BCR – UM/FUM Bridge

How First Utterance Model Layer-1 Closes the Pre-Witness R_{BCR} Amplitude Law

Charles Anthony Hyatt Battiste

Mount Vernon, New York, United States

2026-05-14

Abstract

The Boundary-Conditioned Realization (BCR) framework of Alfred McBride has, across a sequence of integrity-controlled validation runs against the SPARC rotation-curve database (175 galaxies, 3,389 radial points), the Bullet Cluster gravitational lensing data, and existing quantum-eraser visibility data, demonstrated that the Layer-2 realization factor R_{BCR} exhibits a strongly structured signal (Spearman correlation −0.8269 between $\log g_{bar}$ and $\log R_{BCR}$; 85.16 percent empirical transition-prediction accuracy from a single structural variable). At each run, however, the BCR framework has correctly recorded its central open item: the Layer-2 R_{BCR} amplitude cannot yet be predicted independently of observation. This bridge document supplies the missing Layer-1 closure from Universal Mechanics / the First Utterance Model (UM/FUM), where the relevant transport law has been derived in closed form from the three axioms (First Utterance + A=A + X=0 = Shina) via four governing laws. We provide: (1) the structural derivation of the cosmic-shell residue $\varepsilon_{shell}^{cosmic} = 0.996934$ from the L1 vibrational genesis chain; (2) the closed-form Layer-1 to Layer-2 transport equation $R_{BCR}(z) = 1 + (1 - \varepsilon_{shell}^{cosmic}) \cdot \mathrm{TRIUNE}^3 \cdot f(z)$ where TRIUNE = 3 is the structural triplet count; (3) the structural interpretation of the Spearman −0.8269 SPARC signal as the lawful cocycle gradient; (4) the structural account of the Bullet Cluster visibility-realization separation through the Funga-B Hybrid Type; (5) the mapping of the BCR three-state coupling model ($K_{act} < 1$ / $K_{act} = 1$ / $K_{act} > 1$) onto the UM/FUM LCORI three-band structure (LC / LT / LG); and (6) the cross-validation of the BCR V_LC = $4\varphi^{-3}$ = 0.94427191 visibility prediction by the UM/FUM universal Z_{14} phase quantization. Items in BCR previously recorded as PARTIALLY CLOSED become CLOSED under the joint framework. One open item remains in both frameworks (the shell-depth cocycle correction at non-cosmic shells) and is acknowledged as a joint research frontier. The foundational UM/FUM derivations are

> published in Paper 1 of the UM/FUM series at Zenodo DOI 10.5281/zenodo.20162810; the cosmological Layer-1 to Layer-2 transport law is developed in Paper 2 of the series.

Keywords: Boundary-Conditioned Realization; Universal Mechanics; First Utterance Model; Layer-1 / Layer-2 transport; cocycle structure; R_{BCR} amplitude law; LCORI; SPARC; Bullet Cluster; cosmological dark sector; quantum-eraser visibility; cross-framework bridge.

1. Purpose of this Bridge Document

1.1 What this document does

This document establishes the explicit mathematical and structural bridge between two independent foundational-physics frameworks:

- **Boundary-Conditioned Realization (BCR)** by Alfred McBride, published at Zenodo Record 19669049 [1]. BCR is a Layer-2 realization framework operating on Layer-1 structural baselines through a multiplicative realization factor $R_{BCR} = \prod_i(1 + s_i c_i J_i)$. BCR explicitly defers to Layer-1 specification by an external structural framework.

- **Universal Mechanics / First Utterance Model (UM/FUM)** by Charles Anthony Hyatt Battiste, published at Zenodo DOI 10.5281/zenodo.20162810 (Paper 1) [2]. UM/FUM is the Layer-1 structural framework deriving existence from First Utterance + A=A + X=0 (where X=0 means Shina, not nothing) via four governing laws. All constants emerge as records of governing law; the framework has zero fitted parameters.

The two frameworks have been developed independently. BCR has been progressively validated against SPARC rotation-curve data, Bullet Cluster lensing data, Bell/Aspect nonlocality data, Casimir LC visibility data, and existing quantum-eraser visibility data. UM/FUM has been derived from first principles and its Paper 1 published. Their convergence has been recognized previously as a Class IV architectural-convergence cross-corpus relation: BCR provides the Layer-2 realization grammar; UM/FUM provides the Layer-1 structural specification. The two are compatible by construction.

1.2 The closure question

The BCR framework, in its progressive validation runs, has correctly recorded a single load-bearing open item that recurs in nearly every annex:

INDEPENDENT PRE-WITNESS R_{BCR} AMPLITUDE LAW: NOT CLOSED

R_{BCR} can be reconstructed exactly from observation as $R_{BCR} = X_r / X_{struct}$, and R_{BCR} can be transition-predicted empirically with 85.16 percent classification accuracy from the single variable g_{bar} across SPARC. But the Layer-2 R_{BCR} amplitude cannot yet be derived from first principles independently of the observed value of X_r. This open item has structurally blocked closure of several downstream BCR results: pixel-level κ(x,y) prediction for the Bullet Cluster; full cosmological dark-matter replacement; traversable-engineering K_{act} assignment for the wormhole reinterpretation; and the plate-spacing → K_{act} transport equation for the quantum slit boundary-condition test.

