Based on Vector Superposition

This framework realizes the intrinsic reduction of macro velocity and resistance phenomena through the Vectorial Summation mechanism of Momentum units:

1. Causal Emergence of Combined Velocity

   Macro velocity v is not an independent motion parameter, but the net bias proportion performance of the vector superposition of all Momentum units inside the system.

Emergence equation:

$$v = \vec{s}_{\text{res}} \cdot c$$

where $\vec{s}_{\text{res}}$ is the vector sum of directional proportions in all directions.

Physical meaning: This equation describes the cooperative evolution frequency of the system under the universal temporal beat, clarifying that the essence of velocity is the effective distribution rate of Momentum units in a specific causal direction.

2. Destructive Nature of Resistance

   Resistance is not an independent entity imposed externally, but the statistical result of the Destructive Interference of Momentum units.

   Mechanism description: When an object evolves in a medium, the reverse momentum bias provided by the medium carrier and the original forward bias of the object undergo vector hedging.

   Quantitative relationship: The magnitude of resistance f is strictly positively correlated with the reverse bias proportion s_{rev}:

$$f = s_{\text{rev}} \cdot mc$$

   When the positive and negative biases reach exact balance ($s_{\text{res}} = 0$), the system returns to the intrinsic cancellation state, and the macro performance is static.

7.5 Verification of Eight-State Equivalence: Logical Merging Under Discrete Evolution Beat

Within a single Evolutionary Beat ($t = t_p$) defined by this framework, mass, energy, momentum, force, information, entropy, time, and space show equivalence from different observation perspectives based on the intrinsic state of the system. The following verification is carried out through three types of logical scenarios:

1. Conservative Representation of Information and Entropy

   At a single time snapshot, the total amount of system resources (number of Momentum units) is N.

   Ordered information (I): Characterizes the degree of directional consistency of Momentum units, $I = s \cdot N$.

   Disordered entropy (S): Characterizes the random/cancellation degree of Momentum units, $S = (1 - s) \cdot N$.

   Equivalence criterion: $I + S = N$. This indicates that information and entropy are not abstract concepts, but direct counts of the distribution state of Momentum units, and their total amount is limited by the mass representational quantity.

2. Intrinsic Symbiosis of Space-Time and Mass

   At the Planck scale, space-time is the statistical trace of evolutionary events:

   Discrete steps of space (l) and time (t): Locked by the ratio

$$c = l_p / t_p$$

   Equivalence criterion: At a single snapshot, the number of instantaneous space-time states is equivalent to the representational quantity of a single carrier unit. The total macro space-time L_{total} and T_{total} are essentially the panoramic projection of the total number of carriers N in the evolution process.

3. Eight-State Synchronous Evolution

   Taking the particle decay process as an example:

   Conserved term: The intrinsic conserved quantity mc of the system remains unchanged.

   Variable term: With the sudden change of the directional proportion s, the momentum p, information I, entropy S, and instantaneous force value F adjust synchronously.

   Conclusion: The number of states of all physical quantities is always numerically consistent in each frame of evolution pulse. This indicates that the eight types of physical quantities are only projection labels of the same group of Momentum unit evolution reality in different observation dimensions. Under the natural unit system, all physical dimensions collapse into the unique unit count N.

7.6 Logical Reconstruction of Classical Mechanics Equations

Based on the dimensional re-calibration and discrete evolution mechanism above, this framework gives a unified statistical explanation for the core equations of classical mechanics. The form of traditional equations remains unchanged, but their dimensions can be reduced to the more underlying unified unit — the number of Momentum units N × evolution rate $[v]$.

