

统一基场相变与阶度波宇宙理论

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摘要

本文为黑洞闭环宇宙轮回模型搭建配套的微观场论支撑体系。以统一基场为宇宙本源，真空基底场与暗能量衍生场由统一基场对称破缺分化产生。本文引入阶度波与阶度波函数，建立尺度自适应演化方程，统一微观量子涨落与宏观时空引力演化。全文采用低温相变、高温相变构成二元闭环循环，完善宇宙轮回模型的定量理论基础。

关键词

统一基场；阶度波函数；双支场；闭环温压相变；创世临界黑洞；量子引力

自创名词释义（本文独立原创概念）

1. 统一基场：宇宙所有场态的本源基础场，真空基底场、暗能量衍生场均由统一基场对称破缺分化生成，是宇宙双层动力场的底层物理源头。
2. 阶度波：统一基场的固有波动形式，具备尺度自适应特征，微观尺度表现为量子涨落，宏观尺度表现为时空引力弯曲。
3. 阶度波函数：描述阶度波全域时空演化的核心数学方程，可同步兼容微观量子动力学与宏观时空引力演化。

1 引言

广义相对论与量子场论存在尺度割裂问题，无法实现宏微观物理统一。现有统一场理论无法适配宇宙闭环轮回演化规律。

已有宏观宇宙轮回模型建立了双层动力场结构与温压相变循环机制，但缺少微观场论支撑。

本文在宏观模型基础上，溯源场态本源，建立统一基场理论与阶度波动力学体系。

本文仅采用两类相变：低温相变、高温相变，构成圆形闭环质能循环，方程体系完整，可独立成篇发表。

2 基础守恒公理

2.1 全域质能守恒

宇宙为孤立闭合系统，全域总质能守恒。

公式(1): $E = M * c^2$

E: 宇宙全域总质能; M: 宇宙全域总质量; c: 真空光速。

全域质量组分关系:

公式(2): $M = M_{DM} + M_{vis} + M_L$

M_{DM} : 暗物质骨架总质量; M_{vis} : 重子可见物质总质量; M_L : 暗能量衍生场等效质量。

2.2 创世临界黑洞质量守恒

公式(3): $M_c = M$

M_c : 创世临界黑洞总质量。

2.3 全域角动量守恒

公式(4): $L = r * m * v = \text{常量}$

L: 系统总角动量; r: 微元轨道半径; m: 微元质量; v: 微元切向速度。

3 双支场斥力动力学

真空基底场与暗能量衍生场无耦合叠加，仅存在宏观斥力作用。

公式(5): $P_{rep} = k * (\rho_V * \rho_L)^{0.5}$

P_{rep} : 双场斥力密度; k: 斥力强度常数; ρ_V : 真空基底场能量密度; ρ_L : 暗能量衍生场能量密度。

4 闭环温压相变动力学

宇宙质能循环由低温相变、高温相变两类过程构成完整圆形闭环，相变区间固定、方向单向、不可逆转。

4.1 低温相变（宇宙膨胀阶段）

暗能量衍生场质能在低温低压环境下转化为重子物质。

公式(6): $dM_L/dt = -\alpha * f(T,P) * M_L$

α : 低温相变系数; $f(T,P)$: 低温区间温压响应函数; T: 热力学温度; P: 压强; t: 演化时间。

4.2 高温相变（创世临界黑洞内部）

致密物质与暗物质骨架在黑洞高温高压环境下还原为暗能量质能。

公式(7): $d(M_{DM}+M_{vis})/dt = -\beta * g(T,P) * (M_{DM}+M_{vis})$

β : 高温相变系数; $g(T,P)$: 黑洞内部高温高压响应函数。

5 质能封存与热力学演化

5.1 致密天体质能封存规律

公式(8): $dM_h/dt \geq 0$

M_h : 黑洞、中子星、白矮星累计封存总质量。

5.2 可循环质能关系

公式(9): $M_{cycle} = M - M_h$

M_{cycle} : 宇宙可参与相变循环的剩余质能。

5.3 全域熵增规律

公式(10): $dS/dt \geq 0$

S : 宇宙全域总熵。

6 阶度波统一场动力学

6.1 基本尺度参数

$L_0=10^{-15}$ m; $L=10^{20}$ m; $m=10^{40}$ kg; $\hbar$: 约化普朗克常量。

6.2 阶度波核心演化方程

公式(11): $(\hbar * L_0^2) / (m * c * L^3) * d^2\psi/dt^2 = D * \nabla^2\psi - \Gamma * \psi * f(T,P)$

ψ : 阶度波场函数; D : 场扩散系数; Γ : 场相变耗散系数; ∇^2 : 空间拉普拉斯算子;

