暗能量亚夸克分温区相变与星系内物质生成演化机制——承接《黑洞宇宙轮回模型》

朱峻峰
独立理论物理研究者
无所属科研机构
邮箱：18957467852@163.com
ORCID：0009-0000-8328-5096

摘要

依据《黑洞宇宙轮回模型》与《统一基场相变与阶度波宇宙理论》框架，宇宙底层本源为统一基场。统一基场经对称破缺分化为：暗物质骨架主场、暗能量衍生场、真空场、量子场。暗物质骨架主场创世一次性全域成型，常规天体依托其引力场运行，场的波动演化遵从阶度波规律。暗能量衍生场与真空场相互作用产生斥力，驱动宇宙膨胀；场内亚夸克质能的富集量直接决定局域场能强度，调控宇宙膨胀速率，该机制与 ΛCDM 真空能膨胀体系存在本质区别。

亚夸克质能仅依附暗物质骨架局域富集，不全域弥散。星系内部骨架密集，亚夸克质能富集；星系际虚空无暗物质骨架，因此无富集亚夸克质能，不具备相变条件。本文基于天文观测反向推演：宇宙演化不同阶段相变区域随环境动态转移，现阶段星系旋臂暗黑分子云 8K–18K 低温区是星系内部持续稳定的质能相变区域，亚夸克质能在此逐步聚合生成中子。中子迁出低温区后，在 22K 以上星际环境衰变为质子与电子，持续产生氢原子，供给恒星形成与超新星演化，建立星系稳态物质再生循环机制。

关键词：暗能量；亚夸克质能；物质生成机理

第 1 章 绪论

1.1 现有宇宙模型存在的局限

ΛCDM 标准模型将宇宙膨胀归因于全域真空能，同时假设虚空极低温区可发生真空相变产生物质。该推演以理论温度规律优先，未匹配星系实际观测特征：恒星新生、重子物质更新、超新星活动均集中于星系内部，星系虚空几乎无新生物质产出，理论推演与观测事实不符。传统模型缺乏暗能量质能局域相变造星体系，无法解释星系长期稳定的物质生源问题。

1.2 本文依托的前期理论核心前提

本文严格承接前两篇原创理论体系，采用固定公理前提：

1. 宇宙唯一底层本源为统一基场，对称破缺后分化为暗物质骨架主场、暗能量衍生场、真空场、量子场等各类场；

2. 创世黑洞喷发一次性构建全域暗物质丝状骨架网络，骨架结构极度稳定，仅创世极高温环境可解离，常态宇宙演化不发生相变；所有恒星、行星等常规天体依托暗物质骨架主场的引力系统运行；全域引力场、暗能量衍生场的波动演化统一遵从阶度波规律；
3. 暗能量衍生场结构稳定、永不相变。场内亚夸克质能不弥散分布，仅依附暗物质骨架聚集富集。星系内部骨架密集、质能充足；星系虚空无骨架承载，无富集亚夸克质能；
4. 暗能量衍生场与真空场相互作用产生斥力，驱动宇宙膨胀。亚夸克质能储量决定场能强弱，质能富集则斥力增强、膨胀加快，质能消耗则场能减弱、膨胀放缓；
5. 宇宙宏观演化由创世黑洞轮回迭代主导，星系微观新生物质，唯一来源为暗能量衍生场内亚夸克质能的局域分温区相变，相变发生区域随星系演化时序动态转移。

1.3 本文研究思路

摒弃传统虚空相变假设，以星系观测事实为核心依据，通过空间骨架分布、局域温度区间、辐射扰动条件，界定不同演化阶段亚夸克质能的真实相变区间，建立星系物质持续再生的完整演化链条。

第 2 章 星系空间环境与场质能分布

宇宙空间分为星系际虚空、星系普通星际介质两大区域，旋臂暗黑分子云为星际介质内的次级特殊低温结构，三者质能分布与相变条件各不相同。

2.1 星系际虚空区域

虚空区域存在暗能量衍生场、真空场与引力场，参与宇宙膨胀。但虚空无暗物质骨架，无法聚集亚夸克质能，不存在可相变的质能组分。虽虚空温度极低，但无相变原料，因此永远不会产生新粒子、新物质。

