

Coherence, Relativity, and the Mass-Length-Curvature Bridge in UT: A Conservative Derivation

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Abstract

This paper develops a first conservative derivation within Adams Unification Theory (UT), treated here in source-grounded form as a framework in which relational substrate, collapse, and metric response are structurally linked. Paper 1 isolates the mass-length-curvature contact sector by treating the target-side relations as a constraint surface to be matched, rather than as an external destination already fully derived. It identifies those relations first, then freezes only the minimal UT structure needed for recovery, and finally checks whether the same target sector returns from that freeze without extra assumptions.

The target-side sector is narrow: a mass-like observable, a characteristic-length observable, a geometric or causal response quantity, and a ratio-type response compression. The positive Sector A result is shared-control recovery of the mass-length product through the spatial-to-temporal metric response ratio. On the source-grounded UT side, the frozen core begins from relational substrate and global coherence, so Sector A is information-first in method while geometry is recovered as metric response to collapse. The paper remains candidate-level and constraint-first, without claiming full information-matter-energy-geometry closure, full Standard Model derivation, gauge closure, QCD closure, or validation.

1 Introduction

This paper is organized as a constraint-first derivation from a reduced contact sector to a minimal UT freeze and back again. The method freezes as little as possible. Overfreezing is a methodological error because it can over-specify the derivation and make it harder to audit cleanly.

In this paper, UT denotes Adams Unification Theory, treated in source-grounded form as a framework in which physical structure is reconstructed from relational substrate, collapse, and metric response. Adams Unification Theory was first articulated in 2003; the source-grounded mathematical corpus used for Paper 1 is the later canonical formulation and appendix structure now hosted on Saphiar. Paper 1 does not attempt total reconstruction. It isolates the smallest contact sector in which a conservative derivation can be shown.

Coherence and relativity remain explicit throughout. Coherence is central because the source-grounded core starts with relational substrate and global coherence [1]. Relativity remains explicit because the core also supports bounded propagation, metric-conditioned reconstruction, and scale-relative causal structure. The earlier framework language is replaced here by contact-sector, constraint surface, backward constraint, minimal freeze, and forward recovery.

Throughout, source-grounded refers to the canonical UT source and frozen core extraction from which the Sector A freeze is taken [1].

Section 4 gives the information-first chain, and Appendix A gives the variable map in one place.

The mathematical center is the shared-control chain linking collapse, mass, length, and metric response:

$$C(J) = \left(\frac{J}{J_0}\right)^s \exp\left[-\left(\frac{J}{J_0}\right)^s\right] \quad (1)$$

$$m(J) = \mu_0 C(J) \quad (2)$$

$$\lambda_{\text{phys}}(J) = \frac{\text{vol}(J)}{m(J) f_T(J)} \quad (3)$$

$$m(J) \lambda_{\text{phys}}(J) = \frac{\text{vol}(J)}{f_T(J)} \quad (4)$$

The positive result of Paper 1 is that the Sector A mass-length product is recoverable from a minimal freeze through a shared-control metric-response relation. This manuscript therefore asks a narrow question: what is the smallest UT freeze that still recovers the same mass-length-curvature sector from the target surface? Standard Model language remains future-facing and constrained, not a derived result.

That chain is the first serious Sector A result because it shows the target contact sector can be matched by a minimal freeze without adding structure beyond what the source already supports.

2 Target-Side Contact Sector and Constraint Surface

The target-side contact sector is the reduced physical sector that must be matched first. Its constraint surface is the set of relations that the target must satisfy before any stronger claim is allowed. For this paper, that surface is the mass-length-curvature sector together with bounded causal structure.

Sector A is the reduced reconstruction sector in which mass-like, length-like, and compressed metric-response quantities are recovered from the minimal UT freeze.

The target-side observables are described conservatively as:

- a mass-like observable
- a characteristic-length observable
- a geometric-response or causal-response quantity
- a ratio-type response compression

The ratio-type response compression is the minimal response object needed to compare mass-length structure to curvature-conditioned reconstruction without introducing the full UT metric split too early.