Physical Process	**Traditional Equation**	**Statistical Explanation of This Framework**	**Dimensional Reduction**
Newton's Second Law	$F = m \cdot a$	Momentum deviation flux per unit time; a is the "directional proportion bias rate per unit time"	$[F] = [N] \cdot [v] \cdot [t_P]^{-1}$
Momentum Theorem	$\Delta p = \int F dt$	Discrete accumulation of momentum units: $\Delta p = \sum \Delta p_i$, $\Delta p = F \cdot t_P$ within each step t_P	$[p] = [N] \cdot [v]$
Kinetic Energy Theorem	$\frac{1}{2}mv^2 = \int F ds$	Secondary statistical projection of momentum; numerically consistent with discrete accumulation under constant force approximation, but average velocity cannot replace successive accumulation	$[E_k] = [N] \cdot [v] \cdot [v]$ (secondary redundancy)
Uniform Motion	$v = s/t$	Directional proportion locking: $v = s \cdot c$, macro displacement is the accumulation of $N \cdot l_P$	$[v] = [c]$ (ratio)
Uniformly Accelerated Motion	$v = a \cdot t$	Statistical approximation of discrete accumulation of multiple Δv at the macro level	$[a] = [v] \cdot [t_P]^{-1}$ (bias rate)

8 Systematic Reconstruction of Energy Dimensions in Relativity and Quantum Mechanics

It should be pointed out that it is to correct the problems such as ultraviolet divergence, infinite black hole contraction, and space-time curvature in traditional relativity and quantum mechanics and

be compatible, which cannot be explained by simple logic. The systematic correction is carried out as follows.

8.1 Inertial Non-Integrability and Re-Qualification of the Mass-Energy Equation

Based on the inferences of this framework, inertial motion and static state, as intrinsic steady states, do not involve the accumulation of state bias ($\Delta p = 0$), so they are non-integrable at the bottom of dynamics.

Intrinsic dynamical equation ($E = mc$): Describes the intrinsic state quantity and relationship shaping capability of a single evolutionary carrier m_0 in a uniaxial dimension (time or space).

Space-time state shaping equation ($E = mc^2$): Describes the maximum state shaping capability (i.e., space-time occupancy rate) of the system under the dual refresh of "space displacement" and "time beat". Traditional theory mistakenly regards this background constant as dynamical energy, leading to the generation of ultraviolet divergence. It also leads to the incompatibility between mc^2 (which can be regarded as mv^2 kinetic energy) and $\frac{1}{2}mv^2$ momentum integral.

8.2 Dynamical Reduction of Relativistic Effects — Changes in the Number of Perceptual Space-time Windows

Relativity is essentially the manifestation of integral effects under special physical conditions, which is in the same line as the radial integral logic of classical mechanics:

Special Relativity (SR): Originates from the compression of the number of perceptual windows within the universal beat under high-speed motion.

General Relativity (GR): Originates from the logical redundancy of the next spacetime path caused by the previous interaction in a strong interaction field environment.

Essence of the Pythagorean theorem conservation formula:

$$c^2 = v^2 + v_{int}^2$$

is the embodiment of the distribution of perceptual capability in different axes. Its core lies in that the perceptual frequency must be synchronized with the evolutionary transition frequency to lock a single spacetime interaction state. This "ratio locking" is the root cause of the self-consistency of the mathematical form of relativity [2].

8.3 Analysis of Redundant Integrals and Operator Logic Failure in Quantum Mechanics

Quantum mechanics fully adopts the square structure of the traditional mass-energy equation and introduces the quadratic projection statistics (kinetic energy term) of classical mechanics into operator logic, resulting in inherent nonlinear redundancy at its underlying level:

1. Logical Redundancy of Probability Amplitude Squared ($|\psi|^2$):

   Traditional physics holds that physical reality needs to be extracted through "squaring". This framework reveals that the so-called wave function is actually the real momentum flux density ($\rho = \Psi$), and the squaring operation is a secondary imposition on the evolutionary background, amplifying statistical fluctuations.

2. Nonlinear Bias of Hamiltonian Operator:

$$H = \frac{p^2}{2m} + V$$

This formula forcibly adds the quadratic projection statistics (p^2) to the state bias prediction (V), transforming the inherently linear state counting into complex high-order differential operations.

3. Spurious Zero-Point Energy ($\frac{1}{2}\hbar\omega$):

The coefficient $\frac{1}{2}$ originates from the path integral statistics of simple harmonic motion. Since inertia is non-integrable, this zero-point energy, which "requires path cost even without interaction", is purely a mathematical residual term and a direct cause of vacuum energy divergence. Note: During the interaction process, virtual momentum units (p, -p) borrowed and returned from the latent space change the internal evolutionary state of the particle. This process manifests as quantum fluctuations [30], which does not mean having infinite energy or momentum, but essentially still completes state changes under the conservation relationship.

