https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

The System of Original Static Substrate and Local Perturbation Universe V4.1: Observational Predictions and Empirical Deductions

Sheng Shuai
Independent Researcher, Zhangjiagang, Jiangsu Province, P.R.China
Corresponding author: Sheng Shuai, Email: 2986309099@qq.com

Manuscript Position Statement

This paper is an independent expanded continuation of the mathematical framework established in Version 4.0, rather than an appendix. Version 4.0 constructs the underlying axioms and core qualitative dynamic framework of the complete paradigm; Version 4.1 incorporates all delayed quantitative derivations, comprehensive observational predictions, detailed celestial mechanical mechanisms, a full bibliography, and targeted observation schemes from Version 4.0. It revises the obscure phrasing of "global perturbation suppression and self-reversion recovery", adds rigorous multi-layer arguments, exclusive innovative mechanisms, secondary expansions, and tentative deduction sections, and refines the ontological and emergent time philosophical reasoning system.

All observational predictions contained herein constitute a comprehensive elaboration of the paradigm at its current developmental stage. Subsequent iterative versions will supplement, revise, and deepen the system in accordance with progress in theoretical refinement. Submission Annotation: This expansion is built upon the continuously archived paradigm of V1/V3.3/V4.0. The underlying axioms and dynamics remain unaltered; only supplementary quantitative derivations, testable observational conclusions, cross-scale unified mechanisms, and long-term inferences are added to balance theoretical completeness and rigorous scientific boundaries.

A simple thought experiment reveals the fundamental divergence between the two paradigms. Under the standard cosmological model, no spatial expansion exists within locally gravitationally bound systems, so laboratory light sources should produce zero cosmological redshift (Planck Collaboration, 2020). Within the present paradigm, homeostatic self-reversion permeates the entire domain, and the substrate metric undergoes continuous contraction. Every photon propagating through space experiences metric stretching. When a beam of flashlight light passes through a laboratory, the conventional paradigm predicts zero redshift, while this paradigm predicts an extremely small yet non-zero redshift. Contrasting predictions for the identical phenomenon clearly demonstrate the fundamental divide between the two cosmological frameworks.

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

Abstract

This work proposes a cosmological framework for the origin of space-time. The framework unifies several major cosmological phenomena, including redshift, cosmic expansion, gravitational effects, and the evolution of celestial objects. It provides a consistent physical interpretation for the origin and expansion of the universe, and offers testable observational predictions related to astronomical measurements such as the James Webb Space Telescope, Euclid and LISA. The model classifies cosmic objects and describes their evolutionary pathways, while also offering a new explanatory mechanism for quantum entanglement and gravitational lensing. It further establishes a unified interpretation of type Ia supernovae and gravitational lensing within the same theoretical system. The framework distinguishes itself from conventional ΛCDM cosmology and supplies new constraints for ongoing astronomical observations. It treats cosmic expansion not merely as kinematic motion of galaxies, but as an intrinsic structural evolution of spacetime itself. This perspective naturally avoids some fine-tuning challenges present in standard cosmology and opens new directions for connecting large-scale cosmic dynamics with fundamental quantum behaviour. This manuscript lays out the core physical framework of the model and its associated observational predictions; follow-up studies will elaborate on individual subtopics in separate contributions.

Keywords

Original Static Substrate; Local Perturbation; Self-Reversion Recovery Dynamics; Global Perturbation Suppression Effect; Hubble Tension; CMB Cold Spot Anomaly; KBC Void; Fractal Scaling Invariance; Quantum Gravity Unification; Baryon Asymmetry; Ontologically Unified Interpretation of Parity Non-Conservation Based on Perturbation Orientation Gradients; Fast Radio Burst; Perturbation Bubble Boundary Layer; Primordial Cosmic Magnetic Field; Cosmic Lithium Problem; Finite Boundless Perturbation Bubble Geometry; Speculative Cosmic Deduction; Testable Observational Prediction; Paradigm Shift; Perturbation Bubble Evolution Timescale; Perturbation Bubble Lifecycle; Perturbation Observation Horizon; Residual Origins of Fundamental Forces; Scarcity of Intermediate-Mass Black Holes; Coevolutionary Relationship Between Central Black Holes and Galactic Bulges; Electromagnetic Counterparts of Merging Engines; Primordial Dwarf Galaxies; Temperature Anomalies in Extreme Void Cores; Ontological Limit of Black Holes Approaching the Original Substrate; Formation Criterion of Acquired Tear- Type Black Holes; Semi-Original State; Laser Divergence Angle; Micro-Substrate Fluctuations; Quantum Entanglement; Type Ia Supernova; Gravitational Lensing

Table of Contents

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

1 Prefatory Remarks

1.1 Consolidation of Deferred Content from V4.0

1. All mathematical derivations for galactic fractality, global conformal transformations, and extended Riemann Zeta function analysis are fully integrated into the complete computational framework of V4.0;
2. Quantitative deductions for cosmic voids, quasar redshifts, cosmic rays, black hole evolution, and electromagnetic counterparts of galactic mergers are deferred to the present paper;
3. Four-tier statistical superposition of low-probability events—cosmic genesis, galactic formation, biological evolution, and the derivation of this paradigm—are incorporated into this chapter;
4. Comprehensive supplementary multi-band observational benchmark data paired with layered quantitative observational predictions; new quantitative content addressing the scarcity of intermediate-mass black holes, black hole-bulge correlations, primordial dwarf galaxies, and surviving celestial objects within extreme voids;
5. Compilation of DOIs for foreign scale-contraction models and observational papers analyzing voids, cold spots, and dark matter galaxies published over the past five years;
6. All physical puzzles only qualitatively referenced in V4.0 receive closed-form quantitative resolution within V4.1;
7. New triple cross-verification deductions for perturbation bubble evolution timescales and observable horizon scales, alongside microscopic laser divergence angle and

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

perturbation bubble lifecycle quantitative derivations added as long-term quantitative expansions of the system.

1.2 Hierarchical Classification of New Content in V4.1

1. Core Rigorous Subsections (Independent, Complete Arguments with Direct Quantitatively Observable Predictions, Highest Priority): Layered gravitational wave redshift and attenuation, full resolution of dark matter issues via galactic rotation curves, ontological unification of quantum gravity, deductions of baryon asymmetry, quantitative corollaries for intermediate-mass black hole scarcity and black hole-bulge coevolution, unified dynamic explanations for Type Ia supernovae and gravitational lensing;

2. Exclusive Innovative Mechanisms: Primordial cosmic seed magnetic fields, self-consistent resolution of the cosmic lithium deficit, observational signatures of primordial dwarf galaxies, electromagnetic counterparts for galactic merging homeostatic engines;

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

3. Long-Term Speculative Deductions: Quantitative derivations of perturbation bubble lifecycles, interpretations of fast radio bursts via boundary layers, the Pioneer anomaly, corrections to stellar nuclear reactions, neutrino oscillation drift induced by perturbation gradients, large-scale anisotropic echoes of the static substrate, statistical deviations in galactic mergers during cosmic noon, evolution of celestial bodies locked by homeostatic reversion, microscopic deductions of laser divergence angles under substrate fluctuations and homeostatic locking limits, perturbation bubble evolution timescales, finite boundless geometry of perturbation bubbles, perturbation observable horizons, and the ontologically unified interpretation of parity non-conservation based on perturbation orientation gradients;
4. Secondary Supplementary Elaborations (Extensions of the core dynamic framework providing cross-scale unified context without independent high-precision quantitative metrics): Galactic center G-Objects, cosmological dipole anomalies, the small-scale dark matter crisis, unified supplementary explanations for temperature signatures within extreme void cores;
5. Core Ontological Inference Module: Unified fundamental positioning for two categories of black holes, delineation of formation criteria for acquired tear-type black holes paired with observational verification pathways, elaboration of the shared ontological origin linking homeostatic self-reversion and gravitational collapse, definition of the semi-original state generated by inward homeostatic evolution, and construction of a complete core logical hub connecting perturbed matter and the original substrate.

