Critical Analysis of the ΛCDM Model

and Fully Expanded Comparison with the Universal Ψ Field Mathematics

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Abstract

The ΛCDM cosmological model, despite its empirical adaptability, lacks a closed variational foundation and therefore cannot internally generate any physical constant, interaction, or metric relation. Its parameters — the cosmological constant Λ, dark matter density ρ_{DM}, and dark energy equation of state w — are externally imposed, not derived.

In this paper the model's structural non-closure is analysed and compared with the fully expanded mathematics of the Universal Ψ Lagrangian. Starting from the closed, self-referential variational principle

$$\frac{\delta}{\delta\Psi^\dagger(x)}\left\{\left|\sum_{i,j}\Psi_i^\dagger\Gamma\Psi_j\right|^2-\lambda_1\sum_i(\Psi_i^\dagger\Psi_i-1)^2-\lambda_2\sum_{i,j,k}\mathrm{Tr}\Big[\Gamma(\Psi_i\Psi_j^\dagger-\Psi_k\Psi_i^\dagger)\Big]^2\right\}=0,$$

we derive, step by step, the emergence of all observable constants — the effective speed of propagation c_Ψ, the quantum action ratio $\hbar_\Psi$, the gravitational coupling G_Ψ, the cosmological curvature Λ_Ψ, and the neutrino mass $m_{\nu,\Psi}$ — without inserting any external value.

Each quantity arises as a stationary correlation of the same coherent field, proving that cosmology, gravitation and quantum scales are informationally linked. In contrast, the ΛCDM framework is shown to be informationally open and mathematically incomplete: it fits data without generative power.

This establishes a concrete mathematical basis for why current cosmology, while phenomenologically accurate, cannot discover new constants or mechanisms. Every fundamental observable must emerge from the closed Ψ field, not from an external spacetime postulate.

1. Introduction and Theoretical Inconsistency of the ΛCDM Framework

The so–called ΛCDM model has been considered the "standard" cosmological paradigm for more than two decades. It assumes a Friedmann–Robertson–Walker metric with curvature parameter $k \simeq 0$, a cosmological constant Λ, and a mixture of baryonic matter, dark matter, and dark energy. Its Lagrangian density is conventionally written as

$$L_{\Lambda\mathrm{CDM}}=\frac{1}{16\pi G}\,(R-2\Lambda)+L_{\mathrm{m}},$$

where R is the Ricci scalar and L_{m} represents the matter sector.

1.1 Structural weakness

This formulation already hides a fundamental inconsistency. The metric tensor $g_{\mu\nu}$, the gravitational constant G, and the cosmological parameter Λ are *external inputs*; they are not generated by the variational process itself. The functional derivative

$$\frac{\delta L_{\Lambda\mathrm{CDM}}}{\delta g_{\mu\nu}} = \frac{\partial L_{\Lambda\mathrm{CDM}}}{\partial g_{\mu\nu}} - \partial_\alpha \left(\frac{\partial L_{\Lambda\mathrm{CDM}}}{\partial(\partial_\alpha g_{\mu\nu})} \right) \neq 0,$$

because Λ and G are constants that do not depend on $g_{\mu\nu}$ through the same field dynamics. Therefore, the action is *open*: it does not close upon total variation. Any constant inserted by hand breaks informational closure.

1.2 Consequence of openness

From this structural openness, all present cosmological parameters emerge as empirical coefficients fitted to observation:

$$\{\Lambda,\, H_0,\, \Omega_\mathrm{m},\, \Omega_\mathrm{DE}\} \;\Rightarrow\; \text{empirical set without generative origin.}$$

This explains why every update of the observational dataset (CMB, BAO, lensing) forces a re–fit of the same parameters: the theory does not generate them, it merely accommodates them.

1.3 Failure of predictive consistency

Mathematically, a predictive theory must derive every physical constant from a stationary condition of a single closed action. In the ΛCDM/GR framework, the constants $\{G, \Lambda\}$ and even the metric background are external to the variational domain. Hence the theory cannot, by construction, yield any new physical constant or mechanism:

$$\frac{\delta L_{\Lambda\mathrm{CDM}}}{\delta g_{\mu\nu}} \neq 0 \quad \Longrightarrow \quad \text{informational non–closure.}$$

All extensions — inflationary potentials, scalar fields, quintessence — inherit the same defect because they remain defined on an external manifold with imposed couplings.

1.4 Transition to the closed formulation

To recover closure, every term in the action must depend on the same self–referential field. In the Universal Ψ Lagrangian, the metric, curvature, energy density and interaction strengths all emerge from bilinear combinations of Ψ:

$$g_{\mu\nu}^{(\Psi)} = \frac{\partial_\mu \Psi^\dagger \Gamma \partial_\nu \Psi}{\langle \partial_\alpha \Psi^\dagger \Gamma \partial_\alpha \Psi \rangle}, \qquad R_{\mu\nu}^{(\Psi)} \propto \nabla_\mu \nabla_\nu (\Psi^\dagger \Gamma \Psi),$$

so that the total variation satisfies

$$\frac{\delta L_\Psi}{\delta \Psi} = 0 \quad \forall x,$$

ensuring variational and informational closure.

In the next section the Ψ field will be expanded around its coherent equilibrium $\Psi = \Psi_0 + \delta\Psi$, and all emergent constants c_Ψ, $\hbar_\Psi$, G_Ψ, Λ_Ψ, and $m_{\nu,\Psi}$ will be derived step by step without external insertion.