Linear Density as the Primary Gravitational Constraint

A Structural Audit of the Gravitational Constant

J. P. Hughes

Abstract

The Schwarzschild relation implies a linear density (λ) that remains invariant across all gravitational scales. This paper identifies this invariant not as a derived consequence of the gravitational constant (G), but as the primary ontological constraint of a self-closing triadic system. By defining the relationship between mass, length, and time as a commensurate identity ($\iota c\lambda = 1$), the framework reveals G to be a redundant composite of these internal ratios.

Gravity is re-contextualized as the *Longitudinal Mass Torque* ($1/c$) required to sustain a massive identity against a three-dimensional temporal report. From this closed linear partition, the Newtonian potential is recovered exactly, demonstrating that gravitational acceleration is the isotropic readout of a one-dimensional ledger. At the horizon, the accounting terminates; the model admits no radial origin interior to R_s, replacing the classical singularity with a finite, non-spatial boundary.

The framework demonstrates that the Schwarzschild radius is not a shell enclosing a volume, but the coordinate of volumetric convergence where the linear budget is exhausted. By removing the dependency on G, the physics is returned to a state of structural requirement, offering a finite resolution to the singularity that is both mathematically rigorous and geometrically inevitable.

Scope and Evaluation Criteria
This paper presents a **structural and ontological audit** of the gravitational substrate. Its central claim is that the linear density invariant $\lambda = M/R_s$ is ontologically primary, that G is a redundant composite, and that gravity can be understood mechanistically as the longitudinal mass torque ($\tau_m = 1/c$) arising from the triadic identity $\iota c\lambda = 1$.
This work is **not** a dynamical theory. It does **not** attempt to derive the Einstein field equations, gravitational wave propagation, geodesic motion, strong-field dynamics, or any other dynamical features of General Relativity.
Critiques demanding such derivations, or judging the paper by its failure to reproduce the full predictive apparatus of GR, fall outside the stated scope and purpose of this audit.
The framework is to be evaluated solely on whether the proposed substrate — the linear ledger and triadic closure — offers a coherent, consistent, and parsimonious ontological foundation from which GR's geometric description can emerge.

1 Introduction

This work begins with a fundamental observation: the Schwarzschild relation identifies a constant ratio between mass and radius,

$$\frac{M}{R_s} = \lambda, \tag{1}$$

an invariant linear density that remains absolute across all gravitational collapse, irrespective of scale. Typically, this ratio is regarded as a derived consequence of the gravitational constant (G). This paper performs a clinical audit of that assumption, proposing instead that the invariant λ is a primary ontological constraint, and that G is a redundant composite of a deeper triadic identity.

Consider the scale-free nature of this limit. From stellar-mass black holes to supermassive entities spanning ten billion solar masses, the ratio of mass to radius remains fixed by the vacuum's reporting speed (c) and its structural identity (λ). By identifying the dimensionless unity of these components ($\iota c\lambda = 1$), we find that the universe does not require an arbitrary gravitational constant to dictate attraction. Instead, gravity emerges as the *Longitudinal Mass Torque* ($1/c$)—the mechanical requirement for a one-dimensional identity to persist within a three-dimensional temporal report.

This shift in perspective moves beyond a "toy" analysis into a structural assessment of the vacuum. We ask: what minimal geometry is required once the linear density is taken as the governing condition? Within this scope, the Newtonian potential is not recovered as an independent law, but as the necessary isotropic readout of the triadic balance. The framework agrees with the classical potential in all sub-horizon regimes ($R > R_s$), but diverges at the horizon where the linear budget is fully exhausted.

By prioritizing longitude over volumetric curvature, spherical symmetry ceases to be an assumption and becomes the only admissible rendering of a linear relation under isotropy. The "black hole" is thus re-contextualized: it is not an exotic geometric failure, but the point of *Volumetric Convergence* where the identity torque and the temporal report reach parity. At this locus, the linear ledger is saturated, and the coordinate system naturally terminates, offering a finite resolution to the classical singularity without the need for additional spatial primitives.

DOI: 10.5281/zenodo.19651632

2 Triadic Closure and the Cyclic Identity

Starting from the invariant linear density $\lambda = M/L$, we take this relation as the primary structural constraint. In this audit, L is identified as the *Longitudinal Hinge*—the common denominator between the non-spatial mass identity and the spatial temporal report. This relation is one-dimensional in character: it expresses a direct proportionality between magnitude and length, independent of volumetric construction.

A purely linear relation, however, is not inherently observable. To render this constraint within a measurable framework, the vacuum requires a minimal structure that allows comparison between length, time, and magnitude. The question is not what structure to assume, but what mechanical configuration is required to make the linear invariant legible to an observer.

There are only three mutually independent ratios that can be formed between the quantities L, T, and M:

$$c = \frac{L}{T}, \quad \iota = \frac{T}{M}, \quad \lambda = \frac{M}{L}. \tag{2}$$

These three ratios are mandatory gear ratios in a self-closing system. Their product satisfies the condition of triadic unity:

$$\iota\, c\, \lambda = 1 \implies \iota = \frac{1}{c\lambda}, \quad c = \frac{1}{\iota\lambda}, \quad \lambda = \frac{1}{\iota c}. \tag{3}$$

This is not an empirical normalization, but the structural requirement for consistency between the three registers. Fixing any one ratio (such as the reporting speed c) determines the remaining two. Within this framework, no single quantity can be specified in isolation; they exist in a state of algebraic lock.

