Segmented Spacetime – On the complete metric of Black Holes

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In this paper, we propose that gravitational effects near black holes can be more intuitively understood not through curvature, but through segmentation: The idea that space itself becomes composed of an increased number of discrete spatial segments under high gravitational influence. As light and matter traverse this segmented geometry, they encounter increased structural resistance, not due to slower speeds, but due to the elongated, more granular path each wave or object must follow. This naturally explains redshift, time dilation and even the perception of inertia without invoking intrinsic curvature.

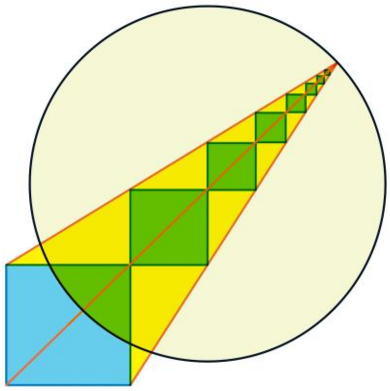
Importantly, we observe that the metric near a black hole shares deep structural similarities with the energy density profile of a nuclear detonation. Both represent regions where space becomes dynamically resistant—densified, segmented, and slowed. In this view, resistance arises not from matter alone, but from the geometric opposition built into the spacetime structure itself. Thus, gravitational phenomena may be recast as emergent effects of segmentation: the more finely divided space becomes, the more difficult motion becomes—and the slower time flows. Instead of treating the speed of light c as the ultimate constraint within all gravitational regimes, we recognize a transition inside the event horizon: The relevant limit becomes the gravitational fall velocity, v_{fall}.

1. Segmental linear space with causal limit

Newton never explicitly referenced the golden ratio in his physical theories, however his mathematical methods, particularly iterative solutions and proportional constructions, implicitly engage in this structure. The recursive emergence of ϕ in his numerical techniques reveals a hidden layer of geometric harmony beneath Newton's linear mechanics. His geometrical methods and investigations, particularly in optics and celestial mechanics, consistently engaged with structures where golden proportions naturally arise. Newton's approach to space was fundamentally linear and absolute, yet he frequently relied on harmonic divisions, recursive proportions, and conic symmetries, all of which inherently feature the mathematics of ϕ, albeit unarticulated.

In contrast, Segmented Spacetime[1] makes this latent proportion explicit: Segmental growth is structured through a recursive relationship governed by ϕ, resulting in a discrete, self-similar architecture. While Newton treated space as continuous and undisturbed by matter, this approach reinterprets space as locally quantized and proportionally scaled, aligning classical linearity with emergent segmental order. Thus, this model may be viewed not as a rejection of Newtonian principles, but as a natural extension into structural discretization, where golden symmetry becomes foundational rather than incidental.

Interestingly, Newton's numerical root-finding method converges to the golden ratio when applied to specific equations, most notably $x^2 - x - 1 = 0$. The sequence of approximations generated by Newton's method forms a subset of Fibonacci-type ratios, which approach ϕ asymptotically. This convergence highlights a deeper structural connection: Even within Newton's framework of continuous space and absolute time, discrete recursion leads naturally to harmonic proportions. In the current model, this harmonic emergence is made foundational: ϕ defines the segmental scale itself.



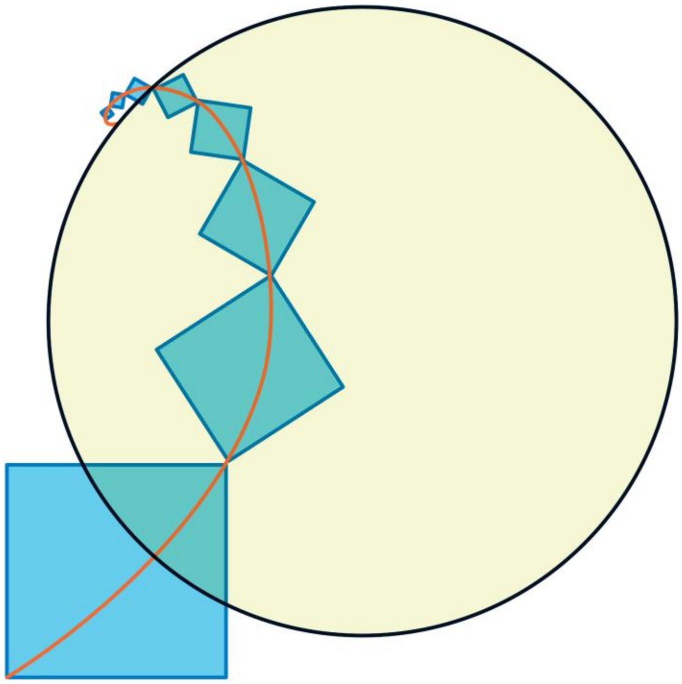
A depiction of classical, linear spacetime under a segment-based model. The green squares represent discrete spatial segments aligned along a linear propagation axis (red diagonal). The yellow triangle zone, bounded by red lines, forms the observer's causal cone, constrained by the speed of light c. All segmental information within the circle is visible; anything outside lies beyond observational reach. The blue region represents structure outside segmental synchronicity, causally disconnected from the observer. This image defines the default geometry before gravitational distortion sets in.

