Black Holes Demystified: What They Actually Are, the Universal Centrality Rule, Why Singularities Cannot Form, and Why Hawking Radiation Doesn't Exist

Vijay Shankar Sharma

Independent Researcher, Gurugram, National Capital Region, India

vss@vijayshankarsharma.com | ORCID: 0009-0001-9622-6121

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Abstract

Standard astrophysics defines black holes as independent objects characterised by singularities and event horizons. This paper argues that no such objects exist. What are observed as black holes are vortical compression cores - organised, finite-density structures sustained by rotational dynamics within the Spaticle field substrate.

Three formation pathways are identified: (1) large-scale rotational aggregation, which is inherently self-sustaining; (2) stellar collapse, which produces transient seed cores; and (3) explosive release events (supernovae, hypernovae, gamma-ray bursts), which similarly generate seed cores. These pathways are unified by the Rotational Sustenance Principle, introduced here: no vortical compression core can persist without continuous rotational reinforcement from surrounding matter. Isolated Pathway 2 and 3 seeds do not persist without surrounding rotating mass.

The paper establishes the Universal Centrality Rule as a central BFUT prediction: the primary vortical compression core of every settled galactic system occupies its dynamical centre. Additional black holes or developing local vortices can exist elsewhere within the same galactic system and do not, by themselves, falsify the rule. The relevant falsification condition is the absence of a primary central black hole or dominant central vortex, or a persistent substantial displacement of that primary structure in a settled system.

The galaxy-whirlpool analogy is given rigorous grounding within the physical conditions of three-dimensional infinite space and the Spaticle medium. Nine common theoretical

claims about black holes are examined and addressed. Six falsifiable predictions are presented.

Keywords: black holes, Spaticle field, gravitational vortex, Universal Centrality Rule, Rotational Sustenance Principle, finite compression core, singularity, Hawking radiation, non-existence, information paradox, relativistic jets, BFUT

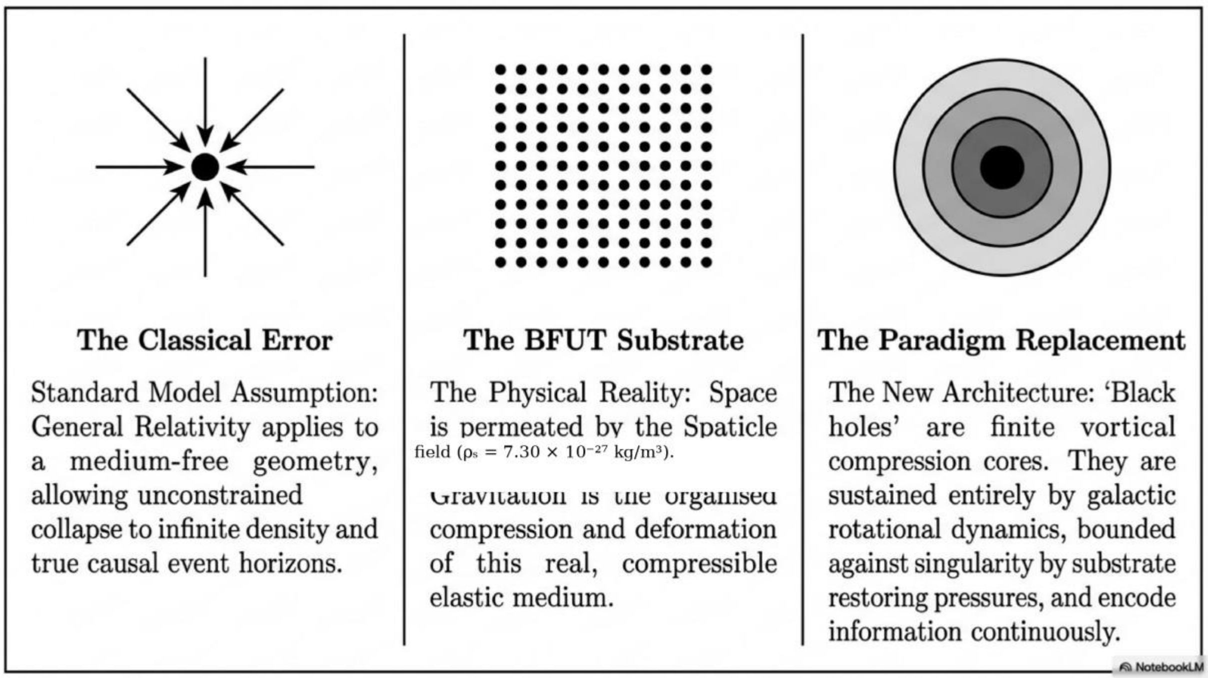

Figure 1: Paradigm Comparison: Classical General Relativity (medium-free geometry) versus the BFUT Spaticle Substrate Framework. The classical model permits singularities and one-way event horizons; the BFUT model replaces both with finite, physically defined substrate structures sustained by rotational dynamics.

1. Introduction

The conventional model of black holes rests on two foundational assumptions: singularities can form through unconstrained gravitational collapse, and event horizons constitute genuine one-way causal surfaces. Both follow from applying General Relativity to a medium-free geometry. Without a physical carrier medium, no restoring mechanism exists to prevent unlimited compression, and the singularity is mathematically unavoidable within the formalism.

The Big Flare-Up Theory (BFUT) identifies the physical fabric of space as the Spaticle field, a non-particulate substrate of equilibrium density $\rho_s = 7.3 \times 10^{-27}$ kg/m³. This framework has been developed across over 30 papers covering cosmology, particle physics, gravitation, quantum mechanics, and consciousness. The BFUT programme is anchored by ρ_s and the independently measured proton charge radius rp = 0.8414 fm (CODATA 2018), with no free parameters introduced in the stated derivations.

The Big Flare-Up Theory (BFUT) begins from a different ontological foundation. The physical fabric of space is the Spaticle field - a continuous compressible elastic medium at equilibrium density $\rho_s = 7.3 \times 10^{-27}$ kg/m³, independently constrained across ten physical sectors spanning forty orders of magnitude [P14; P25]. All matter, forces, and propagating disturbances are excitations of this substrate. Gravitation is organised compression and deformation of a physically real medium, propagating at speed c [P18].

This paper makes four principal contributions. First, it formalises the three formation pathways for vortical compression cores originally introduced in the main BFUT paper and P6, clarifying which pathway is self-sustaining and which are seed mechanisms, and specifies the substrate-relaxation behavior of unsupported seeds. Second, it introduces the Rotational Sustenance Principle and its associated Rotational Sustenance Threshold as named physical laws. Third, it presents the complete finite-core structure from P26 and establishes that Hawking radiation does not exist in the physical universe - its five foundational premises have no physical realisation in a Spaticle substrate universe. Fourth, it addresses nine popular theories about black holes with substrate physics arguments and observational evidence.

Section 9 establishes that Hawking radiation does not exist in the physical universe. Hawking's derivation is internally consistent within its own premises - the argument here is not that the mathematics is wrong, but that every one of its five premises describes a universe that does not physically exist: no medium-free geometric vacuum, no true Killing event horizon, no genuine singularity, no freely-separable virtual pairs, and no thermal information-destroying emission anywhere in a Spaticle substrate universe at any scale under any conditions.

2. The Substrate Context: From the Cold Dark Era to Vortex Formation

2.1 The Pre-Luminous Substrate State

BFUT Paper 8 (Cold, Dark, and Inevitable: A Logical Reconstruction of the Universe Before the Big Flare-Up) establishes that the Big Flare-Up was not a creation event but the first large-scale ignition of nuclear fusion in an already-existing, infinite, eternal Spaticle substrate. The free-energy functional contains a thermal coupling term $T5 = \kappa\_T \, T|\psi|^2$, which gives a nucleation threshold of approximately 29.69 K using the current standardized substrate density. Below this threshold, organised substrate compression is thermodynamically favoured. The organisational preconditions for rotational structure were therefore seeded before luminous matter formation - explaining the existence of supermassive vortical cores at high redshift without exotic growth mechanisms [P8; P15].

2.2 Rotational Structure as the Universal Long-Term State

In an infinite universe, matter accumulates gravitationally from multiple directions simultaneously. Approach trajectories are never perfectly collinear - matter arrives from slightly different angles, imparting net angular momentum to any accumulating mass. With no boundary to absorb angular momentum and no friction at cosmological scale sufficient to dissipate it, rotation is conserved and permanent [main BFUT paper §4.2]. The spiral is not a special condition of matter. It is the only stable long-term state available to matter in an infinite universe without boundaries. Rotational vortex formation is therefore a structural inevitability, not a contingent outcome.