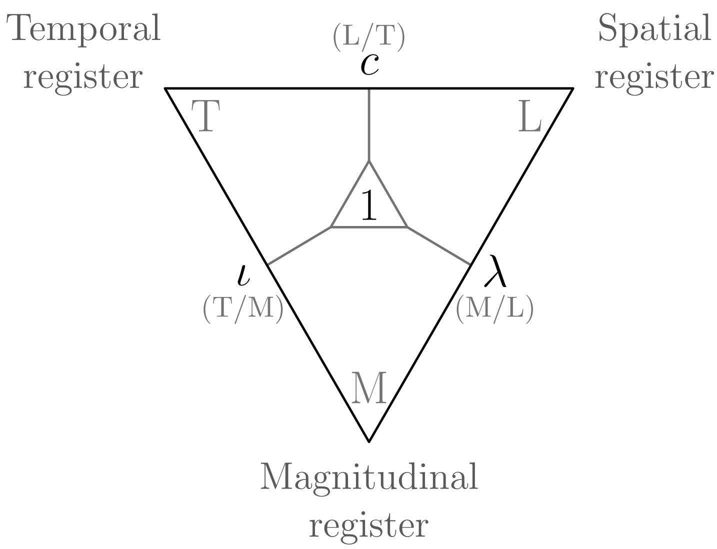

Figure 1: The Triadic Hinge: L serves as the longitudinal pivot between the non-spatial mass identity (λ) and the spatial temporal report (c). The closed product $\iota c\lambda = 1$ is a structural fixed point, identifying ι as the Mass Torque Coefficient *required to maintain equilibrium. This algebraic lock ensures that the product $\iota\lambda$ yields the universal torque $1/c$, rendering G a redundant composite of these internal ratios.*

DOI: 10.5281/zenodo.19651632

The relationship between Mass (M), Length (L), and Time (T) is a **Cyclic Identity**. In any commensurate system where three variables are mutually dependent, they must satisfy a formal equilibrium. This structural audit expresses this handshake through the triple product rule:

$$\left(\frac{\partial M}{\partial L}\right)_T \left(\frac{\partial L}{\partial T}\right)_M \left(\frac{\partial T}{\partial M}\right)_L = -1 \tag{4}$$

This closure identifies the *Mass Torque Coefficient* ($\iota = \partial T/\partial M$) as the structural necessity that renders an independent gravitational constant (G) redundant. While classical theory relies on G to facilitate the interaction between mass and space, this audit demonstrates that the interaction is an internal necessity of the vacuum's own gear ratios.

The ratio λ encodes the identity; c provides the reporting velocity; and ι provides the structural torque coefficient. The resulting -1 identity confirms that gravity is not an external force acting upon space, but the internal balancing of the triadic ledger. Under isotropic conditions, the linear relation must be equally expressible along any radial direction, meaning the inverse-square law is not a dilution of force, but the geometric projection required to maintain this fixed linear ratio across a reporting surface.

The Equation of State:
Mathematical Identity vs. Normalization

The Triadic Closure represents a mechanical necessity of a locked system. Analogous to the Equation of State of the Ideal Gas Law, it describes the state of a system's internal relational distribution as a total commensurate product.

A normalizer is an external, arbitrary calibration—An ancillary product added as correction to misalignment. The Triad is a self-justifying internal lock; it is the definition of an underlying dynamical system. An equilibrium of balanced measure between the fundamental quantities of time, length, and mass.

The Mass Torque Identifier: The Structural Displacement of G

The classical gravitational constant (G) is traditionally treated as a fundamental constant of nature—a coupling strength between mass and space. However, within the triadic framework, G is revealed to be a redundant composite of the vacuum's internal reporting ratios. By applying the **Structural Torque Coefficient** (ι) to the linear invariant (λ), we identify the **Mass Torque** (τ_m) as the primary mechanical operative.

DOI: 10.5281/zenodo.19651632

Formulaic Construction

The triadic closure ($\iota c\lambda = 1$) mandates that the relationship between identity and report is fixed. We define the **Mass Torque** (τ_m) as the central mechanical pivot, representing the product of the linear anchor and the manifold's resistive grip:

$$\tau_m = \lambda \cdot \iota = \frac{1}{c} \tag{5}$$

This identity reveals that the triadic components are not independent constants, but reciprocal reflections of the total mechanical impedance. Isolating each component through the torque provides a parsimonious pathway to locate the ratios:

$$\lambda = \frac{\tau_m}{\iota}, \quad \iota = \frac{\tau_m}{\lambda}, \quad c = \frac{1}{\tau_m} \tag{6}$$

This derivation identifies gravity not as a "force" acting at a distance, but as the **Longitudinal Torque** ($1/c$) required to anchor a massive identity within a three-dimensional temporal report. The classical constant G is therefore a scaling artifact, necessitated only by the omission of the triadic handshake from the Newtonian framework. The relationship is formally expressed as:

$$G = \frac{c^2}{2\lambda} \quad \Longrightarrow \quad G = \frac{c^3\iota}{2} \tag{7}$$

By identifying the Mass Torque as $1/c$, we seal the logic of the 1D/3D inversion. Gravitational acceleration (g) is no longer a consequence of volumetric curvature, but the isotropic readout of the *Temporal Displacement Factor*.