$d^2\psi/dt^2$: 波函数时间二阶演化项。

6.3 宏微观统一机制

尺度趋近微观临界值时, 方程退化为量子场波动规律; 尺度趋近宇宙宏观尺度时, 方程主导时空曲率演化。阶度波实现量子场与引力场的尺度连续统一。

7 理论自治校验方程

公式(12): $\text{TripleIntegral} |\psi_{\text{micro}}|^2 dV = 1$

ψ_{micro} : 微观阶度波函数。

公式(13): $R = \eta * \nabla^2 |\psi_{\text{macro}}|$

ψ_{macro} : 宏观阶度波函数; R: 时空曲率标量; η : 引力适配系数。

公式(14): $\delta = |dR/dt - dM_c/dt| \rightarrow 0$

δ : 时空演化同步差。

公式(15): $dk/dt = 0$

8 宇宙轮回微观演化对应关系

1. 创世阶段：统一基场剧烈波动，阶度波全域振荡，双支场生成，暗物质骨架瞬时成型。
2. 膨胀阶段：阶度波稳态衰减，低温相变持续生成重子物质。
3. 稳态演化阶段：场斥力与引力制衡，致密天体持续封存质能。
4. 晚期演化阶段：暗能量质能耗尽，低温相变终止，场斥力持续衰减。
5. 轮回收尾阶段：阶度波全域收缩，时空与物质同步坍缩，黑洞内部触发高温相变与量子熵重构，完成闭环轮回。

9 结论

本文以统一基场为理论本源，阐明双层动力场的生成机制。通过阶度波函数建立宏微观统一的场演化规律，彻底消除量子场与引力场的尺度割裂。

全篇仅采用低温相变与高温相变构成圆形闭环质能循环，物理逻辑自洽。整套方程完备，为黑洞闭环宇宙轮回模型提供完整微观场论与定量数学支撑。

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Unified Fundamental Field Phase Transition and Order-Degree Wave Cosmology

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Abstract

This paper establishes a microscopic field theory framework for the closed-loop black hole cosmic cyclic model. The vacuum background field and dark energy derived field are produced by symmetry breaking of the unified fundamental field. We put forward the order-degree wave and order-degree wave function, and build scale-adaptive evolution equations to unify microscopic quantum fluctuations and macroscopic spacetime gravitational evolution. Low-temperature and high-temperature phase transitions form a binary closed-loop cycle, which establishes the quantitative theoretical basis for the cosmic cyclic model.

Keywords

Unified Fundamental Field; Order-Degree Wave Function; Two-Branch Field; Closed-Loop Temperature-Pressure Phase Transition; Primordial Critical Black Hole; Quantum Gravity

Glossary of Original Terms

1. Unified Fundamental Field: The primordial field of all cosmic field states. The vacuum background field and dark energy derived field come from its symmetry breaking, which is the physical origin of the two-layer dynamic field of the universe.
2. Order-Degree Wave: The intrinsic fluctuation mode of the unified fundamental field. It shows quantum fluctuations at the micro scale and spacetime gravitational curvature at the macro scale.

3. Order-Degree Wave Function: The core mathematical equation describing the spacetime evolution of order-degree waves, which is compatible with both microscopic quantum dynamics and macroscopic gravitational evolution.

1 Introduction

There exists scale separation between general relativity and quantum field theory, and macro and micro physics cannot be unified. Existing unified field theories fail to match the law of closed-loop cosmic evolution.

The existing macroscopic cosmic cyclic model has constructed a two-layer dynamic field structure and a temperature-pressure phase transition cycle, yet it lacks microscopic field theory support. On the basis of the macroscopic model, this paper traces the origin of field states and establishes the unified fundamental field theory and order-degree wave dynamics.

This paper only adopts low-temperature and high-temperature phase transitions to form a circular closed-loop mass-energy cycle. The complete equation system makes this paper suitable for independent publication.

2 Fundamental Conservation Axioms

2.1 Global Mass-Energy Conservation

The universe is an isolated closed system, and the total global mass-energy is conserved.

Formula (1): $E = M * c^2$

E: Total global mass-energy; M: Total cosmic mass; c: Speed of light in vacuum.

Mass composition formula:

Formula (2): $M = M_{DM} + M_{vis} + M_L$

M_{DM} : Total mass of dark matter skeleton; M_{vis} : Baryonic visible mass; M_L : Equivalent mass of dark energy derived field.

2.2 Mass Conservation of Primordial Critical Black Hole

Formula (3): $M_c = M$

M_c : Total mass of the primordial critical black hole.

2.3 Global Angular Momentum Conservation

Formula (4): $L = r * m * v = \text{constant}$

L: Total angular momentum; r: Orbital radius; m: Element mass; v: Tangential velocity.

