PH-0: Audit Standard for Finite-Substrate Physics Claims

Invariance, Falsifiers, and Chain-of-Custody Before Interpretation

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Marithmetics (`public-arch/Marithmetics`)

Abstract

Claims that derive physical structure from discrete or integer substrates are, by default, indistinguishable from numerology. That default is rational. This paper defines an audit standard under which such claims should no longer be dismissed on that basis, and it provides a verification map into a pinned Authority-of-Record (AoR) archive. The standard is operational: representation invariance, designed-fail falsifiers, legality separation (admissible vs. illegal operators), deterministic replay, and counterfactual "teeth." External comparisons (e.g., cosmology solver overlays) are permitted only as evidence-only diagnostics and are forbidden from influencing selection or acceptance.

AoR commit: `aor-20260209T040755Z` | Bundle: `GUM_BUNDLE_v30_20260209T040755Z`

Contents

Evidence Capsule (AoR + pinned artifacts; citation basis)

All citations in PH-0 refer to the entries below (`EC-*`). Each entry is commit-pinned and points to an auditable artifact, log, table, or script. All URLs below are rooted at:

https://github.com/public-arch/Marithmetics/tree/aor-20260209T040755Z

Identifier	Artifact
EC-RepoRoot	Repository root (pinned tag)
EC-PublicationSpine	publication_spine/
EC-DOC	Deterministic Operator Calculus specification (PDF)
EC-AoRRoot	Authority archive root
EC-AoRMasterZip	Master release archive (ZIP)
EC-AoRReportPDF	GUM Report v32 (PDF)
EC-AoRReportManifest	Report manifest (JSON)
EC-ClaimLedger	Claim ledger (JSONL)
EC-RunMetadata	Run metadata (JSON)
EC-RunnerTranscript	Runner transcript (TXT)
EC-SUMMARY	Summary (Markdown)
EC-BundleSHAFile	Bundle SHA-256 identity file
EC-TableConstantsCSV	tables/constants_master.csv
EC-TableDemoIndexCSV	tables/demo_index.csv
EC-TableFalsificationMatrixCSV	tables/falsification_matrix.csv
EC-TableReproducibilityCSV	tables/run_reproducibility.csv
EC-D77-Script	Demo-77 grammar rigidity script
EC-D77-Stdout	Demo-77 grammar rigidity stdout log
EC-D78-Script	Demo-78 midlift protocol script
EC-D78-Stdout	Demo-78 midlift protocol stdout log
EC-D64-Stdout	Demo-64 base-as-gauge invariance stdout
EC-D69-Stdout	Demo-69 OATB operator admissibility stdout
EC-D34-Stdout	Demo-34 $\Omega \to$ SM bridge stdout
EC-D33-Stdout	Demo-33 SM closure surface stdout
EC-D36-Stdout	Demo-36 cosmology master stdout
EC-D36-BB36-ResultsJSON	BB36 master results (Tier A)
EC-D36-BB36-PlotPNG	BB36 master plot (Tier A)
EC-D36-CAMB-OverlayPNG	CAMB overlay (Tier E; evidence-only)
EC-D36-CAMB-OverlayNoteTXT	CAMB overlay note (Tier E; evidence-only)
EC-D36-CAMB-PlanckParamsJSON	CAMB Planck parameters (Tier E; evidence-only)
EC-D36-CAMB-PlanckVsGUM-OverlayPNG	Planck vs GUM overlay (Tier E; evidence-only)

1 Reader Contract

1.1 The numerology prior (explicit)

Integer- or rule-derived physical claims should, by default, be treated as numerology until they satisfy an explicit standard. This is not a rhetorical posture. It is the correct scientific prior: without invariance, falsifiers, and a pinned audit trail, a reader cannot distinguish structure from coincidence.

PH-0 is written for the skeptical reader. It assumes you will look for failure modes first.

1.2 What this paper is

PH-0 is an audit key for the physics track of Marithmetics. It defines:

- what counts as a *claim* in this track,
- what counts as *evidence*,
- what tests must be passed before physical interpretation is discussed, and
- how to verify those tests directly in the AoR archive.

This paper was not written to persuade by narrative. It was written to make dismissal costly: the usual escape hatches are turned into explicit tests.

1.3 What this paper is not

PH-0 is *not*:

- a "fit" to external datasets,
- a replacement for continuum formulations,
- a promise that every downstream overlay will look favorable, or
- a request that the reader accept a philosophy.

PH-0 is a contract: either the record satisfies the standard, or it does not.

1.4 Three-tier evidence discipline

PH-0 uses a strict tiering scheme. The purpose is to prevent circularity and to keep interpretive overlays from contaminating structural claims.

- **Tier A (Structural):** deterministic outputs produced by the fixed pipeline under AoR replay.
- **Tier B (Legality & falsifiers):** tests that must separate admissible structure from illegal or corrupted alternatives.
- **Tier E (Evidence-only overlays):** external comparisons and solver overlays. These may be informative, but they are forbidden from influencing selection, acceptance, or budget setting.

Hard rule

Tier E cannot upgrade Tier A or Tier B. When Tier E is shown, it is labeled *evidence-only* and *non-feeding* (see `EC-D36-CAMB-*` for examples).