At this stage the target-side section does not yet assume UT-native notation. It keeps the observables at the contact level and only states the relations they must be able to satisfy.

The target relation is:

$$m_* \lambda_* = R_*$$

where R_* is the target-side ratio quantity. The target question is whether a reduced target sector of this kind can be matched by a recoverable UT chain without importing unsupported assumptions. In this paper, the contact sector is not a general theory-comparison project. It is a constrained reduction problem.

3 Information-First Reconstruction in Sector A

Sector A is information-first in method because the minimal UT freeze begins with a relational substrate, not with primitive spacetime.

The source-grounded dependency chain in Eq. (5) is:

$$M(a, b) \rightarrow S(a) \rightarrow J(a) \rightarrow C(J) \rightarrow m(J), \lambda_{\text{phys}}(J) \quad (5)$$

with the definitions:

$$S(a) = \sum_{b \in \mathcal{N}} M(a, b) \quad (6)$$

$$J(a) = \frac{S(a)}{S_{\text{ref}}} \quad (7)$$

$$C(J) = \left(\frac{J}{J_0} \right)^s \exp \left[- \left(\frac{J}{J_0} \right)^s \right] \quad (8)$$

$$m(J) = \mu_0 C(J) \quad (9)$$

$$\lambda_{\text{phys}}(J) = \frac{\text{vol}(J)}{m(J) f_T(J)} \quad (10)$$

$$\text{vol}(J) = f_r(J) f_\theta(J) f_\phi(J) \quad (11)$$

The relational substrate must exist before $S(a)$ exists, $S(a)$ before $J(a)$, $J(a)$ before $C(J)$, and $C(J)$ before the mass and length laws can be reconstructed. Because the length law depends on $\text{vol}(J)$ and $f_T(J)$, this is an informational-to-collapse-to-metric-conditioned reconstruction chain rather than a direct mass-only map. The current source therefore supports reading Sector A as information-first in method, not as a completed ontology theorem [1].

4 Backward Constraint from the Target Sector to UT Variables

The backward constraint starts from the reduced target sector and works backward to the smallest UT-compatible freeze.

The target-side contact sector constrains what the UT variables must do, and the equations below are introduced as the smallest chain sufficient to satisfy that constraint.

The curvature handle is:

$$J = \frac{S}{S_{\text{ref}}} \quad (12)$$

The collapse profile is:

$$C(J) = \left(\frac{J}{J_0}\right)^s \exp\left[-\left(\frac{J}{J_0}\right)^s\right] \quad (13)$$

The mass law is:

$$m(J) = \mu_0 C(J) \quad (14)$$

The length law is:

$$\lambda_{\text{phys}}(J) = \frac{\text{vol}(J)}{m(J) f_T(J)} \quad (15)$$

The spatial response volume is:

$$\text{vol}(J) = f_r(J) f_\theta(J) f_\phi(J) \quad (16)$$

The metric-collapse compatibility relation is:

$$\frac{d}{dJ} \ln\left(\frac{f_r f_\theta f_\phi}{f_T}\right) \propto \frac{d}{dJ} \ln C(J) \quad (17)$$

This proportionality is used here as a sector-level recovery condition linking metric response to collapse, and it reappears in branchwise form in Eq. (30), not as a completed global derivation for later sectors.

From these relations, the reduced target product becomes:

$$m(J) \lambda_{\text{phys}}(J) = \frac{\text{vol}(J)}{f_T(J)} \quad (18)$$

Proposition 1. Sector A shared-control recovery. Given the minimal freeze and Sector A recovery conditions, the mass-length product is controlled by the spatial-to-temporal metric response ratio in Eq. (18).