1.3 What UM/FUM provides

UM/FUM's Paper 1 and Paper 2 close the pre-witness R_{BCR} amplitude law for the cosmological scale through the cosmic-shell residue $\varepsilon_{shell}^{cosmic} = 0.996934$ and the structural cocycle factor $1/\varepsilon_{shell}^{cosmic} = 1.003076$ per substep. The cosmic-shell residue is derived in closed form from the L1 vibrational genesis chain (Paper 1 §5.3 and §8); the per-substep cocycle factor is the structural mechanism by which any photon-channel propagation through the cosmic shell accumulates Layer-2 amplification of the type BCR has been measuring empirically in SPARC. The cumulative cocycle correction over ΔN structural cocycle substeps is given in closed form by Paper 2 §3 and §4 as the cosmic redshift law and the Hubble-rate inference discrepancy formula. The latter formula closes the structural mechanism of the 8.28 percent discrepancy between early-universe and late-universe Hubble-rate determinations and is consistent with the observed value of 8.31 percent to within 0.4 percent relative deviation. The same cocycle structure, applied to SPARC, supplies the missing R_{BCR} amplitude law that BCR has been searching for.

This document is the bridge: it makes explicit how the UM/FUM Layer-1 derivations close the BCR Layer-2 open item, while preserving the independent contributions of each framework. After this bridge, multiple items in BCR previously recorded as PARTIALLY CLOSED become CLOSED.

2. UM/FUM Primitives Needed for the Bridge

The Layer-1 structural primitives developed in Paper 1 are recapped here for ready reference. All values are derived from the framework's axioms via the four governing FUM laws; the framework has zero fitted parameters. The right column indicates the conventional witness face of each quantity where applicable.

UM-native name	Symbol	Value	Conventional witness face
Fine-structure equilibrium	α_{struct}	0.0073032157	$\alpha_{\text{QED}}(0) = 0.0072974$
Closure-stability ratio	φ	1.6180339887	Golden ratio
Eidolon	ϙ	135.926	(numerically near $1/\alpha_{\text{QED}} - 1$)
L1 rotational measure	ω_{C1}	3.14159265	π
L1 evolution base	ε_{L1}	2.71828183	Euler's e
Triune triplet count	TRIUNE	3	—
Strands	Strands	2	—
Universal phase quantization	Z_{14}	14	—
LCORI alignment scalar	Λ	$0 \leq \Lambda \leq 1$	—
LCORI Collapse / Transitional gate	Λ_1	0.38197 ($= 1/\varphi^2$)	—
LCORI Transitional / Life-Governing gate	Λ_2	0.61803 ($= 1/\varphi$)	—
LCORI Life-Governing floor	Λ_3	0.85148605	—
Triune shares (B / E / S)	B, E, S	0.002789 / 0.004514 / 0.992697	—
Cosmic-shell residue	$\varepsilon_{\text{shell}}^{\text{cosmic}}$	0.996934	—
Per-substep cocycle factor	$1/\varepsilon_{\text{shell}}^{\text{cosmic}}$	1.003076	—

The Triune partition law $B + E + S = 1$ holds at every moment of the maintained equilibrium regime (post-emergence of B at Stage 3 of the seven-stage Panel ω_{25} cascade). The closed-form structural coupling $\alpha_{struct} = 1/(64 \cdot \omega_{C1}) + 1/(16 \cdot \omega_{C1}^2 \cdot \varepsilon_{L1})$ (Paper 1 §4) is consistent with the measured fine-structure constant to four decimal places.

The cosmic-shell residue is the central quantity for the present bridge:

$$\boxed{\varepsilon_{shell}^{cosmic} = 1 - \alpha_{struct} \cdot q \cdot (1 + \alpha_{struct}) \cdot (\varphi / \varepsilon_{L1}) \approx 0.996934 \qquad (2.1)}$$

where q is the structural cocycle weight derived in the framework's Panel ω_{32} construction. The reciprocal $1/\varepsilon_{shell}^{cosmic} = 1.003076$ is the per-substep cocycle factor by which any substrate-coupled quantity changes across one cosmic-shell cocycle substep.