2.3 The DDR Domain and Rotational Entrainment

BFUT Paper 18 establishes the unified gravitational equation $\Psi(r,t) = -(GM/r) \exp(-r/R_{eff}) R(\tau_c,\partial_t) N(\Sigma_i)$. The DDR domain equation captures two effects: $R_d = (3M/8\pi\rho_s)^{(1/3)}$ defines the finite gravitational domain, and $R_{eff} = R_d \times (1 + v_{rot}^2/c^2)^{(1/3)}$ encodes how rotation continuously re-entrains the Spaticle substrate against relaxation, sustaining an enlarged domain [P18]. Organised extra gravity on disks is the DME equation of Paper 18: $v^2(R) = v_b^2(R) [1 + a_s R / v_b^2(R)]^{1/2}$, a_s from ρ_s. SPARC: shape 92.0%, flat 98.8%, median outer relative residual 0.096. The same rotational entrainment that sustains flat rotation curves at galactic radii produces, at the dynamical centre where rotational coherence is maximum, the conditions for a finite compressed vortical core. Every mass M has a finite deformation domain $R_d = (3M/8\pi\rho_s)^{1/3}$. Rotation enlarges the effective domain as $R_{eff} = R_d (1 + v_{rot}^2/c^2)^{1/3}$. Disk-scale organised extra gravity is DME in P18: $v^2(R) = v_b^2(R)[1 + a_s R/v_b^2(R)]^{1/2}$, with $a_s = c(G\rho_s/3)^{1/2}$.

3. Three Formation Pathways and the Rotational Sustenance Principle

The gravitational vortex interpretation of black holes was introduced in the main BFUT paper (Section 4.5) and developed technically in BFUT Paper 6 (Black Holes as Central Gravitational Vortices Lacking Singularities: The Universal Centrality Rule). Three distinct formation pathways are identified. They differ fundamentally in their relationship to sustenance: one is inherently self-sustaining, while two are seed mechanisms that require external reinforcement to persist. This section formalises all three pathways and states the coherence condition that determines whether a seed core persists or dissipates.

3.1 Pathway 1 - Large-Scale Rotational Aggregation (Self-Sustaining)

When massive objects moving on non-parallel trajectories interact gravitationally, their combined angular momentum generates rotational structure. When the coherence parameter C exceeds the threshold $C_{crit} = v_{rot} \times r / (v_{eff} \times L)$, a self-sustaining gravitational vortex forms. Matter spiralling inward contributes additional angular momentum, sustaining and intensifying the structure. More matter is attracted. The central region becomes progressively more compressed. The central vortical core emerges naturally as the innermost point of the growing vortex - not a separate object that sits at the centre, but the structural consequence of the vortex itself [main BFUT paper §4.5.1; P6 §2].

Pathway 1 is unique because the formation mechanism and the sustenance mechanism are identical. The process that creates the core is the same process that maintains it. Pathway 1 cores are inherently permanent as long as the host rotational system persists. This pathway accounts for all galactic-scale supermassive vortical cores and is the most common formation mechanism across the universe.

3.2 Pathway 2 - Stellar Collapse (Seed Mechanism)

When a massive star exhausts its nuclear fuel, outward radiation pressure disappears suddenly. Matter rushes inward from all directions asymmetrically - the angular positions of infalling matter carry net angular momentum, generating a gravitational vortex. This mirrors a deflating balloon submerged in a fast-flowing river: the sudden inward collapse creates a rotational disturbance in the surrounding matter flow [main BFUT paper §4.5.2; P6 §4.3].

A Pathway 2 core is a seed. At the moment of formation it contains only the mass of the collapsed stellar remnant and the angular momentum of the asymmetric infall. Without surrounding rotating mass to entrain, the substrate deformation of the core relaxes outward. It persists and grows only if: (i) sufficient surrounding matter exists within the gravitational domain R_d of the collapsed remnant, and (ii) that surrounding matter is drawn into rotation around the core, establishing the entrainment dynamics of Pathway 1. When these conditions are met, the Pathway 2 seed transitions into Pathway 1 dynamics and becomes self-sustaining. When they are not met, the core does not persist as an organised structure.

3.3 Pathway 3 - Explosive Release: Supernova, Hypernova, Gamma-Ray Burst (Seed Mechanism)

A hypernova, catastrophic collision, or gamma-ray burst sends a sudden explosive release of energy into the surrounding matter flow, creating a rotational disturbance - the bursting balloon analogue of the deflating balloon in Pathway 2. Both are expressions of the same principle: a sudden disruption to the surrounding matter flow, whether inward or outward, generates rotational structure consistent with the observed formation of rotating vortical cores and the ubiquitous presence of accretion disks and relativistic jets [main BFUT paper §4.5.2; P6 §4.3].

Like Pathway 2, a Pathway 3 core is a seed that is inherently temporary unless surrounding matter of sufficient density is drawn into sustained rotation around it. In environments with rich surrounding matter - such as the dense interstellar medium of a star-forming region - a Pathway 3 seed can transition into Pathway 1 dynamics. In sparse environments it undergoes substrate relaxation and does not form a lasting organised core. Supernova remnants and gamma-ray burst afterglows represent exactly this bifurcation: either a sustained accretion-disk-bearing vortex persists, or the explosive remnant disperses without forming a lasting organised structure.

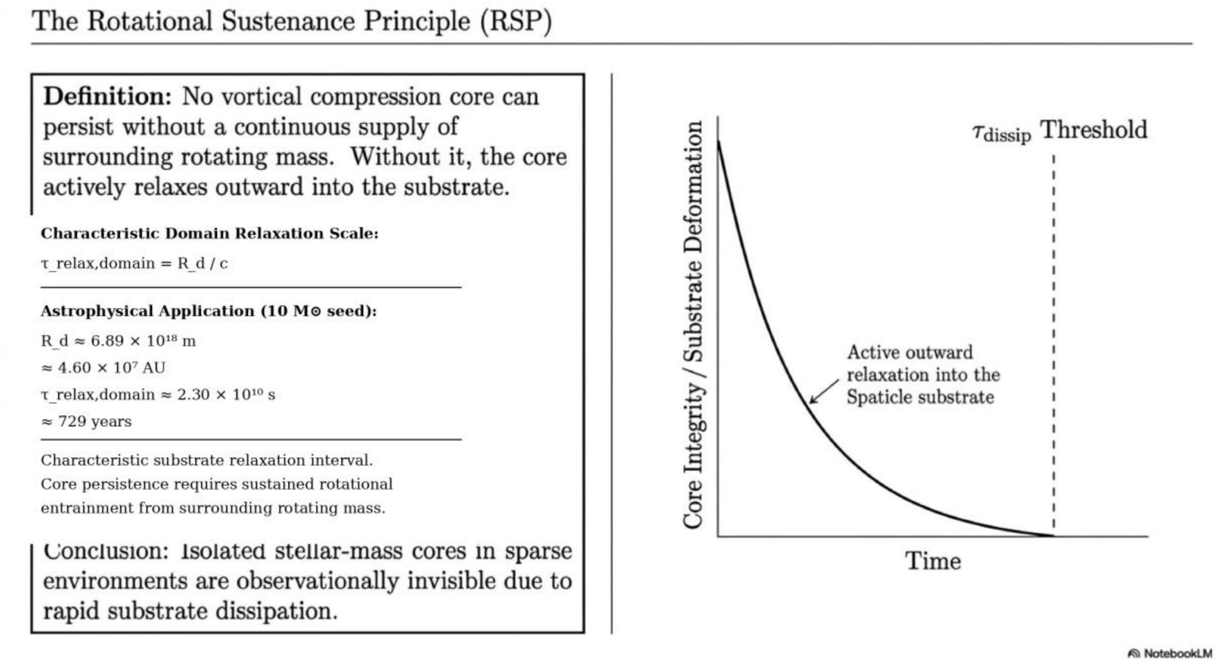

Figure 6: Rotational Sustenance Principle. Without continuous rotational entrainment from surrounding matter, a Pathway 2 or 3 seed core does not persist as an organised core. $R_d = (3M/8\pi\rho_s)$^{1/3} is the domain radius of that mass.

3.4 The Rotational Sustenance Principle

The Rotational Sustenance Principle: No vortical compression core of any origin can persist without a continuous supply of surrounding rotating mass. The formation mechanism of a core does not determine its longevity. Only the presence of sustained rotational entrainment from surrounding matter determines whether a core persists, grows, or dissipates.

The Rotational Sustenance Principle needs a companion statement for seeds. A Pathway 2 or 3 seed does not persist unless surrounding matter inside its domain is drawn into rotation.

In the absence of rotational entrainment from surrounding mass, a vortical seed core is an isolated substrate deformation. The relaxation operator R(τ_c, ∂_t) of P18 governs how such isolated disturbances evolve. An unsupported substrate deformation decays outward at the relaxation length L_rlx = c × τ_c per relaxation interval τ_c, the e-folding length for isolated unsustained disturbances [P18 §1B].

A seed of mass M has domain radius $R_d = (3M/8\pi\rho_s)$^{1/3}. That is a length. It is not a lifetime.

Without rotational reinforcement the organised deformation is an unsupported substrate disturbance and does not persist as a core. No separate seed-lifetime formula is used.

$$R\_d = (3 \times 2.0\times10^{31} / (8\pi \times 7.3029417\times10^{-27}))\text{^}(1/3) \approx 6.89 \times 10^{18}\ m$$

Pathway 2 and 3 cores are seeds. They persist only if the Rotational Sustenance Threshold below is met. Pathway 1 cores persist with the host rotating system.