Eq. (18) is the narrow Sector A result: the mass-length product is controlled by the same spatial-to-temporal metric response ratio. This is nontrivial because the product relation ties two target-side observables to one collapse-conditioned response variable rather than treating them as independent sector inputs. That is the limited sense in which Sector A treats mass and characteristic length as jointly controlled by coherent metric response.

This is the key backward constraint result. Mass and characteristic length are not independent primitives on the target surface. They are already tied to the same collapse-controlled metric response. That is enough to justify a minimal freeze, but not enough to claim completed equivalence.

The ratio variable is a sector-specific compression, not a replacement for the full metric structure:

$$R(J) := \frac{\text{vol}(J)}{f_T(J)} \quad (19)$$

This compression is sufficient for Sector A recovery, but it does not collapse the full metric structure into a single canonical identity.

Within Sector A, informational collapse and metric expansion are not separate mechanisms. They are linked readings of one coherent metric response to relational density, compressed through $R(J)$. The full observer-scale version of that statement belongs to Sector B.

The inversion to curvature is branch restricted, using the standard multibranch Lambert W function [2]. Let

$$x_* := \left(\frac{J_*}{J_0} \right)^s \quad (20)$$

Then

$$C_* = x_* e^{-x_*} \quad (21)$$

and on a chosen monotone branch,

$$x_* = -W_k(-C_*) \quad (22)$$

so

$$J_* = J_0 [-W_k(-C_*)]^{1/s} \quad (23)$$

Proposition 2. Branchwise curvature recovery. Under the branch-restricted inversion of the collapse profile, the curvature handle is recoverable only branchwise, not globally uniquely.

This recovery is branchwise: it recovers a controlled curvature parameter only on the chosen interval, so it is usable at this stage but not globally unique.

5 Minimal Canonical UT Freeze

The minimal freeze is the smallest UT relation set that still satisfies the backward constraint. It is intentionally narrow and is taken from the source-grounded UT core used in this paper [1].

Freeze these relations:

$$S(a) = \sum_{b \in \mathcal{N}} M(a, b) \quad (24)$$

$$J(a) = \frac{S(a)}{S_{\text{ref}}} \quad (25)$$

$$C(J) = \left(\frac{J}{J_0}\right)^s \exp\left[-\left(\frac{J}{J_0}\right)^s\right] \quad (26)$$

$$m(J) = \mu_0 C(J) \quad (27)$$

$$R(J) = \frac{\text{vol}(J)}{f_T(J)} \quad (28)$$

$$\lambda_{\text{phys}}(J) = \frac{R(J)}{m(J)} \quad (29)$$

$$\frac{d}{dJ} \ln R(J) \propto \frac{d}{dJ} \ln C(J) \quad (30)$$

Do not freeze more than this for Sector A.

Do not freeze:

- $D(J)$
- the observer-selection layer
- the dimensionless anchor set

- separate $f_r(J)$, $f_\theta(J)$, $f_\phi(J)$, and $f_T(J)$ reconstruction
- gauge language
- QCD language
- completed equivalence language

The freeze is minimal because the sector only needs the shared-control chain

$$J \rightarrow C(J) \rightarrow m(J) \rightarrow \lambda_{\text{phys}}(J)$$

together with the ratio control variable $R(J)$.

6 Forward Recovery from the Minimal Freeze

The forward recovery runs the same relations from the minimal freeze and checks whether the target-side contact sector returns without extra assumptions.

Start from substrate loading and recover curvature:

$$S(a) = \sum_{b \in \mathcal{N}} M(a, b) \quad (31)$$

$$J(a) = \frac{S(a)}{S_{\text{ref}}} \quad (32)$$

Apply the collapse law:

$$C(J) = \left(\frac{J}{J_0} \right)^s \exp \left[- \left(\frac{J}{J_0} \right)^s \right] \quad (33)$$

Apply the metric response family:

$$f_X(J) = 1 + a_X \left[\left(\frac{J}{J_{\text{ref}}} \right)^{p_X} - 1 \right] \quad (34)$$

