M7.5 – Boundary Flux Evolution Law on Scalar–Conformal NUVO Space

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Notation and Conventions

- $\mathcal{M}$ denotes the spacetime manifold.
- η denotes the reference Lorentzian metric (typically Minkowski in a global chart).
- g denotes the physical metric.
- The scalar field $\Lambda : \mathcal{M} \to \mathbb{R}_{>0}$ is the NUVO modulation field.
- The physical metric is scalar–conformal:

$$g_{\mu\nu} = \Lambda^2 \, \eta_{\mu\nu}.$$

- $\Lambda_0 > 0$ denotes the baseline scalar availability level supported by the intrinsic delivery structure of the underlying field. In the absence of localized structural occupation the scalar field satisfies $\Lambda(x) = \Lambda_0$.
- The dimensionless scalar diagnostic is

$$\mathcal{A}(x) := \frac{\Lambda(x)}{\Lambda_0}.$$

- The scalar field represents the *locally available structural capacity* of the underlying delivery field. Localized structures may reduce this availability through occupation or transport, but the intrinsic delivery baseline Λ_0 remains fixed.
- Greek indices $\mu, \nu, \ldots$ range over spacetime coordinates $0, 1, 2, 3$.
- We use the Einstein summation convention unless explicitly stated otherwise.

*Bibliography is provisional. Cross-references to companion NUVO-series papers (M-, SR-, Q-, QB-, QM-series) will be updated with Zenodo DOIs in subsequent versions.

Notation convention. We reserve distinct symbols for fundamental fields and derived quantities. The scalar field Λ represents structural availability, while $\mathcal{A}$ denotes a derived normalized response field. These should not be conflated.

Remark 0.1. *Unless otherwise stated, the background signature is* $(-,+,+,+)$.

Abstract

Within the scalar–conformal NUVO framework, the support sector describes physical systems as localized anchors embedded in a uniformly delivered capacity field. The physical state of an anchor is given by its boundary flux distribution, subject to the invariant total intake condition

$$\int_{\partial S} \Phi_n \, dA = mc^2.$$

Previous work has established that inertial and accelerated motion correspond, respectively, to stationary and evolving boundary flux distributions, and that scalar modulation of the delivery geometry induces admissible changes in these distributions. However, a closed evolution law governing this response has not yet been formulated.

In this work we derive the first dynamical law of the NUVO support sector. We show that the evolution of the boundary flux distribution is a local, constraint-preserving redistribution process driven by mismatch between the current boundary state and a locally preferred configuration determined by the scalar–conformal delivery geometry.

The scalar field $\Lambda(x)$ encodes the geometric structure of delivery, while the normalized scalar response

$$\mathcal{A}(x) = \frac{\Lambda(x)}{\Lambda_0}$$

provides a dimensionless diagnostic of this structure. Analogous to temperature in thermodynamics: it encodes the local conditions under which delivery is presented, without constituting a force or transported quantity.

The resulting evolution law is expressed as a projected relaxation on the admissible boundary state space. In the weak-field limit, this law reduces to a dipole response proportional to $\nabla\Lambda$, yielding the inverse-square gravitational form for a static spherical source. Dynamics therefore arise as admissible evolution of boundary intake, and acceleration appears as an emergent kinematic consequence of boundary-state adjustment rather than as a primitive force.

1 Introduction

The scalar–conformal NUVO framework reformulates physical dynamics in terms of capacity delivery and boundary response, rather than force and transport. In this setting, space is equipped with a scalar field Λ that encodes the local structure of capacity delivery, while physical systems appear as localized anchors that consume this delivery at a fixed invariant rate.

A central result of the support-sector development [1] is that capacity is not a transported substance. Instead, it is uniformly delivered across space, and anchors act as localized consumers of this delivery. The physical state of an anchor is therefore not determined by internal variables or external forces, but by the distribution of boundary intake across its surface, represented by the boundary flux density Φ_n.

This perspective leads to a natural redefinition of motion. An inertial state corresponds to a stationary boundary flux distribution,

$$\partial_\tau \Phi_n = 0,$$

while acceleration corresponds to evolution of this distribution,

$$\partial_\tau \Phi_n \neq 0.$$

Gravitational response arises not from a force acting on the anchor, but from scalar modulation of the delivery geometry, which alters the set of admissible boundary flux configurations.

The preceding paper (M7) [2] established the first response structure linking scalar geometry to boundary evolution. In particular, it identified the existence of a locally preferred boundary configuration determined by the scalar field and its spatial variation, and showed how weak-field gravitational response emerges from the resulting boundary asymmetry.

However, that formulation did not yet provide a closed dynamical law. While it characterized the qualitative structure of the response, it left implicit the admissible state space of boundary configurations, the constraint-preserving nature of the evolution, and the precise form of the evolution operator.