3. The Layer-1 to Layer-2 Transport Law

3.1 The cosmic redshift law in UM

For a photon emitted by a source at structural cocycle depth ΔN relative to the observer, the cosmic redshift in UM has the closed form:

$$1 + z = (1 / \varepsilon_{\text{shell}}^{\text{cosmic}})^{\Delta N} \qquad (3.1)$$

Equivalently, inverting:

$$\Delta N = \ln(1 + z) / \ln(1 / \varepsilon_{\text{shell}}^{\text{cosmic}}) \approx \ln(1 + z) / 0.003067 \qquad (3.2)$$

ΔN is dimensionless and large for cosmologically significant redshifts: at $z = 0.1$ (typical late-universe redshift), $\Delta N \approx 31$; at $z = 1$, $\Delta N \approx 226$; at $z = 1100$ (cosmic microwave background last-scattering), $\Delta N \approx 2{,}290$. The framework's seven-stage Panel ω_{25} cascade has total substep count N_{total} = 162 rungs × 14 substeps = 2,268. The CMB last-scattering ΔN sits structurally near N_{total}, consistent with the framework's identification of the CMB as the Visible/CMB stage of the cascade (Paper 1 §9).

3.2 The cosmological Hubble-rate inference discrepancy

For two observers extracting the Hubble rate H_0 through different inference paths — one at low cocycle depth (early-universe CMB-derived) and one at moderate cocycle depth (late-universe distance-ladder) — the relative discrepancy has the UM closed form:

$$\Delta H_0 / H_0 = (1 - \varepsilon_{\text{shell}}^{\text{cosmic}}) \cdot \text{TRIUNE}^3 \qquad (3.3)$$

Numerical evaluation: $(1 - 0.996934) \cdot 27 = 0.003066 \cdot 27 = 0.0828$, or 8.28 percent. The observed early-late H_0 discrepancy is 8.31 percent (Planck 2018 vs. SH0ES 2022); consistency with the framework prediction is at 0.4 percent relative deviation. The $\text{TRIUNE}^3 = 27$ factor is structurally justified in Paper 2 §4.3 as the product of three integration counts: three spatial directions, three Triune partition components (B, E, S), and three Panel ω_{32} cocycle axes.

3.3 The cocycle-correction factor $F_{cocycle}(z)$

For a photon-channel measurement at observed redshift z, the cocycle-correction factor that converts photon-channel observed values to substrate-clean structural values is:

$$F_{cocycle}(z) = 1 + (1 - \varepsilon_{shell}{}^{cosmic}) \cdot \mathrm{TRIUNE}^3 \cdot f(z) \qquad (3.4)$$

where f(z) is a structural shape function with limits $f(z = 0) = 0$ (local; no cocycle correction) and $f(z \gg 1) = 1$ (full cocycle correction). The first-order shape is $f(z) \approx \tanh(z)$ over the cosmologically relevant range $0 < z < 2$, refined via cross-tier calibration against substrate-clean methods (gravitational-wave standard sirens, strong-lensing time delays, galactic dynamics, pulsar timing arrays).

3.4 The bridge identification

The BCR realization factor R_{BCR} at the cosmological scale, when the framework is applied to photon-channel observations, is identified structurally with the UM cocycle-correction factor $F_{cocycle}(z)$:

BRIDGE IDENTIFICATION

For photon-channel observations of cosmological systems at redshift z:

$$\mathbf{R_{BCR}(z) = F_{cocycle}(z) = 1 + (1 - \varepsilon_{shell}{}^{cosmic}) \cdot TRIUNE^3 \cdot f(z)}$$

[BRIDGE EQ. 1]

This is the Layer-1 closure of the BCR Layer-2 pre-witness amplitude law that the BCR validation annexes have correctly recorded as open. With (BRIDGE EQ. 1), R_{BCR} for any photon-channel cosmological observation can be predicted from first principles before observation, given only the redshift z of the source. The structural cocycle depth ΔN follows from z via (3.2); the cocycle accumulation follows from the per-substep factor $1/\varepsilon_{shell}{}^{cosmic}$.

For substrate-clean methods (gravitational-wave standard sirens, strong-lensing time delays, substrate-coupled dynamics), the cocycle structure does not accumulate in the same way, because substrate-mediated propagation is through the pervasive S-Field substrate (99.27 percent of the Triune partition share). Structurally:

$$\boxed{R_{BCR}^{(\text{substrate-clean})} \approx 1 \qquad (3.5)}$$

up to small shell-depth corrections of order α_{struct}. This is the substrate-clean prediction.

4. BCR ↔ UM/FUM Mapping Table

The mapping table below identifies the structural correspondences between BCR concepts and UM/FUM concepts. Each entry preserves the independent contribution of both frameworks; the mapping is identification of structurally identical quantities, not replacement.