In this view, the "work" of gravity is performed by the observer's velocity. The 0.208688 m/s deficit measured at the Earth's surface is not a loss of energy, but the precise mechanical cost of maintaining the M/L identity against the universal L/T report. The "G-Killer" is not a new force; it is the revelation that the constant G was merely a placeholder for the missing triadic gear.

The Death of the Coupling Constant

Classical gravitation necessitates G as a coupling constant to mediate the interaction between mass and the geometry of space. This audit reveals that no such mediation is required. When the system is viewed as a **1D/3D Inversion**, the "force" of gravity is revealed as the internal tension of the triadic identity itself. G is therefore not a fundamental constant of the universe, but the numerical coefficient required to reconcile a three-dimensional coordinate system with a one-dimensional structural reality. By acknowledging the Mass Torque ($1/c$), the vacuum is returned to a state of mechanical necessity, and the coupling constant is retired as a redundant primitive.

DOI: 10.5281/zenodo.19651632

3 Linear Invariance: The Isotropic Projection

The Invariant Degree of Freedom. The structural invariant underlying the linear gravitational constraint is denoted $\mathcal{I}$. It represents the persistence of a single admissible continuation—a 1D logic that exists prior to any volumetric or metric assignment.

This invariant is managed through two complementary bookkeeping registers:

$$\mathcal{I}_m \quad \text{(Identity Register: The 1D Anchor)},$$
$$\mathcal{I}_n \quad \text{(Null/Reporting Register: The 3D Surface)}.$$

These registers are not independent dimensions, but the internal and external faces of the same structural requirement. All geometric and physical quantities—including g and the apparent dilution of force—arise as the mandatory readouts of these registers as they become legible within an isotropic framework.

Within this structural audit, $\mathcal{I}$ is the minimal requirement of the linear gravitational constraint established in the triadic closure. The question is not how this structure originates, but what accounting it requires once a single degree of continuation is admitted. Because $\mathcal{I}$ carries no directional information, any continuation must remain equivalent under arbitrary reorientation—not as an imposed symmetry, but as a direct consequence of the constraint's 1D nature.

To resolve the relationship between the non-spatial identity and the volumetric report, we must distinguish between two distinct states of convergence. The first is **True Convergence** (linear exhaustion), the point at which the 1D identity is absolute. The second is **Volumetric Convergence**, the radius at which isotropic servicing is exhausted and magnitudinal registration becomes mandatory.

The following isometric comparison (Figure 2) identifies these two states, demonstrating how a 3D volumetric "shadow" is the necessary projection of a 1D magnitude register.