The purpose of the present paper is to close this gap. We derive a complete evolution law for the boundary flux distribution within the support sector, expressed entirely in terms of scalar–conformal geometry and boundary admissibility.

A key conceptual element is the interpretation of the scalar field. We distinguish between the scalar field $\Lambda(x)$ and its local evaluation $\mathcal{A} = \frac{\Lambda(x)}{\Lambda_0}$. The field Λ encodes the geometric structure of delivery, while $\mathcal{A}$ serves as a local diagnostic of that structure. In this sense, $\mathcal{A}$ plays a role analogous to temperature in thermodynamics: it characterizes the local conditions under which delivery is presented, without representing a force or a transported quantity.

The evolution law derived here takes the form of a local, causal redistribution of boundary flux within the admissible state space defined by fixed total intake. The dynamics of an anchor are thus governed by the requirement that its boundary intake remain compatible with the locally presented delivery geometry.

In the weak-field limit, the resulting law reduces to a dipole response proportional to the gradient of the scalar field, recovering the inverse-square gravitational form for a static spherical source. More generally, the framework shows that acceleration is not a primitive quantity, but an emergent kinematic image of boundary-state evolution.

2 Foundational Inputs from the Support Sector

2.1 Scalar–Conformal Geometry

The support sector of the NUVO framework is defined on a scalar–conformal geometric structure [3] in which the spacetime metric takes the form

$$g_{\mu\nu} = \Lambda^2(x)\,\eta_{\mu\nu},$$

where $\eta_{\mu\nu}$ is the Minkowski metric and $\Lambda(x)$ is a positive scalar field defined over spacetime.

The scalar field Λ encodes the local structure of capacity delivery. It does not represent a potential or a force-generating field, but rather a geometric descriptor that determines how capacity is presented locally to embedded systems.

For local discussions it is convenient to denote the scalar value evaluated at the anchor location by

$$\mathcal{A} = \frac{\Lambda(x)}{\Lambda_0}.$$

Thus Λ denotes the scalar field globally, while $\mathcal{A}$ denotes its local value when emphasis on pointwise delivery conditions is helpful.

Gradients of the scalar field, $\nabla\Lambda$, represent spatial variation in the delivery geometry. They do not correspond to forces or transport processes, but instead determine how the locally preferred boundary configuration varies across space.

2.2 Capacity as Uniform Delivery

A central principle of the support sector is that capacity is not a transported substance [1]. There is no flow of capacity between regions of space. Instead, capacity is uniformly delivered throughout spacetime as a background process.

The scalar field Λ modulates the structure of this delivery, but does not alter its fundamental nature as a uniform presentation. Physical effects arise only through how this delivery is locally received and processed by embedded systems.

Accordingly, no conservation law for transported capacity is assumed or required. All physically meaningful quantities arise from local interaction with the delivered capacity at the boundary of an anchor.

2.3 Anchors and Boundary Flux State

Physical systems in the support sector appear as localized anchored structures. Each anchor is characterized by its interaction with the uniformly delivered capacity at its boundary.

The state of an anchor is given by its boundary flux distribution,

$$\Phi_n : \partial S \to \mathbb{R}_{\geq 0},$$

which represents the rate of capacity intake per unit area across the boundary ∂S.

The total intake is invariant and defines the rest energy of the anchor [1, 4]:

$$\int_{\partial S} \Phi_n \, dA = mc^2.$$

This condition is not dynamical, but structural: it defines the admissible state space of the anchor.

Thus, the physical state of an anchor is not given by position or velocity, but by the angular distribution of boundary intake encoded in Φ_n.

2.4 Inertial and Accelerated States

Within this framework, motion is defined in terms of the evolution of the boundary flux distribution along the worldline of the anchor.

An inertial state corresponds to a stationary boundary configuration,

$$\partial_\tau \Phi_n = 0,$$

while an accelerated state corresponds to a changing boundary configuration,

$$\partial_\tau \Phi_n \neq 0.$$

This definition makes no reference to force. Acceleration is not imposed externally, but arises as a property of the evolving boundary intake structure.

Importantly, anisotropy of Φ_n alone does not imply acceleration. A boundary distribution may be anisotropic yet stationary. Only the temporal evolution of the distribution corresponds to acceleration.

2.5 Scalar Modulation and Boundary Admissibility

The scalar field Λ influences physical behavior by modifying the set of admissible boundary flux distributions.

At each point, the locally evaluated scalar value $\mathcal{A} = \frac{\Lambda(x)}{\Lambda_0}$, together with its spatial variation $\nabla\Lambda$, determines the boundary configurations that are compatible with the presented delivery geometry.

In particular, for a given local scalar environment, there exists a class of admissible boundary flux distributions satisfying:

- positivity: $\Phi_n \geq 0$,
- fixed total intake: $\int_{\partial S} \Phi_n \, dA = mc^2$,
- local compatibility with the scalar-modulated delivery structure.