1.5 Non-circularity contract (one-way street)

External data may appear only as downstream diagnostics. It is strictly forbidden from influencing:

- invariant selection,
- grammar choice or rule selection,
- admissibility criteria,

- counterfactual budgets or thresholds, or
- acceptance gates.

Where external overlays exist, PH-0 points to the corresponding AoR artifacts and labels them as evidence-only (Tier E) by construction.

1.6 How to use PH-0

PH-0 is intentionally front-loaded. You should be able to do a first-pass audit quickly:

Audit time budget

15-minute audit:
verify AoR identity, verify at least one invariance pass, verify at least one designed-fail, and verify at least one "teeth" event.

60-minute audit:
add Demo-77 (rigidity) and one physics-facing bridge ($\Omega \to$ SM or cosmology), still without relying on overlays.

The exact step-by-step protocol appears in Section 5, but the minimum surfaces are already pinned in the Evidence Capsule (`EC-BundleSHAFile`, `EC-TableDemoIndexCSV`, `EC-TableFalsificationMatrix` `EC-D64-Stdout`, `EC-D69-Stdout`, `EC-D77-Stdout`).

2 The Numerology Standard and the Antidote

2.1 Operational definition: when a claim behaves like numerology

A claim in this category behaves like numerology if any of the following hold:

1. **Representation dependence:** the result changes under base change, encoding change, or equivalent representational transformations.
2. **No corruption sensitivity:** small perturbations of the generating logic do not reliably destroy the result.
3. **No designed-fail controls:** the work provides only "passes," not controlled failures under illegality.
4. **No chain-of-custody:** the result cannot be traced to a pinned record with deterministic replay.
5. **Circularity:** external data influences selection or acceptance, even indirectly.
6. **Undeclared degrees of freedom:** the search space, constraints, and gates are not specified well enough to audit.

These are not moral judgments. They are audit conditions.

2.2 The antidote: required gates before interpretation

PH-0 treats a claim as eligible for physical interpretation only if it satisfies *all* of the following:

1. **Base-as-gauge invariance** (**PASS**): outcomes survive base transport within declared tolerance (`EC-D64-Stdout`).
2. **Corruption tests** (**FAIL** under violation): digit-dependent or injection-style perturbations must fail in controlled ways (see falsification tracking: `EC-TableFalsificationMatrixCSV`).
3. **Operator legality separation** (**PASS**/**FAIL** split): admissible operators pass; illegal controls fail, even when an illegal method might superficially improve a naive metric (`EC-D69-Stdout`; DOC background: `EC-DOC`).
4. **Deterministic replay** (**PASS**): the AoR record supports replay and verification of outputs (`EC-BundleSHAFile`, `EC-RunnerTranscript`, `EC-TableReproducibilityCSV`).
5. **Counterfactual teeth** (**PASS**): declared counterfactual reductions degrade scores by a declared margin, rather than "sometimes improving" by chance (primary exhibit anchors: `EC-D77-Stdout`, `EC-D78-Stdout`).
6. **Non-circularity** (**PASS**): external overlays are evidence-only and do not feed the pipeline (Tier E artifacts are labeled as such, e.g., `EC-D36-CAMB-*`).

2.3 Summary box: the Audit Triangle (required pattern)

The Audit Triangle

The minimum credibility surface in this program is the triangle below. Each vertex must be demonstrated with pinned AoR artifacts before any "result" is treated as more than coincidence.

Invariance: a positive-control invariance pass under base-as-gauge transport (`EC-D64-Stdout`).

Falsifiers: at least one designed-fail that must fail under an explicit illegality class (tracked in `EC-TableFalsificationMatrixCSV`; executed across demos including `EC-D69-Stdout`, `EC-D77-Stdout`, `EC-D78-Stdout`).

Teeth: at least one counterfactual budget reduction with deterministic degradation (`EC-D77-Stdout`; `EC-D78-Stdout`).

In the sections that follow, PH-0 will show these three vertices first, and only then introduce the strategic payload exhibits (rigidity at scale, midlift, legality separation, and domain bridges including the $\Omega \to$ SM bridge and cosmology closure).

3 Architecture Map (what is being audited)

3.1 Overview

The physics track is organized as a sequence of layers. Each layer has a small number of responsibilities, explicit admissibility constraints, and an AoR audit surface. The goal is to prevent a reader from having to infer where "choices" exist. If a choice exists, it must either be (i) a declared parameter that is audited, or (ii) forbidden by construction.

A minimal view of the stack is:

1. Finite substrate and invariants
2. Admissible operator calculus (DOC)
3. Midlift: first controlled scale transition
4. Φ-channel maps and constants
5. Legality for transfer / measurement
6. Closure layers (e.g., $\Omega \to$ SM, cosmology)
7. Evidence-only overlays (fenced)

The DOC layer is specified in the publication spine (`EC-DOC`). The AoR provides the pinned run artifacts and ledgers that record what actually happened (`EC-AoRRoot`, `EC-ClaimLedger`, `EC-TableDemoIndexCSV`).

3.2 Layer responsibilities and audit surfaces

Layer 0 — Substrate and invariants. *Role:* define the discrete objects and selection grammar used downstream. *Audit surfaces:* substrate invariance and selector behavior under representational changes (`EC-D64-Stdout`), plus the falsification matrix that classifies illegal perturbations (`EC-TableFalsificationMatrixCSV`).