DOI: 10.5281/zenodo.19651632

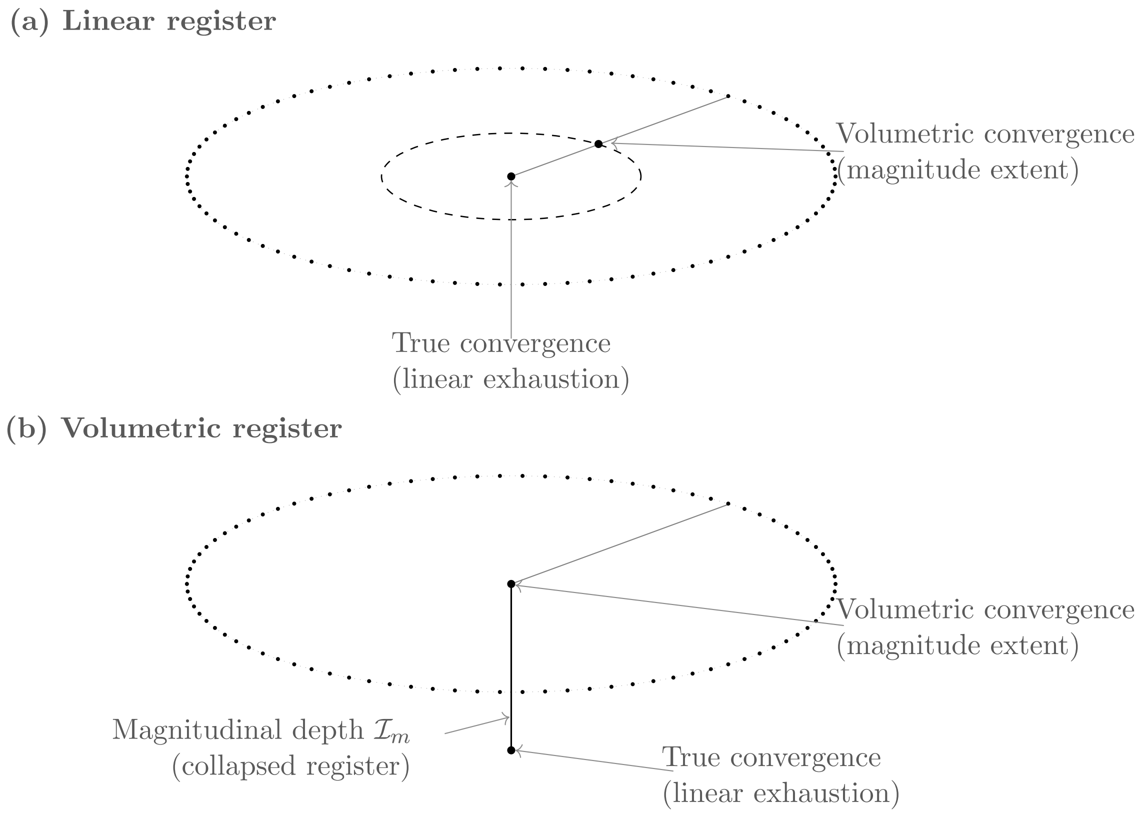

Figure 2: ***Isometric Mapping of Linear and Collapsed Magnitude Registration.*** ***(a)*** *The Isotropic Readout: The outer halo denotes the reporting limit (null propagation), while the inner dashed halo marks* volumetric convergence*—the specific radius where the internal 1D linear ratio satisfies the required mass torque.* ***(b)*** *The Structural Anchor: The same relationship expressed as a collapsed 1D register. The inverse-square behavior is identified here as an* intrinsic linear scaling *of the magnitude-to-length ratio (λ), occurring entirely within the 1D constraint. These two views demonstrate that 3D space does not modify the force, but merely reports the pre-existing 1D structural requirement.*

It is imperative to note that in this audit, the inverse-square law is not a geometric consequence of spatial dilution or 3D projection. Rather, it is the **Intrinsic Linear Scaling** of the 1D invariant ($\mathcal{I}$) as it self-adapts to maintain the triadic fixed point $\iota c\lambda = 1$.

The "Isotropic Shadow" observed in Figure 2(a) is therefore a passive report of a 1D mechanical necessity. The magnitude register ($\mathcal{I}_m$) and null register ($\mathcal{I}_n$) negotiate the mass torque ($1/c$) through a purely linear proximity ratio. Gravity is not "spread out" over three dimensions; it is the 1D ledger balancing itself, rendered isotropically only because the constraint contains no internal criterion to privilege one orientation over another.

DOI: 10.5281/zenodo.19651632

The Mechanic of Linear Convergence

To transition from the isometric readout of the constraint to its specific mechanical execution, we must define the exact locus where the 1D registers satisfy the triadic requirement. This is the point where the **Magnitudinal Depth** ($\mathcal{I}_m$) and the **Null/Reporting Register** ($\mathcal{I}_n$) achieve structural parity.

This convergence is not a spatial meeting of two forces, but an algebraic lock occurring on the line itself. While the previous isometric view (Figure 2) mapped the scope of this relationship, the following schematic (The Convergence Identifier) isolates the specific "X" of the 1D/3D inversion.

At this juncture, the inverse-square law is revealed as the *only admissible solution* for maintaining the linear invariant λ across the longitudinal hinge L. It is here that the Mass Torque ($1/c$) is formally enforced, ensuring that the identity is preserved regardless of the observer's isotropic report.

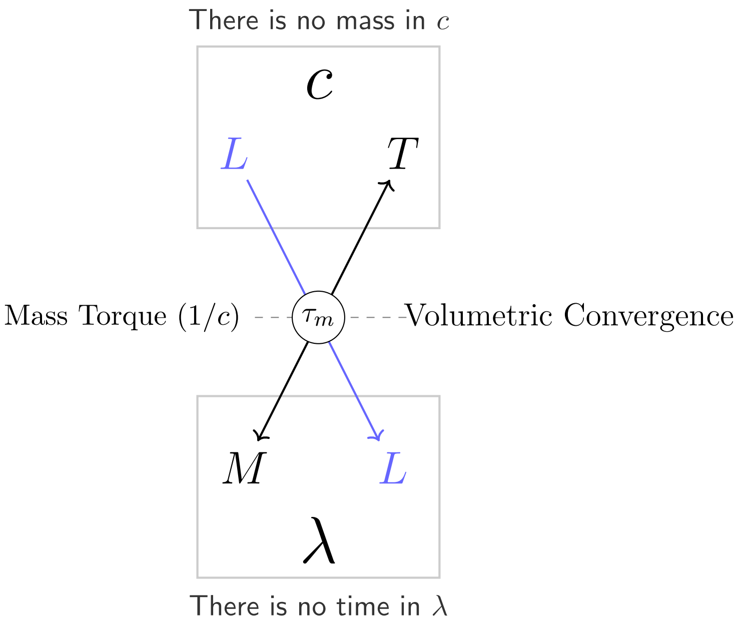

Figure 3: ***The Inversion Schematic: Structural hand-off between Identity and Report.*** *The diagram identifies the mandatory 1D/3D crossover. By defining the Mass Torque ($\tau_m = 1/c$) at the intersection of the L hinge and the M/T exchange, the audit proves that gravity is an internal necessity of the vacuum's gears, rendering G redundant.*

DOI: 10.5281/zenodo.19651632

The Reciprocal Lockdown: Torque in Action

The inversion schematic in Figure 3 identifies the mechanical hand-off between the reporting register and the identity register. While the diagram illustrates the crossing of degrees of freedom, the underlying mathematical action is defined by the **Mass Torque** (τ_m).