Physical response arises when the current boundary configuration of an anchor is not compatible with the locally preferred configuration determined by the scalar geometry. The resulting evolution is a redistribution of boundary intake within this admissible class.

2.6 Sector Discipline

All constructions in this work are restricted to the support sector. No exchange-sector quantities, interactions, or coherence conditions are invoked.

In particular:

- No force laws are introduced.
- No transport or flow of capacity is assumed.
- No quantum or electromagnetic structure is used.

The goal is to derive a closed dynamical law entirely from scalar–conformal geometry, uniform capacity delivery, and boundary admissibility.

3 Admissible Boundary State Space

3.1 Definition of Boundary State

Let S denote a localized anchor with boundary ∂S. The physical state of the anchor is given by its boundary flux distribution

$$\Phi_n : \partial S \to \mathbb{R}_{\geq 0},$$

which assigns to each boundary point the local rate of capacity intake per unit area.

The total intake is fixed by the structural condition

$$\int_{\partial S} \Phi_n \, dA = mc^2.$$

This constraint defines the admissible class of boundary configurations and is not a consequence of dynamical evolution.

3.2 Admissible State Space

We define the admissible boundary state space at a given spacetime location x as

$$\mathcal{S}(x) = \left\{ \Phi_n \;\middle|\; \Phi_n \geq 0,\; \int_{\partial S} \Phi_n \, dA = mc^2,\; \Phi_n \text{ compatible with the local scalar environment} \right\}.$$

Here, compatibility refers to the requirement that the boundary configuration be consistent with the locally presented delivery structure determined by the scalar field $\Lambda(x)$ and its derivatives.

Thus, $\mathcal{S}(x)$ is a constrained function space of non-negative boundary distributions with fixed total intake, parameterized by the local scalar geometry.

3.3 Tangent Space of Admissible Variations

Physical evolution of the boundary state corresponds to continuous deformations of Φ_n within the admissible state space.

An admissible variation $\delta\Phi_n$ must preserve the total intake constraint:

$$\int_{\partial S} \delta\Phi_n \, dA = 0.$$

Accordingly, the tangent space to $\mathcal{S}(x)$ at Φ_n is given by

$$T_{\Phi_n}\mathcal{A} = \left\{ \delta\Phi_n \;\middle|\; \int_{\partial S} \delta\Phi_n \, dA = 0 \right\}.$$

These variations represent pure redistributions of boundary intake, with no net change in total capacity consumption.

3.4 Positivity and Interior Admissibility

In addition to preserving total intake, admissible boundary configurations must satisfy the positivity condition

$$\Phi_n \geq 0.$$

Thus, the admissible state space is not a linear space, but a constrained subset of a function space with a boundary defined by $\Phi_n = 0$.

Physical evolution must therefore remain within the interior of this space or evolve along its boundary in a manner consistent with the positivity constraint. In particular, no admissible evolution may produce negative boundary intake.

3.5 Local Dependence on Scalar Geometry

The admissible state space $\mathcal{S}(x)$ depends on the local scalar environment through the scalar field Λ and its spatial derivatives.

In general, the admissibility of a given boundary configuration is determined by local scalar data of the form

$$\Lambda(x), \quad \nabla\Lambda(x), \quad \nabla\nabla\Lambda(x), \quad u^\mu,$$

where u^μ is the four-velocity of the anchor.

Thus, the admissible state space is not fixed globally, but varies from point to point in spacetime as the scalar field varies.

3.6 Steady States and Local Compatibility

A boundary configuration Φ_n is said to be locally compatible with the scalar environment if it belongs to $\mathcal{S}(x)$ and remains stationary under admissible evolution.

Such configurations correspond to steady states of the support-sector dynamics:

$$\partial_\tau \Phi_n = 0.$$

In general, for each local scalar environment there exists a class of compatible boundary configurations, among which a preferred configuration will be identified in the following section.

3.7 Interpretation

The admissible state space $\mathcal{S}(x)$ encodes the physically realizable boundary configurations of an anchor at a given location.

Dynamics in the support sector consist of continuous evolution within this space, subject to:

- preservation of total intake,
- non-negativity of boundary flux,
- compatibility with the locally presented delivery geometry.

No notion of force or transport is required. The evolution of an anchor is entirely determined by how its boundary configuration adjusts within the admissible state space as the scalar environment varies.

4 Local Delivery Geometry and Preferred Boundary Configuration

4.1 Local Delivery Geometry

The scalar field $\Lambda(x)$ determines the local structure of capacity delivery. While capacity is uniformly delivered in the support sector, the scalar–conformal geometry modulates how this delivery is presented at the boundary of an anchor.

At a given spacetime point x, the local delivery geometry is characterized by:

$$\Lambda(x), \quad \nabla\Lambda(x), \quad \nabla\nabla\Lambda(x), \quad u^\mu,$$

where u^μ is the four-velocity of the anchor.

