WILL: Unified Framework
PART I - RELATIVITY'S

Anton Rize egeometricity@gmail.com

April 2025

Postulate: **Spacetime $\equiv$ Energy Evolution**

$\downarrow$

Geometric Self-Consistency

$\downarrow$

Topological Requirement: Only Closed and Maximally Symmetric Structures Allowed

$\downarrow$

Circle (SR) and Sphere (GR) as Unique Permitted Geometries

$\downarrow$

Result: Projections β (kinetic) and κ (potential) are Strictly Normalized

$\downarrow$

Conservation, Symmetry, Speed Limit, Natural Bounds

$\downarrow$

Unified Field Equation: $\kappa^2 \;=\; R_s/r \;=\; \rho/\rho_{\max}$

$\downarrow$

Closure: Field Equation $\Longleftrightarrow$ Fundamental Postulate

Contents

1 Will: A Relational Framework for Space-Time-Energy

2 Methodological Purity and Epistemic Minimalism

2.1 Foundational Approach

The framework of WILL Geometry is built from a single postulate and zero free parameters. This construction is not a simplification — it is a deliberate epistemic constraint. No assumptions are introduced unless they are strictly derivable from first principles, and no constructs are retained unless they are geometrically or energetically necessary.

Guiding Principle

Nothing is assumed. Everything is derived.
There are no "extra pieces" in reality.

2.2 Epistemic Hygiene

Modern theoretical physics often tolerates hidden assumptions: arbitrary constants, renormalization techniques, or abstract entities with ambiguous physical status. WILL Geometry, by contrast, enforces what we call **epistemic hygiene** — a disciplined refusal to smuggle explanatory weight into unjustified assumptions. All physical quantities, including space, time, mass, and energy, emerge from relational geometry and causal structure.

2.3 No Ontological Commitments

This model makes no ontological claims about the "existence" of space, particles, or fields. Instead, all phenomena are treated as observer-dependent energetic projections, governed by the Energy Symmetry Law:

$$\boxed{\Delta E_{A\to B} + \Delta E_{B\to A} = 0}$$

2.4 Principle of Sufficient Explanation

If a geometric relationship can explain an observation, no additional mechanism is introduced. WILL Geometry seeks not to describe the universe as we imagine it, but to reduce its complexity to the minimal algebraic and causal structure required to explain our measurements.

Summary of Will Geometry

The entire physics of Will Geometry is built upon a single postulate:
"Spacetime is identical to energy evolution."
All formal structure—closed geometry, the speed limit, energy conservation, the absence of singularities—inevitably follows from this postulate.
The resulting equation is not something arbitrary or requiring any external assumptions; it is precisely the mathematical realization of the postulate itself.
Thus, the theory is perfectly closed upon itself: *the fundamental principle is proven by its own consequences, and vice versa.*

3 Motivation and Core Principles

The standard formulation of General Relativity often relies on the concept of an asymptotically flat spacetime, introducing an implicit external reference frame beyond the physical systems under study. While some modern approaches (e.g., shape dynamics) seek greater relationality, we proceed from strict epistemic minimalism, disallowing all background structures, even hidden or asymptotic ones.

Principle: *All physical quantities must be defined purely by their relations.* Any introduction of absolute properties or external frames risks reintroducing metaphysical artifacts and contradicts the foundational insight of relativity.

$$\boxed{\begin{array}{c}\text{Energy is not a substance,}\\ \text{but a } \textit{differential invariant}\\ \text{of state transitions in } \texttt{Will}.\end{array}}$$

What is Energy? Energy is not an intrinsic property of objects, but a measure of difference between possible states. It expresses the system's capacity to transition, always encountered as a relative potential for change—not as something possessed, but as a comparative structure between observers. In this framework, energy marks the directional tendency for one configuration to transform into another.

We therefore posit a single unifying postulate:

$$\boxed{\text{SPACETIME} \equiv \text{ENERGY EVOLUTION}}$$

Clarification: By "energy evolution" we mean the total structure of possible transitions between observable states—not a process unfolding in spacetime, but the very relational geometry from which both space and time emerge. This is not a derived result, but a foundational postulate, subject to geometric and empirical audit in subsequent sections. "Will" is used here as a technical term for this unified, emergent structure.

4 Fundamental Structure of Will

From our postulate, several key properties of the Will framework can be derived:

1. **Self-contained geometry:** Since spacetime is identical to energy evolution, there can be no external objects or reference frames. The geometry must therefore be self-contained.
2. **Conservation law:** A closed geometry naturally leads to conservation principles—nothing enters or leaves the system, making the total energy constant.
3. **Symmetry:** With no external reference, all directions/positions must be equivalent; any asymmetry would require a preferred frame, which is disallowed.
4. **Circular geometry:** Among all closed and maximally symmetric geometries, the circle (and, in higher dimensions, surface of the sphere) uniquely preserves equivalence of all points and directions, ensuring that no hidden reference structure or asymmetry contaminates the framework.

4.1 Emergence of Space and Time

In this construction, space and time are not assumed as independent entities, but arise as complementary projections of the underlying rate and direction of energetic transformation along the closed geometric structure.

The word "evolution" in our postulate implies a non-instantaneous process, requiring a rate of change. This rate naturally establishes a relationship between what we perceive as spatial and temporal units, yielding the speed of evolution.

Any energy state can be represented as a point on the circle. Changes in energy states correspond to movement along this circle, characterized by:

- Speed of state change (rate of evolution)
- Direction of state change

These two orthogonal components naturally give rise to what we interpret as space-like and time-like dimensions without needing to postulate coordinate axes a priori.

4.2 Fundamental Theorem of Will

In this view, the Will manifold encodes all physically meaningful structure as patterns of relational evolution, with no background space, and local features such as causality and intensity emerging solely from the intrinsic properties of this flow.

Theorem 1 (Structure of Will Manifold)**.** The Will manifold $\mathcal{W}$ is defined as the space of all possible energy relations between systems, such that:

1. For any two systems S_1 and S_2, there exists an energy relation $E(S_1, S_2) \in \mathcal{W}$
2. The evolution of energy relations defines a flow on $\mathcal{W}$
3. This flow induces a circular topology on $\mathcal{W}$ where continuity is defined by continuous energy transformations
4. The causal structure emerges from the directional properties of this flow
5. The local structure of $\mathcal{W}$ is determined by the intensity of energy relations

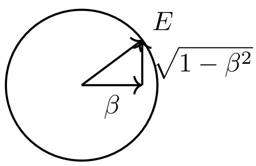
Proof.

5 Kinetic Energy

5.1 Reinterpretation of speed of light:

We interpreting the **speed of light c** as the **universal rate of change** implying that every energy transformation or interaction has the same rate = c distributed between spatial like and temporal like components. We expressing **universal rate of change c** as rotating radial vector so the unit circle naturally emerges as embodiment of conservation law:

- $r = c = 1$ rotating radial vector on a unit circle controlled by:
- $\theta_S = \arccos(\beta)$ relativistic angle represents energy distribution by rotation of radial vector.
- $\beta = \frac{v}{c} = \sqrt{\frac{R_s}{2r}} = \cos(\theta_S)$, **(Orbital velocity)** space like kinetic component (Xaxis)
- $L_c = \sqrt{1-\beta^2} = \sin(\theta_S)$ (Length contraction factor) temporal like component (Yaxis)
- $T_d = \frac{1}{L_c} = \frac{1}{\sqrt{1-\beta^2}} = \frac{1}{\sin(\theta_S)}$ (Time dilation factor) identical to relativistic γ factor.



In our model, the spatial and temporal-like projections are not to be interpreted as traditional coordinates, but as relative geometric ratios derived from the invariant rate of change.

5.2 Special Theory of Relativity (Time Dilation Factor)

The standard time dilation factor in Special Relativity is given by:

$$T_d = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}. \tag{1}$$

Our geometric expression for the relativistic factor is:

$$T_d = \frac{1}{\sin(\arccos(\beta))}, \tag{2}$$

where:

$$\beta = \frac{v}{c}. \tag{3}$$

Derivation of Equivalence: 1. Start with the geometric expression:

$$T_d = \frac{1}{\sin(\arccos(\beta))}. \tag{4}$$

2. Use the trigonometric identity $\sin^2(x) + \cos^2(x) = 1$, which implies $\sin(x) = \sqrt{1 - \cos^2(x)}$:

$$T_d = \frac{1}{\sqrt{1 - \cos^2(\arccos(\beta))}}. \tag{5}$$

3. Evaluate $\cos(\arccos(\beta))$:

$$T_d = \frac{1}{\sqrt{1 - \beta^2}} = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \gamma. \tag{6}$$

Conclusion: The derived expression is identical to the standard time dilation factor, demonstrating the equivalence.

5.3 Interpretation of β: Spatial Energy Projection

β quantifies the energy of an object or system as expressed in terms of the relative rate of change of spatial coordinates. Operationally, it reflects the amount of energy the observer would need to expend to "catch up" with the object.

The range of β is naturally constrained:

$$0 \leq \beta \leq 1$$

Beyond $\beta = 1$, the object moves faster than the speed at which causal signals propagate (speed of light in vacuum), and therefore becomes causally disconnected from the observer.

6 Geometric Derivation of $E = mc^2$ Ab Initio

In standard physics, this identity is often introduced via dynamical or conservation arguments.

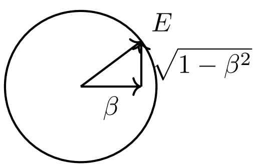
Theorem 2. Within the Will Geometry framework $E = mc^2$ emerges purely from first principles of relational projections, without assuming any spacetime metric or pre-existing formula for rest energy.

Proof. **Circular Projection and Relational Scale**

- Consider a circle of radius c. Every point on this circle—parametrized by angle θ_S—represents a possible distribution of “rate of change” between spatial and temporal components.
- Define $\beta = \cos(\theta_S)$. Then $L_c = \sin(\theta_S) = \sqrt{1 - \beta^2}$. Equivalently,

$$\beta = \frac{v}{c}, \quad L_c = \sqrt{1 - \beta^2} = \sqrt{1 - \frac{v^2}{c^2}}.$$

  This structure forms a right triangle in projection space:



  where the hypotenuse represents the total energy vector E, geometrically arising from the projectional composition of motion and inertia.

- Introduce a single positive constant E_0 (with units of energy) as the “minimal” or “reference” projection when $\beta = 0$. In other words, at $\theta_S = \frac{\pi}{2}$ (i.e. $v = 0$), the vertical projection of the total energy must be exactly E_0. Thus E_0 is not assumed to equal mc^2 yet; it simply sets the physical scale.