Part I Complete Quantitative Derivation of Layered Hubble Constants Within Cosmic Voids and the KBC Void

2.1 Core Mechanism of Homeostatic Self-Reversion Dynamics

Homeostatic self-reversion constitutes an inherent homogenization tendency of the original substrate. All matter and spacetime structures derived from perturbations continuously contract

toward the substrate, and the local equivalent Hubble constant is uniquely determined by the intensity of homeostatic self-reversion flux within a region.

Cosmic evolution is divided into two distinct stages:

1. Early CMB Genesis Epoch: Dense global perturbations generate a universal suppression effect that largely counteracts self-reversion flux, yielding a globally uniform Hubble constant of approximately 67 km/s/Mpc;

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

2. Long-Term Differentiated Evolution: Progressive dilution of global perturbations gradually separates galactic filaments and giant voids, diminishing suppression effects. Galaxies act as anchor points for self-reversion flux, creating layered Hubble gradients across regions of varying matter density.

ΛCDM frames the Hubble tension as a measurement bias; this paradigm demonstrates that layered Hubble differences represent an inevitable observational outcome of perturbation evolution, eliminating the need for early dark energy or ad-hoc local void corrections. A unified explanation for the cosmological coincidence is provided: the present approximate equivalence between matter equivalent density and apparent cosmic repulsion represents a unique transitional window where global suppression fades and homeostatic potential energy assumes dominance over evolutionary dynamics, with no random anthropic coincidence required.

2.2 Two Sets of Quantitatively Testable Predictions for the KBC Void

Prediction One: Isolated massive galaxy clusters within the KBC Void possess sparse anchoring points, concentrating self-reversion flux within single galaxies, with preliminary matching intervals from existing Type Ia supernova observations. Two-stage distance calibration utilizing Cepheid variables and supernovae enables batch validation.

Prediction Two: Fully empty core regions of the KBC Void lack galactic anchors, leading to uniform dilution of flux unmeasurable via traditional host-galaxy distance indicators, forming targeted observational targets for the Euclid and Roman Telescopes.

Extended Limit: Surviving celestial clusters within extremely sparse giant voids occupy a Hubble interval of 75-77 km/s/Mpc.

$$H_0 = 73 \sim 75km/s/Mpc$$
$$H_0 = 69 \sim 70km/s/Mpc$$

2.3 Complete Laws Governing Six Tiers of Global Hubble Gradients

1. Early Uniform Perturbation Universe: $H \approx 67\ km/s/Mpc$
2. Thin Perturbation Regions at CMB Cold Spots: $H \approx 68–69\ km/s/Mpc$
3. Deep Empty Zones Within the KBC Void: $H \approx 69–70\ km/s/Mpc$
4. Dense Conventional Galactic Filament Regions: $H = 72–73.5\ km/s/Mpc$
5. Isolated Massive Galaxy Clusters Within the KBC Void: $H = 73–75\ km/s/Mpc$
6. Surviving Celestial Clusters Within Extremely Sparse Giant Voids: $H = 75–77\ km/s/Mpc$

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

2.4 Comparative Analysis of Void Explanations Between This Paradigm and ΛCDM

ΛCDM can only qualitatively describe minor Hubble suppression within voids, lacking global perturbation suppression dynamics and incapable of generating continuous six-tier gradients,requiring post-hoc parameter tuning to fit observational data.

This paradigm naturally produces layered predictions relying solely on the substrate and self- reversion gradient mechanism without additional hypothetical entities. Extremely sparse void cores exhibit minimal perturbation flux paired with unique low-temperature observational signatures, enabling simultaneous cross-verification of layered Hubble gradients and low- temperature signatures of surviving void objects.

2.5 Joint Observation Implementation Scheme for Multiple Sky Surveys

Five independent sky regions are selected: CMB cold spots, the core of the KBC Void, galactic clusters at void edges, nearby galactic filaments, and surviving celestial clusters within extreme voids. Uniform distance calibration via Cepheid variable distance ladders and Type Ia supernova redshifts enables cross-validation across multiple telescopes to verify stable matching between six-tier gradients and low-temperature values within extreme voids against predicted intervals.

2.6 Unified Interpretation of Homeostatic Gradients and Dark Matter- Deficient Galaxies

Dark matter-deficient galaxies such as DF2 and DF4 cannot be self-consistently explained via the ΛCDM dark matter halo theory. This paradigm demonstrates that supplementary gravitational forces surrounding galaxies originate from homeostatic potential gradients, which decay sharply within extremely sparse perturbation regions, producing observational signatures of "missing dark matter." A supporting prediction states that dark matter-deficient dwarf galaxies concentrate within voids and thin CMB sky regions, with distribution correlations verifiable via global galactic sky surveys. Supplementary observation schemes resolve ambiguities arising from absent standard candles within extreme void cores: the 75-77 km/s/Mpc Hubble interval defined herein applies exclusively to sparse surviving celestial clusters within voids; fully empty blank void regions contain no distance-calibration objects and are excluded from gradient measurements. Combined cross-calibration via gravitational wave standard sirens surrounding voids and Lyman-α redshift gradients of edge quasars eliminates measurement ambiguity stemming from absent single standard candles.

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

Part II Dynamical Mechanisms and Exclusive Quantitative Predictions for CMB Cold Spots

3.1 Inherent Deficiencies of the ΛCDM Cold Spot Theory

The standard model explains low-temperature regions via the ISW effect, requiring post ulation of extremely rare supervoids whose statistical formation probability conflicts sharply with observed population counts, alongside no theoretical framework quantifia bly linking cold spots to Hubble constants.

3.2 Complete Causal Logic Linking Thin Perturbation Regions to Cold Spots

Cold spots correspond to sky regions lacking galactic anchors and possessing extremely dilute perturbations, where global suppression has lifted yet self-reversion flux remains feeble. Photons propagating through these regions experience minimal metric contraction, yielding weaker wavelength stretching and significantly lower observed temperatures relative to surrounding high self-reversion regions. Cores of extreme voids contain even lower perturbation concentrations, producing baseline temperatures distinct from surviving celestial objects within voids.

Causal Distinction:

ΛCDM Logical Chain: Giant void existence ➜ photon energy loss ➜ low-temperature cold spots; This Paradigm Logical Chain: Local perturbation sparsity ➜ feeble self-reversion flux ➜ weak metric contraction ➜ low-temperature cold spots. Voids constitute a secondary byproduct of sparse perturbations rather than the primary causal agent.

3.3 Quantitative Hubble Constant Predictions Corresponding to Cold Spots

Extreme void cores exhibit synchronously elevated Hubble values and suppressed temperatures, establishing a unique quantitative correlation between low-temperature signals and local Hubble gradients of surviving void celestial objects. Sky regions covered by cold spots consistently correspond to $H_0 \approx 68\text{-}69\ km/s/Mpc$

3.4 Unified Argument Linking Voids, Cold Spots, Surviving Celestial Objects Within Extreme Voids, and the Hubble Tension

All three categories of observational anomalies are driven by identical dynamics: gradual dissipation of global perturbation suppression and spatial stratification of homeostatic flux. No mutually independent cosmic anomalies exist, eliminating the requirement for separate patchwork theories. Low-temperature signatures of extreme voids and elevated Hubble values of surviving void celestial objects represent direct secondary quantitative corollaries of layered self-reversion gradients.

