CED-007 — MODEL CARD

Audit ID: CED-007
Paper: *Implications of the graviton one-loop effective action on the dynamics of the Universe*
Authors: T. Janssen, T. Prokopec (2008)
arXiv: 0807.0447
Framework role: Inflation-adjacent, quantum backreaction–driven cosmology
Status: Pre-audit (no diagnostics applied)

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1. Declared Aim (Author-Stated)

The authors aim to evaluate the **one-loop quantum gravitational contribution** to cosmological dynamics in FLRW spacetimes with **constant slow-roll parameter**

$$\epsilon \equiv -\frac{\dot H}{H^2}$$

and to assess whether **secular quantum effects** can:

- modify late-time cosmological evolution,
- screen an arbitrarily large cosmological constant,
- prevent de Sitter (Λ-dominated) attractors,
- alter inflationary or post-inflationary behavior.

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2. Claimed Mechanism (As Written)

The paper claims that:

- One-loop graviton + scalar vacuum fluctuations generate **secularly growing contributions** to the effective Friedmann equations.
- These contributions appear as an **effective stress–energy tensor** $(T_{\mu\nu})_Q$.

- The secular terms **cannot be removed by local counterterms**.
- Near specific values of ϵ, these effects become dominant and can:
    - screen Λ,
    - drive the universe toward non-de-Sitter attractors,
    - or mimic inflation-like smoothing without a fundamental inflaton.

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3. Degrees of Freedom (Explicit)

Fundamental fields:

- Metric $g_{\mu\nu}$
- Scalar matter field ϕ (used as a fluid proxy)

No new fundamental degrees of freedom introduced.

Effective degrees of freedom:

- Graviton loop contributions
- State-dependent vacuum expectation values
- Secular loop corrections encoded in coincidence limits

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4. Action-Level Structure

Base action:

$$S = \int d^Dx \sqrt{-g} \left[\frac{1}{\kappa}(R - (D-2)\Lambda) - \frac12 (\partial\phi)^2 - V(\phi) \right]$$

No:

- higher-curvature terms added *a priori*,
- inflaton potential specified as a driver,
- modified gravity terms inserted by hand.

Quantum effects arise **only** via loop corrections.

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5. Regime of Validity (Explicitly Declared)

The analysis assumes:

- FLRW background
- **Constant** ϵ\epsilonϵ
- Dimensional regularization
- One-loop truncation
- Neglect of ϵ˙\dot\epsilonϵ˙ except where argued small
- Perturbative control only where GNH2≪1G_N H^2 \ll 1GNH2≪1

Authors explicitly acknowledge:

- breakdown near poles in digamma functions,
- sensitivity to vacuum/state choice,
- loss of predictivity in strong secular regimes.

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6. Cosmological Claims (To Be Audited)

The paper claims that, under certain conditions:

- Λ can be dynamically screened.
- De Sitter is *not* the generic late-time attractor.
- Inflation-like expansion may arise or be modified by quantum effects alone.
- Horizon and flatness problems *might* be alleviated without standard inflation (speculative).

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7. Conservation & Closure (As Claimed)

- Effective stress–energy tensor (Tμν)Q(T_{\mu\nu})_Q(Tμν)Q is defined.
- Bianchi identities are imposed.
- Conservation is enforced at the level of effective equations.

Whether this constitutes **mechanism-level closure** or **descriptive closure** is **not assessed here**.

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8. Author-Acknowledged Limitations (Important)

The authors explicitly state:

- Results are strictly valid only for constant ϵ\epsilonϵ.
- Time-dependent ϵ\epsilonϵ corrections are uncontrolled.
- Near singularities, higher-order effects may dominate.
- State dependence may materially affect conclusions.

These statements are taken as **binding declarations** for CEDA.