Accordingly, any point on the circle at angle θ_S has two dimensionless coordinates:

$$(\cos(\theta_S),\ \sin(\theta_S)) \;=\; \big(\beta,\ \ L_c\big).$$

Multiply these by the same factor E (the total energy in physical units) to obtain physical projections:

$$E\ \cos(\theta_S) = E\,\beta, \qquad E\ \sin(\theta_S) = \ E\,L_c.$$

By construction, when $\beta = 0$ ($\theta_S = \frac{\pi}{2}$), we require

$$E\ \sin\!\big(\tfrac{\pi}{2}\big) \;=\; E_0 \quad\Longrightarrow\quad E_0 = E \cdot 1.$$

Hence in general,

$$E\ \sin(\theta_S) \;=\; E_0 \quad\Longrightarrow\quad E = \frac{E_0}{\sin(\theta_S)} \;=\; \frac{E_0}{\sqrt{1-\beta^2}}.$$

Define

$$\gamma \;=\; T_d \;=\; \frac{1}{\sqrt{1-\beta^2}}, \quad \text{so that} \quad E = \gamma\,E_0.$$

Horizontal (Momentum) Projection

In classical mechanics, momentum is $p = m\,v$. We have introduced neither m nor $m\,c^2$ yet—only E_0. Observe:

$$E\ \cos(\theta_S) \;=\; E\,\beta = \gamma\,E_0\,\beta.$$

We identify the horizontal projection $E\,\beta$ with $p\,c$. Thus

$$p\,c \;=\; \gamma\,E_0\,\beta.$$

But since $\beta = v/c$, this becomes

$$p\,c = \gamma\,E_0\,\frac{v}{c} \quad\Longrightarrow\quad p = \frac{\gamma\,E_0}{c^2}\,v.$$

At this stage, E_0 remains an unspecified constant with dimensions of energy; the ratio E_0/c^2 has the dimensions of mass. Define

$$m \;\equiv\; \frac{E_0}{c^2}.$$

Hence

$$E_0 = m\,c^2, \quad p = \gamma\,m\,v, \quad E = \gamma\,m\,c^2.$$

Notice that no step assumed $E_0 = m\,c^2$ as a given "rest-energy" formula; instead, we merely identified the combination E_0/c^2 with a physical mass parameter m. The functional dependence on γ was already fixed by the circle's geometry.

Pythagorean Relation and $E^2 = (pc)^2 + (mc^2)^2$

Having

$$E\ \sin(\theta_S) = E_0 = m\,c^2, \quad E\ \cos(\theta_S) = p\,c,$$

the Pythagorean theorem in projection space yields

$$E^2 = \big(E\ \cos(\theta_S)\big)^2 + \big(E\ \sin(\theta_S)\big)^2 = (p\,c)^2 + (m\,c^2)^2.$$

Since $E = \gamma\,m\,c^2$ and $p = \gamma\,m\,v$, this recovers the standard relativistic energy–momentum relation:

$$\boxed{E^2 = m^2c^4 + p^2c^2} \tag{7}$$

6.1 Why Rest-Energy Invariance Follows from Conservation

Within the Will framework, the total energy vector $\mathbf{E}$ is represented by the hypotenuse of a right triangle inscribed in a unit circle of radius c. Its dimensionless projections satisfy

$$\beta = \cos\theta_S, \quad L_c = \sin\theta_S, \quad \beta^2 + L_c^2 = 1.$$

When scaled by the physical magnitude E, these become

$$E_x = E\,\cos\theta_S, \quad E_y = E\,\sin\theta_S.$$

To connect with the notion of "rest," we operationally define the *rest-energy* E_0 via the projection at zero spatial velocity ($\beta = 0,\ \theta_S = \frac{\pi}{2}$):

$$E_y\big|_{\theta_S=\pi/2} = E\,\sin\tfrac{\pi}{2} = E_0.$$

Because the circle's Pythagorean identity $\cos^2\theta_S + \sin^2\theta_S = 1$ holds for all θ_S, the only way to preserve $E_y = E_0$ as β varies is

$$E\,\sin\theta_S = E_0 \quad\Longrightarrow\quad E = \frac{E_0}{\sin\theta_S} = \frac{E_0}{\sqrt{1-\beta^2}} = \gamma\,E_0.$$

Hence, the rest-energy projection's invariance is not an *additional* axiom but the *inevitable consequence* of:

1. The unit-circle geometry ($\beta^2 + L_c^2 = 1$),
2. The operational choice to define "rest" as the slice $\beta = 0$,
3. The conservation of that chosen projection E_y.

By anchoring this construction in our core postulate

$$\text{SPACETIME} \;\equiv\; \text{ENERGY EVOLUTION},$$

we derive $E = \gamma\,m\,c^2$ and $E^2 = (p\,c)^2 + (m\,c^2)^2$ directly from geometry, with no need for extra hypotheses.

6.2 Dual Scaling in Will Geometry

The Will framework reveals a striking symmetry: both energy and spatial distance emerge from the same unit-circle projections, differing only by the power of the inverse projection used.

- **Energy Scaling:** The total energy E scales inversely with the temporal projection $L_c = \sin\theta_S$:

$$E = \frac{E_0}{\sin\theta_S} = \frac{E_0}{L_c} = \gamma\,E_0,$$

  so that $E\sin\theta_S = E_0$ remains invariant.

- **Distance Scaling:** The (normalized) radial distance r/R_s in both Special and General Relativity scales inversely with the square of the spatial projection $\beta = \cos\theta_S$:

$$\frac{r}{R_s} = \frac{1}{2\,\beta^2} = \frac{1}{2\,\cos^2\theta_S}.$$

In each case, a single dimensionless projection ($\sin\theta_S$ or $\cos\theta_S$) is elevated to a physical quantity by taking its reciprocal (to the appropriate power) and multiplying by a fixed scale (E_0 or $R_s/2$).

Fundamental Implication This duality underscores that at the deepest level, space, time, energy, and distance are all encoded in the same dimensionless geometry of the unit circle. Any physical observable arises from choosing:

1. A projection axis (β or L_c), 2. An inversion power (1 for energy, 2 for distance), 3. A conventional scale factor.

Thus, the entire edifice of relativistic kinematics and gravity can be built from pure, dimensionless projections plus minimal scale conventions."'

6.3 Mass as a Scale Factor

In Will geometry, mass is not an independent dynamical variable but simply the conversion factor between the dimensionless "rest-energy invariant" E_0 and familiar SI units. Concretely:

$$m = \frac{E_0}{c^2}.$$

Thus:

- The rest-energy projection $E \sin\theta_S = E_0$ can be equivalently written $m\,c^2$.
- All inertial and gravitational effects (kinetic terms, Schwarzschild radius R_s, etc.) follow by substituting $E_0 = m\,c^2$ into the dual-scaling laws.

Interpretation

All relativistic properties—energy diverging as $v \to c$, correct normalization at $v = 0$, and the conservation of energy–momentum—follow immediately. In this framework:

- The unit circle embodies the conservation of the "universal rate of change" c.
- The parameter $\beta = v/c$ specifies a point on that circle.
- A single scale E_0 (later identified as $m\,c^2$) fixes the overall magnitude of the energy vector.
- No prior assumption of $E = m\,c^2$ is needed; rather, it is recovered by operational choice to define "rest" as the vertical projection equal to E_0 at $\beta = 0$.

Thus, $E = \gamma\,m\,c^2$ and $E^2 = (p\,c)^2 + (m\,c^2)^2$ are fully derived from the first principle that "energy evolution" is encoded in a self-contained circular geometry.

This geometric approach unifies our understanding of mass, energy, and momentum as different projections of the same fundamental quantity—the energy vector in Will geometry—whose orientation is determined by the relative motion between observer and observed system. □

7 Potential Energy

7.1 Beyond Curvature: A New Perspective

The conventional approach to gravity in General Relativity relies on the concept of curvature—a notion that implicitly assumes the existence of a flat reference frame. This creates a fundamental inconsistency: while rejecting absolute space in principle, standard GR tacitly introduces an absolute reference through the concept of curvature relative to flatness.

In our Will framework, we reject this artifice. Rather than imposing curvature as an interpretational construct, we allow the universe to naturally manifest its geometric structure through energy relations. This approach remains true to our foundational principle:

$$\boxed{\text{SPACETIME} \equiv \text{ENERGY EVOLUTION}}$$

7.2 Dimensional Analysis of Gravitational Energy

If gravity operates within the same geometric structure as relativistic velocity, we must express it as a dimensionless fraction of the speed of light, since we operate on a circle with radius c. However, gravity and velocity differ in their dimensional characteristics:

- β represents one-dimensional energy distribution as a motion vector (1D): $\frac{v}{c}$
- Gravity represents three-dimensional energy distribution as an isotropic field with $\frac{1}{r}$ dependence

This distinction leads us to introduce a new parameter κ to characterize gravitational energy distribution. While β represents a directional (vector) quantity, κ represents a radial (scalar) quantity distributed across a spherical surface (2D).

7.3 Boundary Conditions and Physical Interpretation

For kinetic energy parameter β:

- $\beta = 0$: No relative motion
- $\beta = 1$: Maximum possible relative motion (speed of light)

By analogy, for the gravitational parameter κ:

- $\kappa = 0$: No gravitational influence
- $\kappa = 1$: Maximum possible gravitational influence (event horizon)

The value $\kappa = 1$ corresponds precisely to the point where escape velocity equals the speed of light, creating an event horizon. This provides a natural upper bound for our gravitational parameter, analogous to the light-speed limit for relative motion.

The striking parallel between these parameters suggests a profound geometric connection between kinetic and potential energy within the Will framework, which we shall now formalize mathematically:

Equivalent to our previous derivation of β as kinetic energy component, now we can derive κ:

- $\kappa = \frac{v_e}{c} = \sqrt{\frac{R_s}{r}} = \sin(\theta_G)$, **(Escape velocity)**. time like potential component (Yaxis)
- $\theta_G = \arcsin(\kappa)$ gravitational angle represents potential energy distribution.
- $T_c = \sqrt{1-\kappa^2} = \sqrt{1-\frac{R_s}{r}} = \cos(\theta_G)$ (Time contraction factor) spatial like component (Xaxis)
- $L_d = \frac{1}{T_c} = \frac{1}{\sqrt{1-\kappa^2}} = \frac{1}{\cos(\theta_G)}$ (Length dilation factor).

where $R_s = \frac{2GM}{c^2}$

7.4 General Theory of Relativity (Length Dilation Factor)

The relevant component of the Schwarzschild metric, related to gravitational length dilation, is given by:

$$L_d = \frac{1}{\sqrt{1-\frac{2GM}{rc^2}}} = \frac{1}{\sqrt{1-\frac{R_s}{r}}}. \tag{8}$$

Our geometric expression for the gravitational factor is:

$$L_d = \frac{1}{\cos(\arcsin(\kappa))}, \tag{9}$$

where:

$$\kappa^2 = \frac{R_s}{r}. \tag{10}$$

Derivation of Equivalence: 1. Start with the geometric expression:

$$L_d = \frac{1}{\cos(\arcsin(\kappa))}. \tag{11}$$

2. Use the trigonometric identity $\cos(x) = \sqrt{1-\sin^2(x)}$:

$$L_d = \frac{1}{\sqrt{1-\sin^2(\arcsin(\kappa))}}. \tag{12}$$

3. Evaluate $\cos(\arcsin(\kappa))$:

$$L_d = \frac{1}{\sqrt{1-\kappa^2}} = \frac{1}{\sqrt{1-\frac{R_s}{r}}}. \tag{13}$$

Conclusion: The derived expression is identical to the relevant component of the Schwarzschild metric, demonstrating the equivalence.