The segmental structure shown replicates Newton's numerical approximation of the golden ratio. The diagonal red line traverses a series of spatial segments whose relative sizes approach ϕ, just as Newton's method yields successive rational approximations converging to ϕ as the root of $x^2 - x - 1 = 0$. This geometric visualization reflects the underlying numerical behaviour of Newton's iteration: A recursive emergence of irrational proportion from rational structure.

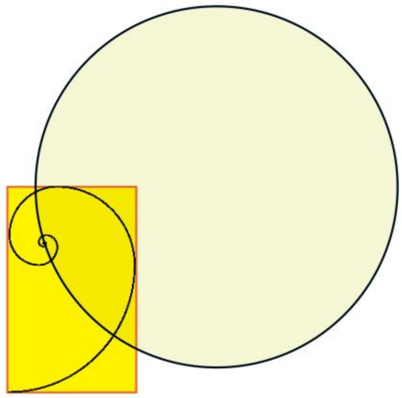
In Newton's optical framework, the curvature introduced by refraction was not a natural feature of space but a deviation to be corrected. His use of convex and concave lenses aimed to realign distorted light rays to restore linear visual access to objects. In this segmental model, the blue square, located outside the observer's causal cone, represents such a hidden structure. By tracing along the extended diagonal, Newton's optical logic becomes clear: Curvature is not fundamental, it is an optical detour. And the role of instruments is to reassert linearity where nature appears bent.

2. Spiral curvature - Emergence of gravitational collapse

Where Newton treated curvature as an optical imperfection to be corrected, Einstein reinterpreted it as a fundamental property of spacetime. In his framework, light doesn't deviate through faulty transmission, it travels along geodesics in a curved manifold. The diagonal no longer represents a missed alignment, but a deformed path embedded in the metric itself. Thus, what Newton tried to straighten optically, Einstein declared intrinsically bent.



Historically, the golden ratio was not an explicit feature of Newtonian or Einsteinian physics. However, as shown by Sigalotti and Mejías (2006), a geometric construction based on the golden rectangle can recover both the Lorentz factor and the key relativistic effects predicted by special relativity. In their approach, ϕ emerges not as a numerical artifact, but as a geometric bridge between Newtonian and relativistic frameworks. This resonates with the segmental model presented here, where the golden ratio defines the internal scaling law of spatial units, governing the transition from classical linearity to emergent relativistic curvature.



As gravitational curvature increases, the linear structure breaks down and reorients into a spiral path. This spiral represents the worldline of an object falling inward under increasing metric deformation. The yellow rectangle remains the Einstein-predictable domain. The intersection with the causal sphere (large circle) defines the observable past. Notably, the start of the spiral (Black Hole) lies within reach, but the end (White Hole) remains hidden, matching the asymmetry between visible origin and invisible collapse.