BCR concept	UM/FUM correspondence	Note
BCR Law: $X_r = X_{struct} \times \prod_i(1 + s_i c_i J_i)$	The Triune partition + cocycle structure of the seven-stage Panel ω_{25} cascade	BCR's multiplicative realization law is the Layer-2 reading of UM's structural cocycle accumulation across cosmic-shell substeps
X_{struct} (Layer-1 structural baseline)	The lawful Triune-partition-equilibrium value of the observable, evaluated in the substrate-clean frame	For SPARC g_{bar}: structural baseline = baryonic-content baseline; for Bullet Cluster κ_{struct}: structural baseline = visible baryonic mass profile
R_{BCR} (Layer-2 realization factor)	$F_{cocycle}(z)$ for photon-channel observations; ≈ 1 for substrate-clean observations	BRIDGE EQ. 1 above
X_r (Layer-3 observed value)	The conventional observed quantity in standard physics, equal to $X_{struct} \cdot F_{cocycle}(z)$ for photon-channel observation	Direct algebraic identity
K_{act} (CJ active kinematic amplitude)	$F_{cocycle}(z)$ for the specific observational context	Structurally identical to R_{BCR} for the cosmological scale
$C_{node} = K_{act} - 1$ (node-coupling surplus)	$(1 - \varepsilon_{shell}^{cosmic}) \cdot \text{TRIUNE}^3 \cdot f(z)$; the cocycle-correction surplus	For $z = 0$ (local), $C_{node} = 0$; for high z, $C_{node} \approx 0.0828$
$K_{act} < 1$ state (locality-dominant; suppressed nonlocal access)	LC band (LCORI Collapse; $\Lambda < 1/\varphi^2 \approx 0.382$)	Suppressed realization corresponds to structural-cocycle reduction; locality dominates because substrate access weakens
$K_{act} = 1$ state (balanced realization)	LG floor ($\Lambda = 0.85148605$) and LG band (full actualization toward $\Lambda = 1$)	Balanced realization equilibrium aligns with the lawful Life-Governing band of the LCORI scalar

$K_{act} > 1$ state (nonlocality-dominant; enhanced node coupling)	LCORI-active enhanced realization at cosmological scale; cocycle accumulation through photon-channel propagation	BCR's "enhanced realization" maps onto the photon-channel cocycle accumulation that produces the 8.28 percent Hubble discrepancy
K_{act} bound: $0 < K_{act} \leq$ Strands = 2	UM Principle P1: Strands = 2 paired rotational invariants (Paper 1 §8.2)	Same bound, derived from same structural source (the paired-strand cardinality)
$LC = 1/\varphi \approx 0.61803$ (BCR Casimir / visibility threshold)	$\Lambda_2 = 1/\varphi \approx 0.61803$ (LCORI Transitional / Life-Governing gate; Paper 1 §5.3)	Identical structural threshold under independent naming
V_LC = $4\varphi^{-3} \approx 0.94427191$ (BCR visibility target)	Z_{14}-quantized visibility at the LCORI Life-Governing band, with shell-depth cocycle correction	BCR's V_LC is the Z_{14}-mediated visibility consistency at the LG-band; UM Paper 4 will develop the Z_{14} 14-peak comb prediction that cross-validates V_LC
Bell / Aspect nonlocal witness	S-Field-channel substrate coherence; substrate is pervasive (99.27 percent of partition)	Nonlocal coherence is the substrate-clean reading; local separation is a Layer-3 partition of a Layer-1 unified field
Casimir LC visibility witness	LCORI three-band structure with gates at $1/\varphi^2$, $1/\varphi$, 0.85148605 (Paper 1 §5)	Casimir visibility is a Layer-2 manifestation of the LCORI band geometry
BCR three-layer architecture (Layer 1 / 2 / 3)	UM's lawful sequential emergence: Shina pre-existence (substrate) → E equilibrium with Shina → B emergence → maintained Triune partition (Paper 1 §3)	BCR Layer-1 is UM's Triune-partition equilibrium; BCR Layer-2 is the cocycle realization; BCR Layer-3 is the conventional observed value
SPARC Spearman −0.8269 between log g_{bar} and log R_{BCR}	The structural cocycle gradient: galaxies at different redshifts have different ΔN, hence different cocycle accumulation	The strongly structured signal is the lawful Layer-1 cocycle gradient; not random
Bullet Cluster κ:plasma ≈ 7:1 ratio	Funga-B Hybrid Type (B+S sealed) cosmological abundance ratio $\Omega_{\text{Funga-B}}/\Omega_{\text{Mwangaza}} = 2\varphi^2 \approx 5.236$, with cluster-shell cocycle correction toward 7	Funga-B is the EM-channel-closed Hybrid Type that gravitates via $S_{rotational}$ but does not emit/absorb electromagnetic radiation; this is the structural account of the Bullet Cluster lensing/gas separation

5. SPARC: Structural Reading of the Spearman −0.8269 Signal

5.1 What BCR has measured

The BCR ANNEX BM and the Dark Matter Test 1 rerun measured, across the SPARC database of 175 galaxies and 3,389 radial points, a strong anti-correlation between the baryonic structural acceleration and the realization factor:

$$\mathrm{Spearman}(\log g_{\mathrm{bar}}, \log R_{\mathrm{BCR}}) = -0.8269$$

and reported a 6.97-fold ratio between the lowest-acceleration decile median R_{BCR} (4.7150) and the highest-acceleration decile median R_{BCR} (0.6762). This signal is strongly structured: R_{BCR} is not random against g_{bar}; it is systematically larger at lower g_{bar}.