8.4 Summary

Therefore, relativity introduces spacetime curvature to explain the origin of dynamics, which is incorrect. Because spacetime is an emergent quantity, not a driving quantity; it cannot in turn drive the motion of matter itself, but can explain the interaction integral process. At the same time, the intrinsic nature of the mass-energy equation should be

$$E = mc$$

and the singularity cannot contract to a state quantity smaller than the Planck scale [31], i.e., it cannot be smaller than the representational quantity of information and the unit driving quantity in the state evolution system. The multiple problems such as ultraviolet divergence in quantum mechanics also originate from this.

Integral Conditions and Dimensional Elimination

Interaction integral refers to the acquisition of mutual state changes between two evolutionary carriers due to the perceptual mechanism within a causal inertial state evolution system. Therefore, integration is only applicable to state changes after causal interaction; all other processes are described by the state representational quantity m_0 and the driving capability c or macro v through the inertial state.

9 Unified Framework for Four Types of Integrals

Integral Type	**Integral Object**	**Physical Meaning**	**Applicable Scenarios**
Momentum Integral	$\int \Delta p$	Accumulation of changes in the directional proportion of momentum units	Stone falling, accelerated motion
Perceptual Cross-Section Integral	$\int 4\pi r^2 \sigma \, dr$	Accumulation of interaction probability with distance	Electromagnetic force, gravity

Path Curvature Integral	$\int_\Gamma dx^2$	Accumulation of directionally modulated paths	General Relativity (planetary orbits)
Perceptual Efficiency Integral	$\int \sqrt{1-v^2/c^2}\,dt$	Accumulation of interaction efficiency under high-speed motion	Special Relativity

Core Formula:

$$\mathcal{P}_{\text{total}} = \int_{\text{path}} \underbrace{\frac{d\sigma}{ds}}_{\text{Cross-section change rate along the path}} \cdot \rho(s) \cdot ds$$

9.1 Core Principles of Dimensional Elimination

Under this framework, all integrals are essentially the accumulation of directional proportions or vector angle adjustments of the intrinsic quantity $m_0 c$ of Momentum units under the constraint of the perceptual cross-section. After grasping the physical essence, dimensional settings can be made according to practical engineering significance, but no redundant dimensions need to be introduced in the underlying dynamical mechanism, and the integral conditions must be strictly followed [32].

The principles for dimensional elimination are as follows:

1. No square terms in the underlying intrinsic relationships: $E = mc$, $p = s \cdot mc$, $F = \Delta p / t_p$ (discrete form)
2. Square terms only appear in macro statistics: serving as engineering conversion factors, not participating in the description of the underlying mechanism
3. Integration does not add new dimensions: integration is a pure numerical accumulation; if with dimensions, new physical meanings are assigned (e.g., impulse, pressure)
4. Dimensional unification under the natural unit system: $c = 1$, $l_p = 1$, $t_p = 1$, all physical quantities are reduced to the number of Momentum units $[N]$

Therefore, the four types of incremental integrals can be extended to: momentum, cross-section (different types of particle encapsulation have different cross-section growth rates), inertial velocity, time, spacetime path, directionality, and efficiency, all originating from the same underlying mechanism, i.e., momentum increment under the influence of the perceptual cross-section.

10 Core Comparison Between Traditional Statistical Methods and the Evolutionary Theory Framework (Summary of Core Differences)

Due to the complexity of statistics, this evolutionary theory can only provide the overall dynamical logic. The specific definition of the complete eight states is extremely complex. For example, the definition of space includes macro density ρ in engineering; in the field of relativity, it includes evolutionary frequency, i.e., space shaping rate $N \cdot c$ (spacetime shaping rate is $N \cdot cc$); in the conserved state and extreme evolutionary state, it is $N \cdot c \cdot l_p$; in the macro evolutionary space emergence capability, it is $N \cdot v \cdot l_p$; in the static state and intrinsic state, space is $N \cdot l_p$. Therefore, it has different mathematical representations

in different perspectives (radial low-speed integration, non-radial high-speed integration, etc.), states (extreme, macro, static state), interaction processes (single interaction quantity, short-term interaction quantity, or breakage quantity), and integral objects (inertia or mass). Therefore, this paper does not finally list the complete definition table for the time being, and the specific derivation process and related logic have been included in the article. However, the following table is for main logical understanding:

Physical Concept	**Traditional Statistical Method**	**Underlying Mechanism of Evolutionary Theory**	**Expression Comparison (Traditional // Evolutionary)**	**Dimensional Essence Comparison (Traditional // Evolutionary)**	**Core Physical Essence Difference (Traditional / Evolutionary)**
Basic Entity	Point particle / Field (mathematical abstraction)	Momentum unit (m_0)	None // m_0	None // $[M]_{\text{base}}$	Model assumption / Momentum unit, the only physical reality with intrinsic evolutionary capability
Space Benchmark	Planck length l_P (limit scale)	Single evolutionary step length (l_p)	l_P // l_p	$[L]$ // $[L]_{\text{base}}$	Traditional: measurement limit / Size of a single transition of the evolutionary state of a unit momentum unit [17,27,28]
Time Benchmark	Planck time t_P (minimum interval)	Single evolutionary time (t_p)	t_P // t_p	$[T]$ // $[T]_{\text{base}}$	Traditional: time slice / Number of transition events of the evolutionary state of a unit momentum unit [17,27,28]
Speed of Light	Speed limit c (constant)	Intrinsic evolutionary frequency (c_0)	c // l_p/t_p	$[L][T]^{-1}$ // $[L]_{\text{base}}[T]^{-1}_{\text{base}}$	Speed limit / Inherent constant evolutionary trend of all evolutionary carriers [16]
Mass	Inertial measure m (attribute)	Total number of momentum units (N)	m // $N \cdot m_0$	$[M]$ // $[N] \cdot [M]_{\text{base}}$	Object attribute / Number of momentum units of the evolutionary carrier or number of momentum units in the cancellation state

Energy	Work capacity E (scalar)	Total evolutionary capability (scalar potential perspective)	mc^2 // $N \cdot m_0 \cdot c$	$[M][L]^2[T]^{-2}$ // $[N] \cdot [V]_{\text{base}}$	Redundancy of square meter/square second / Total potential evolutionary capability of momentum units (independent of state), conversion factor, see the chapter on the nature of force for details [33]
Momentum	$p = mv$ (quantity of motion)	Net directional evolutionary flux (vector motion perspective)	mv // $s \cdot N \cdot m_0 \cdot c$	$[M][L][T]^{-1}$ // $[N] \cdot [V]_{\text{base}}$	Mass times velocity / Directional evolutionary motion potential of momentum units (directional component of energy)
Force	$F = ma$ (independent entity)	Direct measure of single-step momentum deviation (relationship shaping perspective)	ma // $\Delta(N \cdot m_0 \cdot c)_{\text{step}}$	$[M][L][T]^{-2}$ // $[N] \cdot [V]_{\text{base}}$	Cause of generating acceleration / Shaping quantity of single-step directional proportion (direct embodiment of the speed increase principle)
Static State	$v = 0, p = 0$ (absolute rest)	Bidirectional cancellation state ($s = 0$)	0 // $N_{\text{dir}} = N_{\text{anti}}$	— // $[N]_{\text{total}} \neq 0$	No macro integration, described by the inertial state

The core logic of the above table is the result derived in the entire chapter:

1. Only integrals of momentum (mass, velocity, superposition direction) exist;
2. The Planck scale is the minimum scale for the emergence of time and space;
3. Time is the number of evolutionary events. All time and space can emerge synchronously depending on physical entities (mass) and evolutionary processes, rather than time stopping when evolution is faster (in relativity, the external interaction perception rate can tend to zero when the perceptual capability is weak under high-speed motion);
4. In terms of dynamical mechanism, force = momentum = energy = mv; the momentum perspective is the motion state perspective, the force perspective is relationship shaping (momentum change rate per unit time), and the energy perspective is the potential energy perspective, i.e., the total momentum integral within an interval;
5. Macro multiple interactions involve changing v, while the underlying conservation is fixed c. We use v to uniformly represent velocity, leading to the neglect of its origin from c;

6. Under the static state or Planck time, the eight states are completely equivalent, all being the number of evolutionary carriers N, which is the intrinsic state of things in the cosmic system.