Build the spatial response volume:

$$\text{vol}(J) = f_r(J) f_\theta(J) f_\phi(J) \quad (35)$$

Apply the mass law:

$$m(J) = \mu_0 C(J) \quad (36)$$

Apply the ratio control variable:

$$R(J) = \frac{\text{vol}(J)}{f_T(J)} \quad (37)$$

Apply the length law:

$$\lambda_{\text{phys}}(J) = \frac{R(J)}{m(J)} \quad (38)$$

Combine mass and length:

$$m(J) \lambda_{\text{phys}}(J) = R(J) \quad (39)$$

To keep the forward recovery aligned with the same conservative branch structure, parametrize the proportionality on a chosen branch as:

$$\frac{d}{dJ} \ln R(J) = \kappa \frac{d}{dJ} \ln C(J) \quad (40)$$

so

$$R(J) = KC(J)^\kappa \quad (41)$$

on a chosen branch.

Here κ and K are branch-level sector parameters for this recovery step, not new universal constants of the frozen core.

The forward recovery in Eq. (39) returns the same shared-control relation as Eq. (18). That is the recovery test the paper needs. It does not establish completed equivalence, but it shows that the freeze is sufficient for shared-control recovery in Sector A.

7 Recovery Map

This recovery map marks what is core-supported, sector-supported, candidate-level, not yet derived, or not separately recovered in Sector A. Appendix A gives the variable map and the $R(J)$ reading.

Quantity or structure	Status	Notes
$S(a)$ and $J(a)$	core-supported	Substrate loading and curvature handle are fixed by the frozen core.
$C(J)$	core-supported	Collapse law is fixed by the frozen core and used on the chosen branch set.

$m(J)$	core-supported	Mass follows directly from $m(J) = \mu_0 C(J)$.
$R(J) = \text{vol}(J)/f_T(J)$	sector-supported	The sector only needs the ratio control variable.
$f_r(J), f_\theta(J), f_\phi(J), f_T(J)$	not separately recovered in Sector A	The functions are source-supported, but this sector carries only the ratio, not the separate split.
$\lambda_{\text{phys}}(J)$	sector-supported	Recovered through the ratio compression $R(J)/m(J)$.
$m(J)\lambda_{\text{phys}}(J)$	sector-supported	The product reduces exactly to $R(J)$.
$\text{vol}(J)$ and $f_T(J)$ separately	not separately recovered in Sector A	The ratio is available, but the split is not needed for this sector.
$d/dJ \ln R(J) \propto d/dJ \ln C(J)$	sector-supported	The proportional form is retained at the sector level. Branchwise parametrization is used only for recovery.
$J_* = J_0[-W_k(-C_*)]^{(1/s)}$	candidate-level	The inverse is branch-restricted and not globally unique.
$D(J)$	not yet derived	Dimension flow is not part of the Sector A freeze.
Observer-selection anchors	not yet derived	This sector does not need the selection layer.
Full equivalence between mass and length	not yet derived	Sector A supports shared-control recovery, not identity.
Broader Standard Model structure	not yet derived in Sector A	Future-facing constraint context only, not a derived result.
Gauge or QCD closure	not yet derived	Outside the Sector A freeze.

Operational reading:

- Core-supported means the item is directly fixed by the frozen UT core used in Sector A.
- Sector-supported means the item is available at the current sector level and is sufficient for shared-control recovery without implying closure.
- Candidate-level means the item is visible but branch-restricted, compressed, or future-facing, so it is usable but not settled.
- Not yet derived means the current freeze does not produce the item and the paper should not pretend otherwise.
- Not separately recovered in Sector A means the source supports the underlying structure, but this sector only recovers a compressed ratio or relation.

8 Relativity, Causality, and Observer-Scale Reconstruction

The source-grounded core supports bounded propagation and curvature-conditioned reconstruction. That is enough to keep relativity explicit in the derivation without treating causal violation as available; the citation here anchors only the standard relativity background for causal structure, not a validation of UT [3].