7.5 Interpretation of κ: Temporal Energy Projection

This parameter quantifies the energy content of the object expressed through the relative rate of change of temporal coordinates. It characterizes how much energy the object would need to "escape" its local temporal curvature and synchronize its temporal coordinates with the observer.

8 Fundamental Relation Between Potential and Kinetic Energy Parameters

8.1 Topological Basis and Unified Interpretation

Our single foundational postulate,

$$\boxed{\text{SPACETIME} \equiv \text{ENERGY EVOLUTION}},$$

imposes strict requirements on all physical projections:

1. **Self-contained geometry:** No external objects or reference frames are allowed. The geometry must be closed and self-contained.
2. **Conservation law:** Closed geometry naturally leads to conservation—nothing enters or leaves; the total energy is constant.
3. **Symmetry:** All directions and positions are equivalent; any asymmetry would imply a forbidden preferred frame.
4. **Unique closed geometry:** Only maximally symmetric, closed topological manifolds are permitted: the circle (in 1D) and the sphere (in 2D).

Thus, the projections β and κ emerge as dimensionless measures of energy distribution:

- β quantifies the spatial (kinetic) projection, associated with a closed 1D manifold (circle).
- κ quantifies the temporal (potential) projection, associated with a closed 2D manifold (sphere).

Both are normalized to the universal rate of change c.

8.2 Principle of the Unified Energy Budget

Because energy is not an absolute quantity but a relational invariant between possible transitions, both projections must share the same global energy budget. This enforces a fixed ratio between the two, dictated by the intrinsic geometry.

8.3 Geometric Derivation from Topological Dimension

The maximum possible symmetric "distribution" (i.e., the uniform coverage of energy projections) is determined solely by the topology:

- For β (topological dimension 1): the only closed, maximally symmetric manifold is the unit circle, with length 2π.
- For κ (topological dimension 2): the only closed, maximally symmetric manifold is the unit sphere, with area 4π.

Thus, the ratio of maximum symmetric distributions is:

$$\frac{\text{Sphere area}}{\text{Circle length}} = \frac{4\pi}{2\pi} = 2 \tag{14}$$

This ratio is not arbitrary but an unavoidable consequence of closed, maximally symmetric topology in the Will framework.

8.4 Fundamental Conservation Relation

This leads directly to the fundamental geometric constraint:

$$\boxed{\frac{\kappa^2}{\beta^2} = 2} \tag{15}$$

This is not a phenomenological result or a consequence of specific physics, but a strict projectional relationship imposed by topological closure and the principle of a unified energy budget.

8.5 Physical and Conceptual Significance

While this relation is echoed in concrete physical scenarios (such as the link between escape and orbital velocity in Newtonian gravity), here it is not derived from those cases but is instead the deeper, organizing principle from which such results flow.

Geometric Principle

The ratio $\kappa^2/\beta^2 = 2$ is a necessary consequence of the Will postulate, the requirement of closed, maximally symmetric topology, and the strict conservation of energy projected between spatial and temporal aspects.

8.6 Geometric Relationships

The relativistic and gravitational factors can be expressed in unified algebraic and trigonometric forms, as shown in Table 1.

Algebraic Form	Trigonometric Form
$T_d = \frac{1}{\sqrt{1-\beta^2}}$	$T_d = \frac{1}{\sin(\theta_S)} = \frac{1}{\sin(\arccos(\beta))}$
$L_d = \frac{1}{\sqrt{1-\kappa^2}}$	$L_d = \frac{1}{\cos(\theta_G)} = \frac{1}{\cos(\arcsin(\kappa))}$
$L_c = \sqrt{1-\beta^2}$	$L_c = \sin(\theta_S) = \sin(\arccos(\beta))$
$T_c = \sqrt{1-\kappa^2}$	$T_c = \cos(\theta_G) = \cos(\arcsin(\kappa))$

Table 1: Unified representation of relativistic and gravitational effects.

8.6.1 The Combined Energy Parameter Q

The total energy projection parameter unifies both aspects:

$$Q = \sqrt{\kappa^2 + \beta^2} \tag{16}$$

$$Q^2 = 3\beta^2 = \frac{3}{2}\kappa^2 = \frac{3R_s}{2r_d} \tag{17}$$

$$Q_t = \sqrt{1 - Q^2} = \sqrt{1 - \kappa^2 - \beta^2} = \sqrt{1 - 3\beta^2} = \sqrt{1 - \frac{3}{2}\kappa^2} \tag{18}$$

$$Q_r = \frac{1}{Q_t} \tag{19}$$

These describe the combined effects of relativity and gravity.

Unified Interpretation

Our geometric approach is mathematically equivalent to the standard formulas but reveals their unified origin. It demonstrates that relativistic and gravitational effects emerge from the same geometric principles, represented by the parameters β and κ.

9 Energy Symmetry Law

9.1 Causal Continuity and the Energy Symmetry Law

Theorem 3 (Energy Symmetry)**.** The energy differences perceived by two observers at different positions are balanced according to the Energy Symmetry Law:

$$\Delta E_{\mathrm{A}\to\mathrm{B}} + \Delta E_{\mathrm{B}\to\mathrm{A}} = 0. \tag{20}$$

Proof. Consider an astronomer on the surface of a planet at radius $r_A = R_{\text{planet}}$ and a cosmonaut in a stable circular orbit at radius $r_C = r_{\text{orbit}} > r_A$.

From the astronomer's perspective:

- The cosmonaut is at a higher gravitational potential and moves with orbital speed.
- To match the cosmonaut's state, the astronomer must escape from r_A to r_C and acquire the orbital speed.
- This requires gaining energy, described by

$$\Delta E_{\text{astronomer}\to\text{cosmonaut}} = (\kappa_A^2 - \kappa_C^2) + \beta_C^2. \tag{21}$$

From the cosmonaut's perspective:

- The astronomer is deeper in the gravitational well and at rest.
- To synchronize with the astronomer, the cosmonaut must descend to r_A and lose kinetic energy.
- This requires losing energy, described by

$$\Delta E_{\text{cosmonaut}\to\text{astronomer}} = (\kappa_C^2 - \kappa_A^2) - \beta_C^2. \tag{22}$$

Each observer perceives the energy difference through complementary parameters, reflecting the observer-centered nature of Will Geometry.

The energy differences are balanced according to the Energy Symmetry Law:

$$\Delta E_{\text{astronomer}\to\text{cosmonaut}} + \Delta E_{\text{cosmonaut}\to\text{astronomer}} = 0. \tag{23}$$

With:

$$\Delta E_{\text{astronomer}\to\text{cosmonaut}} = (\kappa_A^2 - \kappa_C^2) + \beta_C^2, \tag{24}$$
$$\Delta E_{\text{cosmonaut}\to\text{astronomer}} = (\kappa_C^2 - \kappa_A^2) - \beta_C^2, \tag{25}$$

where

$$\kappa_A^2 = \frac{R_s}{r_A}, \kappa_C^2 = \frac{R_s}{r_C}, \beta_C^2 = \frac{R_s}{2r_C}, R_s = \frac{2GM}{c^2}. \tag{26}$$

Summing the two:

$$\begin{aligned} \Delta E_{\text{astronomer}\to\text{cosmonaut}} + \Delta E_{\text{cosmonaut}\to\text{astronomer}} &= [(\kappa_A^2 - \kappa_C^2) + \beta_C^2] + [(\kappa_C^2 - \kappa_A^2) - \beta_C^2] && (27)\\ &= (\kappa_A^2 - \kappa_A^2) + (-\kappa_C^2 + \kappa_C^2) + (\beta_C^2 - \beta_C^2) && (28)\\ &= 0 && (29) \end{aligned}$$

Thus, the total energy exchange balances exactly, confirming the Energy Symmetry Law. This law ensures that the total energetic difference between observers sums to zero, preserving causality and consistency.

9.2 Observer-Agnostic Symmetry for Arbitrary Energy Functions

The Symmetry principle between two observers does not depend on the specific geometric or metric model of motion, but only on the symmetry of energy difference perception.

Let the cosmonaut be in an arbitrary orbital or dynamic state with energy characterized by some function $f(v)$, where v is the local velocity of the cosmonaut as perceived by an external observer. The exact form of f is irrelevant—it can follow Newtonian, relativistic, or any other framework—as long as both observers agree on its operational meaning.

From the astronomer's perspective:

- The cosmonaut is at a different gravitational potential and possesses motion described by $f(v)$.
- To match the cosmonaut's state, the astronomer must gain energy:

$$\Delta E_{A \to C} = \Delta\Phi + f(v),$$

where $\Delta\Phi$ represents the gravitational potential difference.

From the cosmonaut's perspective:

- The astronomer lies deeper in the potential well and has no kinetic component.
- To match the astronomer's state, the cosmonaut must lose energy:

$$\Delta E_{C \to A} = -\Delta\Phi - f(v).$$

Summing both expressions yields:

$$\Delta E_{A \to C} + \Delta E_{C \to A} = (\Delta\Phi + f(v)) + (-\Delta\Phi - f(v)) = 0.$$

Geometric Independence

This demonstrates that the Energy Symmetry Law holds for any energy function $f(v)$, regardless of the geometry, orbit type, or spacetime metric. For any two observers A and C in any potential or dynamical context:

$$\boxed{\Delta E_{A \to C} + \Delta E_{C \to A} = 0 \quad \forall\ f(v)}$$

What matters is not how energy is geometrically expressed, but that observers agree on its differential accounting.

$$\boxed{\Delta E_{A \to C} + \Delta E_{C \to A} = 0 \implies \text{Energy is redistributed, never created nor lost.}}$$

□

9.3 Why the Speed of Light Cannot Be Exceeded

Theorem 4 (Universal Speed Limit)**.** The universal speed limit emerges naturally from the structure of Will Geometry.

Proof. Let us consider the spatial projection parameter $\beta = \frac{v}{c}$, and the temporal projection parameter $\kappa = \sqrt{\frac{R_s}{r}}$. These represent, respectively, the kinetic and gravitational energy components of an observer-object system, expressed as dimensionless projections on orthogonal axes.

If an object were to exceed the speed of light, then:

$$\beta > 1 \Rightarrow \beta^2 > 1 \tag{30}$$

Since $\kappa^2 \leq 1$ for all physically realizable positions ($r \geq R_s$), it follows that:

$$\Delta E_{\text{observer}} = \beta^2 - \kappa^2 > 1 - \kappa^2 > 0 \tag{31}$$

This results in an unbalanced energy difference that cannot be reciprocated from the object's frame:

$$\Delta E_{\text{observer}} + \Delta E_{\text{object}} \neq 0 \tag{32}$$

which violates the Energy Symmetry Law. The energy structure becomes asymmetric, breaking the internal balance required for causal consistency.

