CEDA MODEL CARD — CED-008

0. Proposal Identification

- **Title:** *Generalized G-inflation: Inflation with the most general second-order field equations*

- **Authors:** Tsutomu Kobayashi, Masahide Yamaguchi, Jun'ichi Yokoyama

- **Year / Venue:** 2011, *Progress of Theoretical Physics*

- **Primary reference:** arXiv:1105.5723

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1. Claimed Mechanism (Author-Stated)

The authors claim that accelerated expansion arises from explicit scalar–tensor interactions encoded in the most general Horndeski action yielding second-order field equations. Inflation is driven by action-level derivative couplings between a scalar field and gravity, without requiring a slow-roll potential, while maintaining stability through imposed no-ghost and no-gradient conditions.

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2. Degrees of Freedom (DOF)

2.1 Explicit Dynamical DOF

- Metric tensor $g_{\mu\nu}$

- Scalar field ϕ

2.2 Effective / Collective DOF

- None introduced beyond action-derived composite quantities (e.g., effective energy density and pressure derived from field equations)

2.3 Fixed / Constrained Quantities

- Background spacetime assumed homogeneous and isotropic (FLRW)

- Slow-variation conditions imposed in many examples

- Stability conditions (positivity of kinetic coefficients and sound speeds)

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3. System–Environment Partition

- **System:** Scalar field ϕ\phi$\phi$ and metric $g_{\mu\nu}$g_{\mu\nu}$g_{\mu\nu}$

- **Environment:** None

- **Boundary definition:** None

No degrees of freedom are traced out.
 The model is treated as a **closed system** for background and perturbative dynamics, enforced by diffeomorphism invariance of the action.

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4. Conservation Accounting (RG-Critical)

4.1 Stress–Energy Structure

- **Stress–energy tensor:** Effective stress–energy derived from variation of the Horndeski action

- **Origin:** Action-derived

4.2 Exchange-Term Status

☑ **No exchange term QQQ; system is closed**

"No exchange term is introduced or required; any effective-fluid representation is reducible to action-derived field equations."

4.3 Conservation Enforcement

- Conservation enforced via diffeomorphism invariance and Bianchi identities

- Conservation holds exactly at the classical level within the EFT regime

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5. Horizon Use

- **Horizon definition:** None

- **Role in the argument:** Not used

- **Quantities dependent on horizon choice:** None

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6. Coarse-Graining Prescription

- **Cutoff scale:** Implicit EFT cutoff (not numerically fixed)

- **Justification:** Validity of Horndeski EFT and avoidance of strong coupling

- **Admissible variations:**

  - Small parameter variations within stability bounds

  - Field redefinitions preserving physical equivalence

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7. Location of Negative Pressure / Acceleration

- **Equation numbers:** Friedmann and scalar field equations derived from Horndeski action

- **Terms responsible:** Derivative coupling terms in $K, G3, G4, G5K, G\_3, G\_4, G\_5K, G3, G4, G5$

- **Physical source:** ☑ dynamical DOF

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8. Model Scope Declaration

☑ **Framework**

Claimed generic:

- Existence of inflationary solutions within Horndeski class under appropriate stability conditions

- Modified perturbation dynamics relative to canonical slow-roll

Explicitly not claimed generic:

- Unique inflationary predictions across all G_iG_i

- Universality of specific consistency-relation violations

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9. Known Fragilities / Author-Acknowledged Limits

- Validity limited to EFT regime below cutoff

- Ghost and gradient instabilities outside stability region

- Strong coupling possible for certain parameter choices

- No UV completion claimed

- No claim of uniqueness or inevitability of inflationary behavior

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10. Diagnostics Requested

- ☑ D1 — Horizon Reconfiguration Null
- ☑ D2 — Coarse-Graining Stability
- ☑ D3 — Exchange-Term Provenance
- ☑ C1 — Coupling Provenance & Redundancy
- ☑ S1 — Scheme / State Dependence Classification
- ☑ D4 — Predictive Wedge