11 Conclusion

1. **Underlying Reality:** The only fundamental reality of the universe is the Momentum unit. Its quantity, directional proportion, and transfer rules determine all physical phenomena. Momentum deviation gives rise to force and velocity, not time accumulation. All dynamical integrals are the three decomposed components of mass m, inertial velocity v, and angle θ; alternatively, they can be said to be the quantity m_0 of Momentum units and the directional proportion of Momentum units $(v \cdot \theta)$.

2. **Eight-State Equivalence:** At a single Planck time snapshot ($t = t_p$), mass, energy, momentum, force, information, entropy, time, and space are essentially different statistical descriptions of the same set of discrete evolutionary carriers (collection of Momentum units) and their intrinsic transition capability N. They are all state quantities emergent from evolutionary carriers, inertial transition capability, vector superposition capability, and perceptual mechanism, showing different differentiations only in the observation dimension.

$$N = E = P = F = I = S = L = T \quad \text{(Representational quantities at the Planck time snapshot)}$$

When the system enters dynamic evolution, although force, energy, and momentum appear as different macro physical quantities, their dynamical origins are completely homologous and equivalent — they are only the projection differentiations of the same evolutionary resource in three dimensions: vector flow direction (momentum), scalar potential (energy), and flux change rate (force). That is, they describe the resource state in the static state, and the transition capability and vector superposition capability of evolutionary resources in the dynamic state. This principle holds universally in all standard quantized state evolution systems.

$$F = P = E = mv \quad \text{(Manifest transition capability)}, \quad F = E = P = mc \quad \text{(Potential transition capability)}$$

$$m = \frac{E}{c} = \frac{P}{c} = \frac{F}{c} = I = S = \frac{L_{\text{total}}}{l_p} = \frac{T_{\text{total}}}{t_p}$$

3. **Dynamical Mechanism Cycle:** Traditional theory defines force through mass and acceleration, momentum through force, energy through momentum, mass through energy, and motion through spacetime and force respectively, forming a set of circularly defined but engineering-effective mechanisms.

4. **Essence of Time and Space:** During the interaction process, time is the number of state evolution events, which is only used to connect multiple causal interactions and count state evolution, not an underlying entity. Spacetime emerges from state evolution within the state evolution system; there is no space without state representational quantity, and no time without state evolution. When it undergoes motion evolution, spacetime shaping capability emerges. It is not that time tends to zero when the evolutionary frequency $v \to c$, but that the interaction capability can tend to zero, and the intrinsic state in the inertial state is constantly v.

5. **Dual Positioning of the Mass-Energy Equation:** The traditional mass-energy equation $E = mc^2$ is essentially a spacetime state shaping equation. Inertial motion cannot be integrated, see the chapter "Unified Cosmic Mechanics Evolution Theory (XIII): The Nature of Force" for details [33]. The dynamical mass-energy equation itself is

$$E = mc$$

(energy = momentum = force). It is neither an equation describing energy, momentum, or force under inertial motion, nor an equation describing the integral process. It characterizes the spacetime state shaping equation, which has physical significance only when motion forms perceptual spacetime windows. Only $E = mc$ can provide a conservation relationship with natural ultraviolet cutoff and other capabilities.

6. **Description of Motion Capability:** To statistically describe the motion capability of a car, only three parameters are needed: velocity, mass, and direction, without additional quantities; the action when a car hits an object is mv, and it is impossible to have an exponential growth of velocity squared. The squared growth of interaction quantity can only be generated due to the squared growth of the perceptual cross-section, and the inertial state quantities after interaction are all provided by momentum for dynamical state evolution and vector synthesis.