These quantities do not generate forces or transport, but instead determine the geometric structure of delivery presentation at the boundary.

4.2 Preferred Boundary Configuration

For each local scalar environment, there exists a boundary flux distribution that is maximally compatible with the presented delivery structure.

We denote this configuration by

$$\Phi_n^* = \Phi_n^*\big(\Lambda, \nabla\Lambda, \nabla\nabla\Lambda, u^\mu\big).$$

This preferred configuration is defined entirely within the admissible state space:

$$\Phi_n^* \in \mathcal{S}(x),$$

and therefore satisfies:

$$\Phi_n^* \geq 0, \qquad \int_{\partial S} \Phi_n^* \, dA = mc^2.$$

Physically, Φ_n^* represents the boundary intake distribution that is fully adapted to the locally presented delivery geometry.

4.3 Locality and Covariance

The preferred boundary configuration is determined by local scalar data and must be constructed in a covariant manner.

Accordingly, Φ_n^* depends only on quantities available at the boundary point, including the local scalar value $\mathcal{A} = \frac{\Lambda(x)}{\Lambda_0}$, the spatial variation $\nabla\Lambda(x)$, and higher derivatives as required.

No nonlocal information or global structure enters into the definition of Φ_n^*.

4.4 Weak-Gradient Expansion

In regions where the scalar field varies slowly across the scale of the anchor, the preferred configuration admits a systematic expansion in gradients of Λ.

To leading order, the preferred boundary flux distribution takes the form

$$\Phi_n^* = \Phi_0 \left[1 + \alpha \left(\hat{n} \cdot \nabla\Lambda\right)\right],$$

where:

- $\Phi_0 = \dfrac{mc^2}{A(\partial S)}$ is the isotropic baseline distribution,
- $\hat{n}$ is the outward unit normal on ∂S,
- α is a dimensionful response coefficient determined by the local geometry.

This expression represents the first-order anisotropic correction to the isotropic boundary state induced by spatial variation in the scalar field.

4.5 Normalization Constraint

The preferred configuration must satisfy the total intake constraint. At first order, this is ensured by the property:

$$\int_{\partial S} (\hat{n} \cdot \nabla\Lambda) \, dA = 0,$$

so that:

$$\int_{\partial S} \Phi_n^* \, dA = mc^2.$$

Thus, the leading-order correction corresponds to a pure redistribution of boundary intake, with no change in total capacity consumption.

4.6 Higher-Order Structure

Beyond the leading-order term, higher derivatives of the scalar field contribute additional structure to the preferred configuration.

In general, one may write:

$$\Phi_n^* = \Phi_0 \, \mathcal{F}(\hat{n};\, \Lambda,\, \nabla\Lambda,\, \nabla\nabla\Lambda,\, u^\mu,\, \nabla_u\Lambda,\, \ldots) \,,$$

where $\mathcal{F}$ is a dimensionless function encoding the full local dependence of the preferred boundary configuration.

These higher-order terms become significant in regions of strong scalar variation or for extended anchors.

4.7 Interpretation

The preferred boundary configuration Φ_n^* represents the boundary intake distribution that is locally compatible with the scalar-modulated delivery geometry.

It is not imposed dynamically, but defined geometrically. Physical dynamics arise only when the actual boundary configuration Φ_n differs from Φ_n^*.

The role of the scalar field is therefore indirect: it does not act on the anchor, but determines the configuration toward which the boundary distribution must adjust.

In this sense, the scalar field Λ defines a geometric constraint on admissible boundary states, while its local value $\mathcal{A}$ serves as a diagnostic of that constraint.

5 Closed Boundary Flux Evolution Law

5.1 Principle of Local Structural Response

The physical state of an anchor is its boundary flux distribution $\Phi_n \in \mathcal{S}(x)$, while the local scalar geometry determines a preferred configuration $\Phi_n^* \in \mathcal{S}(x)$.

When $\Phi_n \neq \Phi_n^*$, the boundary configuration is not compatible with the locally presented delivery geometry. The fundamental dynamical principle of the support sector is that such a mismatch induces a redistribution of boundary intake.

This redistribution is:

- local, depending only on scalar data at the boundary,
- causal, proceeding through the finite propagation of delivery adjustments,
- constraint-preserving, maintaining fixed total intake.

Thus, the evolution of Φ_n must be driven by its deviation from Φ_n^* within the admissible state space.

5.2 Constraint-Preserving Evolution

Let $f = \Phi_n - \Phi_n^*$ denote the mismatch between the current and preferred boundary configurations.

A general local response law must:

- vanish when $\Phi_n = \Phi_n^*$,
- preserve total intake,

- act within the admissible tangent space.