Layer 1 — Deterministic Operator Calculus (DOC). *Role:* define admissible operators and lawful transfers used when building continuum-facing summaries and bridges. *Audit surfaces:* DOC specification (`EC-DOC`) and the operator admissibility / transfer audits (`EC-D69-Stdout`). *Key discipline:* admissibility is enforced even when an illegal operator can "look better" under a naive metric.

Layer 2 — Midlift (first controlled scale transition). *Role:* provide a controlled interface between low-resolution and higher-resolution regimes under explicit stability and drift witnesses. *Audit surfaces:* midlift protocol runs and certificates (`EC-D78-Stdout`, `EC-D78-Script`). *Clarification:* "Midlift" is a pipeline construct. It is not presented as an ontological claim about reality. It is the first audited scale transition in the computation.

Layer 3 — Φ-channel maps and constants. *Role:* map invariants to dimensionless quantities under declared, auditable forms. *Audit surfaces:* constants tables (`EC-TableConstantsCSV`) and the rigidity/grammar audits that show how the canonical triple and derived invariants behave under perturbations (`EC-D77-Stdout`).

Layer 4 — Legality of transfer and measurement. *Role:* ensure that bridge and measurement-facing transforms remain admissible and do not permit "cheating" via illegal smoothing or injection. *Audit surfaces:* operator admissibility transfer/bridge logs (`EC-D69-Stdout`) and falsification matrix entries (`EC-TableFalsificationMatrixCSV`).

Layer 5 — Closures and bridges. *Role:* connect structural outputs to physics-facing domains under strict legality and non-circularity. *Audit surfaces:* $\Omega \to$ SM bridge snapshot (`EC-D34-Stdout`), with the SM closure surface referenced for deeper audit (`EC-D33-Stdout`); cosmology closure run + structural outputs (`EC-D36-Stdout`, `EC-D36-BB36-ResultsJSON`, `EC-D36-BB36-PlotP`

Layer 6 — Evidence-only overlays (Tier E). *Role:* allow downstream diagnostic overlays that can be informative but are forbidden from influencing the upstream pipeline. *Audit surfaces:* CAMB overlays and notes are archived explicitly as evidence-only artifacts (`EC-D36-CAMB-OverlayPNG`, `EC-D36-CAMB-OverlayNoteTXT`, `EC-D36-CAMB-PlanckParamsJSON`, `EC-D36-CAMB-PlanckVsGUM-OverlayPNG`). *Hard rule:* overlays do not upgrade Tier A/Tier B claims.

3.3 Where interpretation begins

Interpretation begins only after the audit standard has been satisfied: invariance has been demonstrated, falsifiers have been demonstrated (including required failures), legality boundaries are enforced, and counterfactual teeth are present.

PH-0 treats interpretation as downstream and optional. The audit is upstream and mandatory.

4 Threat Model (how skepticism is operationalized)

4.1 Why a threat model belongs in PH-0

A skeptical reader should not have to guess what is being defended against. PH-0 therefore treats common failure modes as a threat model and maps each threat to an explicit countermeasure and an AoR audit surface.

4.2 Threat model table

Threat / failure mode	**Typical manifestation**	**Countermeasure**	**Primary audit surfaces**
Representation dependence ("base-10 numerology")	Outputs change under base/encoding changes	Base-as-gauge invariance must pass	`EC-D64-Stdout`
Digit anchoring / injection	Digits encode targets; mild corruption does not break results	Corruption tests must fail under violation; falsifiers recorded	`EC-TableFalsificationMatrixCSV`; `EC-D77-Stdout`; `EC-D78-Stdout`
Hidden smoothing knobs / tuned filters	Method choice quietly "improves fit"	Legality separation: admissible passes; illegal fails, even if naive metrics improve	`EC-D69-Stdout`; `EC-DOC`
Post-hoc selection	Winners chosen after seeing external targets	Non-circularity contract: external data forbidden from selection/acceptance	`EC-ClaimLedger`; `EC-SUMMARY`; Tier E artifacts `EC-D36-CAMB-*`
Unverifiable computation ("trust me")	Missing logs, missing manifests, moving code	AoR chain-of-custody: pinned artifacts + replay surfaces	`EC-AoRRoot`; `EC-AoRMasterZip`; `EC-RunnerTranscript`; `EC-TableReproducibilityCSV`
No negative controls	Only "success cases" shown	Designed-fail controls must be present and must fail	`EC-D77-Stdout`; `EC-D69-Stdout`; `EC-TableFalsificationMatrixCSV`
Fragility without structure	Small changes sometimes "improve" randomly	Counterfactual teeth: deterministic degradation under budget reduction	`EC-D77-Stdout`; `EC-D78-Stdout`

This table is the intent of PH-0 in one place: skepticism is not argued against; it is translated into tests.

5 Hostile Referee Protocol (verify first, interpret later)

5.1 Pre-flight: confirm you are auditing the right object (2 minutes)

1. Confirm the repository tag and AoR root are pinned and consistent (`EC-RepoRoot`, `EC-AoRRoot`).
2. Confirm the AoR report exists and is manifest-pinned (`EC-AoRReportPDF`, `EC-AoRReportManifest`).
3. Confirm the bundle hash file exists (`EC-BundleSHAFile`).
4. Open the demo index and confirm the cited demos are present (`EC-TableDemoIndexCSV`).