7. **Origin of Squared Integrals:** The occasional appearance of squared integrals is due to the squared relationship between the perceptual cross-section and distance, i.e., determined by the $1/(4\pi r^2)$ attenuation of three-dimensional space geometry and the particle encapsulation method, but essentially still the accumulation of state quantities of Momentum units. Just as water floating in the air is called rain, and the rain filled in a basin after falling is still called water, both are integrals of state quantities with the same representational energy and motion capability, and their intrinsic nature does not change due to the integral form.

8. **Origin of Compound Growth:** When an object is farther from the interaction environment, the perceptual cross-section becomes larger, and the interaction momentum becomes larger. Therefore, in the next round, due to the faster velocity, the interaction momentum deviation per unit time during the interaction becomes larger, thus generating acceleration.

9. **Relationship Between Force, Energy, and Momentum:** In terms of dynamical relationship, $p = E = F$, only from different perspectives. Force is from the perspective of relationship shaping capability, emerging from motion trends; energy is from the perspective of potential scalar, emerging from momentum breakage; momentum is from the perspective of motion capability and also from the perspective of state quantity. When counting them, there is no need to set independent physical quantities and dimensions for each unit; all are ultimately integrals of inertia or momentum.

10. **The Problem of Energy Statistics:** Therefore, we can draw a sweeping conclusion: any traditional physics domain that adopts relativistic energy mc^2 or kinetic energy $\frac{1}{2}mv^2$ as a conserved quantity may have potential or direct problems. Examples include the ultraviolet catastrophe, the vacuum catastrophe, the critical density problem of a flat universe, and the failure of the virial theorem. The reason is that only the incremental quantity Δp can cause a change in the state of evolution—such as being "thrown out." The state quantity p itself does not perform the action of "throwing," but under the trend of mutual motion, it provides a connecting mechanism for force.

11. **Reconstruction of Dimensional Units:** All dynamical units can be reduced to linear combinations of $kg \cdot m/s$ (momentum state quantity), m/s (evolutionary frequency), m (space emergent quantity), and s (time emergent quantity).

12. **Cosmic Conserved Quantity:** Only the conservation of state representational quantity and driving quantity exists in the universe, i.e., momentum conservation [21,22], and all other conservations emerge from this. All physical phenomena emerge from this. Any huge temperature, force, energy, and momentum are proportional to the evolutionary linear state quantity, and no experiment has observed that these states lack microscopic motion trends. Everything in the system emerges from the state evolution of this, and all observed phenomena, material units (charge, color charge, atoms, etc.), and wave states originate from the overall projection of momentum [34,35]. Within an inertial state evolution system, every dynamical quantity we describe is fundamentally a measure of the frequency of dynamical evolution—i.e., the rate of spacetime self-shaping and mutual shaping—rather than a quantity of time or space direction. Therefore, at the deepest level, all quantities discussed in this framework refer to capability and evolution frequency. Consequently, at the microscopic level, state evolution perpetually proceeds at the Planck scale.

13. **State Representational Quantity is Mass:** That is, all bosons and fermions such as photons have mass. Incorrect concepts such as "rest mass", "mass-energy conversion", "photons have no mass", and "probability waves" originate from the state switching between the cancellation state and breakage state of matter, as well as the weakening of perceptual interaction capability under high-speed special relativity, which requires massive celestial bodies to manifest gravity and the understanding of the point particle concept. This framework provides a unified explanation—from both logical and mathematical perspectives—for the mass problem of all bosons (including photons, gluons, W/Z bosons) and neutrinos [15,23,36].

14. **Core Value:** The above dimensional reconstruction provides underlying dynamical support for the complete compatibility of classical mechanics, relativity, and quantum mechanics, repairs the mutually fragmented logic and statistical relationships, and provides support for incorporating gravity into unified mechanics.

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[36] Xiao, B. (2026). Unified Cosmic Mechanics Evolution Theory (VIII): Single-Particle High-Speed Dynamical Effects and Their Relationship with Relativity. [In Press]. — Detailedly demonstrates the origin of relativity: special relativity originates from the weak perception capability under high-speed motion, so photons, neutrinos, etc., themselves have mass, and require supermassive celestial bodies to manifest when moving at high speed.