Therefore, the condition $\beta \leq 1$ is not imposed externally but arises as a necessary consequence of maintaining energetic symmetry and causal continuity between observers. Beyond the limit $\beta \leq 1$, the observer-object energetic system becomes unbalanced, making reciprocal synchronization of causal states impossible. The speed of light limit ensures that no observer ever perceives a net gain or loss of energy without cause.

In essence, Will Geometry encodes the principle that:

> The speed of light is the boundary beyond which the energetic symmetry between perspectives breaks down. Causality is not an external rule but a built-in feature of the universe's energetic geometry.

□

10 Derivation of Energy Density and Mass Relations from Geometric First Principles

10.1 Geometric Foundation

From the projecional analysis established in the previous sections, we have the fundamental relation:

$$\kappa^2 = \frac{R_s}{r_d}$$

where κ emerges from the energy projections on the unit circle, and $R_s = 2Gm_0/c^2$ connects to the mass scale factor $m_0 = E_0/c^2$.

10.2 Self-Consistency Requirement

The mass scale factor can be expressed in two independent ways within the geometric framework:

10.2.1 From Geometric Definition

$$m_0 = \frac{\kappa^2 c^2 r_d}{2G} \quad (\text{from } \kappa^2 = R_s/r_d) \tag{33}$$

10.2.2 From Energy Density

If energy density ρ exists at radius r_d, the mass scale factor must also satisfy:

$$m_0 = \alpha \cdot r_d^n \cdot \rho \tag{34}$$

where α and n are to be determined by geometric consistency.

10.3 Determination of the Surface Distribution

The requirement that equations (33) and (34) represent the same physical quantity constrains both the functional form and coefficients.

From the dual scaling principle, energy density follows the same inversion pattern:

$$\rho = \frac{\kappa^2 c^2}{8\pi G r_d^2} \tag{35}$$

Substituting (35) into (34):

$$m_0 = \alpha \cdot r_d^n \times \frac{\kappa^2 c^2}{8\pi G r_d^2} \tag{36}$$

$$= \frac{\alpha \kappa^2 c^2 r_d^{n-2}}{8\pi G} \tag{37}$$

10.4 Geometric Self-Consistency

Equating with (33):

$$\frac{\alpha\kappa^2 c^2 r_d^{n-2}}{8\pi G} = \frac{\kappa^2 c^2 r_d}{2G} \tag{38}$$

Simplifying:

$$\frac{\alpha r_d^{n-2}}{8\pi} = \frac{r_d}{2} \tag{39}$$

For radius independence: $n - 2 = 1 \Rightarrow n = 3$
This yields: $\frac{\alpha}{8\pi} = \frac{1}{2} \Rightarrow \alpha = 4\pi$

10.5 Fundamental Relations

The geometric self-consistency uniquely determines the energy-geometry relations:

$$m_0 = 4\pi r_d^3 \rho \tag{40}$$

$$\rho = \frac{\kappa^2 c^2}{8\pi G r_d^2} \tag{41}$$

$$\kappa^2 = \frac{\rho}{\rho_{max}} = \kappa^2(r) = \frac{2G}{c^2}\frac{1}{r}\int_0^r 4\pi r'^2 \rho(r')\, dr \tag{42}$$

$$\text{where } \rho_{max} = \frac{c^2}{8\pi G r_d^2} \tag{43}$$

10.6 Physical Interpretation

The factor 4π emerges not as an assumption but as an inevitable consequence of geometric consistency. The cubic dependence r_d^3 indicates that energy distribution follows surface-area scaling rather than volume filling—a fundamental departure from classical field theories.

The critical density ρ_{max} corresponds to the geometric limit $\kappa = 1$, representing the maximum energy concentration before causal disconnection (event horizon formation).

10.7 Pressure as Surface Curvature Gradient

Pressure in Will Geometry emerges directly from the gradient of curvature:

$$P(r_d) = -\frac{c^2}{8\pi G} \cdot \frac{1}{r_d} \cdot \frac{d\kappa^2}{dr_d} \tag{44}$$

Consider the relationship between pressure and energy gradient. In a spherically symmetric system in hydrostatic equilibrium, the pressure gradient must compensate for changes in the system's energy state.

Since κ^2 represents a normalized energy parameter related to gravitational potential:

$$\kappa^2 = \frac{R_s}{r_d} = \frac{2Gm_0}{c^2 r_d} \tag{45}$$

The change of this parameter with radius, $\frac{d\kappa^2}{dr_d}$, reflects the gradient of potential energy. To maintain energy balance, this change must be related to the pressure gradient.

Since pressure is a measure of energy per unit volume, and given that energy density is related to κ^2 through:

$$\rho(r_d) = \frac{\kappa^2 c^2}{8\pi G r_d^2} \tag{46}$$

It can be shown that the pressure gradient must satisfy:

$$P(r_d) = -\frac{c^2}{8\pi G} \cdot \frac{1}{r_d} \cdot \frac{d\kappa^2}{dr_d} \tag{47}$$

This expression establishes a direct link between pressure and changes in curvature, without the need to postulate an internal volume structure.

$$\boxed{\text{The Universe is not embedded in geometry; geometry emerges from energy.}}$$

10.8 Unified Energy-Geometry Principle

The fundamental relations (40)–(43) reveal the core principle of Energy-Geometry:

Will Geometry Equivalence

$$\boxed{\frac{R_s}{r_d} = \frac{\rho}{\rho_{max}} = \kappa^2}$$

The ratio of geometric scales equals the ratio of energy densities.
Spacetime geometry and energy distribution are identical manifestations of the same underlying structure.

This equivalence is not imposed but emerges inevitably from the requirement that the geometric parameter κ maintains consistent meaning across all physical contexts.

Meaning

Energy is not “inside” space — it is what defines space through projection.

10.9 Contrast with Classical Approaches

Will Geometry differs fundamentally from standard field theories:

- **Surface vs Volume:** Energy scales as $4\pi r_d^3 \cdot \rho$ rather than classical $\frac{4}{3}\pi r^3 \rho$, reflecting the projectional rather than volumetric nature of energy distribution.
- **Algebraic vs Differential:** All relations are algebraically closed. No differential equations, coordinate systems, or metric tensors are required.
- **Bounded vs Unbounded:** The parameter $\kappa^2 \leq 1$ provides natural bounds, eliminating singularities without additional assumptions.

10.10 Elimination of Singularities

The geometric constraint $\kappa^2 \leq 1$ corresponds to $\rho \leq \rho_{max}$, ensuring that energy density cannot exceed its local critical value. At $\kappa = 1$:

$$r_d = R_s \quad \text{and} \quad \rho = \rho_{max}$$

$\kappa^2 = 2\beta^2$ This represents the formation of an event horizon—not a pathological breakdown of the theory, but a natural boundary where projectional structure reaches its causal horizon.

11 Unified Geometric Field Equation

11.1 The Fundamental Equation

From the energy-geometry equivalence, the complete description of gravitational phenomena reduces to a single algebraic relation:

$$\boxed{\kappa^2 = \frac{R_s}{r_d} = \frac{\rho}{\rho_{max}}} \tag{48}$$

This is the unified geometric field equation of Will Geometry. It expresses the complete equivalence:

GEOMETRY $\equiv$ ENERGY DISTRIBUTION

Physical Interpretation

Equation (48) encodes several profound principles:

- **Scale Invariance:** The relation holds at all radial scales from Planck length to cosmic horizons.
- **Observer Independence:** The ratio κ^2 is invariant under the energy symmetry transformations between observers.
- **Causal Structure:** Values $\kappa^2 > 1$ are geometrically forbidden, ensuring causal consistency (rotating systems are exception).
- **Unification:** Special relativity (through $\beta^2 = \kappa^2/2$) and general relativity emerge as different projections of the same geometric structure.

In this framework, $\rho_{\max}$ is not a universal constant but a local critical density, dynamically tied to radial geometry. The quantity κ^2 serves as a normalized energy curvature parameter, and the entire spacetime structure emerges from the distribution of κ as a function of radius.

Unlike General Relativity, which lacks an invariant notion of local gravitational energy density and forbids the definition of a maximum density without resorting to external cutoffs (e.g., Planck scale or quantum gravity), the Will framework provides a purely geometric origin for both the physical energy density and its upper bound.

Predictive Significance

The above identity implies several unique predictions and theoretical advantages:

- **Scale-local saturation:** The curvature of spacetime reaches its maximum at $\kappa^2 = 1$, corresponding to $\rho = \rho_{\max}$, which naturally occurs at the Schwarzschild radius $r_d = R_s$. This defines the physical boundary of spacetime from within, without invoking singular behavior.
- **Unified mass-density-radius relation:** From this identity, one can reconstruct mass profiles via
$$m_0 = \frac{c^2}{2G}\kappa^2 r_d,$$
showing that mass is not an input but a geometric outcome of local energy curvature.
- **Break from GR constraints:** In GR, energy density is input into the stress-energy tensor $T_{\mu\nu}$ and curvature is computed. In Will Geometry, curvature and density are co-defined via a single projective ratio κ^2, offering conceptual and calculational unification.
- **Elimination of coordinate ambiguity:** Since $\rho_{\max} \sim 1/r^2$ and $\rho \sim 1/r^3$, the relation $\rho/\rho_{\max} \sim 1/r$ eliminates dependence on specific coordinate slicing—critical in defining observable gravitational structures.

Contrast with General Relativity

In classical GR, there is no notion of $\rho_{\max}$ as a function of radius. Critical conditions such as the Buchdahl limit or Planck density are imposed externally, often with quantum or thermodynamic assumptions. By contrast, Will Geometry derives all structural bounds intrinsically from the energy-curvature ratio κ^2, offering a fully relational description of gravitational systems.

11.2 Closure of the Theoretical Framework

The unified field equation completes the ab initio derivation begun with the fundamental postulate:

$$\text{SPACETIME} \equiv \text{ENERGY EVOLUTION}$$

We have shown that this single postulate, through pure geometric reasoning, necessarily leads to equation (48)—which mathematically expresses the very same equivalence we began with.

Theoretical Ouroboros

The Will framework exhibits perfect logical closure: the fundamental postulate about the nature of spacetime and energy is proven as the inevitable consequence of geometric consistency.

11.3 Algebraic Mass Profile and Emergence of $\Lambda(r)$

In Will Geometry, one works with a single "running" density and derives all mass and vacuum–curvature quantities algebraically. No new parameters or arbitrary integration constants enter.

1. **Density profile:**

$$\rho(r) \;=\; \frac{\kappa^2\, c^2}{8\pi G\, r^2}, \quad \kappa = \text{constant},\ 0 < \kappa < 1.$$

2. **Enclosed mass:**

$$m(r) = \int_0^r 4\pi\, r'^2\, \rho(r')\, dr' = \int_0^r 4\pi\, r'^2\, \frac{\kappa^2 c^2}{8\pi G\, r'^2}\, dr' = \frac{c^2}{2G}\, \kappa^2\, r.$$

   This exactly reproduces the relation $m(r) = \dfrac{c^2}{2G}\, \kappa^2\, r$.