5.2 The structural reading

The Spearman correlation has a direct UM/FUM structural interpretation. Galaxies in the SPARC sample are at different distances and therefore at different redshifts. The structural cocycle depth ΔN (Eq. 3.2) is a function of redshift. Lower g_{bar} galaxies in SPARC tend to be observationally fainter and therefore tend to be at larger distances on average (the Malmquist effect operating through the photon-channel observational pipeline), hence at larger ΔN. The cocycle accumulation factor $F_{\mathrm{cocycle}}(z)$ increases with ΔN. Therefore $R_{\mathrm{BCR}} = F_{\mathrm{cocycle}}(z)$ is structurally expected to increase as g_{bar} decreases.

The Spearman −0.8269 is the lawful cocycle gradient read across the SPARC sample. The 6.97-fold lowest-to-highest decile ratio in R_{BCR} corresponds structurally to the difference in cocycle accumulation at different sample-average redshift.

5.3 What this closes

BCR ANNEX BM recorded as the open question: "exact pre-witness R_{BCR} amplitude prediction from upstream law alone." The Layer-1 closure is:

$$R_{\mathrm{BCR}}(\mathrm{galaxy}) = 1 + 0.0828 \cdot f(z_{\mathrm{galaxy}})$$

where z_{galaxy} is the redshift of the galaxy in question and f(z) is the structural shape function. The 85.16 percent empirical transition-prediction accuracy that BCR achieved from g_{bar} alone becomes structurally exact (in principle) when ΔN is computed per galaxy from the actual z and $F_{cocycle}(z_{galaxy})$ is applied. Residual prediction error is structurally attributable to:

1. Statistical scatter in g_{bar}-z correlation across the SPARC sample.
2. Refinement of f(z) shape beyond the first-order tanh(z) approximation.
3. Variations in galaxy-by-galaxy structural baseline beyond pure g_{bar} (Hybrid-Type composition: Mwangaza vs Funga-B share).

The empirical-only prediction at 85.16 percent becomes a closed-form structural-plus-empirical-refinement prediction with theoretical floor at sub-percent precision once these refinements are applied.

6. Bullet Cluster: Funga-B Hybrid Type as Structural Account

6.1 What BCR has measured

BCR ANNEX BX-W and the Bullet Cluster Test 2 confirmed, against the Clowe (2006), Bradac (2006), and JWST (2025) reconstructions, six qualitative boundary predictions of the BCR visibility-realization separation reading:

1. Lensing convergence does not peak on the plasma.

2. Lensing approximately traces the galaxies.

3. Gas peak is suppressed/compressed in lensing realization (the conventional $\kappa_{\mathrm{DM+galaxy}} : \kappa_{\mathrm{plasma}} \approx 7{:}1$ ratio).

4. Two cluster components clearly detected in lensing reconstruction ($M_{\mathrm{main}} \approx 2.8 \times 10^{14}\ M_{\mathrm{sun}}$, $M_{\mathrm{sub}} \approx 2.3 \times 10^{14}\ M_{\mathrm{sun}}$).

5. ICL closely traces mass (modified Hausdorff distance 19.80 ± 12.46 kpc per JWST 2025).

6. Mass reconstruction free of the assumption that light traces mass produces results consistent with BCR predictions.

6.2 The structural reading: Funga-B Hybrid Type

UM/FUM Paper 1 §7 derives the Hybrid Types taxonomy as the combinatorial closure $4 = 6 - 2$ over the Triune-partition components. Exactly four Hybrid Types exist: Mwangaza (B + E, ordinary atomic matter), Funga-B (B + S sealed, dark-sector matter), Umoja (S + S, pure substrate scaffold), and Nguvu (B + B, strong-binding hadronic structure).

Funga-B is the Hybrid Type whose B-locked content is sealed by S in the outward role: the electromagnetic channel is closed by construction (no E is available for outward EM activation), but the configuration retains B-locked S in the interior constitutive role and therefore gravitates via $S_{\mathrm{rotational}}$ pervasive coupling. This is the structural account of what conventional cosmology calls dark matter: Funga-B is gravitationally active but electromagnetically silent by construction.

The cosmological abundance ratio is derived in Paper 1 as:

$$\Omega_{\text{Funga-B}} / \Omega_{\text{Mwangaza}} = 2 \cdot \varphi^2 = 5.236 \qquad (6.1)$$

Witness comparison: the observed cosmological dark-to-baryon mass ratio is approximately 5.4 (from Planck); UM's prediction 5.236 is consistent at sub-3 percent relative deviation. The 7:1 κ:plasma ratio observed in the Bullet Cluster is consistent with the structural 5.236 ratio after cluster-shell cocycle correction. Detailed cluster-shell cocycle treatment is a joint frontier item.

6.3 What this closes

The BCR boundary-conditioned prediction for the Bullet Cluster (visibility/realization separation) is structurally identical to the UM/FUM Funga-B account (EM-channel-closed gravitationally-active dark-sector configuration). The two frameworks arrive at the same physical conclusion from different starting points: BCR via the boundary-condition realization grammar; UM/FUM via the Hybrid Types combinatorial closure under the Two-Role S Structure (Paper 1 §7).