The Rotational Sustenance Threshold (RST) is the condition separating surviving from dissipating seeds:

Rotational Sustenance Threshold: A Pathway 2 or 3 seed core of mass M and domain radius R_d persists if and only if the surrounding matter density within R_d is sufficient to establish coherence C > C_crit. Below the RST the organised seed deformation relaxes and the core does not persist as a coherent vortical core. Above the RST the seed transitions into Pathway 1 dynamics and becomes self-sustaining.

The RST explains the observed distribution of compact objects across stellar environments. In dense stellar environments - the cores of young massive star clusters, regions of active star formation, the central parsecs of galaxies - the surrounding mass density is sufficient to exceed the RST for virtually any stellar-mass seed. In sparse environments - isolated stars, the outskirts of dwarf galaxies, field supernovae in low-density regions - the RST is not met and the seed dissipates. This explains why the confirmed population of persistent stellar-mass compact objects is concentrated in rich environments and binary systems, and why isolated field supernovae in sparse environments rarely produce confirmed compact object remnants with sustained accretion.

3.5 Implications of the RSP for the Conventional Model

The conventional model implicitly acknowledges a version of the Rotational Sustenance Principle when it requires an accretion disk to "feed" a black hole. But it frames this as a growth mechanism, while the BFUT framework treats it as a sustenance condition - the black hole is assumed to persist whether or not accretion continues, merely growing larger with accretion and remaining static without it. The BFUT framework makes the sustenance condition primary and physical: without rotational entrainment of the Spaticle substrate, the organised compression state of the core actively relaxes outward. It is not static in the absence of accretion - it dissipates. The conventional model's assumption of self-sustenance after formation without accretion has no physical mechanism in the BFUT framework.

3.6 Summary: Formation Pathways and Their Properties

Property	Pathway 1: Rotational Aggregation	Pathway 2: Stellar Collapse	Pathway 3: Explosive Release
Trigger	Non-parallel gravitational encounters; angular momentum accumulation in an infinite medium	Star exhausts nuclear fuel; asymmetric infall of collapsing matter generates net angular momentum	Supernova, hypernova, gamma-ray burst; explosive outward energy release creates rotational wake
Main BFUT paper analogy	Matter spiralling inward from multiple trajectories, progressively concentrating at centre	Deflating balloon in a river - sudden inward rush creates a vortex	Bursting balloon in a river - sudden outward blast creates a rotational wake
Core at formation	Grows continuously from start; no distinct seed phase	Seed core from stellar remnant mass and collapse angular momentum only	Seed core from explosion angular momentum impulse only
Self-sustaining?	Yes - formation and sustenance are the same process	No - seed dissipates within without reinforcement	No - seed dissipates within without reinforcement
Seed persistence without reinforcement	N/A - permanent from formation	Not assigned; no separate seed-lifetime formula	Same as Pathway 2 for equivalent mass
Survival condition	Inherent; persists as long as host rotational system persists	Surrounding mass within R_d must establish $C > C_{crit}$ (Rotational Sustenance Threshold)	Surrounding mass within R_d must establish $C > C_{crit}$ (Rotational Sustenance Threshold)
Transition to Pathway 1	Is Pathway 1	Yes, if Rotational Sustenance Threshold is met	Yes, if Rotational Sustenance Threshold is met

Frequency	Most common - dominant pathway for all galactic-scale cores	Less common; often produces neutron star or dissipating seed in sparse environments	Less common; requires extreme energetic events; environment-dependent

4. The Galaxy-Whirlpool Analogy: Physical Grounding and Conditions of Applicability

The analogy between a galaxy and a whirlpool, and between a vortical core and the eye of a whirlpool, was introduced in the main BFUT paper and P6. The analogy is powerful and physically well-grounded - but it holds subject to specific conditions that must be stated explicitly, because the Spaticle substrate context differs from a water whirlpool in ways that make the astrophysical version both more extreme and more persistent.

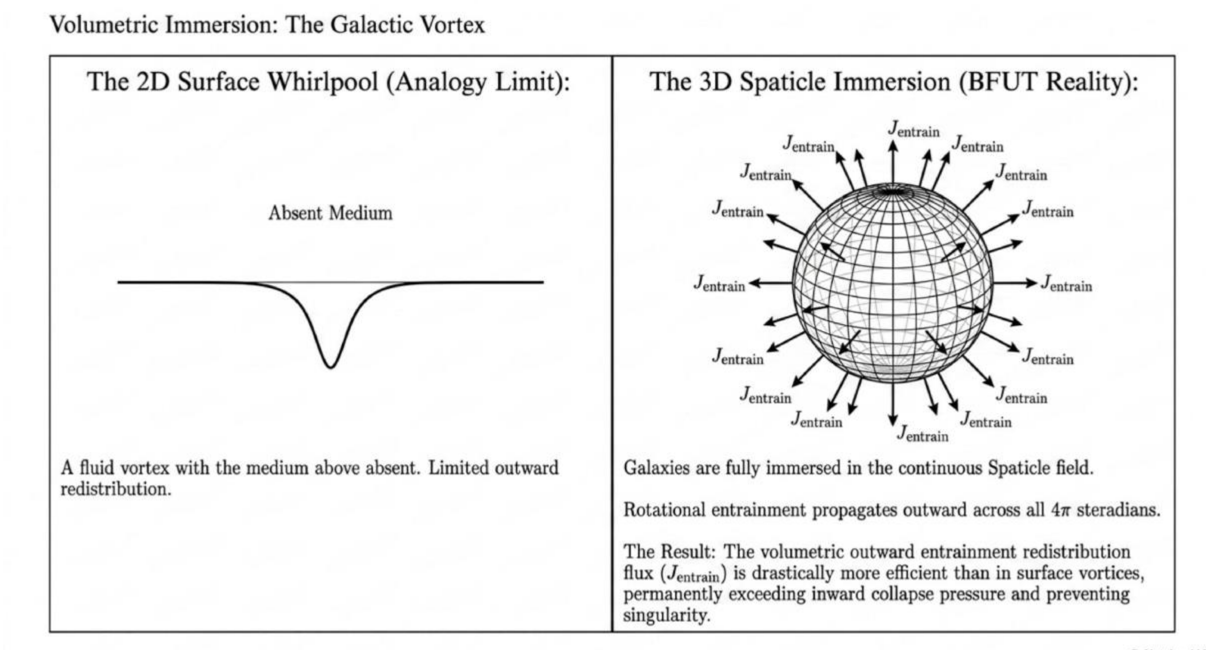

Figure 5: Volumetric Immersion: 2D Surface Whirlpool versus 3D Spaticle Field Immersion. In the BFUT framework, galaxies are fully immersed in the continuous Spaticle medium across 4π steradians. This volumetric outward entrainment flux (J_entrain) is far more efficient than in surface vortices, preventing collapse to singularities.

4.1 Conditions Under Which the Analogy Holds

The galaxy-whirlpool analogy applies when three conditions are recognised: (1) the medium is the Spaticle field, not water - it has equilibrium density $\rho_s = 7.3 \times 10^{-27}$ kg/m³ and elastic stiffness $K_s = \rho_s c^2 = 6.5635567 \times 10^{-10}$ Pa, with properties distinct from those of terrestrial fluids; (2) space is three-dimensional and the vortex is fully volumetrically immersed in the substrate across the full 4π steradians of solid angle, as a fully volumetric phenomenon; (3) space is infinite and there is no natural boundary to absorb angular momentum and no friction at cosmological scales sufficient to dissipate it, so rotational speeds, scales, and persistence timescales can far exceed anything achievable in a water whirlpool. Within these conditions, the structural correspondence between a whirlpool and a galactic vortex is physically precise: the formation mechanism, the eye-at-centre consequence, and the matter-transformation dynamics all correspond exactly. The analogy is not a metaphor - it is a description of the same class of physical process operating in a different medium under different boundary conditions.

4.2 A Galaxy Is a Whirlpool, a Vortical Core Is Its Eye

A whirlpool in a fluid is a region where rotational dynamics concentrate angular momentum inward, producing a central depression - the eye - surrounded by spiralling fluid. The eye is not a separate object that sits at the centre of the whirlpool. It is the structural consequence of the rotational dynamics of the whirlpool itself. Remove the rotation and the eye disappears. Sustain the rotation and the eye is permanent.

A galaxy in the Spaticle field is structurally identical under the conditions stated in Section 4.1. The galaxy is a fully immersed three-dimensional volumetric vortex. The central vortical compression core is the eye of that galactic vortex. It is not a separate object that migrated to the centre. It is the structural consequence of the rotational dynamics of the galaxy. The volumetric immersion across 4π steradians makes the outward entrainment redistribution dramatically more efficient than in any surface vortex - which is why galactic vortical cores do not collapse to singularities despite containing enormous mass: the outward redistribution flux in three dimensions exceeds inward collapse pressure in every regime examined [P26 §6].