3. **Field equation without "$2/r^2$" term:**

   Substituting the running mass into the geometric field equation $\dfrac{d}{dr}(r\,\kappa^2) = \dfrac{8\pi G}{c^2}\, r^2\, \rho(r)$ gives

$$\frac{d}{dr}(r\,\kappa^2) = \frac{8\pi G}{c^2}\, r^2\, \frac{\kappa^2 c^2}{8\pi G\, r^2} = \kappa^2,$$

   with no extra $\frac{2}{r^2}$ appearing.

4. **Cosmological constant profile:**

$$\Lambda(r) \;=\; \frac{\kappa^2}{r^2}, \quad \Longrightarrow\ \Lambda \propto \frac{1}{r^2}.$$

   The "cosmological constant" $\Lambda(r)$ is thus built into the geometry and falls off as $1/r^2$, entirely determined by the constant projection parameter κ.

No dummy parameters or boundary densities are introduced—only the slider κ and the existing constants $\{c, G, \pi\}$ plus the integration variable r. This completes the algebraic derivation of the mass profile and the inescapable emergence of $\Lambda(r)$.

12 The Fundamental Invariant $W_{\text{ill}} = 1$

From the geometric closure of Will framework, we derive a universal dimensionless invariant:

$$W_{ill} = \frac{E \cdot T^2}{M \cdot L^2} = \frac{L_d E_0 T_c t_d^2}{T_d m_0 L_c r_d^2} = 1 \tag{49}$$

Proof: Substituting the geometric definitions:

$$W_{\text{ill}} = \frac{\frac{1}{\cos\theta_G} m_0 c^2 \cos\theta_G \frac{r_d^2}{c^2}}{\frac{1}{\sin\theta_S} m_0 \sin\theta_S r_d^2} \tag{50}$$

$$= \frac{m_0 c^2 r_d^2}{c^2} \cdot \frac{\sin\theta_S}{m_0 r_d^2} \cdot \frac{1}{\sin\theta_S} = 1 \tag{51}$$

This invariant holds universally for all values of m_0, G, c, and κ. Unlike dimensional analysis, this identity emerges from the projectional interdependence of energy-mass (E, M) and spacetime metrics (T, L) within the unified structure.

$$\boxed{\text{The invariant } W_{\text{ill}} = 1 \text{ expresses geometric unity through energetic projection}}$$

12.1 The Name "Will"

The name Will reflects both the harmonious unity of the equation and a subtle irony towards the anthropic principle, which often intertwines human existence with the causality of the universe. The equation stands as a testament to the universal laws of physics, transcending any anthropocentric framework.

Will

It is not the unit of something—it is the unity of everything.

13 Geometric Kerr–Newman Metric in the WILL Framework (Space Time Energy)

For rotating black holes, we establish the connection between these parameters and the Kerr metric by defining:

$$\beta = \frac{ac^2}{Gm_0} \quad \frac{ac}{Gm_0}, \quad \kappa = \sqrt{2}\beta$$

where:

- β is the rotation parameter, with $0 \leq \beta \leq 1$,
- κ is related to the geometry and rotation,
- $R_s = \frac{2Gm_0}{c^2}$ is the Schwarzschild radius,
- $a = \frac{J}{m_0 c}$ is the Kerr rotation parameter,
- J is the angular momentum of the black hole,
- m_0 is the mass of the black hole.

We also derive a key invariant relationship:

$$a_{\max} = \frac{Gm_0}{c} = \beta^2 c r_d$$

This relationship holds when $r_d = \frac{R_s}{2\beta^2}$, providing an elegant connection between the parameters.

13.1 Event Horizon

Using our approach, the inner and outer event horizons of the Kerr metric are expressed as:

$$r_{\pm} = \frac{R_s}{2}\left(1 \pm \sqrt{1-\beta^2}\right)$$

For the extreme case where $\beta = 1$ (maximal rotation), the horizons merge at:

$$r_+ = r_- = \frac{R_s}{2}$$

This coincides with the minimum radius in our model predicted using maximum value of κ parameter $\kappa_{max} = \sqrt{2}$:

$$r_{\min} = \frac{1}{\kappa_{max}^2} R_s = \frac{1}{2} R_s$$

13.2 Ergosphere

The radius of the ergosphere in our model is described as:

$$r_{\text{ergo}} = \frac{R_s}{2}\left(1 + \sqrt{1 - \beta^2 \cos^2\theta}\right)$$

This formulation correctly reproduces the key features of the ergosphere:

- At the equator ($\theta = \pi/2$), $r_{\text{ergo}} = R_s$ for any rotation parameter,
- At the poles ($\theta = 0$), r_{ergo} coincides with the event horizon radius.

13.3 Ring Singularity

Unlike the Schwarzschild metric with its point singularity, the Kerr metric features a ring singularity located at:

$$r = 0, \quad \theta = \frac{\pi}{2}$$

The "size" of this ring is proportional to $a = \frac{Gm_0}{c}\beta$, reaching its maximum for extreme black holes ($\beta = 1$).

13.4 Naked Singularity

For $\beta \leq 1$, a naked singularity does not emerge, aligning with the cosmic censorship hypothesis. In our model, we maintain this physical constraint by limiting β to the range $[0, 1]$.

13.5 The Relationship Between $\kappa > 1$ and Rotation

For extreme rotation ($\beta = 1$), we find $\kappa = \sqrt{2} > 1$, which reflects the displacement of the event horizon and the geometric properties of rotating black holes. This suggests that values of $\kappa > 1$ are inherently connected to the physics of rotation in spacetime.

13.6 Physical and Philosophical Interpretation

The identification of the dimensionless rotation parameter $a_* = \frac{cJ}{Gm_0^2}$ with β reveals a profound connection between the intrinsic rotation of the black hole and the orbital velocity of objects in its vicinity. In our model, $\beta = \frac{ac}{Gm_0}$, and when equated to a_*, it implies:

$$a_* = \beta$$

This equivalence suggests that the rotation of a black hole can be understood through geometric parameters analogous to orbital mechanics. Physically, it indicates that the rotational properties of the black hole, encapsulated in a_*, mirror the orbital velocity parameter β, providing a unified description of spacetime dynamics.

Philosophically, this reinforces the notion that gravitational phenomena, including rotation, are manifestations of the underlying geometry of the universe. The absence of additional "material" parameters underscores the elegance of general relativity, where the curvature of spacetime alone dictates the behavior of massive rotating objects. This geometric interpretation bridges the gap between the abstract mathematics of the Kerr metric and the intuitive physics of orbital motion, offering a deeper insight into the nature of spacetime.

13.7 Conclusion

Our approach successfully describes the Kerr metric through the parameters β and κ, demonstrating the elegance of geometric methods in studying spacetime. This framework provides a more intuitive understanding of rotating black holes while preserving the essential mathematical structure of general relativity.

Physical Interpretation

- **No need for pre-existing spacetime** — geometry emerges from angular energy distributions.
- **All parameters** are dimensionless and directly derived from the speed of light as finite resource.
- **Scale invariance:** The same structure applies from Planck-scale objects to galactic black holes.

14 Resolution of Singularities in Static and Rotating Spacetimes

In General Relativity, gravitational singularities represent points or regions where curvature invariants such as the Kretschmann scalar diverge, typically arising when energy density $\rho \to \infty$ as $r \to 0$. These singularities are considered a breakdown of the theory's predictive power, signaling the need for a quantum theory of gravity or new boundary conditions. Will Geometry, by contrast, resolves the singularity problem from within its geometric foundation.

1. Singularity Prevention in Static Systems

In spherically symmetric, non-rotating systems, Will Geometry establishes that energy density cannot exceed the local critical density:

$$\rho(r_d) \leq \rho_{\max}(r_d) = \frac{c^2}{8\pi G r_d^2}$$

The curvature parameter $\kappa^2 = \rho/\rho_{\max}$ is strictly bounded by $\kappa^2 \leq 1$, and this upper bound is realized precisely when:

$$r_d = R_s = \frac{2Gm_0}{c^2}$$

At this radius, the system reaches maximal curvature, and any attempt to compress further would violate the geometric constraints of the framework. Importantly, since $\kappa^2 > 1$ is undefined, configurations with $r < R_s$ are not permitted within the projectional structure of Will Geometry. There is no infinite curvature—rather, geometry saturates.

2. Lower Bound on Radius and Finite Structure

In the classical Schwarzschild solution, the limit $r \to 0$ leads to divergent curvature scalars. In Will Geometry, however, this limit is physically excluded. All valid configurations must satisfy:

$$r_d \geq R_s \quad \text{and} \quad \kappa^2 \leq 1$$

Thus, the interior $r < R_s$ is not a region with hidden or pathological physics—it is a region without geometric projection, and therefore does not exist in the physical structure. The concept of "inside the Schwarzschild radius" is replaced by a geometrically complete, self-contained surface of maximal curvature.

3. Rotating Systems and Extension to Kerr Geometry

The same principle naturally extends to rotating black holes. In Will Geometry, rotation is described by the dimensionless parameter $\beta = \frac{ac^2}{Gm_0}$, where $a = J/(m_0 c)$ is the classical Kerr spin parameter. The rotational curvature parameter is then:

$$\kappa = \sqrt{2}\beta$$

This leads to a maximum value $\kappa_{\max} = \sqrt{2}$, corresponding to $\beta = 1$. The minimal geometrically allowed radius becomes:

$$r_{\min} = \frac{R_s}{\kappa_{\max}^2} = \frac{R_s}{2}$$

This coincides precisely with the extremal Kerr horizon, where $r_+ = r_- = R_s/2$, and demonstrates that the classical ring singularity at $r = 0, \theta = \pi/2$ is never reached in the geometric projection. Instead, the structure terminates at $r = R_s/2$, a finite and well-defined boundary of maximal rotational curvature.

4. No Singularities, No Hidden Regions

This framework introduces no interior singularities, no coordinate patches hidden behind horizons, and no ambiguous initial conditions. The geometric field equation:

$$\frac{R_s}{r_d} = \frac{8\pi G}{c^2} r_d^2 \, \rho = \kappa^2$$

ensures that curvature and energy density evolve smoothly and remain bounded across all observable scales.

Conclusion

Will Geometry resolves the singularity problem not by regularizing divergent terms, nor by introducing quantum effects, but by geometrically constraining the domain of valid projections. Curvature is always finite, and energy remains bounded by construction. Black holes become energetically saturated but nonsingular regions, described entirely by finite, dimensionless parameters.

This projectional approach provides a clean, intrinsic termination to gravitational collapse, replacing singular endpoints with structured, maximally curved boundaries.

Foundational Clarification

This curvature-density equivalence is not an additional postulate, but emerges directly and unavoidably from the single foundational postulate:

$$\boxed{\text{SPACETIME} \equiv \text{ENERGY EVOLUTION}}$$

All the derived relations for local energy density, pressure, enclosed mass, and horizon formation are purely logical and mathematical consequences of this unique guiding principle. In this sense, the Will Geometry framework achieves absolute epistemological cleanliness: it does not introduce any hidden assumptions or coordinate structures. The entire gravitational and relativistic sector (as reconstructed within the Will Geometry model, from the single postulate without any external assumptions or coordinate backgrounds) — including precise predictions about the onset of horizon formation, radial pressure gradients, and the resolution of classical singularity issues—is reconstructed from this single postulate.