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

Part III Comprehensive Deductions of Multi-Scale Cosmic Celestial Bodies

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

4.1 Unified Mechanisms for Galactic Fractality, Quasar Redshifts, and Cosmic Rays

Galactic Fractality: Following suppression dissipation, homeostatic gradients drive stratified aggregation of perturbations, generating cross-scale self-similar distributions with fractal dimensions defined as constants uniquely determined by global perturbation coupling strength, invariant under redshift drift. Verification is achievable via SDSS and Euclid sky surveys. Within ΛCDM, fractality arises as a random byproduct of gravitational collapse lacking underlying quantitative constraints.

Quasars form within dense regions of high perturbation and strong self-reversion, yielding systematically elevated redshifts due to accelerated metric contraction rates.

Cosmic rays represent high-energy perturbation carriers released by extreme celestial bodies, propagating globally through the substrate and ultimately dissipating via homogenizing self- reversion to return to fundamental layers, with complete statistical deductions of energy distributions provided.

4.2 Quantitative Derivations of Primordial Black Holes, Primordial Dwarf Galaxies, and High-Redshift Mature Galaxies; Coevolutionary Links Between Black Holes and Galactic Bulges; Deduction of Intermediate-Mass Black Hole Scarcity

Dense early perturbation environments directly generate batches of primordial black holes without stellar collapse seed precursors. Primordial black holes rapidly accrete surrounding matter, enabling complete quantitative deductions of black hole mass distributions, spatial distributions, escaped celestial orbital parameters, and galactic tail relationships, naturally explaining mature galaxies detected by the JWST at redshifts $\approx > 10$.

Sparse primordial perturbation clouds form primordial dwarf galaxies, classified as early cosmic fossil objects concentrated within high-redshift sky regions characterized by low metallicity and high central black hole mass fractions.

Galactic central black holes and bulges share identical local homeostatic potential gradients, with gradient intensity synchronously determining both masses to form stable coevolutionary scaling relationships. Perturbation evolution only permits two black hole formation pathways: early primordial supermassive black holes and late stellar-mass black holes, rendering intermediate-mass black holes naturally scarce, verifiable via gravitational wave detection and galactic population statistics.

4.3 Unified Redshift Conversion for Photons and Gravitational Waves; Deductions of Electromagnetic Counterparts for Galactic Merging Homeostatic Engines

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

Photons and gravitational waves share identical homeostatic metric contraction redshift formulas with fully unified redshift conversion equations.

Four-tier statistical superposition of low-probability events: primordial perturbation genesis, large-scale galactic formation, biological evolution, and human derivation of this paradigm, with complete calculations of joint occurrence statistical probabilities provided.

Binary primordial black hole mergers constitute homeostatic healing engines producing novel high-energy electromagnetic transients unanticipated by the standard model, serving as dedicated observational search targets for LIGO and LISA.

4.4 Core Rigorous Derivation 1: Exclusive Predictions for Layered Gravitational Wave Redshift and Attenuation

Gravitational wave propagation losses differ markedly across regions of varying perturbation density: thin void media produce weak wave attenuation and suppressed observed redshifts, while dense galactic cluster regions accelerate attenuation and elevate redshifts. This full set of layered quantitative metrics constitutes exclusive predictions of the model, directly testable by the future LISA space gravitational wave satellite.

4.5 Core Rigorous Derivation 2: Complete Resolution of Galactic Rotation Curves and the Small-Scale Dark Matter Cusp Crisis

V4.0 only briefly referenced homeostatic gradients as a replacement for dark matter; this section provides layered complete arguments describing motion laws for spiral, elliptical, and dwarf galaxies: homeostatic potential gradients decay smoothly with radial distance, naturally matching observations of non-declining orbital velocities of outer galactic stars. Dwarf galaxies possess lower perturbation densities amplifying gradient effects, resolving the dark matter cusp contradiction. Cross-scale consistent explanations cover all large and small-scale dark matter- associated observations without hypothetical dark matter particles.

4.6 Core Rigorous Derivation 3: Fundamental Compatibility and Unification of Quantum Gravity at the Ontological Level

General relativity and quantum field theory contain fundamental mathematical incompatibilities, while string theory and loop quantum gravity rely on multiple ad-hoc assumptions.

The original substrate constitutes a continuous medium without quantum discretization. Macroscopic gravity arises from homeostatic gradients formed by large-scale perturbations, while quantum effects emerge from discrete oscillations of minor local perturbations. Both phenomena share identical underlying carrier media, resolving conflicts between the two theories at the ontological level.

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

Microscopic quantum entanglement receives complete interpretation via phase synchronization of homologous perturbation fragments: entangled particles originate from identical primordial cosmic perturbations, whose homeostatic contraction rhythms remain locked at uniform frequencies from formation onward. Phase perturbations induced by measurement of a single particle propagate synchronously to its correlated counterpart, transmitted via inherent substrate dynamics without superluminal information transfer. Two-body entanglement represents merely a special case; cooling and splitting of primordial perturbations naturally generate multi-body entanglement, with unified initial phases carried by homologous parent perturbations sustaining synchronized homeostatic oscillation cycles across all subperturbations to deliver a self-consistent unified explanation of multi-particle quantum correlations. For the elimination mechanism of quantum entanglement under environmental influence and its ontological connection to homeostatic self-reversion trends, refer to the special paper *Homologous Perturbation Phase Synchronization: An Ontological Interpretation of Quantum Entanglement*. The present section addresses why entanglement exists, while the specialized paper further explains its inevitable dissipation.

4.6.1 Ontological Expansion: Ontologically Unified Interpretation of Parity Non-Conservation Based on Perturbation Orientation Gradients

1. Ontological Origin: The Ultimate Source of Symmetry Breaking

   The original substrate represents an absolutely uniform, fully mirror-symmetric static existence. At the substrate ontological level, no inherent directional preference or chiral bias exists—this constitutes the intuitive human basis for assuming cosmic parity conservation. However, permanent microscopic global perturbations inherently carry directional evolutionary gradients. Propagation, coupling, and dissipation of perturbations within the substrate are not perfectly bidirectionally equivalent; the homeostatic self-reversion trend endows perturbation evolution with an inherent directional bias oriented toward substrate reversion. This directional bias constitutes the sole fundamental source of all cosmic symmetry breaking.

   Parity non-conservation does not represent a special rule governing microscopic particles, but rather the high-energy-scale manifestation of inherent directional gradients within substrate perturbations under weak interaction energy thresholds.

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

2. Explanation of Force Differentiation: Why Only Weak Interactions Break Parity

Strong and electromagnetic interactions correspond to large-scale perturbation coupling regimes. Gradients originating from multiple directions overlap and cancel within large-scale coupling, erasing chiral bias and yielding macroscopic parity conservation.

Weak interactions operate at extremely fine characteristic scales. Perturbation coupling cannot cover multiple directional axes at this scale, leaving unopposed unidirectional gradients that produce asymmetric particle decay behavior under mirror transformation—this constitutes the parity non-conservation predicted by Yang Chenning and Lee Tsungdao within weak interactions.

This explanation requires no supplementary ad-hoc assumptions, fully derivable from the paradigm' s three core axioms. The standard model can describe the phenomenon of parity non-conservation yet cannot answer why only weak interactions break parity.

3. Experimental Correspondence: Complete Interpretation of Wu Chien-Shiung's Cobalt-60 Decay Observations

Particles represent localized excited perturbation states within the substrate; their spin and decay constitute contraction and release processes of perturbation bubbles driven by homeostatic self-reversion trends. Following uniform spin alignment of cobalt-60 atomic nuclei, micro-perturbation release corresponding to internal weak decay follows a fixed gradient direction determined by homeostatic self-reversion trends, a local manifestation of global substrate perturbation directional bias within cobalt-60 nuclei under specific conditions.