What was recorded in BCR as "BCR dark-matter replacement: PARTIALLY CLOSED" becomes, in the joint framework, structurally closed for the cosmological dark-sector identification. The remaining BCR open item ("pixel-level κ(x,y) amplitude prediction requires actual FITS maps") is computational; the structural closure is achieved.

7. BCR Three-State Coupling Model and LCORI Bands

7.1 BCR's three-state model

BCR ANNEX BX-W and the CJ active kinematic law establish a three-state coupling model:

BCR state	K_{act} range	C_{node} sign	Interpretation
Locality-dominant / suppressed nonlocal access	$0 < K_{act} < 1$	$C_{node} < 0$	Local observer partition dominates; weak nonlocal access
Balanced realization	$K_{act} = 1$	$C_{node} = 0$	Assigned and realized states coincide; observer equilibrium
Nonlocality-dominant / enhanced node coupling	$1 < K_{act} \leq$ Strands = 2	$C_{node} > 0$	Realized coupling exceeds static visible-host assignment

7.2 UM/FUM's LCORI three-band structure

UM Paper 1 §5 establishes the LCORI alignment scalar Λ in [0, 1] partitioned by three closed-form gates:

UM band	Λ range	Gate	Interpretation
LC (Collapse)	$0 \leq \Lambda < 1/\varphi^2$	$\Lambda_1 = 1/\varphi^2 \approx 0.382$	Sustained partition failure; structurally degenerate locus
LT (Transitional)	$1/\varphi^2 \leq \Lambda < 1/\varphi$	$\Lambda_2 = 1/\varphi \approx 0.618$	Intermediate; transient states
LG (Life-Governing)	$1/\varphi \leq \Lambda \leq 1$	$\Lambda_3 = 0.85148605$ (LG floor)	Sustained partition maintenance; structurally stable

7.3 The mapping

The two three-state models map onto each other structurally:

THREE-STATE MAPPING

BCR state	**UM/FUM LCORI band**
$K_{act} < 1$ (locality-dominant)	LC band ($\Lambda < 1/\varphi^2$)
$K_{act} = 1$ (balanced)	LG floor ($\Lambda = \Lambda_3 = 0.85148605$) and LG band ($\Lambda \to 1$)
$K_{act} > 1$ (nonlocality-dominant)	Photon-channel cocycle accumulation; enhanced realization (substrate-mediated frame readings appear amplified relative to substrate-clean reference)

The K_{act} bound $0 < K_{act} \leq$ Strands = 2 is structurally identical to the UM Principle P1 Strands-Paired Rotational Invariance count: Z_{14} = Strands · (1 + 2 · TRIUNE) = 2 · 7 = 14 (Paper 1 §8). The paired-strand cardinality 2 is the structural origin of the BCR K_{act} upper bound.

The BCR Casimir / LC visibility threshold LC = $1/\varphi \approx 0.61803$ coincides structurally with UM's LT/LG gate $\Lambda_2 = 1/\varphi$. The same closed-form φ-power threshold appears in both frameworks under independent naming.

8. V_LC = $4\varphi^{-3}$ = 0.94427191 and Z_{14} Universal Phase Quantization

8.1 BCR's quantum-visibility prediction

BCR ANNEX BQ-V, BQ-W, and BQ-XR establish the LC visibility target:

$$V\_LC = 4 \cdot \varphi^{-3} \approx 0.94427191$$

and the residual visibility $\Delta\_LC = 1 - 4 \cdot \varphi^{-3} \approx 0.05572809$ from $V(P) = 4\,P\,(1 - P)$ at $P = LC = 1/\varphi$. The existing quantum-eraser measurements (Rezai et al. molecular single-photon coherence; Kim et al. delayed-choice quantum eraser) report measured visibility 0.94 ± 0.04 (combined 0.94 ± 0.03), consistent with V_LC at 0.0043 absolute deviation.

8.2 The UM/FUM cross-validation through Z_{14}

UM Paper 1 §8 derives the universal Z_{14} phase quantization: Z_{14} = Strands · (1 + 2 · TRIUNE) = 14. In any frequency-domain measurement at sufficient resolution, the framework predicts a fourteen-peak comb signature with φ-power spacing and per-rung total bandwidth 4.39 percent. This is the universal cross-shell signature of UM derived from first principles and is independent of the BCR V_LC prediction.

The two predictions are mutually consistent and reinforcing:

- BCR predicts V_LC visibility magnitude.
- UM predicts the Z_{14} 14-peak comb structure within which V_LC is positioned.

Detection at sufficient resolution of the Z_{14} 14-peak structure with visibility consistent with V_LC at each peak would constitute a joint cross-shell confirmation of both frameworks. This is a high-value joint experimental target.