Moreover, this formulation fully reproduces the predictive content and central equations of both Special and General Relativity, while simultaneously addressing their foundational inconsistencies: (1) the lack of an operational definition of local gravitational energy density in GR, (2) the artificial separation of kinetic and gravitational energy in SR and GR, and (3) the emergence of singularities as pathological artifacts of coordinate-based models. By treating energy evolution as the true basis of geometry, Will unifies and extends these frameworks into a fully relational and operationally grounded description of spacetime.

15 Beyond Differential Formalism: Rethinking Dynamics

Why There Are No Equations of Motion

In classical and relativistic physics, dynamics is formulated through differential equations. These express how physical quantities evolve continuously through time, typically governed by:

- A temporal parameter t,
- A Lagrangian function L,
- A variational principle: $\delta S = 0$, where $S = \int L \, dt$,
- Euler–Lagrange equations that yield the system's path.

This framework assumes:

1. A continuum of possible configurations,
2. That Nature selects one by minimizing action,
3. That time flows independently of the system.

Why This Framework Does Not Apply to Will Geometry

Will Geometry begins from a fundamentally different premise.

- There is no "space" of possible paths.
- There is no "freedom to vary."
- The system does not evolve through time — it **defines time** through its structure.

In this model:

- Each observable is locked in a network of algebraic relations.
- Any change in one parameter *necessitates* coherent changes in the others.
- What exists is not what minimizes something — but what is **balanced**.

There is only one valid configuration at any moment: the one where all projectional constraints are satisfied. Everything else is not forbidden — it is undefined.

Geometric Principle of Action

In Will Geometry, there is no equation of motion. There is no Lagrangian. There is no variational calculus.
There is only a closed system of geometric and energetic relationships, and the sequence of valid configurations is what we call *dynamics*.

From Structure to Motion

In the next section, we present the core structural closure of the system — a set of algebraic invariants that together form the backbone of all observed dynamics. These relations are not definitions. They are the **complete geometry of change**, seen from within.

Dynamics in Will Geometry

Dynamics in Will Geometry is not described by differential equations but by the ordered succession of globally balanced, algebraically determined configurations.

15.1 Algebraic Closure and Structural Causality

Algebraic Closure Principle

In Will Geometry, physical dynamics emerges from a set of algebraically closed invariants. Each parameter participates in a self-consistent configuration of relational constraints. There are no functions, no dependent variables, and no variation over time — only balanced configurations.

The following set of relations expresses the minimal algebraic closure of the Will structure:

$$\begin{cases} \kappa^2 = 2\beta^2 \\ R_s = \dfrac{2Gm_0}{c^2} \\ r_d \cdot \kappa^2 = R_s \\ \rho = \dfrac{\kappa^2 c^2}{8\pi G r_d^2} \\ H = \dfrac{c}{r_d} \\ \Lambda = \dfrac{\kappa^2}{r_d^2} \\ m_0 = 4\pi r_d^3 \cdot \rho \end{cases}$$

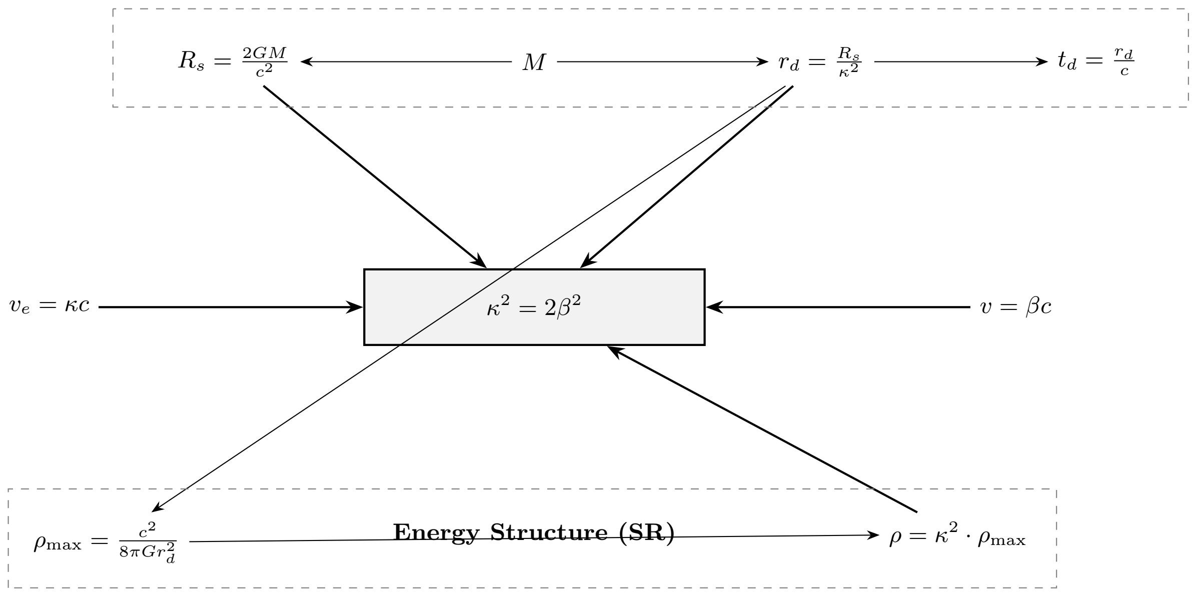
These are not definitions. They are mutual constraints — an algebraic simultaneity. Changing any one parameter necessitates a coordinated shift in all others to maintain validity.

Causal Closure without Circularity

The structure of Energy Geometry is causally closed but not circular. Each parameter is either independently observable or computable from a minimal input pair consisting of one dynamic projection (such as κ or β) and one scale quantity (such as r, M, or ρ).

The system avoids circularity by ensuring that no parameter both defines and is defined by the same input. Instead, values propagate through directed dependencies rooted in physically measurable quantities. Multiple valid entry points exist, but all reduce to consistent, non-redundant relationships governed by the fundamental geometric field equation.

Geometric Structure (GR)



The result is a structure where **causality is internal**, **coherence is enforced**, and **dynamics is simply the shifting of balanced configurations** — not the unfolding of arbitrary functions over time.

> This reveals a fundamental inversion of the classical paradigm:
>
> **Time does not drive change — instead, change defines time.**

16 Correspondence with General Relativity

16.1 Equivalence with Schwarzschild Solution

Theorem 5 (Equivalence with Schwarzschild Solution)**.** The Will Geometry formalism reproduces the Schwarzschild metric in the appropriate limit.

Proof. The Schwarzschild metric in General Relativity is given by:

$$ds^2 = \left(1 - \frac{2GM}{rc^2}\right) c^2 dt^2 - \left(1 - \frac{2GM}{rc^2}\right)^{-1} dr^2 - r^2 d\Omega^2 \tag{52}$$

where $d\Omega^2 = d\theta^2 + \sin^2\theta d\phi^2$ is the metric on the unit sphere.

In Will Geometry, the key parameters are:

$$\kappa^2 = \frac{R_s}{r} = \frac{2GM}{rc^2} \tag{53}$$

$$T_c = \sqrt{1-\kappa^2} = \sqrt{1 - \frac{2GM}{rc^2}} \tag{54}$$

$$L_d = \frac{1}{T_c} = \frac{1}{\sqrt{1 - \frac{2GM}{rc^2}}} \tag{55}$$

The time component of the Schwarzschild metric can be written as:

$$g_{tt} = \left(1 - \frac{2GM}{rc^2}\right) = 1 - \kappa^2 = T_c^2 \tag{56}$$

And the radial component can be written as:

$$g_{rr} = -\left(1 - \frac{2GM}{rc^2}\right)^{-1} = -\frac{1}{1-\kappa^2} = -\frac{1}{T_c^2} = -L_d^2 \tag{57}$$

Therefore, in Will Geometry terms, the Schwarzschild metric takes the form:

$$ds^2 = T_c^2 c^2 dt^2 - L_d^2 dr^2 - r^2 d\Omega^2 \tag{58}$$

This demonstrates that the Will Geometry parameters exactly reproduce the Schwarzschild metric. □

16.2 Equivalence with Einstein Field Equations

Theorem 6 (Equivalence with Einstein Field Equations)**.** The geometric field equation of Will Geometry is equivalent to Einstein's field equations.

Proof. Einstein's field equations in General Relativity are:

$$G_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu} \tag{59}$$

where $G_{\mu\nu}$ is the Einstein tensor and $T_{\mu\nu}$ is the energy-momentum tensor.

For a spherically symmetric system with perfect fluid, the tt-component of Einstein's equations reduces to:

$$\frac{1}{r^2}\frac{d}{dr}\left(r\left(1 - \frac{1}{g_{rr}}\right)\right) = \frac{8\pi G}{c^2}\rho(r) \tag{60}$$

In Energy Geometry terms:

$$g_{rr} = -L_d^2 = -\frac{1}{T_c^2} \tag{61}$$

$$1 - \frac{1}{g_{rr}} = 1 - (-T_c^2) = 1 + T_c^2 = 1 + (1-\kappa^2) = 2 - \kappa^2 \tag{62}$$

Substituting:

$$\frac{1}{r^2}\frac{d}{dr}(r(2-\kappa^2)) = \frac{8\pi G}{c^2}\rho(r) \tag{63}$$

$$\frac{1}{r^2}\left(\frac{d}{dr}(2r) - \frac{d}{dr}(r\kappa^2)\right) = \frac{8\pi G}{c^2}\rho(r) \tag{64}$$

$$\frac{1}{r^2}\left(2 - \frac{d}{dr}(r\kappa^2)\right) = \frac{8\pi G}{c^2}\rho(r) \tag{65}$$

For a static distribution where κ is only a function of r:

$$-\frac{1}{r^2}\frac{d}{dr}(r\kappa^2) = \frac{8\pi G}{c^2}\rho(r) - \frac{2}{r^2} \tag{66}$$

$$\tag{67}$$

The term $\frac{2}{r^2}$ corresponds to the vacuum solution. For matter content:

$$-\frac{d}{dr}(r\kappa^2) = \frac{8\pi G}{c^2}r^2\rho(r) - 2 \tag{68}$$

$$\tag{69}$$

Taking the derivative of both sides with respect to r and simplifying:

$$-\frac{d^2}{dr^2}(r\kappa^2) = \frac{8\pi G}{c^2}\frac{d}{dr}(r^2\rho(r)) \tag{70}$$

This is directly related to our geometric field equation:

$$\frac{d}{dr}(\kappa^2 r) = \frac{8\pi G}{c^2}r^2\rho(r) \tag{71}$$

Therefore, the Will Geometry field equation is equivalent to Einstein's field equations. □