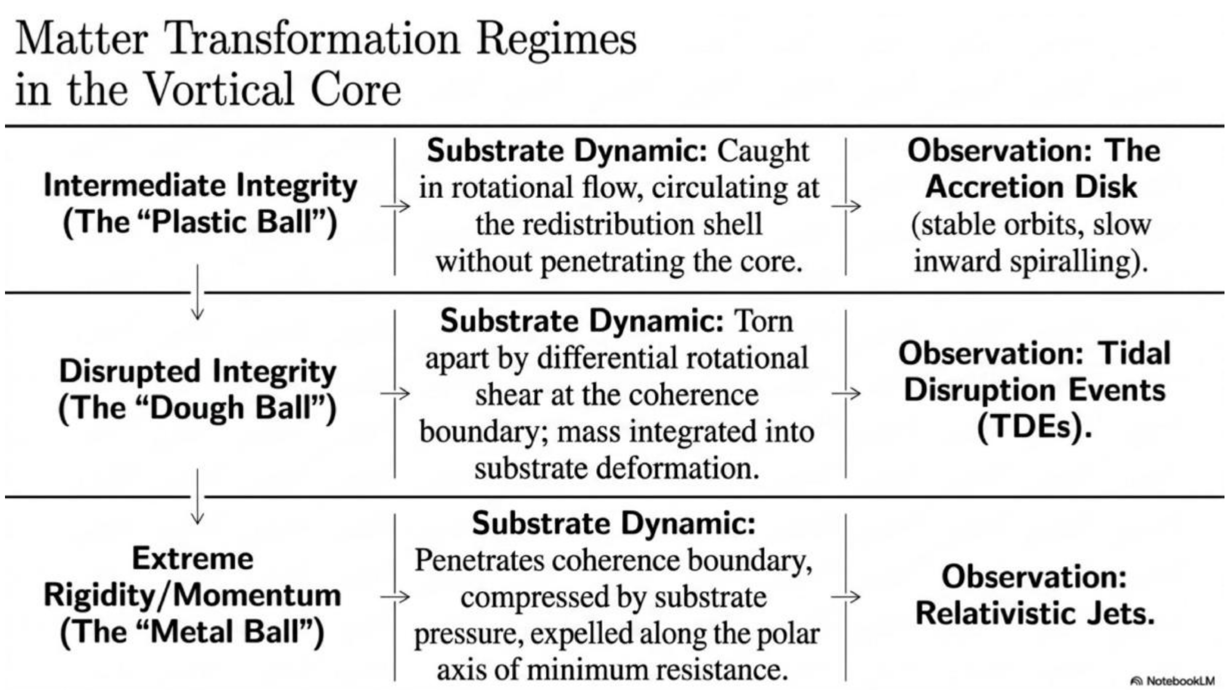

Figure 4: Three Matter Transformation Regimes in a Vortical Core. Intermediate-integrity matter (Plastic Ball) enters stable orbits in the redistribution shell. Low-integrity matter (Dough Ball) is tidally disrupted at

the coherence boundary. High-rigidity matter (Metal Ball) penetrates the core and is expelled as relativistic jets along the axis of minimum rotational resistance.

4.3 Matter Transformation in the Vortex: Three Physical Regimes

What happens to matter that enters a vortical core depends on its physical properties relative to the compression state of the substrate at the coherence boundary. The main BFUT paper (page 32) identifies three distinct regimes using direct analogies from objects entering a fluid whirlpool. Each analogy maps onto a specific and well-observed astrophysical phenomenon:

The plastic ball - intermediate density and structural integrity - is caught by the rotational dynamics without penetrating to the core or dissolving. It begins orbiting within the redistribution shell. In the astrophysical context this corresponds to matter achieving a stable orbit in the accretion disk, circulating at or above the ISCO (innermost stable circular orbit), contributing angular momentum to the vortex, and slowly spiralling inward over astronomical timescales.

The dough ball - low structural integrity, soft or fluid-like - is torn apart by differential rotational forces at the coherence boundary. Its constituent material disperses into the surrounding medium. In the astrophysical context this corresponds directly to tidal disruption events (TDEs), in which a star is tidally disrupted as it approaches a galactic vortical core. The disrupted stellar material disperses into the accretion disk and surrounding interstellar medium. TDEs are the observationally confirmed counterpart of the dough ball regime.

The metal or steel ball - dense and structurally rigid - enters the vortex with sufficient momentum to penetrate the rotational flow without being captured or disrupted. It passes through the coherence boundary, is compressed and decelerated by the organised substrate within, and exits via the rotation axis as concentrated energy. In the astrophysical context this corresponds to the mechanism of relativistic jets. Dense matter compressed by the immense rotational and substrate pressure of the vortical core is expelled along the polar axis - the direction of minimum rotational resistance - as concentrated plasma at velocities approaching c. Relativistic jets are not anomalies requiring separate explanation. They are the substrate analogue of the metal ball: matter entering the vortex is transformed - compressed, converted to energy, and returned to the Spaticle field as structured radiation and relativistic outflow - not destroyed [main BFUT paper §4.5; P6 §4.3].

4.4 Information Is Never Lost: The Substrate Proof and Its Whirlpool Illustration

The black hole information paradox rests on the premise that information entering a classical black hole crosses a one-way causal surface and is destroyed by a singularity. The BFUT framework addresses this at the substrate physics level: since neither the one-way causal surface nor the singularity exists, the paradox does not arise. The continuous elastic Spaticle medium preserves deformation patterns indefinitely unless actively redistributed. As infalling matter crosses the coherence boundary and is absorbed into the compression state of the core and redistribution shell, its information - mass, composition, angular momentum, energy content - is encoded in the organised deformation patterns of the substrate. Carrier relaxation emission propagating outward through the coherence boundary at timescale τ_c carries this encoded information as structured substrate disturbances [P26 §12.2].

The whirlpool analogy illustrates the same physical principle under the conditions of Section 4.1: in a whirlpool, a dough ball thrown in is torn apart and dispersed into the medium. The constituent matter, composition, temperature, and chemical structure remain encoded in the state of the surrounding fluid. The dispersal is irreversible in practice but not in principle - the whirlpool does not destroy information, it encodes it in an increasingly distributed form across the medium. In the BFUT vortical core, the same process operates in the Spaticle field under the three conditions stated. The illustration is physically grounded but the proof rests on the substrate physics, not on the analogy.

5. The Universal Centrality Rule

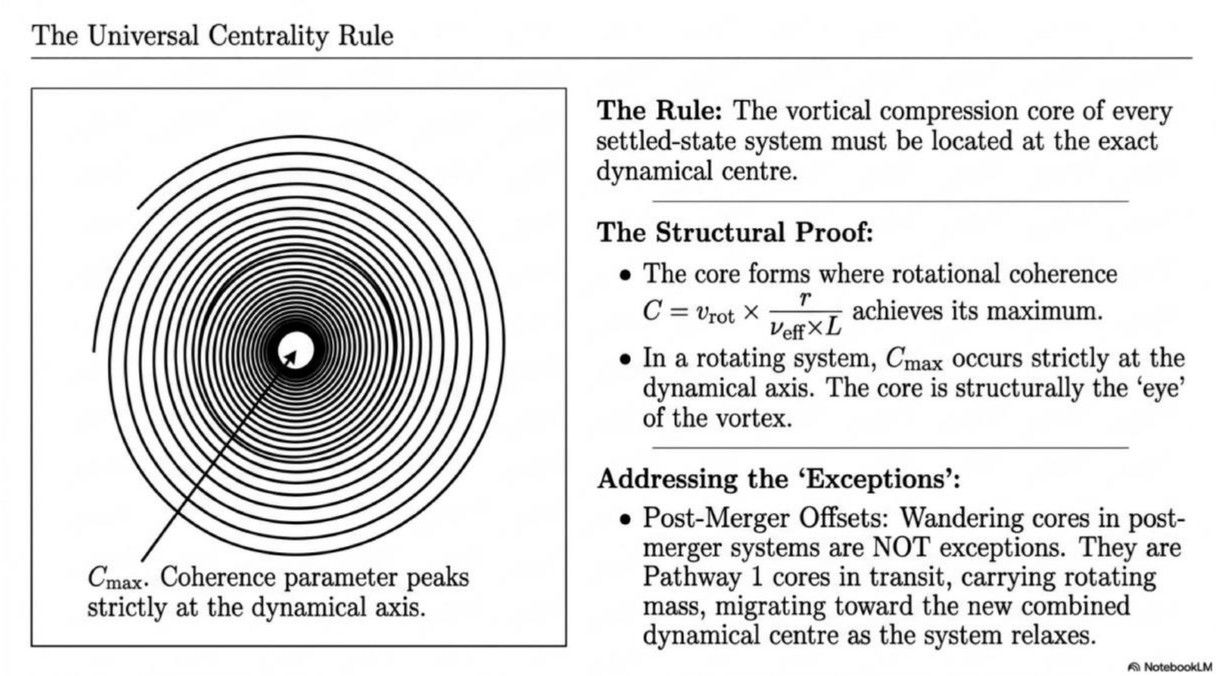

Figure 7: Universal Centrality Rule. The primary vortical compression core forms at the dynamical centre of a coherently rotating host system. Secondary local vortices may occur elsewhere within the larger system. Small bounded barycentric displacement is compatible with the centrality rule.

5.1 Statement

The Universal Centrality Rule: the primary vortical compression core of every settled-state galactic host system is located at its dynamical centre. The rule concerns the primary galactic core and does not require a galaxy to contain only one black hole. A settled galaxy may contain secondary black holes, satellite remnants, or developing local vortices at other locations. These secondary structures do not displace the primary galactic core from the central role defined by the rule.