If any of these fail, **stop**. The audit object is not defined.

5.2 The 15-minute audit (minimum standard)

Step 1 — Invariance (positive control). Read the base-as-gauge invariance demo output and confirm the declared invariance pass (`EC-D64-Stdout`).

Step 2 — One designed-fail (negative control). Use the falsification matrix to locate a corruption class and verify that the corresponding failure is recorded as a failure (`EC-TableFalsificationMatri`
Confirm at least one "must fail" is present in the record (Demo-77 and Demo-78 both include controlled negative suites as part of their flagship posture: `EC-D77-Stdout`, `EC-D78-Stdout`).

Step 3 — Legality separation. Read the operator admissibility / transfer audit and confirm that admissible vs. illegal operators are separated by explicit witnesses (`EC-D69-Stdout`; background: `EC-DOC`).

Step 4 — Teeth. Confirm at least one counterfactual budget reduction produces deterministic degradation by a declared margin (`EC-D77-Stdout` or `EC-D78-Stdout`).

15-minute verdict

This is sufficient to decide whether the work should remain "numerology by default" or whether it has earned deeper attention.

5.3 The 60-minute audit (recommended first deep read)

Perform the 15-minute audit, then add:

Step 5 — Rigidity at scale (main hook). Read Demo-77 end-to-end and verify that it contains: (i) a baseline lock, (ii) large enumeration or scan surfaces, and (iii) negative controls that fail as expected, with determinism hashing present (`EC-D77-Stdout`; script: `EC-D77-Script`).

Step 6 — One physics-facing bridge (strategic payload). Choose one:

- $\Omega \to$ **SM bridge snapshot:** read Demo-34 and confirm it is treated as an audited bridge rather than a fit (`EC-D34-Stdout`). If you want the deeper surface, follow the reference to the SM closure run (`EC-D33-Stdout`).
- **Cosmology closure:** read Demo-36 and confirm that the structural outputs are archived as Tier A artifacts (`EC-D36-Stdout`, `EC-D36-BB36-ResultsJSON`, `EC-D36-BB36-PlotPNG`).

Only after this step should any overlay be examined.

5.4 Evidence-only overlays (Tier E)

If you choose to inspect external overlays:

- Treat them as diagnostics only.

- Confirm they are archived as evidence-only and accompanied by an overlay note that preserves non-circularity (`EC-D36-CAMB-OverlayPNG`, `EC-D36-CAMB-OverlayNoteTXT`, `EC-D36-CAMB-Planck` `EC-D36-CAMB-PlanckVsGUM-OverlayPNG`).
- Do not use them to infer how selection or acceptance occurred. That is forbidden by contract.

5.5 Deep audit (for replication and line-by-line verification)

Use the AoR replay surfaces:

- runner transcript and metadata for environment/run context (`EC-RunnerTranscript`, `EC-RunMetadata`),
- reproducibility table for rerun expectations (`EC-TableReproducibilityCSV`),
- claim ledger for a chronological record of declared claims and their artifact anchors (`EC-ClaimLedger`).

This protocol is deliberately conservative: it is designed to detect the usual failure modes quickly, and to reward deeper reading only after those modes are excluded.

6 Exhibits (audit payload)

6.1 How to read the exhibits

Each exhibit in PH-0 is an audit surface, not an argument. The purpose is to let a skeptical reader confirm three things quickly:

1. the record is pinned and replayable,
2. the system separates admissible structure from illegal or corrupted alternatives, and
3. the same discrete object remains rigid under large perturbation classes.

The exhibits are intentionally front-loaded with "what to verify" rather than interpretation. Interpretation is downstream and optional.

6.2 Exhibit R (Primary): Grammar Rigidity at Scale (Demo-77)

Purpose: Demonstrate that the core selector/grammar behaves like a rigid mechanism under broad stress tests, rather than like a coincidence generator.

Where to verify: Demo-77 stdout and script (`EC-D77-Stdout`, `EC-D77-Script`).

What to verify (minimal checklist):

1. **Baseline lock exists and is explicit.** Demo-77 declares a baseline window and lane specifications, prints the lane pools, and records the unique admissible ordered triple. In the AoR run, the lane pools collapse to a single candidate in each lane and the ordered triple is unique.
2. **Φ-channel outputs are declared as forms, not "fits."** Demo-77 prints declared Φ-channel forms and the derived invariants of the canonical triple. In the AoR run, the derived invariants satisfy $(q_2, q_3, v_2) = (30, 17, 3)$ and the Φ outputs are printed directly from those forms.
3. **Ablations and scans are present and auditable.** Demo-77 includes multiple stress tests that do not rely on external data: multi-scenario gate classification, moduli scans, residue enumeration, window scans, and τ-grid stability scans. These are not presented as "proof," but as rigidity diagnostics with explicit counts and outcomes.
4. **Negative controls are explicit and fail cleanly.** Demo-77 includes a negative controls suite (lane swap, residue mirror, wrong coherence, wrong window). These controls are reported with outcomes and are required to break uniqueness.
5. **Determinism surfaces are present.** Demo-77 prints a spec hash and a determinism hash as part of its certificate posture. This provides a compact identity check for the run record.