The same conservative posture applies to observer-scale reconstruction. The core supports a scale-free substrate and later mapping layers, so physical realization can be discussed as reconstructed differently once dimensional anchors, physical units, and observer-scale access conditions are introduced. This is a mapping discipline claim, not a subjectivist claim.

The section stays within the causal floor. It supports a relativity-explicit derivation, but it does not authorize faster-than-light signaling, causal violation, or any promotion of the strongest thesis wording. A fuller observer-scale statement belongs to later work, not to this Sector A draft.

9 Limits, Non-Claims, and Next Derivation Steps

This paper stops at a conservative candidate-level result. It does not claim full equivalence closure, full Standard Model derivation, gauge closure, QCD closure, or validation.

The remaining tasks are still concrete. The strongest thesis wording still needs a tighter source-to-synthesis path, the equivalence candidate still needs broader recovery work, observer-scale causal reconstruction still needs a formal statement, and the mass-length-curvature sector still needs any later closure step to be earned separately.

The next stage is not expansion but tightening. The paper can later support further promotion only if the recovered sector remains stable under the conservative constraint surface.

A Interpretive Variable Map

A.1 Purpose

This appendix gives the variable map for Paper 1. It stays within Sector A and does not add a second derivation.

A.2 Paper 1 Scope

Paper 1 is Sector A only. It derives a mass-length-curvature contact sector under minimal freeze. It does not derive full Standard Model structure, gauge closure, QCD closure, or full observer-scale reconstruction.

A.3 Variable Map

UT structure	variable	or	Paper 1 role	Familiar physical analogy		Claim status
$M(a, b)$			relational weight	informational relation	or distinguishability weight	core-supported
$S(a) = \sum_b M(a, b)$			informational loading at a node	relational density or strain		core-supported
$J(a) = S(a)/S_{\text{ref}}$			normalized collapse or curvature handle	curvature-control	parameter	core-supported
$C(J)$			collapse profile	coherence or collapse intensity as a function of relational density		core-supported
$m(J) = \mu_0 C(J)$			mass-like expression	collapse-controlled scale	mass	core-supported
f_r, f_θ, f_ϕ			spatial response factors	anisotropic spatial response	metric	source-supported, not separately recovered in Sector A
f_T			temporal response factor	lapse-like or temporal dilation response		source-supported, not separately recovered in Sector A
$\text{vol}(J) = f_r f_\theta f_\phi$			compressed spatial response volume	spatial metric response volume		source-supported
$R(J)$	=		Sector A response compression	spatial-to-temporal response ratio	metric	sector-supported
$\text{vol}(J)/f_T(J)$			characteristic length	metric-conditioned scale	length	sector-supported through $R(J)/m(J)$
κ, K			branchwise parameters	interval-level recovery constants	proportional-	sector-level parametrization only

A.4 Reading $R(J)$

$R(J)$ should not be read as the full metric. It is a Sector A compression of the spatial response volume divided by temporal response. It is used because the mass-length product only needs the ratio:

$$m(J)\lambda_{\text{phys}}(J) = R(J) = \frac{\text{vol}(J)}{f_T(J)}$$

A stable cross-reference for this shared-control product relation appears in Eq. (18) of the main

text.

A later sector may need to recover $\text{vol}(J)$ and $f_T(J)$ separately. Paper 1 does not do that.

References

- [1] Greg Adams. *A Universal Informational Curvature Framework: From Quantum Collapse to Relativistic Geometry*. Saphiar, available at https://www.saphiar.com/unification_theory.php. Accessed April 10, 2026.
- [2] R. M. Corless, G. H. Gonnet, D. E. G. Hare, D. J. Jeffrey, and D. E. Knuth. On the Lambert W function. *Advances in Computational Mathematics*, 5:329–359, 1996.
- [3] Albert Einstein. Die Grundlage der allgemeinen Relativitätstheorie. *Annalen der Physik*, 49:769–822, 1916.