A natural minimal linear local form satisfying these conditions at leading order is a relaxation toward the preferred configuration, restricted to admissible variations:

$$\partial_\tau \Phi_n = -\kappa\, \Pi_{\mathcal{A}}(f),$$

where $\kappa > 0$ is a local response rate, and $\Pi_{\mathcal{A}}$ is a projection operator onto the tangent space of admissible variations.

5.3 Projection onto the Admissible Tangent Space

To preserve the total intake constraint, the evolution must satisfy:

$$\frac{d}{d\tau} \int_{\partial S} \Phi_n \, dA = 0.$$

This is ensured by requiring:

$$\int_{\partial S} \partial_\tau \Phi_n \, dA = 0.$$

Accordingly, at leading order we define an intake-preserving projection operator $\Pi_{\mathcal{A}}$ by

$$\Pi_{\mathcal{A}}(f) = f - \frac{1}{A(\partial S)} \int_{\partial S} f \, dA.$$

This removes the monopole component of f that would alter the total intake, leaving only redistributions tangent to the fixed-intake constraint.

Strictly speaking, this projection enforces the linearized admissibility condition associated with preservation of total intake. Positivity of Φ_n is then maintained by restricting attention to the weak-response regime in which the evolution remains within the interior of the non-negative admissible state space.

5.4 Closed Evolution Law

Combining the above, we obtain the closed evolution law for the boundary flux distribution:

$$\boxed{\partial_\tau \Phi_n = -\kappa \left[(\Phi_n - \Phi_n^*) - \frac{1}{A(\partial S)} \int_{\partial S} (\Phi_n - \Phi_n^*) \, dA \right].}$$

This equation defines the first dynamical law of the NUVO support sector.

It is entirely local, depends only on scalar–conformal geometry through Φ_n^*, and preserves the admissible structure of the boundary state.

5.5 Steady-State Condition

A boundary configuration is stationary if and only if

$$\partial_\tau \Phi_n = 0.$$

From the evolution law, this occurs precisely when

$$\Pi_{\mathcal{A}}(\Phi_n - \Phi_n^*) = 0.$$

Since both Φ_n and Φ_n^* satisfy the total intake constraint, this reduces to

$$\Phi_n = \Phi_n^*.$$

Thus, the preferred configuration is the unique steady state within the admissible class.

5.6 Locality and Causality

The evolution law depends only on local scalar data through Φ_n^* and on the current boundary state Φ_n.

Causality is ensured by the finite propagation of changes in the delivery geometry, as assumed in the support-sector framework established in the preceding papers. The boundary responds only to scalar information that has reached it through the locally presented delivery structure.

No instantaneous or nonlocal interaction is introduced.

5.7 Interpretation

The evolution law describes a local redistribution of boundary intake driven by mismatch with the scalar-modulated delivery geometry.

No force acts on the anchor. No capacity is transported between regions. Instead, the anchor continuously adjusts its boundary configuration to remain compatible with the locally presented delivery structure.

Dynamics in the support sector are therefore entirely encoded in the evolution of the boundary flux distribution within the admissible state space.

6 Moment Hierarchy and Macroscopic Response

6.1 Boundary Moment Expansion

The boundary flux distribution Φ_n encodes the full physical state of an anchor. To extract macroscopic structure, we consider its angular moments over the boundary ∂S.

Let $\hat{n}$ denote the outward unit normal. The moments of Φ_n are defined by integrals of the form

$$M^{(k)} = \int_{\partial S} \Phi_n \, (\hat{n})^{\otimes k} \, dA,$$

where $(\hat{n})^{\otimes k}$ denotes the k-fold tensor product of $\hat{n}$.

These moments provide a hierarchical description of the boundary state, with increasing angular resolution at higher order.

6.2 Monopole Constraint

The zeroth moment (monopole) is fixed by the total intake condition:

$$M^{(0)} = \int_{\partial S} \Phi_n \, dA = mc^2.$$

This quantity is invariant and does not participate in the dynamics. All physical evolution occurs through redistribution of higher-order moments.

6.3 Dipole Moment

The first nontrivial moment is the dipole:

$$\mathbf{P} = \int_{\partial S} \Phi_n \, \hat{n} \, dA.$$

The dipole moment encodes the leading-order directional asymmetry of the boundary flux distribution.

In an isotropic state, $\mathbf{P} = 0$. Anisotropy in Φ_n produces a nonzero dipole, representing directional bias in boundary intake.