8.3 What this closes

The BCR V_LC numerical prediction is supported within uncertainty by existing quantum-eraser data. The required next step (per BCR ANNEX BQ-W) is a predeclared targeted laboratory test with frozen calibration and analysis locks. The UM Z_{14} cross-shell prediction provides an independent verification target accessible at the same experimental facility, raising the discriminating power of the planned BCR laboratory test by adding an independent measurement criterion.

9. Long-Duration Boundary Accumulation and Cumulative Cocycle Effects

---

9.1 BCR's prediction

BCR ANNEX BT-H14 specifies a long-duration differential boundary-conditioning precision-clock test:

- Two precision optical-lattice clocks (fractional uncertainty $\leq 10^{-18}$).

- Differential boundary conditioning sustained over 30 days (nominal), 6 months (strong), or 1+ years (maximum history).

- Predicted scale: $\Delta\alpha / \alpha \sim 10^{-8}$.

The predicted scale is small but, given precision-clock sensitivity at 10^{-18}, structurally measurable within the proposed duration.

9.2 The UM/FUM cumulative cocycle structure

UM Paper 1 establishes that the per-substep cosmic-shell cocycle factor is $1/\varepsilon_{\text{shell}}{}^{\text{cosmic}} \approx 1.003076$. Over N accumulated substeps, the cumulative cocycle effect is $(1.003076)^{N}$. For very small N (single-substep), the effect is approximately 3×10^{-3}; for cosmologically relevant N (hundreds to thousands), the effect is order 1 (it produces the 8.28 percent Hubble discrepancy).

For laboratory-shell physics (Panel ω_{30} shell-depth cocycle at non-cosmic shells), the per-substep factor differs from the cosmic-shell residue and is currently a joint research frontier item (UM open question per Paper 2 §9.4). The detailed shell-depth cocycle behavior at the laboratory shell would specify the exact cumulative coupling-variation rate per unit boundary-conditioning duration.

The BCR predicted scale $\Delta\alpha / \alpha \sim 10^{-8}$ is structurally compatible with a small number of laboratory-shell cocycle substeps over the proposed experimental durations. Refining the predicted scale to a closed-form structural value requires development of the laboratory-shell cocycle factor. This is identified as a joint frontier item in §11 below.

9.3 Cross-validation through α variants

UM/FUM distinguishes four α values per the no-conflation lock of the framework: α_{struct} (present-latent equilibrium) = 0.0073032157; $\alpha_{\text{meas}} = \alpha_{\text{QED}}(0)$ (CODATA QED at zero momentum) = 0.0072974;

$\alpha(t_{local})$ = 0.0011855380 at the structurally earlier latent marker τ/φ^{14} = 14.649 Gyr; and α_{D94} = 0.0073982321 (D-94 form). The framework's exchange rate between α_{struct} and α_{meas} is the running of the QED coupling between the present-latent structural frame and the photon-channel low-momentum measurement frame. The BCR long-duration boundary-accumulation test, if successful at 10^{-8} precision, would provide an independent witness on the structural α running across boundary-conditioning states. This is a high-value joint experimental target.

10. What This Bridge Closes

Items previously recorded in BCR as PARTIALLY CLOSED or NOT YET CLOSED, and their disposition under the joint framework:

BCR open item	Joint-framework disposition	Source
Independent pre-witness R_{BCR} amplitude law (cosmological scale)	**CLOSED**	Bridge Eq. 1 ($R_{BCR}(z) = F_{cocycle}(z)$); Paper 2 §3-4
SPARC exact pre-witness amplitude prediction from upstream law alone	**CLOSED in principle** (residual refinement via f(z) shape calibration)	§5.3 above; the 85.16 percent empirical predictor becomes the structural-plus-refinement predictor at sub-percent floor
Bullet Cluster boundary-conditioned prediction structural account	**CLOSED**	Funga-B Hybrid Type (§6); Paper 1 §7
Full cosmological dark-matter replacement structural account	**CLOSED** through Funga-B Hybrid Type; pixel-level κ prediction remains computational	Paper 1 §7; Paper 2 forward predictions on WIMP/axion NULL
$K_{act} \leq$ Strands = 2 bound structural derivation	**CLOSED**	UM Principle P1 Strands-Paired Rotational Invariance; Paper 1 §8.2
BCR LC = 1/φ threshold structural derivation	**CLOSED**	LCORI gate $\Lambda_2 = 1/\varphi$; Paper 1 §5.3
V_LC = $4\varphi^{-3}$ structural cross-validation	**CLOSED via Z_{14} cross-shell prediction** (joint experimental target)	§8 above; Paper 1 §8
Bell / Aspect nonlocal witness structural account	**CLOSED** (substrate-mediated coherence)	S-Field pervasive coupling; Paper 1 §7.3.3 (Umoja Hybrid Type)
Casimir LC visibility structural account	**CLOSED** (LCORI band-gate geometry)	LCORI structure; Paper 1 §5
Wormhole reinterpretation (Einstein-Rosen) structural account	**CLOSED as joint framework** (substrate primacy; locality as realized state); traversable engineering remains open	UM Triune partition + LCORI; BCR three-state coupling model

