

Notes

Status: Diagnostic framework (CEDA).

Not a theory. Not a mechanism. Not an alternative to inflation.

Purpose: to audit explanatory provenance under conservation-honest bookkeeping.

Model Card Template

Model Card Template (fill-in, model-agnostic)

MODEL CARD CEDA Translation Layer

A. Identity

- Model name:
- Primary reference (paper/author/year):
- Category (inflation / bounce / modified gravity / horizon-based / other):
- Intended target phenomena (check): homogeneity/flatness / perturbations / reheating / entropy-arrow / other

B. Claimed Mechanism (1–3 sentences)

- What is the *actual* dynamical engine (fields, curvature terms, modified gravity, etc.)?
- If “no new dynamics”: explicitly state that and expect D1 pressure.

C. Degrees of Freedom (DOF) Inventory

- Dynamically active DOF (list):
- Inactive / integrated-out / “environment” DOF (list):
- Any “effective” fluids or sectors introduced (list, with *www* if assumed):

D. Causal Domain + Horizon

- Domain definition (what region is treated as “interior?”):
- Horizon/boundary definition (event / particle / apparent / Hubble / other):
- Does the boundary move in time? If yes, by what rule?

E. Coarse-Graining Prescription

- Coarse-graining scale(s): (cutoff k_{ck} , smoothing length, renormalization scale μ , etc.)
- What is traced out and how? (basis choice, near-boundary treatment)
- What is held fixed vs allowed to vary?

F. Effective Stress–Energy Construction

- What sources the metric in practice?
 - $\langle T_{\mu\nu} \rangle_{\text{eff}} = \langle T_{\mu\nu} \rangle_{\text{eff}} =$ (write the schematic form)
- Any vacuum terms / counterterms / potentials included? (explicitly list)

G. Conservation and Exchange Accounting

- Sector continuity equations (write them):
- Any exchange term Q_{QQ} ? If yes:
 - Is Q_{QQ} **derived** from partition evolution, or **assumed/closed**?
 - Does any part of Q_{QQ} “know” the desired outcome (e.g., targets $w \approx -1$ w.simeq -1 w.simeq -1)?

H. Acceleration Source Location (pin it down)

- Where does negative pressure enter (one line)?
 - intrinsic dynamics (potential / higher curvature / modified kinetic / etc.)
 - or bookkeeping/partition choices
 - or unclear (underspecified)

I. Stability Hooks (for D2)

- What “admissible variations” are meaningful here?

- small horizon shift:
- small change in coarse-graining scale:
- reassignment of near-boundary modes:
- What observables must remain stable? (e.g., $w(a)$, ϵH , ϵH , $H(a)$, tilt proxies)

J. Declared Predictive Wedge (required if claiming novelty)

- Where does it differ from vanilla Λ CDM+inflation, operationally?
- What would falsify it?

DIAGNOSTIC REPORT

CEDA DIAGNOSTIC REPORT — v0.1

Model:

Reference:

Diagnostic date/run:

Analyst:

Summary Verdict (one line)

Verdict: Stable Mechanism / Reinterpretation / Ambiguous / Underspecified

Key Findings (3 bullets max)

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-
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Provenance of Acceleration / Negative Pressure

- **Origin:** intrinsic dynamics / bookkeeping-dependent / not present / unclear
- **Where it appears in equations:** (one line)

Test Outcomes

D1 — Horizon Reconfiguration Without Added Dynamics (Null baseline)

- Result: Pass / Fail / N/A
- Evidence: (1–2 lines)

D2 — Coarse-Graining Stability

- Result: Pass / Fail / N/A
- Evidence: (1–2 lines)

D3 — Exchange-Term Provenance (anti goal-seeking)

- Result: Pass / Fail / N/A

- Evidence: (1–2 lines)

D4 — Predictive Wedge Requirement

- Result: Pass / Fail / N/A
- Evidence: (1–2 lines)

Failure Registry IDs Triggered (if any)

- (e.g., Entropy-as-driver; Horizon agency; Privileged coarse-graining; Hidden slow-roll variable; Underspecified exchange)

What Would Need to Be True to Change the Verdict (bounded, non-speculative)

- (1–3 constraints, no “maybe magic happens”)

Worked Examples Pack

WF1.2

Example 1 — WF1.2 (HEEF baseline null / canonical control)

MODEL CARD (compressed):

- **Claimed mechanism:** horizon-mediated accessibility reconfiguration only; no new fields/modified gravity.
- **DOF:** modes with radiation-like dilution $\rho k \propto a^{-4}$, $p k \propto a^{-4}$.
- **Horizon:** modes gated by horizon crossing via smooth logistic weight $wk(a)$.
- **Coarse-graining:** partition system/environment via accessibility + horizon gating.
- **Stress-energy:** accessibility sector built from weighted sum of radiation-like constituents.
- **Exchange QQ: derived mode-by-mode** from partition evolution (no targeting of w). Emergent Horizon Model Framework...