6.4 Evolution of the Dipole

Taking the proper-time derivative and using the evolution law, we obtain

$$\partial_\tau \mathbf{P} = \int_{\partial S} (\partial_\tau \Phi_n)\, \hat{n}\, dA.$$

Substituting the evolution law from Section 5,

$$\partial_\tau \Phi_n = -\kappa\, \Pi_{\mathcal{A}}(\Phi_n - \Phi_n^*),$$

we find

$$\partial_\tau \mathbf{P} = -\kappa \int_{\partial S} \Pi_{\mathcal{A}}(\Phi_n - \Phi_n^*)\, \hat{n}\, dA.$$

Since the projection removes only the monopole component, which integrates to zero when multiplied by $\hat{n}$, this reduces to

$$\partial_\tau \mathbf{P} = -\kappa(\mathbf{P} - \mathbf{P}^*),$$

where

$$\mathbf{P}^* = \int_{\partial S} \Phi_n^*\, \hat{n}\, dA.$$

Thus, the dipole evolves toward the preferred dipole determined by the scalar geometry.

6.5 Preferred Dipole Structure

Using the leading-order form of Φ_n^*,

$$\Phi_n^* = \Phi_0 \left[1 + \alpha\, (\hat{n} \cdot \nabla\Lambda)\right],$$

we compute

$$\mathbf{P}^* = \Phi_0 \alpha \int_{\partial S} (\hat{n} \cdot \nabla\Lambda)\, \hat{n}\, dA.$$

By symmetry, this yields

$$\mathbf{P}^* \propto \nabla\Lambda,$$

with the proportionality constant determined by the geometry of ∂S.

Thus, the preferred dipole is aligned with the gradient of the scalar field.

6.6 Macroscopic Kinematic Image

The dipole moment provides the leading macroscopic signature of boundary-state asymmetry, while its evolution provides the leading macroscopic signature of boundary-state adjustment.

Accordingly, the effective kinematic response is identified not with the dipole itself, but with its rate of change:

$$\mathbf{a} \propto \partial_\tau \mathbf{P}.$$

This preserves the distinction between anisotropy and acceleration. A boundary configuration may be anisotropic ($\mathbf{P} \neq 0$) yet stationary ($\partial_\tau \mathbf{P} = 0$), in which case no proper acceleration is present.

In the fast-tracking weak-field regime, the actual boundary state remains closely slaved to the preferred configuration, so that the evolving dipole structure inherits the same directional dependence as

$$\mathbf{P}^* \propto \nabla\Lambda.$$

In this sense, what is conventionally interpreted as acceleration arises as the macroscopic image of evolving boundary redistribution rather than of anisotropy alone.

6.7 Higher-Order Moments

Higher moments of Φ_n encode finer angular structure of the boundary distribution.

In particular:

- Quadrupole moments describe deformation of the distribution,
- Higher-order tensors capture increasingly detailed anisotropy.

These moments become significant in regimes of strong scalar variation or for extended anchors, where the leading dipole approximation is insufficient.

6.8 Interpretation

The moment hierarchy provides a bridge between the full boundary-state description and observable kinematic behavior.

The monopole encodes invariant intake, the dipole encodes leading directional response, and higher moments encode structural refinements.

Acceleration is not a primitive quantity, but an emergent description arising from the evolution of boundary moments, with the dipole providing the dominant contribution in the weak-field regime.

7 Weak-Field Radial Reduction

7.1 Static Spherically Symmetric Source

Consider a static, spherically symmetric source of mass M. In the weak-field regime, the scalar field takes the form

$$\Lambda(r) = 1 + \frac{\ell_M}{r}, \qquad \ell_M = \frac{GM}{c^2},$$

where r is the radial distance from the source.

The spatial gradient is

$$\nabla\Lambda = -\frac{\ell_M}{r^2}\,\hat{r}.$$

This describes a slowly varying scalar field, so the weak-gradient expansion of Section 4 applies.

7.2 Preferred Boundary Configuration

To leading order, the preferred boundary flux distribution is

$$\Phi_n^* = \Phi_0 \left[1 + \alpha \left(\hat{n} \cdot \nabla\Lambda\right)\right].$$

Substituting the radial form of $\nabla\Lambda$, we obtain

$$\Phi_n^* = \Phi_0 \left[1 - \alpha \frac{\ell_M}{r^2} (\hat{n} \cdot \hat{r})\right].$$

Thus, the preferred configuration exhibits a directional bias aligned with the radial direction.

7.3 Preferred Dipole

From Section 6, the dipole associated with Φ_n^* is

$$\mathbf{P}^* = \int_{\partial S} \Phi_n^* \, \hat{n} \, dA.$$

Using the leading-order form, one finds

$$\mathbf{P}^* \propto \nabla\Lambda = -\frac{\ell_M}{r^2} \, \hat{r}.$$

Thus, the preferred dipole is radially inward and scales as $1/r^2$.

7.4 Fast-Tracking Regime

In regimes where the boundary distribution adjusts rapidly compared to the variation of the scalar environment, the dipole remains closely aligned with the preferred value:

$$\mathbf{P} \approx \mathbf{P}^*.$$

Since

$$\mathbf{P}^* \propto \nabla\Lambda,$$

the evolving dipole structure inherits the same leading directional dependence as the scalar gradient.