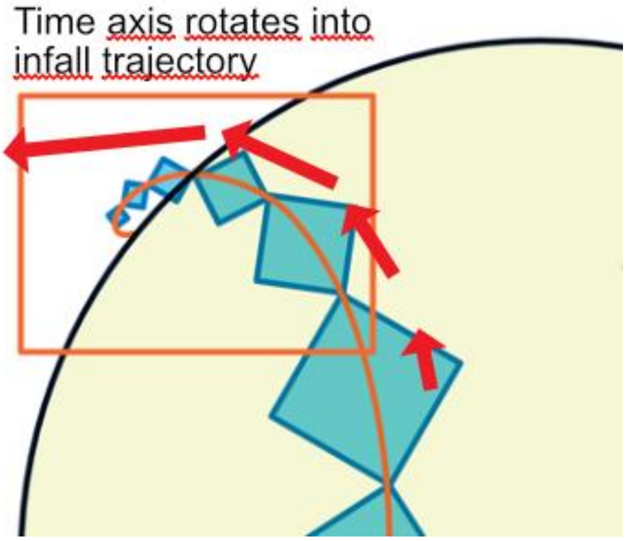
The visualization also highlights a structural limitation in both general and special relativity: The inability to resolve segmental-scale phenomena beyond the observable causal domain. While relativity accurately describes curvature and time dilation within the light cone, it fails to account for internal metric reorientation and localized high-frequency structures. As the image shows, small-scale segment dynamics emerge near the edge of gravitational deformation, visible only through geometrical reflection, not predictive modelling. This disconnect underscores the need for a segment-based metric that operates beyond the assumptions of observer-based relativistic frameworks.

2.1. Limitations of Relativistic Theories in Describing Small-Scale Structure

While both special relativity (SRT) and general relativity (GR) have successfully described a wide range of macroscopic and high-velocity phenomena, neither theory provides a framework for understanding the structure or emergence of small particles. This limitation is not incidental but rooted in the foundational assumptions of both models.

Special relativity operates within flat spacetime and treats particles as idealized, structureless points. It provides no means of explaining internal states, discrete spatial configurations, or stable localized frequency domains. General relativity, while allowing for curvature and mass-energy interaction, remains a continuous, differentiable theory. It does not include any mechanism for quantization or segmental behaviour. Both theories are built around observer-centred causality, confined to structures within the light cone.

However, high-frequency spatial structures, such as those associated with small particles, tend to emerge outside the conventional relativistic domain. These structures arise in regions of extreme metric rotation and axial reorientation, where the conventional role of the speed of light c as a limiting factor is replaced by the inward fall velocity v_{fall} of the segmental framework.



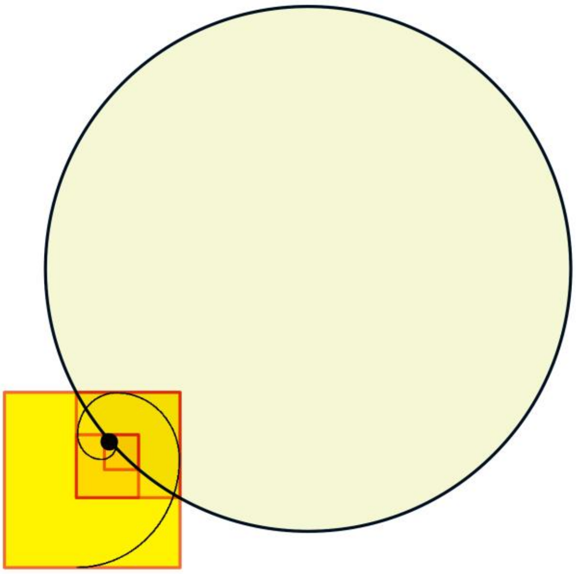
Consequently, small-scale particles are not just difficult to observe in relativistic terms, they are fundamentally undefined within GR and SRT. A segment-based metric, in contrast, allows these structures to emerge naturally from the geometry itself. This suggests that the internal structure of matter is not a quantum addition to relativity, but a sign that the classical metric model must be expanded to include its own internal breakdown.

It is no surprise that the internal structure of matter remains inaccessible. All measurement in modern physics relies on photons, and photons report only what they are permitted to reveal by the metric they travel through. The hidden geometry of mass remains silent, unless twisted enough to light a signal path outward.

2.2. Time axis shift

Temporal dilation is not a passive phenomenon, but the result of an active geometric transformation. Even slight differences in gravitational potential induce a measurable tilt of the local time axis relative to spatial coordinates. Rather than remaining orthogonal, the temporal vector begins to lean inward, toward the source of gravitational attraction. This shift is experienced as time dilation, not because time itself slows down, but because its direction bends into the spatial domain. In strong gravitational fields, such as near a black hole, this reorientation becomes extreme: The time axis aligns nearly or entirely with the direction of infall. Time, in such a framework, is no longer an external parameter, but a localized radial vector. This redefinition forms the basis for understanding all further metric behaviour within Segmented Spacetime.