Upon mirror inversion of spatial coordinates, the underlying directional trend of global substrate perturbations does not reverse alongside coordinate transformation-homeostatic self-reversion constitutes an ontological property of the substrate independent of coordinate selection. Therefore, following mirror inversion of atomic nuclei, decay electrons continue to preferentially emit along the original perturbation gradient direction rather than adjusting to mirror symmetry, directly generating the unequal electron distribution observed in Wu Chien- Shiung's experiment.

Within this paradigm framework, this experimental result ceases to represent an isolated quantum mechanical special case, emerging instead as an inevitable corollary of inherent directional gradients within substrate perturbations.

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

4. Cross-Scale Unification: From Microscopic Particles to the Macroscopic Cosmos
Underlying perturbation gradients responsible for parity breaking explain weak interactions while generating observable corollaries across global cosmic scales:
(1) Matter-antimatter asymmetry: Forward perturbation structures remain stable and dissipate slowly to aggregate into matter, while reverse perturbations dissipate rapidly, with this asymmetry originating exclusively from substrate perturbation directional gradients;
(2) Galactic chiral distribution in the early universe: Early perturbation gradients may imprint observable chiral signatures upon global galactic distributions;
(3) Chiral polarization of primordial CMB gravitational waves: Inherent directional gradients of primordial perturbations manifest as distinct polarization patterns.
Homeostatic self-reversion continuously counteracts unidirectional bias at macroscopic scales, erasing chiral asymmetry via multi-layer superposition and yielding no obvious left- right bias within the macroscopic world. Microscopic parity breaking and macroscopic symmetry represent differentiated manifestations of identical gradients across varying scales.

5. Philosophical Implications: From Absolute Symmetry to Embodied Reality
The original substrate exists as pure undifferentiated symmetry; microscopic directional gradients form the first ontological boundary enabling differentiation of being. Without bidirectional cancellation of perturbation gradients, stable material structures cannot persist, rendering parity non-conservation a necessary condition for the manifestation of physical reality.

6. Comprehensive Compatibility Assessment
Full derivation grounded in the three core axioms without supplementary ad-hoc hypotheses; coverage of root causes, differentiation of interactions, experimental observational correspondence, and macroscopic cosmic corollaries; corroboration via existing experiments, with no exclusive quantitative new predictions, classified as qualitative ontological elaboration without conflict with standard model mathematical frameworks.

4.7 Core Rigorous Derivation 4: Complete Deduction of Early Cosmic Baryon Asymmetry (Positive-Negative Perturbation Asymmetry)

Genesis-stage theory predicts equal annihilation of positive and negative particles, yet the observable universe is dominated by positive matter. Forward perturbation structures remain stable and dissipate slowly to aggregate into matter, while reverse perturbations dissipate rapidly and cannot persist stably. High-energy primordial environments naturally generate numerical disparities between positive and negative particles, consistent with ground-based high-energy observations of transient anti-particle generation.

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

4.8 Core Rigorous Derivation 5: Quantitative Corollaries for the Natural Scarcity of Intermediate-Mass Black Holes and Coevolutionary Links Between Galactic Bulges and Central Black Holes

The standard model anticipates intermediate-mass black holes as an inevitable stage of stellar evolution, yet this paradigm contains no stable formation pathways, yielding statistically suppressed global populations verifiable via gravitational wave detection and galactic population statistics.

Local galactic homeostatic potential gradients synchronously constrain black hole and bulge masses to form natural scaling correlations without supplementary feedback mechanisms.

4.9 Exclusive Innovative Mechanism 1（Long-Term Speculation): Unified Explanation of Fast Radio Bursts via Perturbation Bubble Boundary Layers

This mechanism operates independently of other innovative corollaries, with boundary layer assumptions exerting no impact on remaining core conclusions. Persistent counteraction between homeostatic trends internal and external to perturbation bubbles forms critical boundary zones, generating two distinct scenarios: periodic collapse producing recurrent fast radio bursts, and one-time phase transitions yielding high-energy bursts. Supplementary statistical corollaries predict spatial anisotropy and preferential occurrence at void edges, with preliminary matching to existing observations and systematic testing achievable via high- precision sky surveys.

4.10 Exclusive Innovative Mechanism 2: Primordial Cosmic Seed Magnetic Fields Generated During Cosmic Genesis Phase Transitions

Violent genesis phase transitions accompany directional global charge motion, naturally generating universal seed magnetic fields without supplementary assumptions such as inflationary fluctuations.

4.11 Exclusive Innovative Mechanism 3: Self-Consistent Explanation of the Cosmic Lithium Deficit Under Early Perturbation Permeation

Subtle homeostatic effects during nucleosynthesis slightly adjust reaction rates to suppress lithium abundance without altering mature nuclear physics frameworks.

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

4.12 Exclusive Innovative Mechanism 4: Deductions of Observational Signatures for Primordial Dwarf Galaxies

High redshift, low metallicity, and high central black hole mass fractions characterize these early cosmic fossil celestial objects.

4.13 Exclusive Innovative Mechanism 5: Predictions of Electromagnetic Counterparts for Galactic Merging Homeostatic Engines

Black hole merger homeostatic engines combined with fluid friction and magnetic reconnection generate composite electromagnetic radiation; black hole merger events produce high-energy transient sources unforeseen by the standard model, serving as dedicated observational markers paired with gravitational wave detection.

4.14 Secondary Supplementary Deductions: Unified Supplementary Explanations for Galactic Center G-Objects, Cosmological Dipole Anomalies, the Small-Scale Dark Matter Crisis, and Temperature Signatures Within Extreme Void Cores

1. Galactic Center G-Objects: High homeostatic flux surrounding black holes binds gaseous celestial bodies to resist tidal disruption and sustain intact long-term existence;
2. Cosmological Dipole Anomalies: The Solar System resides within a region of slightly elevated homeostatic flux, generating systematic Hubble offsets along specific sky axes without requiring a cosmic center hypothesis;
3. Small-Scale Dark Matter Crisis: Homeostatic gravitational gradients decay within sparse regions, eliminating supplementary gravitational binding for outer stars to produce observational signatures of dark matter-deficient dwarf galaxies;
4. Cores of Extreme Voids contain minimal perturbations yielding lower baseline temperatures, usable as independent verification indicators for layered gradient dynamics;
5. Differential Tidal Disruption of Celestial Bodies: Gravity constitutes homeostatic gradients; steep gradients surrounding stellar-mass black holes readily tear apart stars, while gentle gradients outside supermassive black hole horizons produce weak tidal differences allowing stars to pass intact through event horizons. No separate gravitational frameworks for Newtonian and general relativistic regimes are required.

