Origin Axiom — Phase 3 (Mechanism): Non-cancelling Vacuum Toy Model

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Abstract

This is a Rung 1 skeleton for the Phase 3 mechanism paper in the Origin-Axiom program. It defines the narrative structure, filesystem layout, and gate behaviour for a future non-cancelling vacuum toy model, but does not yet introduce a concrete mechanism or numerical results. All physical claims about the mechanism remain locked until later rungs populate the sections and appendices with code-backed content.

1 Introduction

Phase 3 in the Origin-Axiom program is the *mechanism phase*: it implements and probes a concrete toy vacuum system in which a non-cancelling global amplitude constraint is enforced, in a way that is compatible with the Phase 0 contract.

The goal at this rung is modest:

- define a clear separation between the non-cancellation rule (the "axiom") and the dynamics of the toy vacuum system;
- specify the observables that the mechanism exposes to the corridor ledger (notably a residual-energy proxy and an admissible θ corridor); and
- provide a minimal reproducible implementation and PDF report, without yet claiming any contact with real cosmological data.

The detailed mechanism design and experiments will be introduced in later rungs; this skeleton paper exists to follow the Phase 0 requirement that each phase have a well-defined narrative, claims table, and gate-verified artifact.

2 Mechanism design (skeleton)

This section is a placeholder at Rung 1. It records the intended role of the Phase 3 mechanism without yet committing to a specific model.

- **State space:** a finite collection of degrees of freedom representing a toy vacuum configuration (to be specified).
- **Dynamics:** an update map or flow that, in the absence of a floor, would admit configurations with arbitrarily small net amplitude or residual.
- **Non-cancellation rule:** an explicit constraint that enforces $|A| \geq \varepsilon$ for a suitable global observable A, in the sense of the Phase 0 contract.
- **Observables:** a residual-energy proxy and a θ-dependent diagnostic that can be exported as a theta-filter artifact.

Subsequent rungs will replace this section with a fully specified toy model, including equations, update rules, and the definition of the binding regime and binding certificate.

3 Baseline experiments (skeleton)

At Rung 1 no numerical experiments are yet performed. This section exists only to mark the structure of the eventual paper:

- description of the baseline unconstrained dynamics;
- description of the dynamics under the non-cancellation rule;
- definition of the residual-energy observable; and
- extraction of an admissible θ corridor and a theta-filter artifact compatible with the Phase 0 ledger.

All numerical values, figures, and tables are deliberately omitted at this stage to avoid giving the impression of claims that have not yet been earned by code and data.

4 Discussion and limitations (skeleton)

This Phase 3 mechanism paper is at a very early rung. The present version only defines the narrative structure and the contracts that future rungs must satisfy.

In particular, we do not yet:

- commit to a specific toy vacuum system or update rule;
- claim any correspondence with observed vacuum energy or cosmological data; or
- claim that the toy mechanism realises a fundamental physical principle rather than an exploratory numerical construction.

These limitations are intentional at this stage and will be narrowed in later rungs as concrete models and experiments are introduced.

Appendix A: Phase 3 mechanism claims table (skeleton)

At Rung 1 no positive scientific claims are made beyond those already stated in the Phase 0 contract and the Phase 3 mechanism contract ("MECHANISM_CONTRACT.md"). This appendix will eventually contain a structured table (C3.m.x) of Phase 3-specific claims, once a concrete mechanism and experiment suite exist.

Appendix B: Reproducibility and gate levels (skeleton)

The Phase 3 mechanism implementation follows the multi-level gate structure defined in the Phase 0 contract. At Rung 1 we define only the filesystem layout and the top-level gate script:

- source code under `phase3/src/phase3_mech/`,
- paper sources under `phase3/paper/`,
- outputs under `phase3/outputs/`,
- artifacts under `phase3/artifacts/`, and
- Snakemake workflow under `phase3/workflow/Snakefile`.

The gate script `scripts/phase3_gate.sh` drives the workflow from the repository root. At this rung, Level A/B gates only verify that the skeleton paper compiles and that the canonical PDF `phase3/artifacts/origin-axiom-phase3.pdf` is regenerated from the LaTeX sources.