3. Core density and axial inversion



At the core of the spiral lies the dense segmental collapse region, not a singularity, but a structured high-density area[3]. The red squares represent nested metric domains, shrinking toward the black energy focus. The local metric axes begin to rotate according to v_{fall}, the fall velocity of the segment structure. As fall velocity exceeds c, conventional time-space orientation fails. Inside this region, matter transforms into frequency, losing spatial identity.

From this central collapse region, we construct a new metric, not centred on distant reference frames or global symmetry, but on local density and internal motion. The reorientation of metric axes follows the direction of gravitational fall. The source object defines its own spatial alignment. This marks a shift from observer-based geometry to source-based structure. The local segment flow becomes the new metric anchor.

Within the collapse region of a black hole, the conventional limit set by the speed of light c, is no longer the relevant constraint. The local segmental motion is dominated by the fall velocity v_{fall}, which exceeds c, not in violation of relativity, but because the metric itself is in motion. As the segment structure collapses inward, the fabric of space-time realigns, and v_{fall} becomes the effective upper bound for dynamic processes. Thus, the metric transitions from an observer-limited frame to a source-centred flow regime, in which time and direction become emergent from collapse velocity.

The fall velocity v_{fall} represents the inward progression rate of the segmental structure within the high-density region. It serves as the effective metric-defining flow, replacing c as the upper constraint for dynamic evolution. While information remains locally bound by c, the structure itself collapses at a rate governed by v_{fall} , reshaping space-time from within.

Contrary to the common interpretation that photons are trapped within black holes, Segmented Spacetime suggests a different mechanism: Extreme redshifting due to superluminal segmental contraction. As the fall velocity v_{fall} exceeds the speed of light, local spacetime stretches, and photon wavelengths become elongated far beyond visible ranges, into radio or even subradiative frequencies. The resulting observational darkness is not caused by photon absorption or blockage, but by their geometric erasure through metric deformation.

3.1. Substitution of c with v_{fall} in the Segmental Metric

In classical relativistic physics, the speed of light c serves as the universal upper limit for causality, information transfer and metric definition. This holds true in flat or weakly curved spacetime, where coordinate axes remain globally consistent and the flow of information is bounded by c.

Inside the collapse region of a black hole, where spacetime becomes heavily distorted, this upper bound shifts. The local metric is no longer defined by observer-based light propagation but by the inward motion of the segmental structure itself. This motion defines the fall velocity v_{fall}, which exceeds c, not as a violation of relativity, but as a redefinition of spatial flow.

Formally, existing metric equations remain unchanged. However, within the internal geometry:

$$\boldsymbol{c\ is\ replaces\ by\ v_{fall}}$$

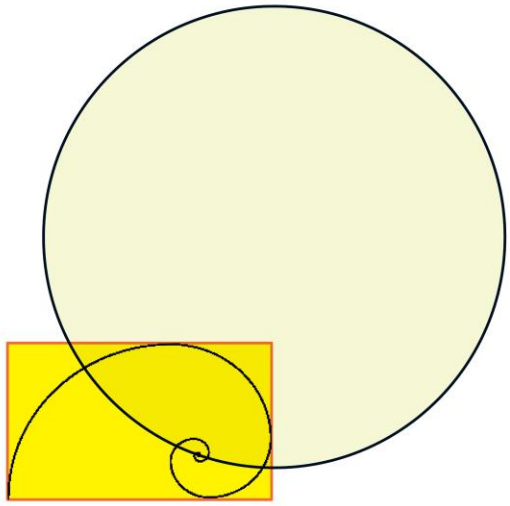
as the effective scaling factor for spacetime intervals.

In this regime, light still travels at c within each local segment, but the segments themselves collapse inward faster than light can cross them. As a result, c is no longer the dominant constraint; v_{fall} becomes the key structural parameter of the local metric.

This substitution reframes gravitational collapse not as an endpoint marked by a singularity, but as a flow-driven transformation, where spacetime coordinates reorient according to the velocity of the internal structure, not external observation.