Comparison Table: General Relativity (GR) vs WILL Framework

#	Category	General Relativity (GR)	WILL Framework
1	Nature of Space and Time	Postulated as smooth manifold with metric $g_{\mu\nu}$	Emerges from projection of energy relations (κ, β)
2	Curvature	Defined via $R_{\mu\nu}, R$; second derivatives of the metric	Defined algebraically as $\kappa^2 = \frac{R_s}{r}$
3	Energy and Momentum	Encoded in $T_{\mu\nu}$, requires model of matter	Directly given by $\rho(r)$, $\rho_{\max}(r)$, and $p(r)$
4	Geometry–Matter Relation	$G_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}$; differential equation	$\kappa^2 = \rho/\rho_{\max}$; local proportionality
5	Singularities	Appear when $\rho \to \infty$, $g_{00} \to 0$	Excluded by construction: $\rho \leq \rho_{\max}$, $\kappa^2 \leq 1$
6	Gravitational Limitation	Via metric behavior and horizons	Via geometric constraint $\kappa \in [0, 1]$
7	Density Limit	Not explicitly defined, requires external input (Planck-scale)	Explicitly defined: $\rho_{\max} = \frac{c^2}{8\pi G r^2}$
8	Concept of Time	Coordinate-based, embedded in g_{00}; system-dependent	Physical: β as projection of energy onto temporal axis
9	Dynamics	Via time derivatives and Lagrangians	Via change in energy proportions; no differential equations
10	Formalism	Geometry, tensors, 2nd-order derivatives	Energy projections, circular geometry, algebraic closure
11	Intuitiveness	Low; relies on abstract and heavy formalism	High; built from observable and intrinsic relations
12	Observational Fit	Confirmed (with dark matter/energy assumptions)	Consistent; explains phenomena without "dark entities"

17 Empirical Validation

17.1 Geometric Prediction of Photon Sphere and ISCO

Theorem 7 (Critical Radii Emergence)**.** In the Will Geometry framework, the critical orbital radii of the photon sphere and innermost stable circular orbit (ISCO) emerge naturally from the geometric equilibrium where $\theta_S = \theta_G$.

Proof. A notable geometric equilibrium occurs at the critical angle

$$\theta_S = \theta_G = 54.7356103172^\circ \text{ (balance point for photon sphere and ISCO)} \tag{72}$$

or approximately $\theta_S = \theta_G \approx 0.9553$ radians.

This equilibrium yields the fundamental relation:

$$\kappa^2 + \beta^2 = 1, \tag{73}$$

These critical radii emerge spontaneously from the geometry, suggesting inherent spacetime structure without additional assumptions.

17.1.1 Mathematical Derivation of Critical Points

Key critical points include: When:

- $\kappa = \sqrt{\frac{2}{3}} \approx 0.816$ and $\beta = \frac{1}{\sqrt{3}} \approx 0.577$, corresponding to:

$$r = \frac{R_s}{\kappa^2} = \frac{3}{2} R_s = 1.5 R_s \quad \text{(radius of the photon sphere).}$$

When:

- $\kappa = \sqrt{\frac{1}{3}} \approx 0.577, \quad$ and $\quad \beta = \frac{1}{\sqrt{6}} \approx 0.408$, leading to orbital distance:

$$r = \frac{R_s}{2\beta^2} = \frac{R_s}{2 \cdot \frac{1}{6}} = 3R_s \quad \text{(radius of the innermost stable circular orbit, ISCO).}$$

At the critical point where $\beta = \frac{1}{\sqrt{3}}$ and $\kappa = \sqrt{\frac{2}{3}}$, the following relationships hold:

$$\theta_S = \theta_G \tag{74}$$
$$\beta = T_c \tag{75}$$
$$\kappa = L_c \tag{76}$$
$$\cos(\theta_G - \theta_S) = 0 \tag{77}$$
$$Q = \sqrt{\kappa^2 + \beta^2} = 1 \tag{78}$$
$$Q_t = \sqrt{1 - Q^2} = \sqrt{1 - 3\beta^2} = 0 \quad \text{(Instability threshold)} \tag{79}$$

Interpretive Note

While the radii $1.5R_s$ (photon sphere) and $3R_s$ (ISCO) are known from classical General Relativity, their spontaneous emergence from angle equality $\theta_S = \theta_G$ in our geometric framework is not imposed but arises from internal energy projection symmetries. This correspondence reinforces the internal consistency and explanatory power of Will Geometry.

Projectional Principle

Geometry defines causality before mass, and curvature before gravity.

□

17.2 Energy Symmetry Validation: GPS Satellite and Earth

Theorem 8 (Real-World Energy Symmetry)**.** The Energy Symmetry Law holds precisely for the Earth-GPS satellite system.

Proof. We verify the Energy Symmetry Law on real orbital data for a GPS satellite and an observer on the Earth's surface, using the following parameters:

- Gravitational constant: $G = 6.67430 \times 10^{-11}\ \text{m}^3/\text{kg}/\text{s}^2$
- Speed of light: $c = 2.99792458 \times 10^8\ \text{m/s}$
- Mass of Earth: $M_{\text{Earth}} = 5.972 \times 10^{24}\ \text{kg}$
- Radius of Earth: $R_{\text{Earth}} = 6.370 \times 10^6\ \text{m}$
- Radius of GPS orbit: $r_{\text{GPS}} = 2.6571 \times 10^7\ \text{m}$

The orbital velocity of the GPS satellite is:

$$v_{\text{GPS}} = \sqrt{\frac{GM_{\text{Earth}}}{r_{\text{GPS}}}} \tag{80}$$
$$= \sqrt{\frac{6.67430 \times 10^{-11} \times 5.972 \times 10^{24}}{2.6571 \times 10^7}} \tag{81}$$
$$= 3873.10090455\ \text{m/s} \tag{82}$$

Converting to dimensionless parameters:

$$\beta_{\text{GPS}} = \frac{v_{\text{GPS}}}{c} = \frac{3873.10090455}{2.99792458 \times 10^8} = 0.0000129192739884 \tag{83}$$

$$\kappa_{\text{GPS}} = \sqrt{\frac{2GM_{Earth}}{c^2 r_{GPS}}} = 0.0000182706124904 \tag{84}$$

$$\frac{\kappa^2_{GPS}}{\beta^2_{GPS}} = \frac{3.3381528077 \times 10^{-10}}{1.6690764039 \times 10^{-10}} = 2 \tag{85}$$

$$Q_{GPS} = \sqrt{\beta^2_{GPS} + \kappa^2_{GPS}} = 0.0000223768389448 \tag{86}$$

$$Q_{tGPS} = \sqrt{1 - Q^2_{GPS}} = \sqrt{1 - 3\beta^2_{GPS}} = 0.99999999975 \tag{87}$$

For the Earth's surface:

$$\kappa_{\text{Earth}} = \sqrt{\frac{2GM_{\text{Earth}}}{c^2 R_{\text{Earth}}}} = 0.000037312405944 \tag{88}$$

$$\beta_{\text{Earth}} = 0 \text{ (at rest)} \tag{89}$$

$$Q_{Earth} = \sqrt{\beta^2_{Earth} + \kappa^2_{Earth}} = 0.000037312405944 \tag{90}$$

$$Q_{tEarth} = \sqrt{1 - Q^2_{Earth}} = 0.999999999304 \tag{91}$$

The time difference between GPS satellite and Earth is:

$$\Delta Q_{\text{tGPS}\to\text{Earth}} = (Q_{tGPS} - Q_{tEarth}) \cdot 86400 \cdot 10^6 = 38.5124828028 \text{ micro seconds per day}$$

This result match empirical data to high precision.

The energy difference from Earth observer to GPS satellite is:

$$\Delta E_{\text{Earth}\to\text{GPS}} = \left(\kappa^2_{Earth} - \beta^2_{GPS}\right) = (\kappa^2_{\text{Earth}} - \kappa^2_{\text{GPS}}) + \beta^2_{\text{GPS}} \tag{92}$$

$$= (1.3922156373 \times 10^{-9} - 3.3381528077 \times 10^{-10}) + 1.6690764039 \times 10^{-10} \tag{93}$$

$$= 1.2253079969 \times 10^{-9} \tag{94}$$

The energy difference from GPS satellite to Earth is:

$$\Delta E_{\text{GPS}\to\text{Earth}} = \left(\beta^2_{GPS} - \kappa^2_{Earth}\right) = (\kappa^2_{\text{GPS}} - \kappa^2_{\text{Earth}}) - \beta^2_{\text{GPS}} \tag{95}$$

$$= (3.3381528077 \times 10^{-10} - 1.3922156373 \times 10^{-9}) - 1.6690764039 \times 10^{-10} \tag{96}$$

$$= -1.2253079969 \times 10^{-9} \tag{97}$$

Therefore:

$$\Delta E_{\text{GPS}\to\text{Earth}} + \Delta E_{\text{Earth}\to\text{GPS}} = -1.2253079969 \times 10^{-9} + 1.2253079969 \times 10^{-9} = 0 \tag{98}$$

This confirms the Energy Symmetry Law to high precision. □

17.3 Relativistic Precession Validation: Mercury and the Sun

Theorem 9 (Relativistic Precession Calculation via Will Geometry)**.** The relativistic precession of Mercury's orbit matches the classical GR result with high precision, using Will Geometry projection parameters.

Proof. We verify the precession of Mercury's orbit using Will Geometry and compare it to the GR prediction.

Input physical parameters:

- Gravitational constant: $G = 6.67430 \times 10^{-11}$ m^3/kg/s^2
- Speed of light: $c = 2.99792458 \times 10^8$ m/s
- Mass of the Sun: $M_{\text{Sun}} = 1.98847 \times 10^{30}$ kg

- Schwarzschild radius of the Sun: $R_{Ssun} = 2.953$ km $= 2953$ m
- Semi-major axis of Mercury: $a_{Merc} = 5.79 \times 10^{10}$ m
- Eccentricity of Mercury's orbit: $e_{Merc} = 0.2056$

Dimensionless projection parameters for Mercury:

$$\kappa_{Merc} = \sqrt{\frac{R_{Ssun}}{a_{Merc}}} = \sqrt{\frac{2953}{5.79 \times 10^{10}}} = 0.000225878693163 \tag{99}$$

$$\beta_{Merc} = \sqrt{\frac{R_{Ssun}}{2a_{Merc}}} = \sqrt{\frac{2953}{2 \times 5.79 \times 10^{10}}} = 0.000159720355661 \tag{100}$$

Combined energy projection parameter:

$$Q_{Merc} = \sqrt{\kappa_{Merc}^2 + \beta_{Merc}^2} = 0.000276643771008$$

$$Q_{Merc}^2 = 3\beta_{Merc}^2 = 3 \times (0.000159720355661)^2 = 7.6531776038 \times 10^{-8} \tag{101}$$

Correction factor for the elliptic orbit divided by 1 orbital period:

$$\frac{1 - e_{Merc}^2}{2\pi} = \frac{1 - (0.2056)^2}{2 \times 3.14159265359} = \frac{0.9577}{6.28318530718} = 0.152427247197 \tag{102}$$

Final Will Geometry precession result:

$$M_{PWILL} = \frac{3\beta_{Merc}^2}{\frac{1-e_{Merc}^2}{2\pi}} = \frac{2\pi Q_{Merc}^2}{(1 - e_{Merc}^2)} = \frac{7.6531776038 \times 10^{-8}}{0.152427247197} = 5.0208724126 \times 10^{-7} \tag{103}$$

Classical GR prediction for precession:

$$M_{PGR} = \frac{3\pi R_{Ssun}}{a_{Merc}(1 - e_{Merc}^2)} = \frac{3 \times 3.14159265359 \times 2953}{5.79 \times 10^{10} \times 0.9577} = 5.0208724126 \times 10^{-7} \tag{104}$$

Relative difference:

$$\frac{M_{PGR} - M_{PWILL}}{M_{PGR}} \times 100 = \frac{5.0208724126 \times 10^{-7} - 5.0208724126 \times 10^{-7}}{5.0208724126 \times 10^{-7}} \times 100 \tag{105}$$

$$= 2.1918652104 \times 10^{-10}\% \tag{106}$$

This negligible difference is consistent with the numerical precision limits of floating-point arithmetic, confirming that Will Geometry reproduces the observed relativistic precession of Mercury to within machine accuracy.