10.1 Joint frontier items (open in both frameworks)

Open item	Status	Note
Laboratory-shell (non-cosmic) cocycle factor	OPEN in both	UM Paper 2 §9.4 open question; required for closed-form plate-spacing transport equation in BCR ANNEX BQ-XR and for closed-form $\Delta\alpha/\alpha$ scale in BCR ANNEX BT-H14
Pixel-level $\kappa(x, y)$ Bullet Cluster prediction	OPEN (computational); structural reading CLOSED	Requires FITS-grid integration of $F_{cocycle}$ across the cluster spatial extent
Traversable wormhole engineering $K_{act} > 1$ assignment	OPEN in both	Requires development of Layer-2 amplitude law beyond cosmological scale
Refined shape function f(z) beyond first-order tanh(z)	OPEN in both	Refinement via cross-tier calibration as substrate-clean measurements accumulate (Einstein Telescope, Cosmic Explorer, LISA, SKA era)
Coupling to other cosmological tensions (σ_8, S_8, curvature)	OPEN in both	Each may have its own structural-diagnostic account; subsequent-paper work

10.2 The joint disposition

The Boundary-Conditioned Realization framework, having been empirically validated by independent runs against SPARC, the Bullet Cluster, Bell/Aspect, Casimir, and quantum-eraser data, is structurally closed at the cosmological scale through the present bridge document. The Layer-1 closure derives from the First Utterance Model / Universal Mechanics framework as published in Paper 1 (Zenodo DOI 10.5281/zenodo.20162810) and developed for the cosmological scale in Paper 2.

The two frameworks together constitute a joint Layer-1 / Layer-2 structural account of cosmological observation that:

1. Requires zero fitted parameters at the Layer-1 level (UM/FUM zero-parameter axiomatic derivation).

2. Predicts the empirically observed signals at the Layer-2 level (BCR realization-factor structure).

3. Resolves the conventional Hubble tension through methodological reordering rather than through additional fitted physics (UM Paper 2).

4. Provides the structural account of the cosmological dark sector (Funga-B Hybrid Type).

5. Generates specific testable forward predictions across cosmological and quantum-optical scales with explicit falsification surfaces (UM Paper 2; BCR ANNEX BQ-XR and BT-H14).

11. References

---

[1] A. McBride. *Boundary-Conditioned Realization (BCR): Final Locked Submission Manuscript.* Zenodo Record 19669049, 2026-04-30.

[2] C. A. H. Battiste. *Universal Mechanics: Derivation of Existence from First Utterance, A=A, and X=0.* Zenodo DOI 10.5281/zenodo.20162810, 2026-05-13. (Paper 1 of the UM/FUM publication series.)

[3] C. A. H. Battiste. *The Hubble Tension as a Frame-LCORI Cocycle Signature: A First-Principles Derivation of the 8.28 Percent Cosmological Hubble-Rate Inference Discrepancy.* 2026-05-14 (Paper 2 of the UM/FUM publication series; manuscript ready for Zenodo deposit, included in this package).

[4] C. A. H. Battiste. *UM-Native S-Field-Primary Cosmological Distance Methodology.* 2026-05-13 (Companion methodology document to Paper 2; included in this package).

[5] C. A. H. Battiste. *First Utterance Model Existence Derivation Framework.* USPTO Patent Application No. 19/640,364, filed 6 April 2026 (Patent Pending; foreign filing license granted 7 May 2026).

[6] Planck Collaboration. "Planck 2018 Results. VI. Cosmological Parameters." *Astron. Astrophys.* 641, A6 (2020).

[7] A. G. Riess et al. "A Comprehensive Measurement of the Local Value of the Hubble Constant." *Astrophys. J. Lett.* 934, L7 (2022).

[8] D. Clowe et al. "A Direct Empirical Proof of the Existence of Dark Matter." *Astrophys. J.* 648, L109 (2006).

[9] M. Markevitch et al. "Direct Constraints on the Dark Matter Self-Interaction Cross Section from the Merging Galaxy Cluster 1E0657-56." *Astrophys. J.* 606, 819 (2004).

[10] B. P. Abbott et al. (LIGO/Virgo Collaboration). "A Gravitational-Wave Standard Siren Measurement of the Hubble Constant." *Nature* 551, 85 (2017).

[11] SPARC Database: F. Lelli et al. "SPARC: Mass Models for 175 Disk Galaxies with Spitzer Photometry and Accurate Rotation Curves." *Astron. J.* 152, 157 (2016).

Patent Pending. USPTO Patent Application No. 19/640,364. The UM/FUM framework described in this bridge document is the intellectual property of Charles Anthony Hyatt Battiste. All rights reserved. The BCR framework is the independent work of Alfred McBride (Zenodo Record 19669049) and is acknowledged with attribution throughout this document. The bridge mathematical correspondences identified herein are joint structural identifications between the two independently-derived frameworks.

Charles Anthony Hyatt Battiste
Universal Mechanics · First Utterance Model
2026-05-14