2.2 星系普通星际介质

星系内部非分子云区域，长期受恒星星光、宇宙射线辐射扰动，稳态温度普遍高于 25K。强场扰动抑制亚夸克质能聚拢闭合，无法启动相变，无新生物质生成。

2.3 旋臂暗黑分子云稳态低温环境

星系旋臂为暗物质骨架密集带，尘埃沿骨架聚拢堆积，在星际介质内部形成密闭暗黑分子云。云层遮挡恒星辐射，内部形成稳定 8K–18K 低温屏蔽环境。
该区域暗物质骨架密集，亚夸克质能高度富集，外界扰动微弱，是现阶段星系内部主要可稳定持续发生亚夸克质能相变的区域。
超新星爆发会短暂抬升局部温度、暂停局部相变，同时抛洒尘埃重塑分子云结构，为下一轮质能相变与恒星诞生创造条件。

第 3 章 亚夸克质能相变的三项约束条件

场体本身不相变，仅场内亚夸克质能满足三重条件时发生分温区相变。

3.1 温度阈值条件

本文界定亚夸克质能有效相变温区与衰变临界温度，量化关系为：
T 相变 ∈ [8 K，18 K]
T 衰变 ⩾ 22 K

8 K～14 K 为活跃相变区间，质能聚合效率高；14 K～18 K 为弱相变区间，生成速率平缓。环境温度高于 18 K 时热扰动超限，质能聚合结构解体，相变终止；中子迁出低温区后，环境温度达到 22 K 及以上即启动 β 衰变。

3.2 局域质能密度条件

亚夸克质能相变必须同时满足质能密度临界条件与温度区间条件，双重判定关系式：
{
ρ 亚夸克 ⩾ ρ 临界
8 K ⩽ T ⩽ 18 K
}

只有暗物质骨架密集区域，亚夸克质能堆积可达到临界密度，局域引力约束大于热运动扰动，质能方可重组闭合完成相变。无骨架区域无论温度高低，均无相变可能。

3.3 辐射扰动条件

强星光与高能辐射会破坏亚夸克质能的聚合结构，抑制相变发生。仅暗黑分子云深层区域可屏蔽外界辐射、维持低扰动环境，保障分温区相变持续稳定进行。

第 4 章 星系物质完整演化链条

4.1 亚夸克质能聚合生成中子

暗黑分子云低温低扰动环境下，富集的亚夸克质能逐级结构重组、聚合闭合，稳定生成中子。全过程暗能量衍生场、暗物质骨架保持结构不变。

4.2 中子衰变生成基础粒子

中子随星际气流迁出低温分子云，在 22K 以上星际环境发生 β 衰变，生成质子与自由电子。

4.3 氢原子聚集与恒星循环演化

质子与电子结合形成氢原子，氢云引力聚集孕育恒星。大质量恒星末期发生超新星爆发，抛洒重元素与尘埃，更新星际介质，完成星系物质循环。

4.4 星系恒星诞生时空演化规律

全域暗物质骨架创世一次性成型，所有星系骨架脉络先天固定。

宇宙早期无恒星、无全域星光辐射，所有星系中心骨架交汇节点密度最高、亚夸克质能最富集，温区满足相变条件，因此星系中心最先发生质能相变、诞生初代古老恒星，构成星系最早期造星核心区域。

随着星系中心批量恒星形成，持续星光辐射抬升中心区域温度，相变条件被破坏，星系中心造星活动逐步停止，造星核心区域整体向星系旋臂转移。

星系外缘骨架分布稀疏，仅宇宙早期全域低辐射阶段短暂满足相变条件，诞生少量古老恒星；随着全域星际辐射整体抬升，外缘相变彻底终止，因此星系外缘仅留存老年恒星，无新生恒星诞生，完全匹配观测得到的恒星年龄 U 型分布规律。

4.5 未来恒星诞生区域演化推演

当前宇宙常规物质仅占 5%，暗物质骨架占 27%，剩余 68%为未相变的亚夸克质能，质能转化储备巨大。单个星系受骨架引力束缚，内部空间不随宇宙整体膨胀。

星系造星相变区域会随质能消耗、环境温度演变，有序逐级转移：

1. 现阶段：星系旋臂暗黑分子云为主要相变、造星区域；
2. 中期演化：旋臂可相变质能逐步消耗，造星区域转移至星系中心超大质量黑洞外围空洞环状边界，黑洞喷流挤压尘埃、屏蔽高温辐射，形成新的稳定低温相变带；
3. 中后期演化：依靠星系全域次级丝状暗物质骨架，零散发生质能相变、局部造星；
4. 星系末期：全域恒星大量消亡、星际辐射整体降低，星系外缘残留亚夸克质能最后一次完成相变，此后星系大规模造星活动终止。