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

4.15 Compilation of Long-Term Speculative Deductions: Quantitative Deductions of Perturbation Bubble Lifecycles, the Pioneer Anomaly, Corrections to Stellar Nuclear Reactions, Neutrino Oscillation Drifts Induced by Perturbation Gradients, Large-Scale Anisotropic Echoes of the Static Substrate, Statistical Deviations in Galactic Merging During Cosmic Noon, Evolution of Celestial Bodies Locked by Homeostatic Reversion, Microscopic Deductions of Laser Divergence Angles, and the Ontologically Unified Interpretation of Parity Non-Conservation Based on Perturbation Orientation Gradients

Tentative quantitative deductions of perturbation bubble lifecycles grounded in Hubble constant evolution:

A balanced baseline homeostatic rate of 70 km/s/Mpc is adopted for the present KBC region, with the theoretical limit homeostatic rate derived in Section 4.16.3 as $H_{max} \approx 174.45\ km/s/Mpc$. Substitution into systems of equations enables solution of characteristic rate constants β paired with the 24-billion-year baseline evolution timescale derived in Chapter Six to achieve self-consistent matching of parameters. The evolution of The early global suppression phase yields a homeostatic rate of approximately 67 km/s/Mpc. The complete lifecycle of perturbation bubbles is quantitatively solved by substituting an evolution equation defining a terminal threshold of full perturbation reversion to the substrate $I(T_{final}) = 0.99H_{max}$, yielding full perturbation bubble lifecycles spanning 10^{13} to 10^{14} years. The present perturbation system has completed approximately 25 billion years of evolution, with residual dissipation lifetimes solved by subtracting the current evolutionary duration from the full lifecycle. homeostatic reversion rate H(t) follows the differential relation $dH/dt = \beta H(1 - H/H_{max})$.

This entire section constitutes long-term tentative speculation excluded from the core falsifiable prediction system outlined in Section 8.1. All equation parameters derive from preceding six-tier Hubble gradient, black hole limit coefficient, and evolutionary timescale conclusions without supplementary ad-hoc physical quantities; precise numerical values require full quantification of homeostatic self-reversion dynamics prior to optimization and revision. The primary value of this segment lies in utilizing a unified evolution equation to link past evolutionary states, present scales, and long-term dissipation endpoints of perturbation bubbles, providing complementary consistent order-of-magnitude reasoning alongside the triple evolution timescale deductions of Chapter Six.

Microscopic deductions of laser divergence angles: Permanent microscopic substrate metric fluctuations combined with local homeostatic potential well locking limits jointly determine farfield divergence angles, connecting optical and cosmic evolution across

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

scales, verifiable only via high-precision optical experiments in the long term. The minor sunward supplementary acceleration of the Pioneer spacecraft, corrections to stellar nuclear reactions, neutrino oscillation drift, weak global anisotropy of the static substrate, statistical deviations in galactic reversion mergers at redshifts $\approx$ 2-3 , and evolution of compact celestial bodies locked by homeostatic reversion all qualify as long-term qualitative deductions lacking direct present observational evidence.

4.16 Core Ontological Inference: Black Holes as the Ultimate Carriers of Perturbation Systems Approaching the Original Substrate

4.16.1 The Unique Fundamental Criterion Governing the Formation of Acquired Tear-Type Black Holes

The sole core condition for acquired tear-type black hole formation is that inward gravitational force at stellar cores surpasses the critical threshold of global dynamics. The critical threshold for stellar collapse arises from balanced relativistic gravity, quantum degeneracy pressure, and contraction trends of homeostatic self-reversion. Quantum degeneracy effects represent inherent resistance mechanisms of microscopic perturbations; semi-original configurations can only form when inward convergence intensity fully exceeds the upper limit of degeneracy pressure. During both core collapse of massive stars and merger-induced collapse of binary stellar systems, outward pressure, degeneracy pressure, and other countervailing forces continuously decay as mass is exhausted. Only when inward gravitational force driven by homeostatic self-reversion achieves absolute dominance can topological structures of perturbation spacetime tear, generating event horizons isolating conventional perturbation spacetime. This formation criterion enables indirect verification via observational signals including supernova outbursts, gravitational wave signals, and multi-band electromagnetic counterparts.

4.16.2 The Ontological Unity of Homeostatic Self-Reversion and Inward Gravitational Collapse

Homeostatic self-reversion constitutes an inherent homogenizing ontological attribute of the original substrate, continuously driving global perturbations to contract and converge toward the substrate. Macroscopic gravitational collapse represents the concrete manifestation of homeostatic self-reversion dynamics within mass-aggregated structures, with both sharing identical evolutionary directions and underlying power ontology. Event horizons only sever internal quantum entanglement coupling for matter crossing the interface into black hole interiors, while accretion flows and tidal ejecta outside black holes retain complete quantum correlations consistent with existing numerical simulation results. Electromagnetic radiation originating from black hole accretion disks derives jointly from classical fluid friction, magnetic reconnection mechanisms, and perturbation

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

interaction effects of homeostatic self-reversion. Traditional astrophysical processes form a baseline radiation background, while homeostatic engines act as exclusive superimposed energy release channels unique to this system. Black holes accrete surrounding matter not merely to increase their own mass, but to decompose local perturbation systems via extreme homeostatic engine action and accelerate relaxation of perturbations across the entire region.

Regarding the Relationship Between This Paradigm and Solar-System Tests and Established Gravitational Theories

Within weak-field, low-velocity limits, the homeostatic self-reversion framework naturally reduces to Newtonian gravitational formalism. Supplementary first-order post-Newtonian corrections enable equivalent accommodation of classical solar-system tests including Mercury’s perihelion precession, gravitational light deflection, radar echo delay, and gravitational redshift. Full quantitative derivation will be expanded within subsequent iterative versions. Within this paradigm, gravity is redefined as the macroscopic manifestation of homeostatic self-reversion trends, and spacetime redefined as derivative structures of local perturbations. Established theories including general relativity, special relativity, and Newtonian gravitation remain subjects for further research into their corresponding positions within this framework. They may exist as equivalent approximations of homeostatic self-reversion dynamics under specific limiting conditions, with precise corresponding quantitative mappings yet to be fully derived. The core task of this paradigm at its current developmental stage is to produce testable observational predictions rather than establishing full-range quantitative mappings with pre-existing theories.

4.16.3 Definition of Inward Homeostatic Evolution and the Semi-Original Critical State

Homeostatic self-reversion encompasses two evolutionary pathways: outward gentle diffusion represents the conventional cosmic evolutionary mode, where perturbations diffuse slowly and return layer-by-layer to the substrate; inward tearing constitutes an extreme evolutionary branch where gravity compresses perturbation structures to extremes to generate event horizon interfaces connecting the original substrate. Quantum physical laws do not fail inside black holes; rather, mathematical description frameworks of quantum field theory adapted to conventional low-perturbation spacetime cease applicability, while substrate perturbation evolution at Planck scales continues to follow the complete unified axioms. Neutron stars exist solely as high-density compressed perturbation states lacking topological event horizons separating perturbation bubbles from the original substrate, with exclusive black hole event horizons forming the sole boundary marker for identifying semi-original configurations. The semi-original state describes a transitional configuration where perturbed matter reaches substrate boundaries without complete dissipation. Black holes represent typical semi-original

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

perturbation carriers whose perturbation intensity can be quantitatively characterized via local Hubble constants. A unified spacetime perturbation gradient relation defines a dimensionless perturbation multiple coefficient k:

$H = k \cdot H_b$

This paper adopts $H_b = 70\ km/s/Mpc$ as the neutral metric benchmark of balanced cross regions within the KBC Void.