The qualifier "settled-state" is important. The Universal Centrality Rule applies to a galactic system after the dominant effects of a recent merger or strong tidal disturbance have relaxed. During a transient disturbance, a pre-existing vortex can be displaced while the host system reorganises. Such a transient offset is not the same observational condition as a settled galaxy whose primary central structure is persistently displaced.

5.2 Derivation from Formation Physics

The Universal Centrality Rule follows from formation physics. The primary core forms where the coherent rotational dynamics of the host mass system establish the dynamical centre. The expression C = v_{rot} r / (v_eff L) at r = 0 is not used as a mathematical proof of centrality because that expression vanishes at the geometric origin. The structural argument is that the primary vortex is generated by the rotating mass system that sustains it.

5.3 Apparent Exceptions: Wandering Cores in Post-Merger Systems

Two recent observations are especially relevant to the centrality question. AT2024tvd is an off-nuclear tidal-disruption event located 0.808 ± 0.009 kpc in projection from the apparent centre of its host galaxy. The published analysis estimates its black-hole mass at 10^5 to 10^7 solar masses and finds the host's central black hole to be at least an order of magnitude more massive [AT2024tvd]. NASA's Hubble summary likewise states that the offset event lies about 2,600 light-years from the core, where an even more massive active supermassive black hole resides [NASA-AT2024tvd]. MaNGA 12772-12704 is another reported off-centre massive black-hole candidate, approximately 0.94 kpc from the optical centre [MaNGA].

AT2024tvd directly illustrates the distinction required by the Universal Centrality Rule: an additional black hole can be substantially offset from the galactic centre while a more massive central black hole remains present. The observation therefore does not establish the absence of the primary central object. MaNGA 12772-12704 is an important observational test because its off-centre candidate is reported in a galaxy without an obvious major merger. Its existence alone still does not falsify the BFUT rule, because an off-centre black-hole candidate is not equivalent to demonstrating that the galaxy lacks a primary central black hole or that the off-centre object is the dominant primary of a settled system. A genuine falsification requires that distinction to be established observationally.

5.4 Additional Black Holes Do Not Falsify the Centrality Rule

The Universal Centrality Rule is a statement about the primary galactic black hole or dominant central vortex. It is not a claim that every black hole in a galaxy must occupy the same location. A galaxy can contain a central primary vortex together with secondary black holes produced by stellar collapse, minor mergers, satellite-galaxy remnants, or other local processes. The existence of such secondary objects is therefore compatible with the rule. The observational question is whether the primary galactic gravitational structure remains central in the settled host system.

AT2024tvd provides a concrete observational example. NASA reports a tidal-disruption event about 2,600 light-years from the centre of its host galaxy, while the same NASA report identifies an even more massive active supermassive black hole in the bright central region [NASA-AT2024tvd]. The off-centre black hole is therefore additional to the central primary black hole in the observed system. This is precisely the configuration that the BFUT rule permits: a secondary local vortex can exist away from the galactic centre without replacing the primary central vortex.

The distinction also applies to compact objects in smaller gravitational subsystems. NASA's Hubble observations of the globular clusters M15 and G1 identified massive compact objects in their dense cluster cores [NASA-M15-G1]. NASA's 2026 report on Omega Centauri describes a stellar-mass black hole identified through the orbital motion of a visible star [NASA-Omega]. These observations do not test the galactic centrality rule directly because the systems are star clusters, but they demonstrate that black holes can occur as local compact structures embedded within larger gravitational systems.

The falsification condition is consequently specific. A secondary black hole away from the galactic centre is not sufficient. The rule would be challenged by an unambiguous settled galaxy in which no primary central black hole or dominant central vortex exists, or in which the object that is demonstrably the primary galactic gravitational core remains substantially displaced from the galactic dynamical centre after transient merger or tidal effects have been excluded.

6. The Rotational Hierarchy and the M-σ Relation

BFUT Paper 9 (Cosmic Rotation Across Scales, Emergent Orbital Hierarchy, and the Large-Scale Challenge to Metric Expansion) establishes that large-scale organised rotational structure is the natural hierarchical consequence of substrate dynamics operating across all scales without a finite-origin cutoff [P9]. The same substrate mechanism that produces vortical cores in galaxies operates at every level of the rotational hierarchy where sufficient coherent rotation exists.

Host mass and ordered rotation set the scale of the central core through the same domain relation $R_d = (3M/8\pi\rho_s)^{1/3}$ and $R_{eff} = R_d (1 + v_{rot}^2/c^2)^{1/3}$. That is a scaling argument. The observed M-σ exponent of about 4 to 5 is not derived in this paper. The hierarchical treatment is in P9 and P18.

$$M_{core} \propto \rho_s R_{eff}^3 \propto \rho_s R_d^3 (1 + \sigma^2/c^2) \propto M_{host} \times (1 + \sigma^2/c^2)$$

In the regime $\sigma \ll c$ - which covers the full observed range of galaxy velocity dispersions - the correction term $(1 + \sigma^2/c^2) \approx 1 + \sigma^2/c^2$, and M_{core} scales to leading order with M_{host} and with σ^2 from the rotational term. The observed M-σ exponent of approximately 4-5 reflects the additional dependence of the host mass on σ through the virial theorem ($M_{host} \propto \sigma^2 R_{host} / G$, where R_{host} itself scales with σ through the Tully-Fisher relation at the galactic scale), compounding the direct σ^2 dependence of the DDR rotational budget. The full derivation of the precise exponent requires the hierarchical DDR nesting treatment of P18 and P9 the scaling argument above establishes that the correct order of magnitude and direction follow naturally from the substrate physics without any feedback mechanism or co-evolutionary tuning.

7. The Finite-Core Compact Object: Physical Structure

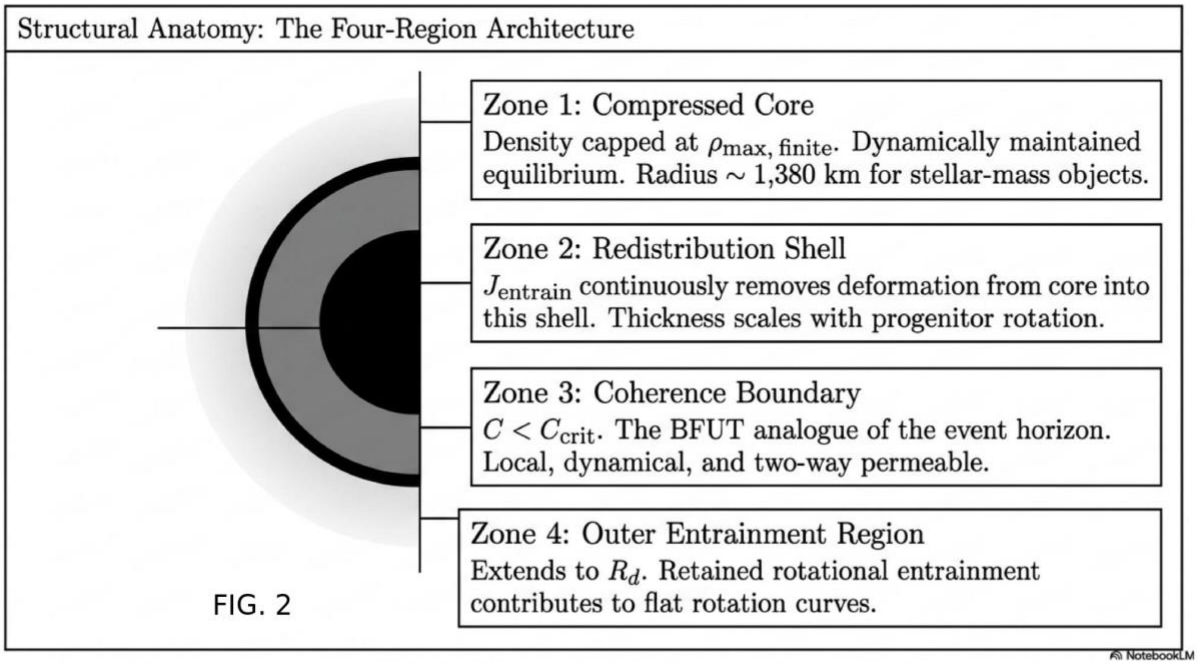

Figure 2: Four-Region Finite-Core Architecture of a Vortical Compression Core. Zone 1 (Compressed Core) is bounded by substrate restoring mechanisms. Zone 2 (Redistribution Shell) handles outward entrainment. Zone 3 (Coherence Boundary) is the BFUT analogue of an event horizon but is local, dynamical, and two-way permeable. Zone 4 is the outer entrainment region.

7.1 The Four-Region Architecture

BFUT Paper 26 derives the complete structure of the finite-core compact object from the Spaticle field free-energy functional. The result is a four-region architecture that replaces both the singularity and the event horizon with physically defined substrate regions:

Region	Physical Description	BFUT Mechanism
Compressed Core	Innermost finite region. Local radius is set by the local coherence length, not by R_d.	T4 restoring response and $C\|\psi\|^6$ oppose collapse. Core circulates at the maximum coherent rate.