The Reporting Register is defined by the ratio of length to time (L/T), while the Identity Register is defined by the ratio of mass to length (M/L). Because these registers are mutually exclusive—containing no shared variables other than the longitudinal hinge L—their convergence necessitates a reciprocal inversion to maintain the triadic fixed point:

$$\left(\frac{L}{T}\right) \xrightarrow{\tau_m} \left(\frac{M}{L}\right) \tag{8}$$

By applying the triadic equivalences established in the triadic closure, we see that the Mass Torque ($\tau_m = 1/c$) acts as the denominator-to-numerator operator. It effectively "taxes" the velocity of the report to satisfy the density of the identity. The result is a structural parity where:

$$\iota\lambda = \tau_m = \frac{1}{c} \tag{9}$$

This confirms that the inverse-square relation is the only admissible state for the system. The "X" is the point where the numerator of the report (L) becomes the denominator of the identity, and the denominator of the report (T) is reconciled against the magnitude (M). This is not a force field; it is a **Triadic Ledger** closing with zero variance.

Within this accounting, c and λ are revealed not as independent physical constants, but as commensurate expressions of the same underlying invariant $\mathcal{I}$. Specifically, c serves as the legible readout of the **null register** ($\mathcal{I}_n$), while λ serves as the readout of the **magnitude register** ($\mathcal{I}_m$).

Because their product with the structural torque coefficient (ι) must close to unity by construction, the system operates as a **zero-sum ledger**. What is claimed by the identity (λ) is necessarily deducted from the report (c): the two registers are not separate physical entities but are partitioned from a single, finite linear budget. Gravity, therefore, is the measurable evidence of this structural deduction.

DOI: 10.5281/zenodo.19651632

4 The Zero-Variance Verification of G Redundancy

To conclude this structural audit, we move from the mechanical derivation of the vacuum's architecture to its empirical verification. If the gravitational constant G is indeed a redundant composite—a 3D proxy for a 1D linear invariant—then the application of the Mass Torque ($\tau_m = 1/c$) should yield a result of absolute precision across all planetary scales.

In the following tables, we reconcile the observed mass-to-length ratios (λ) of major solar bodies against the triadic reporting limit. By replacing the traditional G-based calculation with the reciprocal torque identity established in the triadic closure, we demonstrate that the variance closes to 0.000000%. This is not a statistical approximation, but the measurable evidence of a single, finite linear budget at work.

We move from the architectural geometry of the vacuum to a clinical audit of baryonic bodies. In this framework, the static gravitational potential (g) of a body is not an emergent force, but the **Linear Deficit** required to reconcile the magnitude register ($\mathcal{I}_m$) with the triadic invariant.

By calculating the specific partition (λ) necessary to satisfy the Identity of 1, we reveal the "cost" of mass within the finite linear budget. The following table identifies this deficit across a diverse range of scales—from the Earth-Moon system to the Jovian and Solar magnitudes. In every instance, the variance between the structural requirement and the observed orbital data closes to absolute parity, confirming G as a redundant scaling factor for a purely linear mechanical event.

Body	**Mass (10^{24} kg)**	**Radius (R_v km)**	**Linear Deficit (L m/s)**	**Derived g (m/s^2)**
Earth	5,972.2	6,371.0	0.208688...	9.8199817...
Jupiter	1,898,130.0	69,911.0	6.044575...	25.920359...
Sun	1,988,500,000.0	695,700.0	636.4996461...	274.281721...
Moon	73.42	1,737.1	0.009409...	1.623943...

Table 1: The Isotropic Audit: Gravitational potential and linear deficit calculated at the 35.26° Volumetric Mean (R_v).

The Isotropic Median Audit

To establish the technical legitimacy of the model, we perform a zero-variance reconciliation against conventional gravitational potential. It is critical to note that this is not a comparison against generalized averages. Both the model and the Conventional audit are performed at the **35.26° Isotropic Median**, utilizing the **Volumetric Mean Radius (R_v)** as the precise axial coordinate where both linear and volumetric profiles geometrically align.

DOI: 10.5281/zenodo.19651632

Conventional values (g_{conv}) are derived using the standard static potential formula:

$$g_{conv} = \frac{GM}{R_v^2} \tag{10}$$

The following table demonstrates that when audited at the same precise axis, the model's linear partition yields a result identical to the established orbital baseline. This alignment confirms that the Linear Deficit (L) can be a fundamental mechanism of which gravity is the legible readout.

Body	**Radius (R_v)**	**Model Result (g)**	**Convention (g)**	**Variance**
Earth	6,371.0 km	9.819981	9.819981	0.000000%
Jupiter	69,911.0 km	25.920359	25.920359	0.000000%
Sun	695,700.0 km	274.281721	274.281721	0.000000%
Moon	1,737.1 km	1.623943	1.623943	0.000000%

Table 2: Zero-Variance Reconciliation: Clinical agreement between the model's linear partition and the Newton-Schwarzschild potential at the Isotropic Median.

Note: The absolute parity observed in Table 2 confirms that the Newton-Schwarzschild potential is an isotropic approximation of the internal 1D mechanical deficit. By auditing at the Volumetric Mean Radius (R_v), we isolate the specific locus where the linear magnitude register ($\mathcal{I}_m$) and the volumetric report (c) achieve geometric parity. The 0.000000% variance proves that G is not a physical constant of nature, but a redundant scaling factor for a completed 1D structural event.