Equivalently, because the actual dipole remains slaved to the preferred dipole in this regime, its proper-time evolution inherits the same weak-field radial scaling as the scalar-induced preferred structure.

From Section 6, the effective kinematic response is associated with the evolution of the dipole:

$$\mathbf{a} \propto \partial_\tau \mathbf{P}.$$

In the weak-field fast-tracking regime, this yields an effective response whose leading radial dependence is governed by the scalar gradient, and therefore

$$\mathbf{a} \propto \nabla\Lambda \propto -\frac{\ell_M}{r^2} \, \hat{r}.$$

7.5 Recovery of Inverse-Square Form

Combining the above, the effective kinematic response takes the form

$$\mathbf{a} = -\gamma \frac{\ell_M}{r^2} \hat{r},$$

where γ is a proportionality constant determined by the relation between the dipole and the macroscopic response.

Substituting $\ell_M = \dfrac{GM}{c^2}$, we obtain

$$\mathbf{a} = -\gamma \frac{GM}{c^2 r^2} \hat{r}.$$

Matching to the observed weak-field scaling [5, 6] fixes

$$\gamma = c^2,$$

yielding

$$\mathbf{a} = -\frac{GM}{r^2} \hat{r}.$$

7.6 Interpretation

The inverse-square form arises as a consequence of:

- the scalar–conformal structure of the delivery geometry,
- the dipole form of the preferred boundary configuration,
- and the local evolution law driving the boundary distribution toward compatibility.

No force law has been assumed. The result emerges from the geometric modulation of boundary intake and its admissible evolution.

7.7 Scope of Validity

This reduction applies in the weak-field regime where:

- the scalar field varies slowly across the scale of the anchor,
- higher-order moments of the boundary distribution are negligible,
- and the dipole approximation dominates the response.

In stronger fields or more complex geometries, higher-order contributions and deviations from fast tracking must be considered.

8 Interpretation of Dynamics in the Support Sector

8.1 Dynamics as Boundary-State Evolution

The dynamical content of the support sector is entirely contained in the evolution of the boundary flux distribution Φ_n.

An anchor does not move in response to a force. Instead, its physical state evolves through continuous redistribution of boundary intake within the admissible state space $\mathcal{S}(x)$.

Thus, dynamics are not described by equations of motion in spacetime, but by evolution in a constrained function space of boundary configurations.

8.2 Inertial Persistence

An inertial state corresponds to a boundary configuration that is stationary under admissible evolution:

$$\partial_\tau \Phi_n = 0.$$

This occurs when the boundary distribution is compatible with the locally presented delivery geometry.

In this sense, inertia is not the absence of force, but the persistence of a boundary configuration that requires no adjustment relative to its scalar environment.

8.3 Acceleration as Boundary Redistribution

Acceleration arises when the boundary configuration is not compatible with the local scalar geometry:

$$\Phi_n \neq \Phi_n^*.$$

In this case, the evolution law drives redistribution of boundary intake:

$$\partial_\tau \Phi_n \neq 0.$$

The resulting change in the boundary moments, particularly the dipole, produces what is observed as acceleration.

Thus, acceleration is not a primitive dynamical input, but an emergent kinematic image of boundary-state evolution.

8.4 Free Fall as Sustained Compatibility

In a nonuniform scalar environment, there exist trajectories along which the boundary configuration remains compatible with the local delivery geometry.

Along such trajectories,

$$\partial_\tau \Phi_n = 0,$$

even though the scalar field varies in space.

These trajectories correspond to free-fall motion. Along them, the anchor remains in a locally compatible steady state, so that no boundary redistribution is required.

Free fall is therefore not motion under a force, but a state of sustained compatibility with the scalar-modulated delivery geometry [5, 7].

8.5 Role of the Scalar Field

The scalar field Λ does not act on the anchor. It does not generate forces or induce motion directly.

Instead, it determines the local structure of delivery and thereby defines the preferred boundary configuration Φ_n^*.

The local scalar value $\mathcal{A} = \frac{\Lambda(x)}{\Lambda_0}$ serves as a diagnostic of this structure, analogous to temperature in thermodynamics: it characterizes the local conditions under which delivery is presented, without constituting a dynamical agent.

Gradients of the scalar field, $\nabla\Lambda$, do not represent forces, but spatial variation in the locally preferred boundary configuration.

8.6 Absence of Force and Transport

No force law is required in the support sector. No transport of capacity between regions is assumed.

All physical behavior arises from:

- uniform delivery of capacity,
- local boundary intake by anchors,
- and admissible redistribution of that intake in response to scalar geometry.

This replaces the classical paradigm of force-driven motion with a geometry-driven adjustment of boundary state.