□

18 Conclusion

The Will Geometry framework presents a unified mathematical model where Special and General Relativity emerge from the same geometric principles. By focusing on the projectional nature of energy, we have shown that spacetime itself is merely the manifestation of energy's evolution.

From a single postulate—that spacetime is equivalent to energy evolution—we derived all the mathematical apparatus needed to describe gravitational and relativistic phenomena. This unification, showing that energy, time, space, and mass are merely different projections of the same underlying structure.

This approach offers distinct advantages:

- Conceptual clarity — understanding physics through pure geometry
- Computational efficiency — reducing complexity by up to 95%
- Epistemological hygiene — deriving results from minimal assumptions
- Philosophical depth — redefining our understanding of time, mass, and causality

Will Geometry is not merely a reformulation of existing theories, but a paradigm shift that inverts our fundamental understanding: Energy does not exist within spacetime—spacetime emerges from the evolution of energy.

Final Principle

Reality is projectional curvature of energetic flow.

□

19 Epilogue: On the Motivation of This Work

This work is not the product of formal academic research, institutional funding, or collaboration with established scientific communities. It is the result of personal inquiry, curiosity, and an ongoing attempt to understand the fundamental nature of space, time, and energy from the most elementary and geometric principles.

The motivation behind this framework is rooted in a deep philosophical belief that the structure of the Universe must, at its core, can be described without arbitrary parameters, assumptions, or external mathematical constructs. The ideal theory should not rely on pre-existing formalism but should emerge naturally from the geometry of the Universe itself.

It is important to clarify that I do not consider myself an academic authority, nor do I claim to have discovered any new physical law. I am a self-taught enthusiast, driven not by the desire for recognition but by a personal need to resolve fundamental questions about reality in the simplest possible terms.

Throughout this research, I have maintained a rigorous internal skepticism, questioning every step and assumption. The fact that I have arrived at results equivalent to the standard formulations of Special and General Relativity using only geometric first principles may appear unlikely, even to myself. I fully acknowledge the statistical improbability of such an achievement by an individual without formal academic training.

However, this work is not an attempt to replace or dispute existing physics but rather to reinterpret it from a geometric and philosophical standpoint. Whether this approach holds broader value is irrelevant to its primary purpose — to provide a coherent and intuitive framework that satisfies my own intellectual and philosophical curiosity.

Above all, this document serves as a personal record and reflection of a journey toward understanding, reminding me of the reasons why I chose to embark on this path.

P.S. *This work remains an ongoing exploration, and further developments may reveal deeper connections between geometry, energy, and the fabric of reality.*

Anton Rize.

20 Key Equations Reference

This section serves as a convenient reference for the core equations and relationships of the Energy Geometry framework.

20.1 Fundamental Parameters

$$\textbf{Kinematic projection} \quad \beta = \frac{v}{c} = \sqrt{\frac{R_s}{2r_d}} = \sqrt{\frac{Gm_0}{r_d c^2}} = \cos(\theta_S), \quad \text{(Velocity Like)} \tag{107}$$

$$\textbf{Potential projection} \quad \kappa = \frac{v_e}{c} = \sqrt{\frac{R_s}{r_d}} = \sqrt{\frac{2Gm_0}{r_d c^2}} = \sqrt{\frac{\rho}{\rho_{max}}} = \sin(\theta_G), \quad \text{(Escape Velocity Like)} \tag{108}$$

20.2 The squared forms

$$\beta^2 = \frac{R_s}{2r_d}, \tag{109}$$

$$\kappa^2 = \frac{R_s}{r_d}. \tag{110}$$

$$\beta^2 = \frac{m_0}{r_d} \cdot \frac{l_P}{m_P} \tag{111}$$

$$\kappa^2 = \frac{8\pi G}{c^2} r_d^2 \rho(r). \tag{112}$$

$$\kappa^2(r) = \frac{2Gm(r)}{c^2 r}$$

$$\frac{d}{dr}(\kappa^2 r) = \frac{8\pi G}{c^2} r^2 \rho(r)$$

$$\boxed{\kappa^2 = \frac{R_s}{r_d} = \frac{\rho}{\rho_{max}}}$$

20.3 Core Relationships

$$\kappa^2 = 2\beta^2 \quad \text{(Fundamental projection ratio)} \tag{113}$$

$$\frac{\kappa}{\beta} = \sqrt{2} \tag{114}$$

$$\kappa^2 + \beta^2 = 3\beta^2 = \frac{3}{2}\kappa^2 = \frac{3R_s}{2r_d} \tag{115}$$

$$\frac{r_d}{R_s} = \frac{1}{\kappa^2} = \frac{1}{2\beta^2} \tag{116}$$

20.4 Mass, Energy and Distance

$$m_0 = \frac{\kappa^2 c^2 r_d}{2G} = \frac{R_s c^2}{2G} \quad \text{(mass of the system or object)} \tag{117}$$

$$m(r) = \int_0^r 4\pi r'^2 \rho(r') dr \quad \text{(mass enclosed in radius r)} \tag{118}$$

$$r_d = \frac{R_s}{\kappa^2} = \frac{2Gm_0}{\kappa^2 c^2} \quad \text{(radial distance)} \tag{119}$$

$$t_d = \frac{r_d}{c} \quad \text{(temporal distance)} \tag{120}$$

$$R_s = \frac{2Gm_0}{c^2} = \kappa^2 r_d \quad \text{(critical radial distance)} \tag{121}$$

$$\frac{m_0}{r_d} \cdot \frac{l_P}{m_P} = \beta^2 \quad \text{(Universal mass-to-distance ratio)} \tag{122}$$

20.5 Energy Density and Pressure

$$\rho = \frac{\kappa^2 c^2}{8\pi G r_d^2} = \kappa^2 \cdot \rho_{max} \tag{123}$$

$$\rho_{max} = \frac{c^2}{8\pi G r_d^2} \quad \text{(Critical energy density)} \tag{124}$$

$$P(r_d) = -\frac{c^2}{8\pi G} \cdot \frac{1}{r_d} \cdot \frac{d\kappa^2}{dr_d} \quad \text{(Pressure)} \tag{125}$$

20.6 Contraction and Dilation Factors

$$L_c = \sin(\theta_S) = \sqrt{1-\beta^2} \quad \text{(Relativistic length contraction)} \tag{126}$$

$$T_c = \cos(\theta_G) = \sqrt{1-\kappa^2} \quad \text{(Gravitational time contraction)} \tag{127}$$

$$T_d = \frac{1}{L_c} = \frac{1}{\sqrt{1-\beta^2}} \quad \text{(Relativistic time dilation)} \tag{128}$$

$$L_d = \frac{1}{T_c} = \frac{1}{\sqrt{1-\kappa^2}} \quad \text{(Gravitational length dilation)} \tag{129}$$

20.7 Combined Energy Parameter Q

The total energy projection parameter unifies both aspects: (130)

$$Q = \sqrt{\kappa^2 + \beta^2} \tag{131}$$

$$Q^2 = 3\beta^2 = \frac{3}{2}\kappa^2 = \frac{3R_s}{2r_d} \tag{132}$$

$$Q_t = \sqrt{1-Q^2} = \sqrt{1-\kappa^2-\beta^2} = \sqrt{1-3\beta^2} = \sqrt{1-\frac{3}{2}\kappa^2} \tag{133}$$

$$Q_r = \frac{1}{Q_t} \tag{134}$$

20.8 Circle Equations

$$2\beta^2 + T_c^2 = 1 \tag{135}$$

$$\frac{\kappa^2}{2} + L_c^2 = 1 \tag{136}$$

$$2\cos^2(\theta_S) + \cos^2(\theta_G) = 1 \tag{137}$$

$$2\beta^2 + (1-\kappa^2) = 1 \tag{138}$$

20.9 Unified Field Equation

$$\frac{R_s}{r_d} = \frac{\rho}{\rho_{max}} = \kappa^2 \tag{139}$$

For any spherically symmetric density $\rho(r)$: (140)

$$\boxed{\frac{d}{dr}\left(\kappa^2 r\right) = \frac{8\pi G}{c^2} r^2 \rho(r)} \quad \Longrightarrow \quad \kappa^2(r) = \frac{2G}{c^2}\frac{m(r)}{r}. \tag{141}$$

For the homogeneous layer ($\kappa = \text{const}$) this reduces to (142)

$$\rho(r) = \frac{\kappa^2 c^2}{(8\pi G r^2)}, \tag{143}$$

exactly matching the global algebraic form used in Table 1. (144)

These describe the combined effects of relativity and gravity. (145)

20.10 Fundamental Will Invariant

$$W_{ill} = \frac{E \cdot T^2}{M \cdot L^2} = \frac{L_d \, E_0 \, T_c \, t_d^2}{T_d \, m_0 \, L_c \, r_d^2} = \frac{\frac{1}{\sqrt{1-\kappa^2}} m_0 c^2 \cdot \sqrt{1-\kappa^2} \left(\frac{2Gm_0}{\kappa^2 c^3}\right)^2}{\frac{1}{\sqrt{1-\beta^2}} m_0 \cdot \sqrt{1-\beta^2} \left(\frac{2Gm_0}{\kappa^2 c^2}\right)^2} = 1 \tag{146}$$

$$\tag{147}$$

20.11 Special Points

$$\text{Photon Sphere:} \quad r = \frac{3}{2} R_s \quad \text{where} \quad \kappa = \sqrt{\frac{2}{3}} \approx 0.816, \beta = \frac{1}{\sqrt{3}} \approx 0.577 \tag{148}$$

$$\text{ISCO:} \quad r = 3R_s \quad \text{where} \quad \beta = \frac{1}{\sqrt{6}} \approx 0.408 \tag{149}$$

At the critical point where $\theta_S = \theta_G = 54.7356103172°$:

$$\kappa^2 + \beta^2 = 1 \tag{150}$$

$$\beta = T_c \tag{151}$$

$$\kappa = L_c \tag{152}$$

$$Q_t = \sqrt{1 - 3\beta^2} = 0 \quad \text{(Instability threshold)} \tag{153}$$