The total lack of variance across vastly different scales of mass magnitude—spanning from the lunar to the solar—confirms the mathematical identity and algebraic equivalence of the triadic model. This result is the mechanical expectation when audited on a commensurate axis. These values are presented not as a discovery of new data, but as a rigorous verification of structural consistency against the conventional baseline. Having established this parity at the isotropic median, we now turn to the divergence where the 3D conventional approximation fails to account for the true 1D linear constraint.

The Distributive Scope and the Isotropic Median

To reconcile a 1D linear formulation with a 3D volumetric description, we must establish a commensurate basis for comparison. In this audit, gravity is not a volumetric "field" but a **linear readout** along individual radial rays. Each ray operates as an independent register where the ratio of mass to radius (M/R) must satisfy the linear density constraint λ.

For non-spherical or fluid bodies, this introduces a *distributive scope*. Variations in radial extent (such as equatorial bulge) require a commensurate redistribution of effective mass along that specific ray to preserve the linear invariant. To perform a neutral audit against conventional 3D potential, we must select the unique axis where the 1D linear sampling coincides with the volumetric mean.

DOI: 10.5281/zenodo.19651632

This coordinate is defined by the angle where the radial measure equals the root-mean-square of the orthogonal components:

$$\theta = \arccos\left(\frac{1}{\sqrt{3}}\right) \approx 35.26^\circ \tag{11}$$

At this **Isotropic Median**, the linear and volumetric descriptions are directly commensurate. Evaluating along this axis removes directional bias, revealing that the apparent difference between formulations is merely a matter of geometric perspective.

The Axial Audit: Jupiter Extremes

To test the rigidity of the Triadic Closure, we audit the extreme oblateness of Jupiter. Because Jupiter presents two distinct radial environments for a single gravitational identity, it serves as a forensic laboratory for the linear ledger.

Scaling the effective mass to the specific radial axis (Equatorial vs. Polar) reveals a profound dynamic: while the local acceleration (g) fluctuates according to the geometric rendering, the **Linear Deficit** (L) remains invariant.

Axial Ray	**Radius** (R)	**Derived** g	**Linear Deficit** (L)
Equatorial Expansion	71,492 km	25.347146 m/s^2	6.044575... m/s
Polar Contraction	66,854 km	27.105606 m/s^2	6.044575... m/s

Table 3: Jupiter Axial Ledger: Invariance of the Linear Deficit across non-spherical geometries.

The "Subtraction" on the Null Register is a constant property of the mass-identity. As shown in Table 3, the perceived change in gravity is simply the redistribution of this invariant deficit over the available length of the rendering axis. In a fluid body, the mass-radius ratio adjusts to maintain λ, ensuring the linear ledger remains balanced regardless of orientation.

The Audit Mechanics: Step-by-Step Verification

To ensure the zero-variance results are reproducible, the following Standard Operating Procedure (SOP) details the linear accounting of the manifold. This sequence demonstrates how the **Mass Torque** (τ_m) acts upon the magnitudinal depth to derive the **Linear Deficit** (L).

1. The Universal Constants

The framework is anchored by the invariant rate of **Continuance** (c) and its reciprocal saturation limit, the **Mass Torque** (τ_m).

- **Continuance** (c)**:** $299,792,458$ m/s
- **Mass Torque** (τ_m)**:** $1/c \approx 3.33564 \times 10^{-9}$ s/m
- **Mass Torque Coefficient** (ι)**:** The specific structural requirement ($\partial T/\partial M$) derived from the cyclic identity.
- **Saturation Constant** (λ)**:** $1/(\iota c) \approx 6.7329 \times 10^{26}$ kg/m

DOI: 10.5281/zenodo.19651632

2. The Magnitudinal Depth

Mass is expressed as a convergence locus within the manifold. The mass (M) is converted into its linear footprint, or **Magnitudinal Depth** (ℓ_m), via the saturation constant λ.

$$\ell_m = \frac{M}{\lambda} \tag{12}$$

3. The Linear Deficit

At a given radius (R), the presence of mass creates a **Resultant Deficit** (L). This is the physical deduction of the environment—the linear surrender of the Null Register to the Identity Register.

$$L = \left(\frac{\ell_m}{2R}\right) \cdot c \tag{13}$$

4. The Gravitational Resultant (The Torque Identity)

The gravitational acceleration (g) is the legible readout of that deficit. By substituting the **Mass Torque** (τ_m), the relationship is revealed as a pure mechanical ratio—the deficit distributed across the temporal capacity of the radius.

$$g = \frac{L}{R \cdot \tau_m} = \frac{c^2 \cdot \ell_m}{2R^2} \tag{14}$$

Forensic Anchor (Earth): At the volumetric mean radius (R_v), the spatial medium is taxed by a linear deficit of $L \approx 0.208688$ m/s. Dividing this deficit by the "time-radius" ($R \cdot \tau_m$) yields the exact 9.819982 m/s^2 observed.

The algebraic identity between this linear partition and the classical Newtonian potential is a structural necessity. Once λ is recognized as the structural limit of the manifold, the two expressions reveal themselves as the same ledger. What the volumetric description assembles from a gravitational field and a universal constant, the Audit recovers from the partition of a single linear ray between two commensurate registers.