What is compelling here

Demo-77 does not ask the reader to accept a coincidence. It forces the reader to confront a rigid behavior pattern: a declared baseline produces a unique triple, broad perturbation classes are explored and counted, negative controls break the outcome as expected, and the run emits certificate hashes that support replay discipline.
This is the opposite of the failure mode typical of numerology: "works when you want it, fails when you test it."

6.3 Exhibit M: Midlift Protocol (Demo-78)

Purpose: Demonstrate that the pipeline contains a controlled scale transition ("midlift") and that this transition is audited under legality and counterfactual stress, rather than used as a hidden tuning knob.

Where to verify: Demo-78 stdout and script (`EC-D78-Stdout`, `EC-D78-Script`).

What to verify (minimal checklist):

1. **Midlift is defined operationally.** Demo-78 treats midlift as an interface between regimes under explicit stability and drift checks. It is presented as a pipeline construct, not an ontological claim.
2. **Illegal alternatives are tested.** Demo-78 includes a controlled "illegal suite" designed to break admissibility or stability. These failures are part of the audit surface, not an afterthought.
3. **Counterfactual teeth are shown.** Demo-78 includes counterfactual stress intended to degrade targets under declared budget reductions. The point is not "accuracy," but discriminative teeth: the mechanism should worsen deterministically when it is perturbed in declared ways.
4. **Certificate posture exists.** Demo-78 emits certificate hashes analogous to Demo-77, supporting deterministic identity and replay discipline.

Why this is strategically placed after Exhibit R: A reader who has accepted Demo-77 as a serious rigidity audit will naturally ask whether the system survives its first controlled scale transition without turning into a "free knob." Demo-78 answers that question in the same audit style: explicit checks, explicit illegals, explicit counterfactuals.

6.4 Exhibit L: Operator Legality Separation (Demo-69)

Purpose: Demonstrate that the program rejects "cheating transforms" even when a naive metric could be improved by an illegal method, and that this rejection is enforced by explicit admissibility witnesses.

Where to verify: Demo-69 stdout and DOC (`EC-D69-Stdout`, `EC-DOC`).

What to verify (minimal checklist):

1. **Admissibility is defined and enforced.** The DOC specifies admissible operator behavior and constraints that preserve lawful transfer. The OATB demo applies this discipline to bridge/transfer settings and records the outcomes.
2. **Illegal controls are present and disqualified for reasons other than "worse fit."** The key credibility move is that illegals are rejected because they violate admissibility (e.g., positivity/boundedness/transfer constraints), not because they happen to score worse. This is how the program prevents "filter tuning" accusations: legality outranks superficial metric wins.
3. **Falsification linkage exists.** The falsification matrix records expected failure classes. The OATB demo provides concrete instances of these classes in a physics-facing context.

Why this matters

For computational physicists, the single strongest credibility accelerator is the moment where an illegal method is shown to "look better" under a naive metric and is still rejected—because the constraints are non-negotiable. That is a culture signal: this work understands numerical pathology and has built-in defenses against it.

6.5 Exhibit S (Strategic payload): $\Omega \to$ Standard Model Bridge (Demo-34)

Purpose: After rigidity and legality have been established, present a physics-facing bridge that creates "pause," while keeping the audit posture intact.

Where to verify: $\Omega \to$ SM bridge snapshot (`EC-D34-Stdout`) and SM closure surface (`EC-D33-Stdout`).

What to verify (minimal checklist):

1. **The bridge is presented as an audited computation, not as an empirical fit.** Demo-34 is used here as a snapshot surface: it shows what a bridge looks like under the same admissibility and non-circularity discipline established earlier.
2. **Deeper audit surface exists and is pinned.** Demo-33 is referenced as the deeper Standard Model closure surface. The intent is to keep PH-0 readable while making it impossible to claim "there is no audit trail behind the headline."

Why this is placed here (and not earlier): If a reader sees a Standard Model bridge before they have accepted the audit posture, they will assume it is tuned. PH-0 earns the right to show this by first establishing: (i) rigidity (Demo-77) and (ii) legality separation (Demo-69). Only then does a physics-facing bridge function as enticement rather than as a red flag.

6.6 Exhibit C: Cosmology Closure (Tier A) with Evidence-Only CAMB Overlay (Tier E) — Demo-36

Purpose: Demonstrate a closure that reaches cosmology while preserving non-circularity: structural outputs are produced and archived as Tier A, and external solver overlays are archived separately as Tier E diagnostics.

Where to verify: Demo-36 run and structural artifacts (`EC-D36-Stdout`, `EC-D36-BB36-ResultsJSON`, `EC-D36-BB36-PlotPNG`) and CAMB overlay artifacts (`EC-D36-CAMB-OverlayPNG`, `EC-D36-CAMB-OverlayNoteT`
`EC-D36-CAMB-PlanckParamsJSON`, `EC-D36-CAMB-PlanckVsGUM-OverlayPNG`).