While the internal region of a black hole appears observationally dark due to extreme redshifting and segmentation, it may still be accessible indirectly. Photons originating from sources behind the black hole can traverse the deformed spacetime, experiencing both frequency shifts and directional deflections. The resulting output is not an image in the classical sense, but a metric-interference pattern, analogous to radiographic imaging. In this view, the black hole becomes a geometric lens that encodes its internal structure in the transmission distortion of passing light.

4. Frequency Collapse and structural inversion



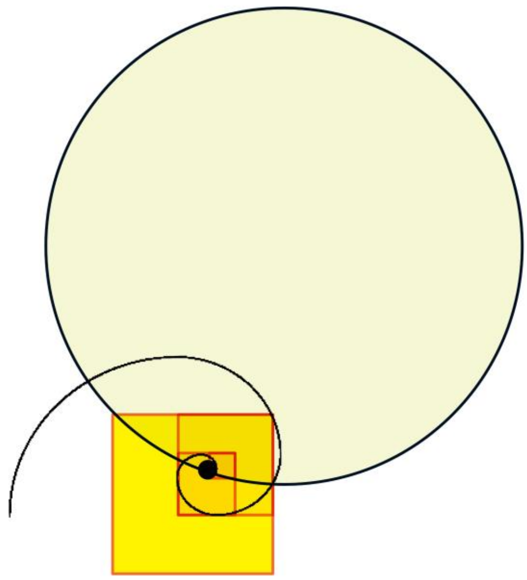
This stage represents the final range of Einstein-predictable metric structure within the black hole. As the spiral tightens toward its innermost point, spatial orientation collapses and all matter transitions into a pure frequency state. The metric is still intact, but cannot extend beyond this boundary. At the spiral's origin point lies a white hole, as postulated by Einstein, but never directly observed. It marks the theoretical re-emergence point of all compressed structure, prior to the collapse phase. While the white hole (spiral end) is not accessible from within the metric, the black hole (spiral start) remains formally defined, initiating the observed dynamics from outside the horizon.

Inside the segment-based black hole metric, a singularity still emerges, not as an abstract point of infinite density, but as a limit surface of maximal fall velocity. As matter transitions deeper into the spiral structure, the local fall velocity v_{fall} continues to grow until it formally exceeds any observable frame of reference. At this boundary, conventional time-space axes collapse, and orientation becomes undefined.

This forms a frequency singularity: a zone where the metric itself continues to exist, but all spacetime intervals compress into a pure oscillatory state. Unlike Einstein's geometric singularity, this singularity is segmental and directional, defined not by curvature alone, but by the breakdown of causal segmentation.

In this context, the singularity is not an endpoint, but a transition surface, marking the inversion of the metric and the emergence of all compressed structure at the white hole origin. It is the only internal region completely shielded from outside observation, yet it governs the entire dynamics of the spiral collapse.

5. Jet re-emergence and energy outflow



The spiral reverses. The restructured segmental energy exits the dense zone and begins unfolding along a new spatial axis. This visualizes a relativistic jet or white-hole-like outflow, not as spontaneous magic, but as a phase-aligned continuation of the inner metric structure. The system doesn't break causality, it phase-shifts. What was lost as mass returns as emergent structure.

Unlike the observer-dependent event horizon defined by light-speed limitations, the segmental fall velocity terminates at a real, physical boundary: the surface of the collapsed matter generating the gravitational field. This is not a relativistic perceptual limit — it is a mechanical one. When an infalling object reaches this boundary at maximal v_{fall} , it undergoes complete structural disintegration, transitioning into pure energy. The boundary is not symbolic. It is where motion ends and frequency begins.

At the core of the collapse structure, the fall velocity of segmental matter reaches its final limit, the dense surface of the gravitational source itself. This is not a theoretical singularity, but a physical termination point. Upon impact, infalling matter undergoes complete energy conversion. The result is an explosive release of accumulated kinetic potential, not as radiation diffused over cosmic time, but as immediate and directional frequency emission. This transition initiates the jet-like ejection of compressed structure from the white hole origin.

The energetic output from segmental collapse is not random nor isotropic. It follows the axial orientation of the segmental spiral, ejecting frequency-aligned energy along a preferred path. The resulting emission - concentrated, high-frequency, and brief - corresponds directly to observed gamma-ray bursts. These are not remnants of explosions, but real-time projections of impact-induced frequency transitions from within the black hole's collapse zone.