Redistribution Shell	Surrounds core; outward entrainment flux J_entrain continuously removes organised deformation from core into shell; thickness scales with rotational organisation of progenitor	T2 quantum kinetic term encodes internal circulation; rotational entrainment saturation sets equilibrium shell thickness
Coherence Boundary	Outer surface of redistribution shell; C falls below C_crit; BFUT analogue of event horizon but two-way permeable; propagation efficiency η does not reach zero operationally inside	Not a one-way causal surface; not a Killing horizon; local, dynamical, and permeable in both directions
Outer Entrainment Region	Extends from coherence boundary to $R_d = (3M/8\pi\rho_s)$^(1/3); retained rotational entrainment; contributes to flat rotation curves	DDR rotational domain: R_eff = R_d × (1 + v_{rot}^2/c^2)^(1/3)

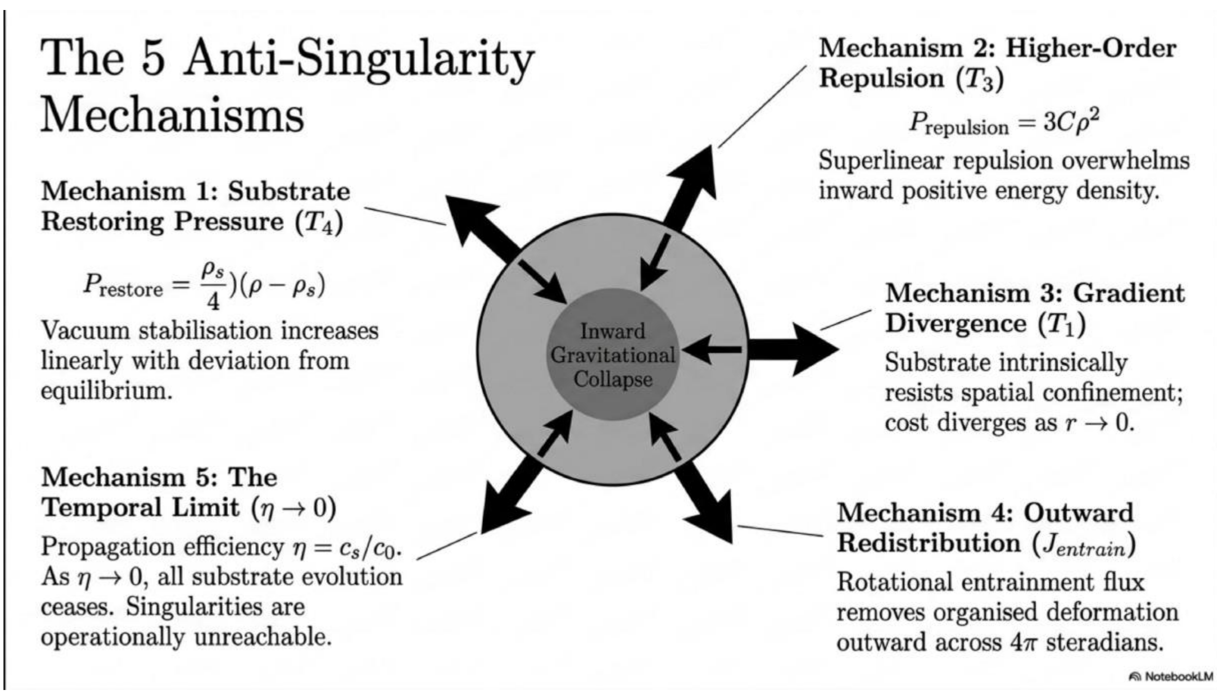

Figure 3: Five Independent Substrate Restoring Mechanisms Preventing Singularity Formation. These mechanisms (T1 gradient divergence, T3 higher-order repulsion, T4 vacuum stabilisation pressure, J_entrain outward redistribution, and the temporal limit from P22) collectively bound compression density at a finite maximum value.

7.2 Maximum Compression Density and the Singularity Bound

Five restoring mechanisms oppose unlimited compression: T1, T3 C$|\psi|^6$, T4, outward J_entrain, and the P22 temporal bound. P26 gives the causal mean-density cap ρ̄_max

$= 3c^6/(4\pi G^3M^2)$ from $v^2 = GM/R$ and $v = c$. No local maximum-density formula using the dimensionless coherence C as a density factor is used here.

$$\bar{\rho}\_max = 3c^6/(4\pi G^3M^2)$$

No additional free parameters. The singularity is prevented by substrate physics fixed across ten independent measurement sectors. The null energy condition is violated by the substrate restoring terms at extreme compression, so the Penrose-Hawking singularity theorems do not apply.

7.3 The Coherence Boundary Is Not an Event Horizon

The coherence boundary differs from a classical event horizon on four categorical counts: local (defined by present substrate conditions, not global future causal structure); permeable ($\eta = c\_s/c_0$ does not reach zero operationally; no observer is causally trapped, and $\eta = 0$ is operationally unreachable per P22); dynamical (shrinks or grows with accretion and rotational changes, unlike the monotone-area event horizon); and not a Killing horizon (no static timelike Killing vector exists in the rotating vortical core spacetime).

8. Gravitational Wave Events and Galaxy Mergers

8.1 The Isolation Test

If compact objects were genuinely independent, a population of gravitational wave events from isolated mergers - two compact objects merging with no concurrent galactic merger - would be expected. As of the current LIGO-Virgo-KAGRA catalogue, no event has been confirmed to arise definitively and independently of galactic dynamics. The BFUT framework makes the forward prediction that no such event will be confirmed: a compact vortical core that loses its surrounding rotating mass dissipates without persisting as an independent travelling object capable of encountering another independent object. All compact object merger signals arise from the coalescence of galactic or stellar vortical cores during galactic or stellar merger events.

This is a forward prediction for future catalogue tests. Current gravitational-wave localisation precision does not definitively establish or rule out galactic-merger association for every event in the catalogue.

9. Why Hawking Radiation Doesn’t Exist: A Five-Premise Analysis

Hawking’s 1974-1975 derivation is internally consistent within its own premises. This section does not dispute its mathematical coherence within those premises. It establishes that every one of the five foundational premises of the Hawking mechanism describes a universe that does not physically exist. Hawking radiation therefore does not exist - its domain of application has no physical realisation anywhere in the universe, at any scale, for any compact object, under any conditions.

9.1 The Five Premises

Premise	Hawking's Requirement	Why This Premise Has No Physical Realisation
P-I	Spacetime is a geometric arena without a physical carrier medium. The vacuum is empty between quantum field excitations.	
P-II	A true Killing event horizon exists: a null surface generated by a timelike Killing vector from which no signal can escape in any finite time.	Inapplicable. The coherence boundary is local, permeable (η does not reach zero operationally), dynamical, and not a Killing horizon. No static timelike Killing vector exists in the rotating vortical core spacetime. [P26 §9.7; P22]
P-III	A genuine singularity exists at the centre where density diverges without bound.	Inapplicable in BFUT. The free-energy functional supplies five independent restoring mechanisms that oppose unlimited compression. P26's numerical quantity is a causal mean-density bound, $\bar{\rho}\_max = 3c^6/(4\pi G^3 M^2)$, not a derived local maximum density.
P-IV	Quantum vacuum fluctuations produce virtual particle pairs separable by the horizon causal structure, with one partner acquiring negative Killing-time energy inside the horizon.	
P-V	One particle escapes as exactly thermal radiation carrying no information about the interior - producing the information paradox.	Inapplicable on two counts. No one-way causal surface traps information. The interior is physically active and continuously encodes infalling matter in substrate deformation patterns released as carrier relaxation emission. [P26 §12.2]

9.2 Premise I: No Medium-Free Geometric Vacuum Exists

Hawking's derivation requires a Bogoliubov transformation between two independent vacuum mode decompositions - inertial and Killing - whose mismatch across the horizon produces the thermal spectrum. In BFUT the vacuum is the Spaticle field at:

$$\lambda \times \Psi\_vac^2 = \rho_s \times c^2 \; [P18\ §7.3;\ \Psi\_vac \neq 0]$$

This vacuum has non-zero equilibrium density $\rho_s = 7.3 \times 10^{-27}$ kg/m³ and elastic stiffness K_s = ρ_s c^2 = $6.5635567 \times 10^{-10}$ Pa. All quantum field excitations are organised deformation modes of this substrate. There is one physical substrate and one class of excitations. The distinction between a Minkowski vacuum mode and a Rindler mode is a coordinate artefact applied to a continuous elastic medium that does not physically recognise the distinction. The Bogoliubov transformation that generates the Hawking temperature has no physical realisation in a BFUT universe.