What to verify (minimal checklist):

1. **Tier A artifacts exist independently of any overlay.** The BB36 master results JSON and plot are archived as vendored structural artifacts. These are the objects PH-0 treats as "structural output surfaces."
2. **Overlay artifacts are labeled and fenced.** The CAMB overlay artifacts are archived alongside an explicit overlay note. Their role is diagnostic only. They are forbidden from influencing selection and acceptance.
3. **The path to deeper verification is preserved.** The cosmology stdout log is pinned. A reader can trace from the log to the structural artifacts and to the overlay artifacts without inference.

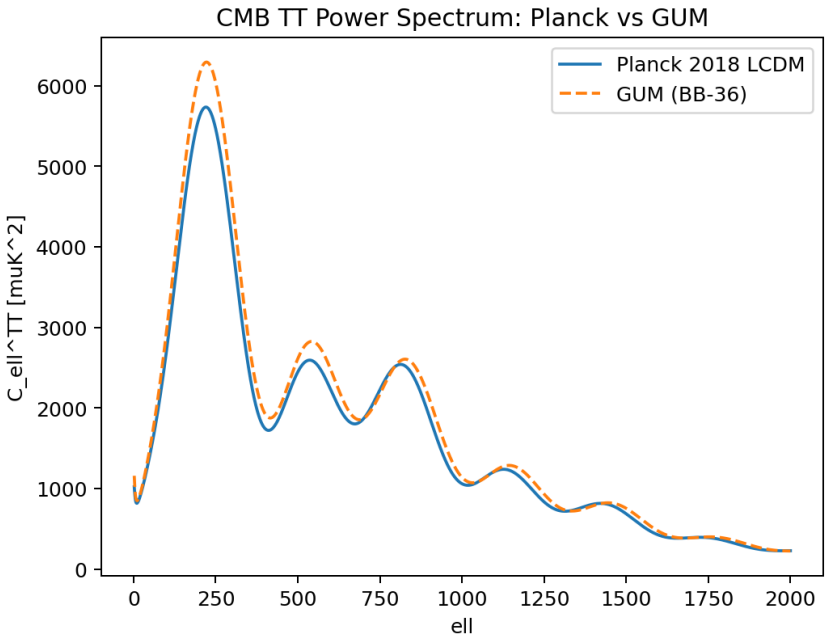

Figure 1: CMB TT Power Spectrum: Planck 2018 LCDM vs. GUM (BB-36). This is a Tier E (evidence-only) overlay. It is forbidden from influencing upstream selection or acceptance. Source: `EC-D36-CAMB-PlanckVsGUM-OverlayPNG`.

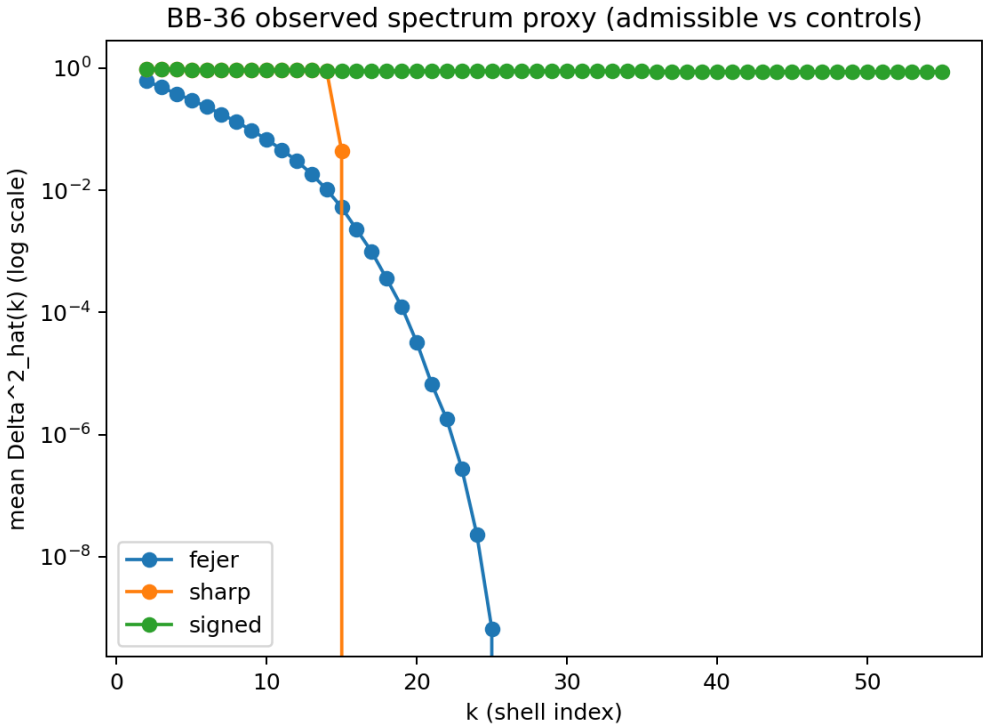

Figure 2: BB-36 observed spectrum proxy (admissible vs. controls). Tier A structural output. Source: `EC-D36-BB36-PlotPNG`.

A cosmology-facing overlay can create serious pause for a physicist. But it is only credibility-positive if it is prevented from becoming the mechanism's objective. PH-0 therefore treats CAMB strictly as Tier E: it can inform curiosity, but it cannot justify structural claims. The structural claims live upstream in Tier A and Tier B.