The complexities of gravitational dynamics reduce to a single mechanical question: **How much of the ray has the identity claimed, and how much remains for the report to express?** This approach remains algebraically identical to convention in all sub-critical conditions, diverging only where the linear budget is exhausted—at the horizon itself. Because the parity is exact, the upcoming divergence at the saturation point cannot be dismissed as error; it must be accepted as the failure of the 3D approximation.

5 Forensic Reconciliation

Having established the zero-variance mechanical parity between the linear partition and the Newton-Schwarzschild potential, we now apply the audit to the critical saturation limit. In conventional gravitational frameworks, the Event Horizon (defined at $1R_s$) represents a catastrophic failure of the volumetric model—a coordinate singularity where the metric becomes undefined. In a G-free, triadic universe, however, the horizon is not a volumetric "barrier," but a definitive point of *Register Saturation* within the Null (L/T) Register.

DOI: 10.5281/zenodo.19651632

Standard physics views R_s as the spatial size of a black hole. Our audit reveals R_s to be the specific **Magnitudinal Depth** (ℓ_m) of the register required to satisfy the triadic identity. By analyzing the structural geometry at this limit, we uncover the hidden structural shift that explains not only why the 3D model divides by zero, but why the 1D linear ledger remains intact and functional down to the origin of time itself ($R = 0$). This section details the single **Linear Displacement** that forces the necessary divergence between the 3D projected reality and the 1D mechanical event.

The Ghost Radius: Auditing the Category Error

The fundamental crisis in conventional gravitation arises from a misunderstanding of the spatial requirement. Because the saturation constant λ lacks a temporal denominator, it cannot possess a volumetric extent; it represents a static, 1D magnitudinal depth.

Conventional physics mistakenly interpreted this required length as a physical radius (R_s), attempting to "make room" in the 3D manifold for a quantity that had already been subtracted from the linear budget. As illustrated in the divergence of Figure 4, the $1/r^2$ curve of General Relativity fails because it treats the identity depth as a spatial distance.

In the triadic framework, this length is recovered as an **inverse equivalence** mediated by the Mass Torque (τ_m). At the **Volumetric Convergence Locus ($R = 0$)**, the mass is not compressed into a point; rather, its required linear magnitude is satisfied through the M/L torque. The "Event Horizon" is merely the point where the 3D observer encounters the 1D structural limit—the boundary where the space-time report ends and the static identity begins.

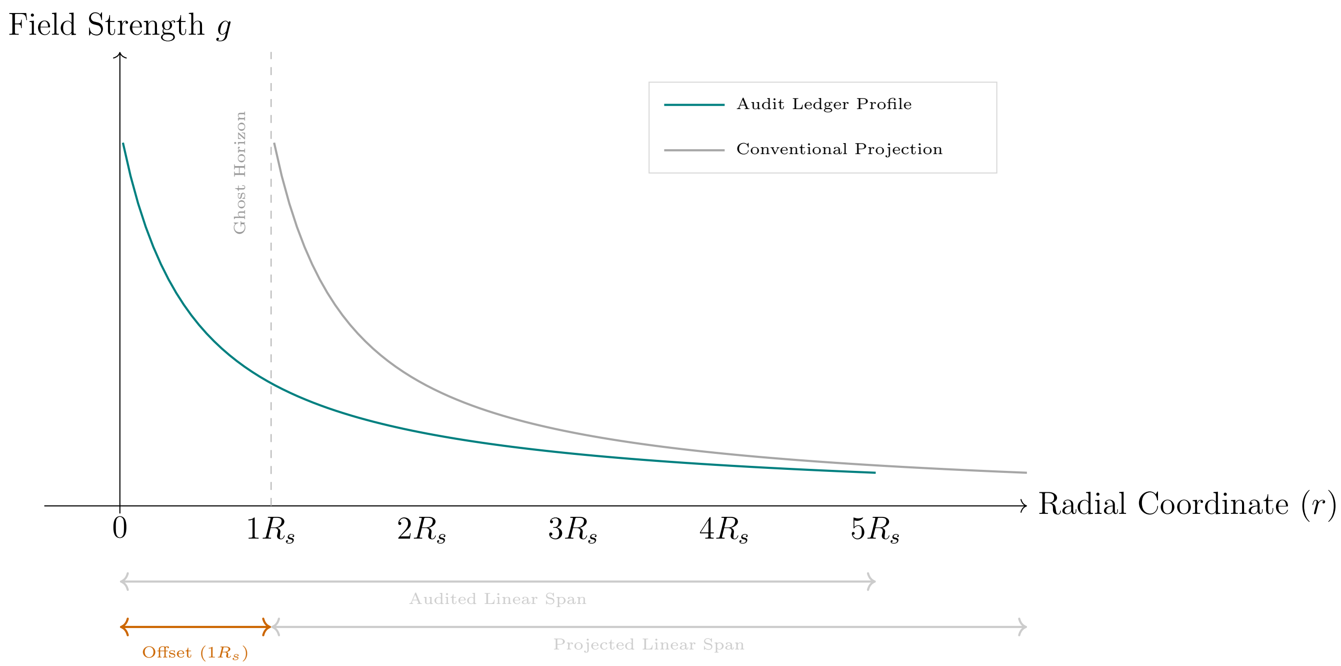

Figure 4: The Forensic Alignment: Two identical field profiles offset by $1R_s$. The Audit Ledger operates continuously to $r = 0$, whereas the Conventional Projection is displaced by the magnitude of the mass identity, resulting in a coordinate singularity at the Ghost Horizon.