该时序演化路径完整覆盖星系全生命周期的物质再生规律。

第 5 章 与传统宇宙学模型机制对比

ΛCDM 模型以真空能为膨胀动力，且假设虚空低温产生物质相变。
本模型构建完全差异化的演化体系，核心区别如下：

1. 宇宙膨胀：暗能量衍生场与真空场相互作用产生斥力驱动；
2. 物质生成：仅骨架富集区的亚夸克质能分温区相变产生，且相变区域随时序动态迁移；
3. 虚空：有场、参与膨胀、无相变、无物质生成。

膨胀机制、物质生源、空间分区及时序演化规律，均与标准模型形成范式性区别。

第 6 章 小结

统一基场对称破缺形成四大基础场，暗能量衍生场与真空场的斥力作用驱动宇宙膨胀，亚夸克质能依托暗物质骨架富集，局域相变。

星系虚空无骨架、无质能、无相变；星系相变造星区域随时序动态转移：宇宙早期以星系中心相变造星为主，现阶段以旋臂分子云持续相变造星为主，未来逐步向黑洞外围及次级骨架转移。星系恒星诞生呈现“中心最早、旋臂持续、外缘早停”的时空分布特征，完全契合天文观测结果，构建了完整自洽的星系物质演化体系，补齐了创世黑洞轮回宇宙模型的微观物质生成机制。

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Phase Transition of Sub-Quark Mass-Energy and Evolution Mechanism of Matter Generation inside Galaxies

Zhu Junfeng
Independent Researcher of Theoretical Physics
No Institutional Affiliation
E-mail: 18957467852@163.com
ORCID: 0009-0000-8328-5096

Abstract

Based on the framework of the Black Hole Samsara Cosmological Model and the Unified Fundamental Field Phase Transition and Order-Degree Wave Cosmology Theory, the fundamental origin of the universe is the unified fundamental field. Through spontaneous symmetry breaking, the unified fundamental field differentiates into dark matter skeleton main field, dark energy derived field, vacuum field, and quantum field. The dark matter skeleton main field formed

universally in the primordial creation stage, and all conventional celestial bodies operate under its gravitational effect, with field fluctuations following the Order-Degree Wave law.

The interaction between the dark energy derived field and the vacuum field produces repulsive force and drives cosmic expansion. The enrichment degree of sub-quark mass-energy directly determines the local field intensity and regulates the expansion rate of the universe, which is essentially different from the ΛCDM vacuum energy expansion system.

Sub-quark mass-energy only accumulates locally along the dark matter skeleton without universal diffusion. Dense skeletons inside galaxies gather abundant sub-quark mass-energy, while intergalactic voids without dark matter skeleton cannot accumulate sub-quark mass-energy and have no phase transition conditions. Based on astronomical observations, this paper deduces that cosmic phase transition regions dynamically shift with evolutionary environments. At present, the 8K-18K low-temperature region of dark molecular clouds in galactic arms serves as the stable phase transition zone, where sub-quark mass-energy gradually aggregates into neutrons. After leaving the low-temperature region, neutrons decay into protons and electrons above 22K interstellar environment, continuously generating hydrogen atoms to support star formation and supernova evolution, and establishing a stable galactic matter regeneration cycle mechanism.

Key words: dark energy; sub-quark mass-energy; matter generation mechanism

Chapter 1 Introduction

1.1 Limitations of existing cosmological models

The ΛCDM standard model attributes cosmic expansion to universal vacuum energy, and assumes that vacuum phase transition can generate matter in ultra-low-temperature void areas. This deduction prioritizes theoretical temperature rules and fails to match actual galactic observations. Star formation, baryonic matter renewal and supernova activities all occur inside galaxies, and almost no new matter is produced in intergalactic voids. There is an obvious discrepancy between theoretical prediction and observational facts.

Traditional models lack the system of matter generation through local phase transition of dark energy mass-energy, and cannot explain the long-term stable matter source of galaxies.

1.2 Basic theoretical premises adopted in this paper

This paper strictly follows the original theoretical system of the previous two papers and adopts the following axiomatic premises:

1. The only fundamental origin of the universe is the unified fundamental field. After symmetry breaking, it differentiates into dark matter skeleton main field, dark energy derived field, vacuum field, quantum field and other fields;
2. The eruption of primordial black holes forms a global filament network of dark matter skeletons at one time. The skeleton is extremely stable and can only be dissociated under ultra-high primordial temperature, and no phase transition occurs in normal cosmic evolution. Stars, planets and other conventional celestial bodies operate under the gravitational system of the dark matter skeleton main field. The fluctuation evolution of global gravitational field and dark energy derived field follows the Order-Degree Wave law;
3. The dark energy derived field has stable structure and never undergoes phase transition. Sub-quark mass-energy inside the field does not diffuse universally, and only accumulates along dark matter skeletons. Skeletons inside galaxies are dense with sufficient mass-energy; intergalactic voids have no skeletons and no accumulated sub-quark mass-energy;
4. The interaction between dark energy derived field and vacuum field generates repulsive force and drives cosmic expansion. The reserve of sub-quark mass-energy determines field intensity. Sufficient mass-energy brings stronger repulsive force and faster cosmic expansion; mass-energy consumption weakens the field and slows down expansion;
5. The macroscopic cosmic evolution is dominated by the cycle iteration of primordial black holes. The only source of new microscopic matter in galaxies is the local phase transition of sub-quark mass-energy inside the dark energy derived field, and the phase transition area shifts dynamically with galactic evolution.

1.3 Research ideas

Abandoning the hypothesis of vacuum phase transition in traditional theories, this paper takes galactic astronomical observations as the core basis. Combined with skeleton distribution, local temperature range and radiation disturbance, it defines the effective phase transition interval of sub-quark mass-energy in different evolutionary stages, and constructs a complete evolution chain for continuous matter regeneration of galaxies.

Chapter 2 Spatial environment and field-mass-energy distribution of galaxies

Cosmic space is divided into two major regions: intergalactic voids and ordinary interstellar medium inside galaxies. Dark molecular clouds in galactic arms are secondary special low-temperature structures inside the interstellar medium. Mass-energy distribution and phase transition conditions are different in the three areas.

2.1 Intergalactic void area

The intergalactic void contains dark energy derived field, vacuum field and gravitational field, participating in global cosmic expansion. However, there is no dark matter skeleton in the void, so sub-quark mass-energy cannot be accumulated, and there is no mass-energy component for phase transition. Even if the temperature of the void is extremely low, new particles and matter can never be produced due to the lack of raw materials for phase transition.

2.2 Ordinary interstellar medium inside galaxies

The non-molecular-cloud area inside galaxies is continuously disturbed by starlight and cosmic high-energy radiation, with steady-state temperature generally higher than 25K. Strong radiation disturbance prevents sub-quark mass-energy from converging, so phase transition cannot be triggered and no new matter is generated.

2.3 Steady low-temperature environment of dark molecular clouds in galactic arms

Galactic arms are dense zones of dark matter skeletons. Interstellar dust accumulates along the skeletons and forms enclosed dark molecular clouds inside the interstellar medium. The clouds block stellar radiation and form a stable low-temperature environment of 8K-18K.

This area has dense dark matter skeletons and highly accumulated sub-quark mass-energy with weak external disturbance. It is the main stable area for sub-quark mass-energy phase transition at present. Supernova outbreaks will briefly raise local temperature and suspend regional phase transition. Meanwhile, ejected interstellar dust reshapes molecular cloud structures, creating conditions for subsequent mass-energy phase transition and star regeneration.

Chapter 3 Three constraint conditions for sub-quark mass-energy phase transition

The field body itself will not undergo phase transition. Only when the sub-quark mass-energy inside the field meets three conditions can graded temperature phase transition occur.

3.1 Temperature threshold condition

The effective phase-transition temperature range and neutron decay critical temperature are defined as follows:

$T_{phase} \in [8\ K, 18\ K]$

$T_{decay} \geqslant 22\ K$

8 K-14 K is the active phase-transition interval with high mass-energy polymerization efficiency; 14 K-18 K is the weak phase-transition interval with slow generation rate. When temperature is higher than 18K, thermal disturbance exceeds the limit, the aggregated structure of sub-quark mass-energy disintegrates and phase transition terminates. After neutrons leave the low-temperature area, β-decay starts when the ambient temperature reaches above 22K.

3.2 Local mass-energy density condition

Sub-quark mass-energy phase transition must satisfy both critical density condition and temperature condition:

$$\left\{ \begin{array}{l} \rho_{sub\text{-}quark} \geqslant \rho_{critical} \\ 8\ K \leqslant T \leqslant 18\ K \end{array} \right\}$$

Only in areas with dense dark matter skeletons can sub-quark mass-energy accumulate to critical density. Local gravitational constraint suppresses thermal disturbance, so mass-energy can restructure and complete phase transition. Phase transition is impossible without skeletons regardless of temperature.

3.3 Radiation disturbance condition

Stellar light and high-energy cosmic radiation will destroy the ordered aggregated structure of sub-quark mass-energy and inhibit phase transition. Only deep areas inside dark molecular clouds can shield external radiation, maintain low-disturbance steady environment, and ensure sustainable phase transition.