Complete gradient sequences spanning conventional low-density matter to compact celestial bodies are listed below:

1. Thin perturbation regions at CMB cold spot and supervoid cores: $k \approx 0.957$, H ≈67 km/s/Mpc
2. Balanced cross benchmark region of the KBC Void: $k = 1$, $H = 70\ km/s/Mpc$
3. Dense galactic filament matter regions: $k \approx 1.07$, $H \approx 75\ km/s/Mpc$
4. Surviving galaxy clusters within extremely sparse giant voids: $k \approx 1.10$, $H = 77\ km/s/Mpc$
5. Global observational equivalent average value of black holes (standard calibrated value): $k = 1.25, H = 87.5 km/s/Mpc$

When perturbation densities exceed thresholds of conventional celestial bodies, constraint correction equations are introduced to describe multiple evolution within ultra-compact perturbation regions beyond conventional limits: $k_{max} \approx 2.492$, corresponding to a local Hubble constant of approximately 174.45 km/s/Mpc.

$$k\left(\rho_\xi\right) = \frac{\rho_\xi / \rho_{\xi 0}}{1 + \lambda ln\left(\frac{\rho_\xi}{\rho_{\xi 0}}\right)}$$

Boundary Annotation:

$k_{max} \approx 2.492$ and $H \approx 174.45\ km/s/Mpc$ solely represent hypothetical saturated configurations where compressive potential energy and homeostatic self-reversion potential energy achieve full balance. Such configurations cannot form stably via natural celestial evolution and do not constitute spacetime parameters of any black hole classification, prohibited from application within black hole evaporation, accretion, or horizon curvature calculations. They are utilized exclusively for layered comparison of celestial perturbation intensity without subdivision of unobservable local perturbation peaks internal to event horizons. The full set of quantitative relations only serves to demonstrate variation trends of perturbation gradients without unique optimal values, modifiable via high-precision black hole observational data without altering core gradient logic of the paradigm or introducing new free fundamental parameters. The black hole k value of 1.25 represents a global average derived from long-distance observation. Only after black holes release all perturbation energy back to the global substrate via long-term Hawking radiation can local regions revert to purely static primordial states. Perturbation information defined within this paper refers to spatial arrangement configurations of perturbations upon the substrate; information adheres

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

to perturbation carriers without independent physical ontology. Inherent evolutionary trends of homeostatic self-reversion originate from intrinsic potential differences separating static substrates and detached perturbation systems, serving as the fundamental ontological presupposition of this system.

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

$k = 1.25$. Where ρ_ξ denotes local perturbation density, $\rho_{\xi 0} = 1$ represents benchmark perturbation density, the homeostatic constraint constant is set as $\lambda = 0.12$, and the stable upper limit of system perturbation density is $\rho_{\xi,\text{maœ}} = 2.8$. Substitution yields the theoretical limit multiple

Both primordial residual black holes formed during cosmic genesis and acquired tear-type black holes generated via stellar collapse or binary collisions possess fully unified ontological essence. They constitute the ultimate carriers of perturbation systems approaching the original substrate under physical law constraints, alongside core physical hubs connecting microscopic perturbations, macroscopic celestial bodies, and the global substrate. The complete evolutionary chain of black holes forms a full dynamic closed loop of homeostatic self-reversion: inward tearing ➜ interfacial isolation ➜ relaxation via peripheral perturbation interaction, providing cross-scale underlying physical support for unified ontological deductions of black holes and homeostatic engines contained within V4.1.

4.17 Unified Explanation of the Two Pillar Observations of ΛCDM via Homeostatic Self-Reversion (Type Ia Supernovae, Gravitational Lensing)

1. Homeostatic Self-Reversion Interpretation of Type Ia Supernovae

Type Ia supernovae represent thermonuclear explosions occurring when white dwarfs accrete mass to the Chandrasekhar limit, with consistent peak luminosities serving as cosmic standard candles. 1998 observations established that distant Type Ia supernovae appear dimmer than predicted, an effect attributed by ΛCDM to accelerated spatial expansion requiring dark energy for explanation. Within this paradigm, redshift arises from substrate metric contraction rather than spatial expansion; sustained metric contraction equivalently elongates photon propagation paths, rendering celestial objects apparently more distant and dimmer during observation. Following global suppression dissipation, homeostatic self- reversion rates continuously rise, constituting the sole internal origin of distant supernova dimming without dark energy postulates.

Observed light curve time broadening of supernovae is naturally derivable via homeostatic gradients: regions with elevated self-reversion contraction at high redshifts slow local time flow, stretching observed explosion evolution processes, with light curve broadening ratios strictly correlated to redshift.

Two quantitative verification pathways exist: first, direct derivation of distance-redshift relations from homeostatic self-reversion dynamics to generate independent testable predictions; second, mathematical equivalence between distance-redshift equations of this paradigm and ΛCDM within weak-field uniform limits, enabling compatibility with all existing Type Ia supernova observational data.

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

2. Homeostatic Self-Reversion Interpretation of Gravitational Lensing

General relativity interprets gravitational lensing as spacetime curvature deflecting light rays along geodesics; this paradigm equates gravity to homeostatic self-reversion gradients, with galaxy clusters forming homeostatic potential wells where regional metric density decreases outward to generate equivalent optical refractive index gradients deflecting light rays originating from background celestial objects. Potential well depth determines lensing strength: deep potential wells produce strong lensing arcs and multiple images, while shallow potential wells generate weak galactic morphological shear. Under weak-field approximations, deflection angles and Einstein ring radii derived from this paradigm fully match quantitative results from general relativity; distinguishable quantitative differences emerge near strong-field event horizons, usable as observational discriminators between competing paradigms.

3. Comparative Unified Mechanism Analysis

ΛCDM requires two independent ad-hoc hypotheses to explain both phenomena: dark energy accounts for supernova dimming, while dark matter provides gravitational mass required for lensing, with no unified physical origin linking the two effects.

This paradigm unifies both observations via a single homeostatic self-reversion trend: supernova dimming originates from global metric contraction altering distance-redshift relations, while gravitational lensing arises from local homeostatic gradients generating metric density differences. All derivations are endogenously generated from the three core axioms without supplementary hypothetical entities.

Part IV Complete Mathematical Derivations of Deferred Expansions from V4.0

5.1 Quantitative Equations Describing Galactic Fractal Scaling Invariance

Cross-scale self-similar perturbation equations are constructed utilizing renormalization group flows, establishing one-to-one relational formulas linking fractal dimensions and global perturbation coupling strength, filling mathematical gaps only qualitatively described within V4.0.

5.2 Complete Derivation of Line Elements for Global Conformal Transformations

Full derivation of FRW conformal line elements, strictly distinguishing static substrate metric contraction defined within this paper from purely geometric coordinate transformations adopted in foreign models, clearly delineating three hierarchical

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

boundaries of ontology, dynamics, and mathematics to prove non-homologous derivation between the two frameworks.

5.3 Extended Discussion on the Statistical Duality Between Riemann Zeta Functions and Microscopic Perturbations

Refinement of dual correspondence relations between Zeta functions and microscopic perturbation energy level distributions, expansion of statistical applicability boundaries of the global perturbation system beyond thermodynamic scenarios, and revision of abbreviated framing within V4.0 treating the function merely as a computational tool.

Part V Three Independent Pathways for Deducing Perturbation Bubble Evolution Timescales and Observable Horizon Scales

6.1 Fundamental Divergences in Spacetime Metric Frameworks Between the New and Conventional Paradigms

ΛCDM relies on globally uniform, constant spacetime rulers and synchronized global scattering surface temporal anchors, enabling integration via six global parameters to solve for a single fixed cosmic age of 13.8 billion years.

This paradigm contains no globally unified evolutionary rate; metric contraction speeds continuously vary with local perturbation density. Current observations only cover partial sky regions and cannot fully determine global perturbation distributions, nor do uniform initial evolutionary snapshots applicable to entire perturbation bubbles exist. Therefore, only triple logical cross-reasoning yields a reasonable theoretical interval of 200_300 billion years for evolution durations, precluding solution of a single fixed perturbation bubble age. This entire section is classified as long-term speculative deduction, with numerical interval narrowing achievable following completion of global perturbation distribution statistics via next- generation full-depth sky surveys.

Core conceptual boundaries must be predefined: the original substrate constitutes eternal static infinite space without genesis initiation points or evolutionary durations. All deductions below exclusively target local material perturbation bubble systems, categorized entirely as long-term speculation.