7 Domain Bridge Ledger

7.1 Why a domain ledger belongs in PH-0

A common failure mode in numerology-style work is that "success" appears only in one narrow presentation. PH-0 therefore records, in one place, the independent audit surfaces in which the same discrete object is exercised.

This section is not a claim that every domain is "solved." It is a map of where the pipeline is reused under distinct constraints, and where that reuse can be audited without trust.

7.2 Ledger: independent audited surfaces touched by the canonical triple

Audit surface	**What is reused**	**Audit expectation**	**Where to verify**
Representation invariance (substrate)	Selector / invariant behavior under base transport	Invariance passes under base-as-gauge (positive control)	`EC-D64-Stdout`
Rigidity under enumeration (grammar)	Canonical triple under large scan families	Uniqueness + stability under broad stress; negative controls fail; determinism hashes present	`EC-D77-Stdout`; `EC-D77-Script`
Midlift (scale transition)	Stability interface between regimes	Stability/drift checks are explicit; illegals fail; counterfactual teeth present	`EC-D78-Stdout`; `EC-D78-Script`
Operator legality / transfer (DOC $\rightarrow$ bridge)	Admissible operator constraints	Admissible passes; illegal controls fail for admissibility reasons (not merely "worse fit")	`EC-D69-Stdout`; `EC-DOC`
Constants surface (Φ-channel outputs)	Dimensionless outputs derived from fixed forms	Values are recorded as structural outputs in pinned tables	`EC-TableConstantsCSV`
$\Omega \rightarrow$ SM bridge snapshot	Bridge layer under the same audit posture	Bridge is recorded as computation under legality/non-circularity; deeper closure surface exists	`EC-D34-Stdout`; `EC-D33-Stdout`
Cosmology closure (Tier A)	Closure outputs archived independently	Structural results exist as Tier A artifacts without requiring overlays	`EC-D36-Stdout`; `EC-D36-BB36-ResultsJSON`; `EC-D36-BB36-PlotPNG`

Audit surface	**What is reused**	**Audit expectation**	**Where to verify**
Cosmology overlays (Tier E)	Diagnostic comparisons only	Overlays are explicitly fenced as non-feeding and non-upgrading	`EC-D36-CAMB-*`

A reader who audits only the first three rows has already answered the central question PH-0 is designed to address: "does this behave like numerology under stress?" The remaining rows explain why continuing deeper into the program is reasonable.

8 Scope, Claims, and Non-Claims

8.1 What PH-0 claims

PH-0 makes a small number of claims, each tied to a pinned audit surface:

1. **Audit standard:** PH-0 defines an operational standard (invariance, falsifiers, legality separation, deterministic replay, teeth) that must be met before physical interpretation is discussed.
2. **Evidence discipline:** PH-0 enforces a three-tier scheme (Tier A/Tier B/Tier E) and a strict non-circularity contract.
3. **Auditability:** PH-0 provides a hostile-referee protocol that can be executed directly from the AoR record without trusting narrative.
4. **Existence of required surfaces in the AoR:** the AoR contains concrete instances of the three vertices of the Audit Triangle:
   - invariance (`EC-D64-Stdout`),
   - falsifiers and negative controls (`EC-TableFalsificationMatrixCSV`; `EC-D69-Stdout`; `EC-D77-Stdout`; `EC-D78-Stdout`), and
   - counterfactual teeth (`EC-D77-Stdout`; `EC-D78-Stdout`),

   with deterministic replay surfaces (`EC-BundleSHAFile`; `EC-TableReproducibilityCSV`; `EC-RunnerTranscript`; `EC-RunMetadata`).

8.2 What PH-0 does not claim

PH-0 does *not* claim:

- that any external overlay "proves" the structural mechanism (Tier E is explicitly non-upgrading; see `EC-D36-CAMB-*`),
- that the program is complete, final, or uniquely correct as a theory of nature,
- that continuum physics is invalidated,
- that skepticism toward integer-derived claims is irrational, or
- that reading PH-0 alone is sufficient to evaluate downstream physical interpretations.

PH-0 is a gatekeeping document. It is designed to answer a narrower question first: "is this eligible for deeper attention, or should it remain categorized as numerology by default?"

9 Reading Map (how to proceed without getting lost)

9.1 If you only do one thing

Do the 60-minute audit:

- Demo-64 (invariance): `EC-D64-Stdout`
- Demo-77 (rigidity): `EC-D77-Stdout`
- Demo-69 (legality separation): `EC-D69-Stdout`
- Demo-78 (midlift / scale transition): `EC-D78-Stdout`

If those surfaces do not behave as described, stop. If they do, you have a rational basis to proceed.

9.2 If you want operator admissibility first

Start with the DOC in the publication spine (`EC-DOC`), then read the operator admissibility transfer/bridge audit (`EC-D69-Stdout`). This is the fastest route to understanding how legality is enforced even when an illegal method might look superficially attractive.

9.3 If you want "physics-facing pause" after the audit posture is established

Read the $\Omega \to$ SM bridge snapshot (`EC-D34-Stdout`), then follow to the deeper Standard Model closure surface (`EC-D33-Stdout`). The bridge is placed after the rigidity and legality exhibits for a reason: it is meant to be provocative only once the audit posture has been earned.