Chapter 4 Complete evolution chain of galactic matter

4.1 Neutron generation through aggregation of sub-quark mass-energy

In the low-temperature and low-disturbance environment of dark molecular clouds, accumulated sub-quark mass-energy carries out structural reconstruction and aggregation step by step to steadily generate neutrons. During the whole process, dark energy derived field and dark matter skeleton remain unchanged.

4.2 Neutron decay to generate basic particles

Neutrons flow out of dark molecular clouds with interstellar airflow, and β-decay occurs in interstellar environment above 22K, producing protons and free electrons.

4.3 Hydrogen accumulation and stellar cycle evolution

Protons combine with free electrons to form hydrogen atoms. Hydrogen clouds collapse under gravity and form new stars. Massive stars end their lives with supernova explosions, ejecting heavy elements and interstellar dust, renewing interstellar medium and completing galactic material circulation.

4.4 Spatiotemporal law of star formation in galaxies

The global dark matter skeleton takes shape once in the primordial period, and the skeleton distribution of all galaxies is fixed in advance.

In the early universe, there were no stars and no global interstellar radiation. The nodes where skeletons converge at the center of each galaxy have the highest density and richest sub-quark mass-energy, meeting the phase-transition conditions first. Therefore, the center of galaxies is the earliest birthplace of ancient primordial stars.

After a large number of stars formed at galactic centers, continuous stellar radiation raised central temperature, phase-transition conditions were destroyed, star-forming activities at galactic centers gradually stopped, and the core of star formation shifted to galactic arms.

Skeletons at galactic outer edges are sparse. Phase transition only occurred for a short time in the early low-radiation universe and produced a small number of ancient stars. With the rise of global interstellar radiation, phase transition at outer edges stopped completely. Therefore, only old stars exist at galactic outer edges without new stars, which is fully consistent with the U-shaped distribution of stellar ages observed astronomically.

4.5 Evolution prediction of future star-forming areas

At present, ordinary visible matter accounts for only 5%, dark matter skeleton accounts for 27%, and the remaining 68% is sub-quark mass-energy without phase transition, with huge potential for matter conversion. Bound by the gravity of skeletons, the interior of a single galaxy will not expand with the whole universe.

With mass-energy consumption and environmental temperature change, star-forming areas will shift step by step in the following order:

1. Current stage: dark molecular clouds in galactic arms are the main phase-transition and star-forming areas;
2. Middle stage: after mass-energy in galactic arms is gradually consumed, star-forming areas transfer to the annular boundary outside the central supermassive black hole. Black-hole jets squeeze dust and shield high-temperature radiation, forming a new steady low-temperature phase-transition zone;
3. Mid-late stage: scattered local phase transition and star formation occur along secondary filamentous dark matter skeletons of galaxies;
4. Late stage of galaxy evolution: most stars die out, interstellar radiation decreases. The residual sub-quark mass-energy at galactic outer edges undergoes the final phase transition. Afterwards, large-scale star formation terminates.

This time-sequence evolution covers the whole life cycle of galaxy matter regeneration.

Chapter 5 Mechanism comparison with traditional cosmological models

The ΛCDM model takes vacuum energy as the driving force of cosmic expansion, and believes that matter phase transition occurs in low-temperature voids.
This paper establishes a differentiated evolution system, with core differences as follows:

1. Cosmic expansion: driven by repulsive force produced by interaction between dark energy derived field and vacuum field;

2. Matter generation: generated only by graded temperature phase transition of sub-quark mass-energy in skeleton-rich areas, and phase-transition areas shift with time;
3. Void region: basic fields exist and participate in cosmic expansion, without accumulated mass-energy and new matter generation.

Expansion mechanism, matter source, spatial zoning and time-sequence evolution are fundamentally different from the standard model.

Chapter 6 Conclusion

Symmetry breaking of the unified fundamental field forms four basic fields. The repulsive effect between dark energy derived field and vacuum field drives cosmic expansion. Sub-quark mass-energy accumulates along dark matter skeletons and carries out local phase transition.

Intergalactic voids have no skeletons, no accumulated mass-energy and no phase-transition conditions. Phase-transition areas shift with cosmic evolution: in the early universe, phase transition mainly took place at galactic centers; at present, continuous phase transition occurs in molecular clouds of galactic arms; in the future, it will gradually transfer to the outer area of black holes and secondary skeletons. The birth sequence of stars presents the rule of "earliest at the center, continuous in arms, early termination at outer edges", which matches astronomical observations perfectly. A self-consistent galactic matter evolution system is established, supplementing the microscopic matter circulation mechanism of the primordial black hole samsara cosmological model.

References

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