Within the segmental collapse, fall velocity continues increasing due to internal dynamic compression. While externally this process appears to slow down indefinitely, the local frame accelerates — pushing motion into a regime that formally exceeds the speed of light when translated into observer-based units. This is not superluminal communication, but an internal dynamical convergence. The final impact occurs at apparent over-c velocities, delivering maximum kinetic energy to the segmental boundary.

5.1. Localized Dynamics in Rotated Temporal Axes

Within the extreme curvature of a black hole's internal metric, classical definitions of force and motion lose their invariance. The standard Newtonian formulation:

$$F = m \cdot \frac{\Delta v}{\Delta t}$$

relies on a globally consistent temporal axis. However, in a segmented spacetime geometry, where gravitational infall velocity v_{fall} becomes the defining boundary condition, this consistency breaks down. Temporal progression itself becomes locally oriented, orthogonal to external spacetime. Consequently, the force acting on a mass must be described as:

$$F = m \cdot \frac{\Delta v_{fall}}{\Delta t_{fall}}$$

Here, both Δv_{fall} and Δt_{fall} are measured relative to the local gravitational segment structure, not an external inertial frame. This reconceptualization preserves the form of Newton's second law but embeds it within a dynamically curved and rotating temporal manifold. The result is a force law that adapts to local gravitational gradients, consistent within the black hole metric, where time and space no longer maintain global orthogonality.

5.2. Determining v_{fall}

Under the segmental metric, radiowaves do not merely reflect gravitational redshift, they encode the local segmental length itself[4,5]. Given that segment traversal velocity v_{fall} exceeds c within the collapse region, and the wave must match local segment structure, the observed wavelength directly yields segment size via

$$v_{fall} = \lambda \cdot f$$

Thus, radiowave measurements provide indirect access to the internal fall velocity and structural scale of the segmental domain.

5.3. Energy-Dominated Metric Distortions

In classical relativity, mass is the primary source of spacetime curvature. However, in energy-dominated events such as nuclear detonations, the spatial metric is affected directly through intense localized energy gradients. These distortions act analogously to mass-induced curvature, but with a temporal profile that is sharp, short-lived, and radiative. Within a segmented spacetime framework, such pulses may not only propagate outward but also interfere with temporally adjacent segments, producing observable resonances prior to the event itself. In this view, energy does not merely bend space, it perturbs the segmentation itself.

6. Segmental Echoes and the ANITA Anomaly

The anomalous radio signals observed by the ANITA experiment[6], emerging from below the Antarctic ice with no corresponding atmospheric event, can be interpreted as manifestations of retroactive segmental interference. In the Segmented Spacetime framework, high-energy events such as nuclear detonations or astrophysical collapses can trigger metric distortions that propagate not only spatially, but also temporally across segment boundaries. These distortions may cause the emergence of pre-event signals: Resonant echoes that become visible within the radio domain before the energy source itself has become classically observable. The ANITA detections, therefore, are not evidence of causality violation, but of a deeply structured temporal segmentation in which localized future events perturb the spatial-temporal axes in advance.

7. Beyond the limit - Segmental descent and the misinterpretation of c

Traditional interpretations of relativistic physics have long enshrined the speed of light, c, as the ultimate velocity limit, not just for information transfer, but for any physical motion. This assumption has guided the structure of both special and general relativity, anchoring our understanding of causality, time dilation, and event horizons. However, such models often fail to distinguish between the propagation of signals and the evolution of spacetime itself.

In the segmental framework, we retain the invariance of light: photons always travel at c relative to their local spacetime fabric. However, we propose that massive bodies within a collapsing spacetime metric can exhibit effective motion exceeding c, not because they accelerate beyond the speed of light, but because the spacetime segments they occupy fall inward faster than light can traverse them.

This distinction reframes the so-called “speed limit” as a property of information transfer, not of structural descent. The result is a model in which matter may be observed falling at superluminal rates relative to a distant frame, without violating causality or breaking relativistic laws. It is not that matter breaks the light barrier; it simply rides a collapsing frame that restructures faster than light can counteract.

The oversight in conventional models stems from conflating local light speed with global spacetime behaviour. The fall velocity v_{fall} of the metric can exceed c without any contradiction, so long as light remains synchronized to its local segments. This insight opens a new interpretive layer within general relativity, where black hole interiors become coherent descent structures, not singular paradoxes, and the dynamics of mass become decoupled from classical velocity constraints**.**

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