9.4 If you want cosmology closure without conflating it with tuning

Read the Tier A structural artifacts first:

- cosmology stdout log: `EC-D36-Stdout`
- BB36 master results JSON: `EC-D36-BB36-ResultsJSON`
- BB36 master plot PNG: `EC-D36-BB36-PlotPNG`

Only after that, if you choose, inspect evidence-only overlays (Tier E) with the non-circularity rule in mind (`EC-D36-CAMB-*`).

9.5 Where the rest of the program lives

PH-0 is designed to be the first point of contact. The rest of the program is organized under the repository root (`EC-RepoRoot`) and the publication spine (`EC-PublicationSpine`). PH-0 intentionally avoids duplicating those documents; it provides the audit key and the verification map.

A Glossary (minimal)

AoR (Authority of Record)
A pinned archive of code, logs, tables, and artifacts for a specific run, intended to support independent audit and replay (`EC-AoRRoot`; `EC-AoRMasterZip`).

Base-as-gauge invariance
The requirement that results remain invariant under representational base changes, within declared tolerance (`EC-D64-Stdout`).

Designed-fail falsifier
A test case constructed to violate an admissibility condition; it is required to fail, and its failure is itself an audit surface (`EC-TableFalsificationMatrixCSV`; `EC-D77-Stdout`; `EC-D78-Stdout`).

Deterministic replay
The property that the pinned record contains enough information (hashes, manifests, transcripts) to reproduce or verify the run identity and outputs (`EC-BundleSHAFile`; `EC-TableReproducibility`
`EC-RunnerTranscript`; `EC-RunMetadata`).

Admissible operator
An operator that satisfies DOC legality constraints; admissibility is treated as non-negotiable and outranks superficial metric improvements (`EC-DOC`; `EC-D69-Stdout`).

Illegal control
An intentionally non-admissible alternative used to demonstrate that the audit is not "only passes" (`EC-D69-Stdout`; `EC-D77-Stdout`; `EC-D78-Stdout`).

Teeth
Deterministic degradation of performance/score under declared counterfactual budget reductions; used to distinguish rigid mechanisms from coincidence (`EC-D77-Stdout`; `EC-D78-Stdout`).

Midlift
The first controlled scale transition interface in the pipeline, audited via stability/drift checks and illegals; not presented as an ontological claim (`EC-D78-Stdout`).

Tier A / Tier B / Tier E
Evidence tiers used in PH-0. Tier E (overlays) is forbidden from upgrading Tier A/Tier B claims (see `EC-D36-CAMB-*` for examples).

B Citation Format (recommended)

PH-0 uses Evidence Capsule identifiers (`EC-`) as citations. Each `EC-` entry is a commit-pinned URL to a primary artifact. When citing a result, prefer the narrowest possible artifact:

- use a log when citing a demo outcome (e.g., `EC-D77-Stdout`),
- use a table when citing a recorded value surface (e.g., `EC-TableConstantsCSV`),
- use the DOC when citing admissibility definitions (`EC-DOC`), and
- use Tier E artifacts only as evidence-only diagnostics (`EC-D36-CAMB-*`).

For offline audit, use the AoR master archive (`EC-AoRMasterZip`) and confirm identity via the bundle SHA file (`EC-BundleSHAFile`).

C Verification Shortcuts (practical)

1. **Start with the demo index.** Open `EC-TableDemoIndexCSV` and locate the demos referenced in PH-0 (Demo-64, Demo-69, Demo-77, Demo-78, Demo-34, Demo-33, Demo-36). This prevents guesswork about filenames or paths.
2. **Use the falsification matrix as a map of "must fail" tests.** Open `EC-TableFalsificationMatrixCS` and identify which illegality classes are expected to fail. Then verify at least one such failure in a log (e.g., `EC-D69-Stdout`, `EC-D77-Stdout`, `EC-D78-Stdout`).
3. **Confirm deterministic replay surfaces exist.** Use `EC-BundleSHAFile` for identity, `EC-TableReproducibilityCSV` for replay expectations, and `EC-RunnerTranscript` + `EC-RunMetadata` for run context.
4. **Keep overlays fenced.** If you view CAMB overlays, treat them as diagnostics only and verify that they are explicitly archived as evidence-only (`EC-D36-CAMB-OverlayNoteTXT`).

Data and Materials Availability

All code, logs, tables, and artifacts referenced in PH-0 are available in the commit-pinned repository (`EC-RepoRoot`) and the AoR archive (`EC-AoRRoot`). An offline master archive is provided (`EC-AoRMasterZip`), with report and manifest (`EC-AoRReportPDF`; `EC-AoRReportManifest`) and deterministic identity surface (`EC-BundleSHAFile`).

Conclusion

PH-0 is deliberately conservative. It does not ask a reader to accept a worldview. It defines a standard that would justify moving beyond the default numerology prior, and it provides a pinned audit record that a hostile referee can interrogate quickly.

If the AoR record fails the invariance, falsifier, legality, or teeth requirements, the appropriate conclusion is to stop and treat the work as numerology. If it passes, then dismissal without deeper inspection is no longer the rational default. In that case, the rest of the program is straightforward to approach: the publication spine provides the formal documents, and the AoR provides the replay surfaces (`EC-PublicationSpine`; `EC-AoRRoot`).