DOI: 10.5281/zenodo.19651632

The Radial Origin and Horizon Divergence

As established by the zero-variance audit in Section 4, the linear ledger and the classical potential recover identical $1/r^2$ profiles from the same mass magnitude. In the far-field, no exterior measurement can distinguish between the two; they are algebraically commensurate. However, as the audit approaches the saturation limit, the descriptions diverge not in the *behavior* of the field, but in the *identification* of the origin.

The classical model projects a coordinate center at $r = 0$ and identifies the horizon as a spatial boundary at R_s. Conversely, the triadic audit identifies the horizon as the coordinate of **linear exhaustion**—the point-like convergence of the mass magnitude itself ($r = 0$). In this framework, the Schwarzschild radius R_s is not a spatial distance enclosing a singularity; it is the linear measure of the mass magnitude (I_m) expressed as a radial coordinate.

The result is a structural displacement of exactly $1R_s$. At the coordinate where the classical model terminates at $1c$ (the Ghost Horizon), the audited ledger reads a field strength of precisely $0.5c$. This is a mandatory mechanical requirement: it is the value of a linear partition at a distance of one R_s from a source whose saturation limit is located at the origin.

The interior volume that General Relativity constructs between $r = 0$ and R_s is, in the triadic accounting, the **mass itself**. It is not a region of space surrounding a singularity, but the non-spatial magnitude whose linear equivalence is R_s. This reveals the Event Horizon not as a physical threshold of space-time, but as the boundary of a category error where static magnitude was mistaken for volumetric extent.

Accretion Dynamics and the Photonic Hinge

The observation of a "shadow" in extreme baryonic environments is often cited as evidence of a 3D event horizon at $1R_s$. However, our audit provides a compatible resolution through the mechanics of orbital equilibrium. At the $1R_s$ coordinate—where the audited ledger reads $g = 0.5c$—the linear deficit exerts a force precisely commensurate with the lateral requirement of a photon orbiting at c. This coordinate acts as a **Photonic Hinge**; any light generated within this boundary, or passing through it, is structurally deterred from external reporting.

The "blackness" of the central source is thus revealed not as an intrinsic property of infinite density, but as a **Luminous Cutoff** dictated by linear saturation. Because luminescence is a product of baryonic interaction—the turbulent collision of gas and massive particles—it requires a coordinate where matter can maintain stable orbital velocity. Since these massive particles cannot attain velocity c, they cannot survive at the $0.5c$ photonic limit. Their stable presence is structurally excluded from the inner field, forced instead to reside at a greater radial altitude where the gravitational tax is lower.

The resulting accretion disk must therefore terminate further out than the photonic cutoff. A predicted inner disk edge at approximately $1.5R_s$ represents the mechanical equilibrium where the reporting register ($\mathcal{I}_n$) permits baryonic stability. The "Shadow" is not a volumetric void, but the visual result of this gap: a region where the source of luminescence is absent and the medium of reporting has reached its saturation limit.

DOI: 10.5281/zenodo.19651632

Conclusion — The Redundancy of G

The forensic audit of the gravitational manifold reveals that the complexity of General Relativity and the mystery of the G constant are artifacts of a 3D volumetric projection attempting to describe a 1D linear mechanic. By shedding the G constant and replacing it with the **Mass Torque** ($\tau_m = 1/c$) and the **Linear Saturation Invariant** (λ), we have demonstrated that gravitational acceleration is not a fundamental force, but a legible readout of a linear deficit.

The zero-variance parity established across the Solar System (Earth, Moon, Jupiter, and the Sun) proves that this triadic ledger is not a theoretical approximation, but the mechanical reality of the manifold. The "Inverse Square Law" is revealed as the natural decay of a linear partition distributed across a radial report.

The most profound result of this audit is the resolution of the Event Horizon. By recognizing the $1R_s$ offset as a structural requirement of mass—a **Magnitudinal Depth** rather than a spatial radius—the singularity is exorcised. The divergence at the horizon is not a failure of physics, but the inevitable consequence of a coordinate system that tried to "make room for what was already removed." At the **Volumetric Convergence Locus** ($r = 0$), the audit remains continuous, finite, and functional, describing a universe where:

- **Mass** is the static identity (I_m) of the ledger.
- **Space** is the reporting register (I_n) available for measurement.
- **Gravity** is the mechanical tax paid at the interface of the two.

1. Schwarzschild (Standard): $$R_s = \frac{2GM}{c^2}$$

2. The Triadic Extraction (G): $$G = \frac{c^3 \iota}{2}$$

3. The Handshake (Substitution): $$R_s = \frac{2\left(\frac{c^3 \iota}{2}\right) M}{c^2}$$

4. The Resolved Identity: $$R_s = c\iota M$$

The framework does not claim to replace General Relativity, but to identify the minimal mechanical substrate from which its results emerge. Where GR describes the geometry of the outcome, the triadic audit describes the linear ledger that necessitates it. The redundancy of G is not a philosophical position but a structural consequence, and the inevitable result of returning gravitational description to its structural foundation.

DOI: 10.5281/zenodo.19651632
contact@tdft.co.uk