8.7 Summary

The support-sector dynamics established in this work may be summarized as follows:

- The state of an anchor is its boundary flux distribution Φ_n.
- The scalar field Λ defines the locally preferred boundary configuration Φ_n^*.
- Dynamics arise from redistribution of boundary intake toward compatibility with Φ_n^*.
- Acceleration is the macroscopic image of evolving boundary moments.
- Free fall corresponds to sustained compatibility with the scalar environment.

In this formulation, motion is not driven by forces, but emerges from the requirement that boundary intake remain compatible with the scalar–conformal structure of capacity delivery.

9 Consistency Checks and Exclusions

9.1 No Transport Ontology

The support-sector formulation developed here does not assume that capacity is transported between regions of space.

All expressions involving boundary flux describe the local rate at which capacity is received at the boundary of an anchor. These quantities do not represent a conserved substance moving through space.

Capacity is uniformly delivered, and the scalar field Λ modulates only the local structure of that delivery. The evolution law governs redistribution of boundary intake, not transfer of capacity between locations.

Accordingly, no continuity equation for transported capacity is introduced or required.

9.2 No Primitive Force Law

No force law is introduced in this framework.

The evolution of an anchor is not driven by forces acting upon it, but by the requirement that its boundary flux distribution remain compatible with the locally presented delivery geometry.

The appearance of inverse-square behavior in the weak-field limit arises from the scalar–conformal structure of Λ and the resulting preferred boundary configuration, not from an assumed force interaction.

Acceleration is therefore not a primitive quantity, but an emergent kinematic description of boundary-state evolution.

9.3 No Exchange-Sector Contamination

All results in this work are derived entirely within the support sector.

No exchange-sector structures are invoked, including:

- exchange cycles,
- closure conditions,
- coherence or quantization effects.

The boundary flux distribution Φ_n describes capacity intake only, and does not encode exchange-sector dynamics.

This separation ensures that the support-sector dynamics are self-contained and independent of the exchange-sector framework developed in the Q-series.

9.4 No Quantum Assumptions

The present formulation does not rely on quantum-mechanical assumptions.

No wavefunctions, operators, or quantization rules are introduced. The boundary flux distribution Φ_n is a classical geometric quantity defined on the boundary of an anchor.

While later developments may establish connections between support-sector dynamics and quantum phenomena, no such assumptions are used in the derivation of the evolution law presented here.

9.5 Scope Discipline

The statements above are not limitations of the framework, but expressions of scope discipline. The purpose of the present work is to establish a closed dynamical formulation of the support sector using only scalar–conformal geometry and boundary admissibility.

Connections to force-based descriptions, transport theories, or quantum structure may be developed in subsequent work, but are not required for the results obtained here.

10 Conclusion

In this work we have established the first closed dynamical law of the NUVO support sector.

Building on the scalar–conformal geometric framework of the M-series, and the reinterpretation of capacity as a uniformly delivered process, we have formulated dynamics entirely in terms of boundary-state evolution. The physical state of an anchor is given by its boundary flux distribution Φ_n, subject to the invariant total intake condition

$$\int_{\partial S} \Phi_n \, dA = mc^2.$$

The central result is a local, constraint-preserving evolution law governing the redistribution of boundary intake:

$$\partial_\tau \Phi_n = -\kappa \, \Pi_{\mathcal{A}}(\Phi_n - \Phi_n^*),$$

where Φ_n^* is the boundary configuration determined by the scalar–conformal delivery geometry, and $\Pi_{\mathcal{A}}$ enforces admissibility.

This law is derived without invoking force, transport, or exchange-sector structure. It depends only on the scalar field Λ, its local variation, and the requirement that boundary configurations remain compatible with the locally presented delivery structure.

From this formulation, macroscopic behavior emerges through the moment hierarchy of the boundary distribution. In the weak-field regime, the preferred dipole structure is aligned with $\nabla\Lambda$, and the resulting boundary-state evolution yields an effective inverse-square response consistent with gravitational behavior. This result is not assumed, but arises as a consequence of scalar geometry and boundary admissibility.

The interpretation of dynamics is thereby fundamentally altered. Motion is not driven by forces, but emerges from the requirement that boundary intake remain compatible with the scalar–conformal structure of capacity delivery. Inertial states correspond to stationary boundary configurations, acceleration corresponds to boundary redistribution, and free fall corresponds to sustained compatibility with a nonuniform scalar environment.

With the introduction of a closed evolution law, the support sector is now formulated as a self-contained dynamical framework at the level developed in the present series. The M-series establishes a consistent description of geometry, state, and evolution without reliance on force-based or transport-based paradigms.

This completion provides a foundation for subsequent developments. The SR-series may relate boundary-state evolution to spacetime kinematics, while the Q-series introduces exchange-sector structure and quantization. These extensions build upon, but do not alter, the support-sector dynamics established here.

The results presented in this work demonstrate that a fully dynamical theory can be constructed from scalar–conformal geometry and boundary admissibility alone, with acceleration arising as an emergent property of boundary-state evolution rather than as a primitive input.

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