DIAGNOSTIC REPORT (one-page style):

- **Verdict: Reinterpretation (Null confirmed)**
- **Acceleration provenance: not present;** bookkeeping cannot create negative pressure from radiation constituents.
- **D1: Pass (null confirmed)** — w_A stays radiation-like; no sustained $w \approx -1$; no acceleration. Emergent Horizon Model Framework...
- **D2:** N/A for “mechanism” (it’s the null baseline), but stability behavior is consistent with “no special slicing produces inflation.”
- **D3: Pass** — exchange derived without goal-seeking; that’s why it’s trusted.
- **D4:** N/A — no novelty claim remains after null.
- **Failure IDs:** none; this is the control result.
- **Constraint takeaway:** Under conservation-honest accounting, repartition of radiation-like DOF \Rightarrow radiation-like effective behavior. CEDA (1)

Starobinsky inflation

Example 2 — Starobinsky inflation (gold standard “passes robustness”)

(You already started this in the CEDA draft; we’re formalizing it.)

CEDA (1)

MODEL CARD (compressed):

- **Claimed mechanism:** higher-curvature term $R+R^2R+R^2$ (equivalently scalaron in Einstein frame) provides genuine dynamics yielding $w\approx-1$ for an interval.
- **DOF:** metric + scalaron effective DOF (real dynamics).
- **Horizon/coarse-graining:** standard EFT coarse-graining; not responsible for acceleration.
- **Stress–energy:** negative pressure from scalaron potential/dynamics (intrinsic).
- **Exchange \mathcal{Q} :** not “invented” from partition motion; acceleration survives without it.

DIAGNOSTIC REPORT:

- **Verdict: Stable Mechanism**
- **Acceleration provenance:** intrinsic dynamics (scalaron / R^2R^2 term), not bookkeeping.
- **D1:** N/A (it *does* add structure; it isn’t claiming horizon-only).
- **D2: Pass** — inflationary behavior persists under admissible coarse-graining/horizon re-descriptions (Jordan \leftrightarrow Einstein frame, small cutoff shifts).
CEDA (1)
- **D3: Pass** — no goal-seeking exchange closure required.
- **D4: Pass** — has standard inflationary predictions/constraints; not a “same story” relabel.
- **Failure IDs:** none.

Entropy / horizon causes inflation

Example 3 — “Entropy / horizon causes inflation” narrative proposal

This is the kind of pitch HEEF was designed to shred politely.

MODEL CARD (compressed):

- **Claimed mechanism:** “entropy increase / horizon growth drives expansion” (no explicit new field; horizons treated as quasi-agent).
- **DOF:** usually unspecified; or treated as “information” / “accessible states” without explicit stress–energy.
- **Horizon:** invoked as driver rather than boundary condition.
- **Coarse-graining:** implicit and privileged (“choose the right slicing and it inflates”).
- **Exchange Q :** either absent, hand-waved, or effectively tuned.

DIAGNOSTIC REPORT:

- **Verdict: Reinterpretation (conceptual failure)**
- **Acceleration provenance:** bookkeeping + category error (“entropy as driver”).
- **D1: Pass (null confirmed against it)** — without added dynamics, it can’t generate $w \approx -1$ from ordinary constituents.
CEDA (1)
- **D2: Fail** — behavior depends on privileged descriptive choices; small changes in partition break claimed effect.
- **D3: Fail** — exchange/pressure terms not derived; often implicitly goal-seeking.
- **D4: Fail** — no falsifiable wedge; “same outputs, different words.”
- **Failure IDs:** Entropy-as-driver; Horizon agency; Privileged coarse-graining; Underspecified exchange.

Alternative early universe

Example 4 — An “alternative early universe” that’s often Ambiguous under CEDA (bounce/ekpyrotic-style as a class)

Not declaring a verdict on the whole literature here—this is showing how CEDA would classify a class when details vary.

MODEL CARD (compressed, generic):

- **Claimed mechanism:** smoothing/flattening via contraction + stiff equation of state, or a bounce via quantum gravity effects.
- **DOF:** often includes scalar fields with steep potentials, modified gravity terms, or quantum corrections.
- **Horizon:** causal structure changes are central, but not treated as “agents.”
- **Coarse-graining:** varies; sometimes explicit, sometimes not.
- **Stress–energy:** may be intrinsic (good) or partly effective/phenomenological (watch this).
- **Exchange QQQ:** can be explicit or absent depending on formulation.

DIAGNOSTIC REPORT (generic classification):

- **Verdict: Ambiguous (until a specific model is fully specified)**
- **Acceleration provenance:** not necessarily required (many bounce models don’t inflate); smoothing may be dynamical (good) but must be pinned to explicit DOF and equations.
- **D1:** N/A unless it claims “horizon-only generates inflation.”
- **D2: Pending** — some specific models pass; others fail if they rely on special slicing/closure to achieve a stable bounce.
- **D3: Pending** — if any exchange/closure is introduced, provenance must be shown.
- **D4: Pass/Fail depends** — many claim wedges (non-Gaussianity, tensor signatures, etc.), but must be constrained, not rhetorical.
- **Failure IDs:** None by default; “Underspecified” if the Model Card can’t be completed.

Failure Registry

Report Pack