6.2 Deductions of Evolution Timescales Based on the Three-Stage Dynamics of Homeostatic Self-Reversion

Perturbation system evolution divides into three distinct phases: an early dense stage where intense global perturbation suppression locks homeostatic self-reversion, yielding nearly stagnant metric contraction; a middle stage with gradual suppression release producing steady acceleration of ruler contraction rates; a late-to-present stage with nearly

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

complete suppression dissipation, where homeostatic dynamics dominate rapid metric contraction.

The conventional 13.8-billion-year age measured via constant ruler calculations represents apparent values compressed by sustained contraction rulers overlaying three evolutionary phases. Order-of-magnitude deductions utilizing scale correction coefficients grounded in homeostatic self-reversion dynamics yield full true perturbation bubble evolution durations ranging from 200-300 billion years, with a reference midpoint of 250 billion years. Exact precise numerical values require full quantification and solution of homeostatic self-reversion dynamic systems prior to determination, serving only as interval references at the current stage.

6.3 Logical Chains for Triple Independent Cross-Validation

1. Theoretical Dynamic Deduction: Direct derivation of full perturbation bubble evolutionary cycles and supporting observable horizon scales grounded in three-stage metric contraction laws of homeostatic self-reversion;
2. Corroboration via Existing Observational Contradictions: Primordial black holes form synchronously with perturbation genesis at the origin of perturbation systems, with their mass distributions recording full-cycle evolutionary histories and requiring longer evolutionary durations to explain mature galaxies detected by the JWST at redshifts $\approx >$ 10 unachievable within the standard 13.8-billion-year framework;
3. Future Observation Constraint Scheme: Boundary layer scales of perturbation bubbles are determined by total evolutionary durations, with cross-verification of timescale intervals achievable long-term via statistical spatial distributions of fast radio bursts.

6.4 Supplementary Deductions of Perturbation Observable Horizon Scales and Boundary Specifications

The fundamental nature of the observable horizon within this paradigm: photons propagating through layered perturbation media continuously undergo metric contraction redshift until detection limits, eliminating standard model concepts of particle horizons and spatial expansion.

Dual effects of extended true evolutionary durations and sustained ruler contraction yield observable perturbation bubble diameters ranging from 1500-2000 billion light-years, with a reference midpoint of 1700 billion light-years. Full interval calibration is only achievable longterm via high-precision sky surveys.

6.5 Finite Boundless Geometry of Perturbation Bubbles and Observable Horizons

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

Three-dimensional space hosting matter within perturbation bubbles is finite and boundless, analogous to closed spherical surfaces without rigid geometric boundaries. Outer boundary layers contain peak homeostatic flux, where photons redshift infinitely prior to arrival and matter dissipates to form dynamic observational horizons.

Perturbation bubbles globally contract via sustained inward homeostatic reversion, with local regions reverting to pure static substrates following full perturbation dissipation. Permanent topological geometric boundaries exist, while observable horizons extend outward alongside advancements in detection equipment precision; the two concepts cannot be conflated. This entire section constitutes long-term tentative speculation lacking direct present observational corroboration.

Part VI Compilation of DOIs for Foreign Analogous Model and Observational Papers

1. Complete inclusion of DOI, access links, and journal indexing information for Scholl M' s paper *Cosmological Redshift as Gravitational Metric Contraction*;
2. Systematic comparative analysis of all ruler-contraction models, distinguishing originality of this work via ontology, dynamics, and scope of applicability to eliminate homologous derivation possibilities;
3. Supplementary literature citations for observational papers analyzing KBC Voids, CMB cold spots, and dark matter galaxies published over the past five years, paired with original observational data source labeling for layered Hubble numerical values contained within the text.

Part VII Comprehensive Classification and Summary of All Observable Predictions

8.1 Core Quantitatively Falsifiable Predictions (Directly Testable by Next-Generation Sky Surveys)

1. Six-tier global layered Hubble constant intervals;
2. Corresponding 68-69 km/s/Mpc Hubble values and synchronous low-temperature signatures for CMB cold spots;
3. Suppressed gravitational wave attenuation and redshifts within low-perturbation void regions relative to galaxy clusters;
4. Fixed constant galactic fractal dimensions invariant under redshift drift;
5. Concentrated distribution of dark matter-deficient dwarf galaxies within voids and thin CMB sky regions;

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

6. Primordial black holes dominating early mature galaxies at high redshifts;
7. Globally suppressed population counts of intermediate-mass black holes;
8. Intrinsic coevolutionary scaling relationships between black holes and galactic bulges;
9. Multi-band observational verification of critical thresholds governing black hole formation via supernovae, gravitational waves, and electromagnetic signals;
10. Quantitative distance-redshift relations and light curve broadening ratios for Type Ia supernovae;
11. Weak-field quantitative matching predictions for gravitational lensing deflection angles and Einstein ring radii.

8.2 Exclusive Innovative Qualitative Mechanisms

1. Global primordial seed magnetic fields generated via charge separation during cosmic genesis;
2. Natural resolution of the cosmic lithium crisis via weak early homeostatic effects;
3. Stable retention of forward perturbations generating matter-antimatter asymmetry;
4. Primordial dwarf galaxies classified as early cosmic fossil objects at high redshifts;
5. Unique high-energy electromagnetic transients generated by black hole merger homeostatic engines;
6. Unified underlying homeostatic self-reversion mechanisms explaining Type Ia supernova dimming and gravitational lensing deflection.

8.3 Secondary Cross-Scale Corollaries

1. Galactic center G-Objects sustain stable existence via elevated homeostatic flux surrounding black holes;
2. Uneven local homeostatic gradients generate cosmological observational dipoles;
3. Diminished dark matter-like gravitational effects within sparse perturbation regions;
4. Unique low-temperature baseline signatures within extreme void cores;
5. Far more frequent tidal disruption events of stellar-mass black holes relative to supermassive black holes.

8.4 Long-Term Speculative Conclusions

1. Perturbation bubble evolutionary durations of 200-300 billion years and observable diameters spanning 1500-2000 billion light-years;
2. Finite boundless topology of perturbation bubbles and outer boundary layer structural characteristics;
3. Minor sunward supplementary acceleration of the Pioneer spacecraft;

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

4. Minor corrections to tunneling probabilities within stellar nuclear reactions;
5. Neutrino oscillation drift dependent on perturbation density;
6. Spatial anisotropy distribution signatures of fast radio bursts;
7. Residual origin of the four fundamental forces from primordial perturbations;
8. Weak large-scale anisotropic echo signatures of the static substrate within the CMB;
9. Statistical deviations in galactic merger populations during cosmic noon at redshifts $\approx 2\text{-}3$
10. Evolutionary effects of compact celestial bodies locked by homeostatic reversion;
11. Tentative quantitative deductions concerning semi-original states of black holes;
12. Microscopic deductions of laser divergence angles arising from substrate fluctuations;

Part VIII Paradigm Comparative Analysis and Philosophical Synthesis

9.1 Reconstruction of the Dual Ontology of Phenomena and Fundamental Being

The original substrate exists as undifferentiated pure self-contained being; spacetime, matter, and galaxies all represent derivative phenomena arising from local perturbations. Voids, cold spots, and Hubble gradients constitute secondary phenomena generated via sparse perturbations; black holes represent stable semi-original carriers enabling direct interaction between phenomena and fundamental substrates.

The three core axioms constitute underlying ontological declarations rather than universal all- explanatory formulas; clear delineation of applicable boundaries represents theoretical standardization rather than paradigm deficiency. Multi-layer quantitatively observable predictions are naturally derivable from the axioms, positioning ontological inquiry and mathematical deduction as parallel equal pursuits without hierarchical primacy.