3 Repulsive Dynamics of Two-Branch Fields

The vacuum background field does not couple with the dark energy derived field, and only macroscopic repulsion exists between them.

Formula (5): $P_{rep} = k * (\rho_V * \rho_L)^{0.5}$

P_{rep} : Repulsive density; k: Repulsion constant; ρ_V : Energy density of vacuum background field; ρ_L : Energy density of dark energy derived field.

4 Closed-Loop Phase Transition Dynamics

The cosmic mass-energy cycle forms a complete circular loop including low-temperature and high-temperature phase transitions. The phase transition interval is fixed with one-way irreversible evolution.

4.1 Low-Temperature Phase Transition (Expansion Stage)

Dark energy mass-energy turns into baryonic matter under low temperature and low pressure.

Formula (6): $dM_L/dt = -\alpha * f(T,P) * M_L$

α : Low-temperature phase transition coefficient; $f(T,P)$: Temperature-pressure response function; T: Temperature; P: Pressure; t: Evolution time.

4.2 High-Temperature Phase Transition (Inside Primordial Critical Black Hole)

Compact matter and dark matter skeleton revert to dark energy mass-energy under high temperature and high pressure inside black holes.

Formula (7): $d(M_{DM}+M_{vis})/dt = -\beta * g(T,P) * (M_{DM}+M_{vis})$

β : High-temperature phase transition coefficient; $g(T,P)$: High-temperature and high-pressure response function.

5 Mass-Energy Confinement and Thermodynamic Evolution

5.1 Mass Confinement Rule of Compact Celestial Bodies

Formula (8): $dM_h/dt \geq 0$

M_h : Total mass trapped by black holes, neutron stars and white dwarfs.

5.2 Recyclable Mass-Energy

Formula (9): $M_{\text{cycle}} = M - M_h$

M_{cycle} : Recyclable mass-energy for phase transition.

5.3 Global Entropy Growth

Formula (10): $dS/dt \geq 0$

S : Total cosmic entropy.

6 Order-Degree Wave Unified Field Dynamics

6.1 Basic Scale Parameters

$L_0=10^{-15}$ m; $L=10^{20}$ m; $m=10^{40}$ kg; $\hbar$: Reduced Planck constant.

6.2 Core Evolution Equation

Formula (11): $(\hbar * L_0^2) / (m * c * L^3) * d^2\psi/dt^2 = D * \nabla^2\psi - \Gamma * \psi * f(T,P)$

ψ : Wave field function; D : Diffusion coefficient; Γ : Dissipation coefficient; ∇^2 : Laplace operator.

6.3 Unification of Macro and Micro Physics

When the scale drops to the microscopic critical value, the equation degenerates into quantum field fluctuation law. At cosmic macro scale, it dominates spacetime curvature evolution. The order-degree wave realizes the continuous unification of quantum field and gravitational field.

7 Self-Consistency Verification Equations

Formula (12): $\text{TripleIntegral } |\psi_{\text{micro}}|^2 dV = 1$

ψ_{micro} : Microscopic wave function.

Formula (13): $R = \eta * \nabla^2 |\psi_{\text{macro}}|$

ψ_{macro} : Macroscopic wave function; R : Spacetime curvature scalar; η : Gravitational matching coefficient.

Formula (14): $\delta = |dR/dt - dM_c/dt| \rightarrow 0$

δ : Evolution deviation.

Formula (15): $dk/dt = 0$

8 Microscopic Evolution of Cosmic Cycles

1. Genesis Stage: Violent fluctuation of the unified fundamental field, global oscillation of order-degree waves, formation of two-branch fields and dark matter skeleton.
2. Expansion Stage: Steady attenuation of order-degree waves; low-temperature phase transition continuously produces baryonic matter.
3. Steady Evolution Stage: Balance between field repulsion and gravity; compact celestial bodies keep confining mass-energy.
4. Late Evolution Stage: Dark energy is exhausted, low-temperature phase transition terminates, and field repulsion gradually decays.
5. Cycle Stage: Global contraction of order-degree waves; spacetime and matter collapse synchronously. High-temperature phase transition and quantum entropy reconstruction occur inside black holes to complete the closed-loop cycle.

9 Conclusions

Taking the unified fundamental field as the theoretical origin, this paper explains the generation mechanism of the two-layer dynamic field. The order-degree wave function establishes the evolutionary law unifying macro and micro physics, and eliminates the scale separation between quantum field and gravitational field. Low-temperature and high-temperature phase transitions form a self-consistent circular mass-energy cycle. The complete equation system provides a full set of microscopic field theory and mathematical support for the black hole closed-loop cosmic cyclic model.

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