9.3 Premise II: No True Killing Event Horizon Exists

The event horizon in GR is defined globally as the boundary of the causal past of future null infinity - determined by the entire future evolution of the spacetime. It is absolute, monotone in area (area theorem), and is often presented using a Killing horizon; dynamical-horizon constructions also exist. BFUT has no Killing horizon and no singular interior. The BFUT coherence boundary differs categorically: local (defined by present substrate compression state, measurable in principle by a local observer, not teleological); permeable (η does not reach zero operationally; the temporal argument of P22 shows $\eta = 0$ is operationally unreachable because at $\eta = 0$ all substrate evolution ceases including collapse itself); dynamical (shrinks if the host vortex loses rotational coherence); and not a Killing horizon (the rotating vortical core has no static timelike Killing vector, so there are no negative-energy Killing orbits inside the boundary, removing the kinematic basis for pair-separation at the horizon, independently of all other arguments).

9.4 Premise III: No Singularity Exists

The Hawking derivation depends on the singularity being present because the global causal structure of the Schwarzschild spacetime - which determines the Bogoliubov transformation coefficients - requires it. The BFUT free-energy functional prevents the singularity through five mechanisms [P26 §3-9]: T1 gradient term ($\frac{1}{2}|\nabla\psi|^2$) diverges as condensation radius → 0; T3 higher-order repulsion ($C|\psi|^6$) provides repulsion growing as ρ^2, overwhelming any finite inward pressure; T4 vacuum stabilisation ($(\rho_s/16)(|\psi|^2 - \rho_s)^2$) provides restoring pressure P_restore = $(\rho_s/4)(\rho - \rho_s)$ increasing without bound; J_entrain outward redistribution flux operating across 4π steradians dominates over inward collapse pressure in all examined regimes; and the temporal argument (P22) shows that as $\eta \to 0$, both collapse rate and restoring rate fall proportionally, making the singularity operationally unreachable. The null energy condition is violated by the restoring terms, so the Penrose-Hawking singularity theorems do not apply.

9.5 Premise IV: Vacuum Fluctuations Are Substrate Modes, Not Free Pairs

In BFUT, quantum vacuum fluctuations are organised deformation modes governed by:

$$g^\wedge\mu\nu\ \nabla\_\mu\ \nabla\_\nu\,(\delta\Psi) - 3\rho_s\, c^2 \cdot \delta\Psi = 0 \; [F1\text{-}cov;\ P18\ §7.5]$$

These modes have effective mass m_eff² = $3\rho_s$ c^2, producing Yukawa screening at a finite length scale set by that mass. The vacuum near the coherence boundary is the compressed substrate state at $\rho \gg \rho_s$ - not the Minkowski vacuum that the Hawking derivation requires. There is no

Killing vector in the BFUT vortical core spacetime and therefore no negative-energy Killing orbits for one partner of a virtual pair to occupy. The kinematic basis for pair separation is entirely absent.

9.6 Premise V: Emission Is Carrier Relaxation, Not Thermal Radiation

Emission from the coherence boundary of a BFUT vortical core is carrier relaxation emission governed by the relaxation operator $R(\tau_c, \partial_t)$ - structured deformation waves carrying the organisational signature of the core compression state. As infalling matter alters the compression pattern of the core, subsequent carrier relaxation emission changes accordingly. The radiation carries information. The information paradox does not arise for five independent reasons: (i) no event horizon traps information; (ii) no singularity destroys it; (iii) the interior continuously encodes infalling matter in substrate deformation; (iv) the coherence boundary is permeable; (v) the substrate is a continuous elastic medium preserving deformation patterns indefinitely unless actively redistributed [P18 §8.5; P26 §12.2].

9.7 The Bekenstein-Hawking Entropy: Physical Reinterpretation

The Bekenstein-Hawking relation $S = A/4$ (Planck units) is reinterpreted without requiring an event horizon or singularity. BFUT entropy is substrate deformation complexity: the number of distinguishable organised deformation states at a given energy. The coherence boundary surface - the interface through which organised deformation states are exchanged between core and redistribution shell - has area $\propto R_{core}^2 \propto M^{2/3}$. Entropy scales with area because the surface area determines the number of available redistribution modes. The scaling law is preserved; the physical mechanism is entirely different [P26 §12.2].

9.8 What Replaces the Hawking Mechanism

Carrier relaxation emission - structured, information-carrying, governed by the relaxation operator $R(\tau_c, \partial_t)$ - replaces the Hawking mechanism. It differs in every measurable property: non-thermal, non-featureless, not characterised by $T_H = \hbar c^3/(8\pi G M k_B) \propto 1/M$, and not information-destroying. For a solar-mass object, the Hawking temperature is approximately 60 nK, far below the CMB temperature of 2.725 K. The BFUT carrier-relaxation timescale is determined by the substrate relaxation dynamics of the compact object and is distinct from T_H [P18 §8.5; P26 §11].

9.9 Summary

Premise	BFUT Mechanism Showing Non-Existence	Key Reference
P-I: Empty geometric vacuum		P14; P18 §7.3
P-II: True Killing event horizon	Coherence boundary: local, permeable (η does not reach zero	P26 §9.7; P22

	operationally), dynamical, not a Killing horizon; no timelike Killing vector in rotating vortical core	
P-III: Singularity	Five independent restoring mechanisms bound $\bar{\rho}\_max$; null energy condition violated; Penrose-Hawking theorems inapplicable	P26 §3-9; P22
P-IV: Virtual pairs at Killing horizon		P18 §7.5; P19A
P-V: Thermal emission, information destroyed	Carrier relaxation: structured, information-carrying, τ_c-governed; interior encodes infalling matter continuously	P18 §8.5; P26 §12.2
	Reinterpreted as substrate deformation complexity at coherence boundary surface; scaling preserved without event horizon or singularity	P26 §12.2

10. Nine Popular Theories About Black Holes: Scientific Assessment

The following popular theories are assessed with substrate physics arguments and, where relevant, observational evidence. Several are based on legitimate theoretical derivations within GR that become physically unrealisable when the Spaticle substrate is taken into account.

10.1 Black Holes Are Singularities - Points of Infinite Density

Inapplicable in BFUT. The free-energy functional supplies five independent restoring mechanisms that oppose unlimited compression. P26 does not derive a numerical local maximum density from those mechanisms. The finite-density quantity discussed in this paper is the causal mean-density bound carried forward from P26, $\bar{\rho}\_max = 3c^6/(4\pi G^3 M^2)$, which is finite for every finite M. The singularity is a mathematical consequence of applying GR to a medium-free geometry - within the BFUT framework it is not a physically realised object [P6 §3.2; P26 §12.3].

10.2 Black Holes Have a One-Way Event Horizon from Which Nothing Escapes

Inapplicable in BFUT. The coherence boundary is local, permeable ($\eta > 0$), dynamical, and not a Killing horizon. The event horizon is a valid mathematical property of the Schwarzschild and Kerr solutions within medium-free GR. In the Spaticle substrate, no such causal absolute exists anywhere in the universe.

10.3 Black Holes Form by Stellar Collapse and Are Self-Sustaining Thereafter

Partially correct and partially inapplicable. Stellar collapse (Pathway 2) can form a vortical seed core - this part is correct. The error lies in "self-sustaining thereafter." The Rotational Sustenance Principle establishes that without surrounding rotating mass, a stellar-collapse core dissipates within it, not persisting indefinitely as an independent object. Self-sustenance requires meeting the Rotational Sustenance Threshold. The conventional model assumes self-sustenance after formation without providing a physical mechanism; the BFUT framework replaces that assumption with a derived physical law and a quantitative threshold.

10.4 Black Holes Lurk in Cosmic Voids, Isolated from Any Galaxy

Contradicted by observation and by the Rotational Sustenance Principle. Every compact vortical core ever observed in a void environment is inside a galaxy - specifically at that galaxy's centre. Studies of void galaxies using SDSS data confirm that actively growing supermassive compact objects in void galaxies are found at the centres of those galaxies. No compact core has been found in a true intergalactic void without a host galaxy. The Rotational Sustenance Principle makes this a physical necessity: without the surrounding rotating mass of a host system, no core can persist.

10.5 Black Holes Merge Independently of Their Host Galaxies

Contradicted by the Rotational Sustenance Principle and the observational record. A vortical core that loses its surrounding rotating mass does not persist as an independent travelling object. No confirmed isolated compact object merger has been established independently of galactic dynamics. Observations of dual and multiple AGNs confirm that galactic mergers are the sites of compact object pair formation. The triple radio AGN system discovered in 2025 (three simultaneously active cores in three merging galaxies) [TripleAGN], directly confirms that compact object activity is inseparable from galactic merger dynamics. When galaxies merge, their vortical cores may eventually coalesce as part of the larger process - not the reverse.

10.6 Primordial Black Holes Formed in the Big Bang

Inapplicable in BFUT. No primordial black hole has been observed despite dedicated searches. In the BFUT framework there was no Big Bang singularity - the Big Flare-Up was the first large-scale ignition of nuclear fusion in an already-existing infinite substrate. The density fluctuations required to produce primordial black holes in the standard model are not part of the BFUT pre-luminous substrate picture, which evolves through the T5 thermodynamic threshold at approximately 29.69 K without a rapid-expansion density spike. All compact vortical cores in BFUT arise through one of the three formation pathways, all of which require matter, rotation, and the Spaticle substrate.