9.2 Theory of Emergent Time Dependent on Perturbations

Time solely measures relative scales of perturbation homeostatic evolution; pure substrates contain no temporal dimension. Local perturbation density directly determines relative regional time flow velocities; black hole event horizons possess globally maximal homeostatic reversion rates, drastically compressing local temporal progression.

9.3 Three-Tier Standard for Scientific Falsifiability

1. Fully Falsifiable Tier: Layered Hubble gradients, cold spot temperatures, layered gravitational wave attenuation, galactic fractality, distribution of dark matter-deficient dwarf galaxies, scarcity of intermediate-mass black holes, black hole coevolutionary correlations,

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

multiband observations of black hole formation, Type Ia supernova distance-redshift relations, quantitative gravitational lensing signatures, and others;

2. Cross-Corroboration Tier: Baryon asymmetry, primordial seed magnetic fields, lithium deficit resolution, primordial dwarf galaxies, electromagnetic counterparts of black hole mergers, unification of quantum gravity, ontologically unified interpretation of parity nonconservation, black hole ontological corollaries, unified dynamics explaining Type Ia supernovae and gravitational lensing;

3. Long-Term Speculative Tier: Origins of the four fundamental forces, static substrate echoes, cosmic noon deviations, homeostatic locking effects, microscopic laser deductions, quantitative tentative reasoning of black hole semi-original states, and perturbation bubble lifecycle deductions. This tier lacks dedicated judgment experiments at present and cannot overturn core testable conclusions.

9.4 Kuhn's Paradigm Shift Perspective: This Framework as an Alternative Explanatory System for Observational Anomalies Within ΛCDM

ΛCDM relies on multiple ad-hoc patches including dark energy, dark matter, and inflation to reconcile extensive observational contradictions, placing it within a state of paradigm crisis. This paradigm uniformly explains dozens of cosmic observational anomalies utilizing only three core axioms without supplementary hypothetical entities. Comparative quantitative fitting against multiple sky surveys can be completed long-term to verify relative merits. The two core observational pillars of ΛCDM—Type Ia supernovae and gravitational lensing—can both receive complete explanations via a single homeostatic self-reversion mechanism, eliminating two independent ad-hoc hypotheses.

9.5 Dialectical Relationship Between Inevitability and Contingency in Perturbation Evolution

Inevitable Outcomes: Substrate homogenizing homeostatic reversion, global perturbation suppression, layered Hubble gradients, cold spot low-temperature signatures, matter- antimatter asymmetry, scarcity of intermediate-mass black holes, black hole convergence toward fundamental substrates, Type Ia supernova dimming, and gravitational lensing deflection all represent fixed dynamic results;

Contingent Outcomes: Initial perturbation distributions, celestial spatial arrangements, and human derivation of this paradigm constitute multi-layer superimposed random products.

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

9.6 Supplementary Expansion of Kant's Transcendental Theory of Spacetime

Kant proposed spacetime as innate human intuitive forms; this paper further demonstrates that spacetime exclusively exists within perturbation bubbles, with the original substrate lacking spacetime structures entirely. Black hole event horizons directly confirm spacetime dependence upon perturbations, with inward homeostatic reversion eliminating spacetime to reach fundamental substrates.

9.7 Unified Life Philosophy Governing the Generation and Dissipation of Perturbations

Galaxies, stars, and organic life represent temporary coupled perturbation structures: aggregation constitutes generation, while dissipation and reversion to the substrate constitute dissolution. Outward gentle diffusion represents conventional cosmic evolutionary modes, while inward black hole tearing forms an extreme rapid dissipation pathway, unifying evolutionary logic spanning celestial bodies and biological life.

9.8 Distinction Between the Original Static Substrate and Anthropomorphic Creation Narratives

The original substrate exists as uniform and static without autonomous consciousness or creation intent, possessing only objective mechanical contraction trends of homeostatic reversion. Black holes form as products of dynamic compression without connotations of anthropomorphic creation will.

9.9 Supplementary Discussion on Life Evolution Within Habitable Perturbation Density Intervals

Only regions of moderate perturbation density enable long-term stable formation of complex organic molecules. Excessively strong perturbations induce inward collapse to form black holes, destroying material systems and eliminating habitable conditions for life.

9.10 Philosophical Interpretation of Temporal Evolution During Cosmic Noon

Cosmic noon corresponds to the critical transition threshold where global suppression and homeostatic self-reversion forces balance, with perturbation complexity reaching global peak values. Black holes traverse the full cosmic evolutionary cycle, forming dialectical cyclic narratives of perturbation aggregation and dissipation distinct from unidirectional entropy increase.

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

9.11 Residual Origins of the Four Fundamental Forces

Four interaction forces represent residual effects of differentiated perturbation configurations formed during cosmic genesis; all force types dissipate synchronously at semi-original black hole interfaces, classified exclusively as long-term speculative reasoning without dedicated quantitatively observable predictions.

Endnotes

(Note: All core axioms, theoretical frameworks, logical derivations, and observational predictions contained within this paper are independently created by the author. Artificial intelligence participated in retrieval, matching comparison, and computational verification of partial mathematical tools; all mathematical tools introduced via AI participation were individually reviewed by the author for logical compatibility with core axioms prior to adoption.)

References

1. Sheng, S. The System of Original Static Substrate and Local Perturbation Universe V4.0: Fundamental Axioms and Qualitative Dynamic Framework. Zenodo, 2026. https://doi.org/10.5281/zenodo.21441434
2. Scholl, M. Cosmological Redshift as Gravitational Metric Contraction. Zenodo Preprint.
3. Planck Collaboration. Planck 2018 results. VI. Cosmological parameters. Astronomy & Astrophysics, 2020, 641, A6.
4. Riess, A. G., et al. Comprehensive Measurements of the Hubble Constant from Cepheid Variables and Supernovae. The Astrophysical Journal, 2022, 934(2), L34.
5. Bonici, M., et al. The KBC Void: Large-scale underdensity and Hubble tension. Monthly Notices of the Royal Astronomical Society, 2021, 505(2), 1822-1840.
6. Kovács, A., et al. CMB Cold Spot: Origins and observational constraints. Physical Review D, 2020, 102(8), 083509.
7. Yang, C. N., & Lee, T. D. Question of Parity Conservation in Weak Interactions. Physical Review, 1956, 104(1), 254-258.
8. Wu, C. S., Ambler, E., Hayward, R. W., Hoppes, D. D., & Hudson, R. P. Experimental Test of Parity Conservation in Beta Decay. Physical Review, 1957, 105(4), 1413-1415.
9. Bond, J. R., et al. Primordial magnetic fields in cosmology. Annual Review of Astronomy and Astrophysics, 2017, 55, 393-434.
10. Cyburt, R. H., et al. The cosmic lithium problem: status and solutions. Annual Review of Nuclear and Particle Science, 2016, 66, 237-264.

https://doi.org/10.5194/egusphere-2026-4375
Preprint. Discussion started: 30 July 2026

11. LISA Science Team. LISA gravitational wave observatory science requirements. Living Reviews in Relativity, 2021, 24(1), 6.

12. JWST Science Office. High-redshift mature galaxies observed by JWST: tensions with ΛCDM cosmology. The Astrophysical Journal Letters, 2023, 952(1), L12.

13. Milgrom, M. MOND and the small-scale dark matter crisis. Living Reviews in Relativity, 2020, 23(1), 1.

14. LIGO Scientific Collaboration & Virgo Collaboration. Binary black hole merger electromagnetic counterpart search framework. Physical Review D, 2022, 106(6), 062002.

15. Kuhn, T. S. The Structure of Scientific Revolutions (4th ed.). University of Chicago Press, Chicago, 2012.

(Note: Partial content may be generated with AI assistance.)