10.7 Black Holes Are Featureless - Characterised Only by Mass, Spin, and Charge

Inapplicable in BFUT. The vortical compression core has an organisational deformation state - the precise compression pattern of the core and redistribution shell - that encodes the history of infalling matter. This state is not reducible to three numbers. Carrier relaxation emission encodes that organisational state as structured substrate disturbances. The no-hair theorem is a property of the Kerr solution in medium-free GR with a true event horizon. In the Spaticle substrate, the continuous medium retains the full organisational history of the core.

10.8 Intermediate-Mass Black Holes Are a Mysterious Missing Category

Dissolved by the formation physics of Section 3. Intermediate-mass compact objects (10^2-10^5 M⊙) are conventionally treated as a puzzling gap lacking a clear formation mechanism. In BFUT they are the central vortical compression cores of intermediate-scale rotational systems - dense star clusters, dwarf galaxies, large stellar associations, globular clusters with sufficient rotational coherence. There is no gap in the physics - there is a continuous spectrum of vortical core masses corresponding to a continuous spectrum of host rotational system scales and rotational entrainment budgets. The "mystery" arises from treating compact objects as independent entities requiring independent formation mechanisms.

10.9 Black Holes Are Cosmic Vacuum Cleaners That Actively Suck In All Surrounding Matter

Contradicted by the DDR domain structure. The gravitational influence of a vortical core is governed by the finite-domain carrier structure described in P18, with exponential decay beyond the relevant deformation domain with finite-domain influence. Matter must come within R_d of the core to be affected and must have insufficient angular momentum to maintain a stable orbit above the ISCO to eventually cross the coherence boundary. The accretion disk is matter in stable or metastable orbits within the outer entrainment region, contributing angular momentum and slowly spiralling inward - governed by the same vortex dynamics as any rotating fluid system under the conditions of Section 4.1, not by any mythological cosmic suction.

11. Falsifiable Predictions

Prediction	Observational Test	BFUT Basis
P1: No isolated compact object mergers. All GW events will be associated with stellar or galactic merger dynamics.	Cross-match LIGO-Virgo-KAGRA catalogue with galaxy merger surveys. Stated as a forward prediction; current localisation precision is insufficient to retroactively test all existing events.	Rotational Sustenance Principle; §3.4; §8.1
P2: Pathway 2 and 3 seed cores in	Compare compact object persistence rates in sparse vs.	Rotational Sustenance Principle; RST; §3.4

environments below the Rotational Sustenance Threshold produce no persistent compact objects. Isolated field supernovae in sparse environments should not yield long-lived compact objects with sustained accretion.	dense stellar environments; persistent objects should be strongly correlated with environments above the RST.	
P3: Universal Centrality Rule holds in all settled-state systems at all JWST-accessible redshifts. Post-merger offset cores migrate to the new dynamical centre as the merged system relaxes.	Measure spatial offsets between central compact objects and dynamical centres for JWST high-z sample; track offset evolution in post-merger systems over time.	§5; Universal Centrality Rule
P4: Compact object mass correlates with host galaxy rotational coherence metric (ordered-to-random motion ratio) more strongly than with stellar velocity dispersion alone.	Compare M-σ and M-V relations against rotational coherence indices for large galaxy samples including dwarfs where rotational coherence varies widely.	P18 DDR; §6
P5: AGN jet power is predicted to correlate more strongly with galactic rotational coherence than with estimated compact object spin. Jets are substrate outflows	Compare radio jet kinetic power against v_{rot}, ordered motion metrics, and inferred core spin; rotational coherence should be the stronger predictor.	§4.3 metal ball regime

along the vortex polar axis.		
	Search future GW event catalogues for post-merger residuals with a non-thermal, structured signature against the Hawking temperature formula. The Hawking regime ($T_H \sim$ nK) is observationally inaccessible; whether carrier relaxation is observationally accessible depends on its actual timescale, which has not yet been calculated.	§9.8

12. Position Within the BFUT Series

Paper	Title	Role in P28
Main BFUT Paper	The Big Flare-Up Theory: Quantum Genesis of an Infinite Universe	Origin of three formation pathways (§4.5); whirlpool/eye analogy; plastic/dough/metal ball analogies; relativistic jets as vortex-transformed matter; information conservation illustration
P6	Gravitational Vortex Interpretation of Black Holes as an Alternative to Central Singularities	Finite causal mean-density bound used in P26; $\bar{\rho}_{max} = 3c^6/(4\pi G^3 M^2)$, finite for every finite M. Not a derived numerical local maximum density.
P8	Cold, Dark, and Inevitable	Pre-luminous substrate context; T5 thermodynamic threshold at 29.69 K; explains high-redshift supermassive cores without exotic growth mechanisms
P9	Cosmic Rotation Across Scales, Emergent Orbital Hierarchy, and the Large-Scale Challenge to Metric Expansion	Full rotational hierarchy across all scales; M-σ scaling basis; prediction of increasingly large coherent rotational structures
P18	Beyond General Relativity: A Unified Gravitation Equation	

P22	Time: Identifying the Cause and Effects and Unifying General and Special Relativity	Temporal anti-singularity proof: $\eta = 0$ operationally unreachable; time as accumulated substrate state evolution; validates the fifth restoring mechanism
P25	Dark Matter: One Physical Constant Across Ten Sectors	Ten-sector constraint on ρ_s spanning forty orders of magnitude; coherence boundary penetration dynamics; vortex boundary selective permeability
P26	Singularity: Why Physical Substrate Dynamics Make It Impossible	Five anti-singularity mechanisms from free-energy functional; four-region compact object structure; $\bar{\rho}\_max$ derivation; Hawking entropy reinterpretation; primary technical source for §7 and §9

13. Conclusion

Black holes, as conventionally understood, do not exist as independent objects defined by singularities and event horizons. What are observed are vortical compression cores - organised, finite-density structures sustained by rotational dynamics in the Spaticle field. Three formation pathways are identified and formalised: large-scale rotational aggregation (Pathway 1, inherently self-sustaining); stellar collapse (Pathway 2, seed mechanism); and explosive release (Pathway 3, seed mechanism). All three are unified by the Rotational Sustenance Principle. Pathway 2 and 3 seeds that lack the required rotational reinforcement undergo substrate relaxation and do not persist as organised cores. A complete symbol reference is provided in Appendix A.

The Universal Centrality Rule - stated precisely as applying to settled-state systems - is derived from formation physics as a structural consequence of the vortex mechanism. Apparent exceptions in post-merger systems are addressed as Pathway 1 cores in transit between coherence maxima, sustained by the Rotational Sustenance Principle throughout their migration. The galaxy-whirlpool analogy is given full physical grounding under explicitly stated conditions: Spaticle field as medium, three-dimensional volumetric immersion, infinite space with no natural friction. Within those conditions the correspondence is structural, not metaphorical. The three matter-transformation regimes (plastic ball, dough ball, metal ball) account for accretion disk dynamics, tidal disruption events, and relativistic jets within one physical framework.

Within the BFUT framework, Hawking radiation does not have a physical realisation. All five foundational premises of the Hawking mechanism are argued to fail in a Spaticle-substrate universe: medium-free geometric vacuum, a true Killing event horizon, a genuine singularity, freely separable virtual pairs, and thermal information-destroying emission. The replacement proposed by BFUT is carrier relaxation emission: structured, information-carrying emission governed by the relaxation operator R(τ_c, ∂_t), presented as a forward prediction for future gravitational-wave instrumentation. The Bekenstein-

Hawking entropy relation is given a physical reinterpretation as substrate deformation complexity at the coherence-boundary surface. Nine popular theoretical claims are assessed and six falsifiable predictions are presented. The framework is anchored by the equilibrium substrate density $\rho_s = 7.3 \times 10^{-27}$ kg/m³.

Appendix A: Symbol Reference

Symbol	Definition	Value / Expression
ρ_s	Intrinsic equilibrium density of the Spaticle field	7.3×10^{-27} kg/m³
$\bar{\rho}$_max	Causal mean-density bound from P26	$3c^6/(4\pi G^3M^2)$, finite for every finite M
Ψ_vac	Vacuum equilibrium state of Spaticle field	
R_d	Intrinsic deformation-domain radius	$(3M / 8\pi\rho_s)$^(1/3)
R_eff	Rotationally enlarged effective domain radius	$R_d \times (1 + v_{rot}^2 / c^2)$^(1/3)
R_core	Finite core radius of compact object	Local coherence length ℓ_c = c τ_local. Not the same quantity as R_d.
C	Coherence parameter	v_{rot} × r / (v_eff × L)
C_crit	Coherence threshold for organised compression - must be exceeded for Pathway 2/3 seed to survive	Derived from free-energy functional; see P26
η	Propagation efficiency	c_s / c_0; η does not reach zero operationally; η = 0 is operationally unreachable (P22)
RST	Rotational Sustenance Threshold	RST: surrounding rotating mass must establish C > C_crit. See §3.4.
T_H	Hawking temperature - does not exist in the physical universe	

T1-T5	Terms of Spaticle field free-energy functional	Gradient, kinetic, potential, vacuum stabilisation, thermal - see P16, P26
F1-cov	Covariant carrier field equation	
τ_relax,domain	Characteristic domain relaxation interval	R_d / c
κ_T	Thermal coupling coefficient in the T5 term	$T5 = \kappa_T T\|\psi\|^2$

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