Oscillatory Field Genesis (OFGcorV1): Coexistent Drift-Matter Cosmology

J.D.S. aka Drippy (No Formal Training)

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Abstract

We present Oscillatory Field Genesis (OFGcorV1), a cosmological framework unifying inflationary expansion, structure formation, and memory drift dynamics into a coherent extension of standard cosmology. By embedding memory fields into the fabric of spacetime, OFGcorV1 preserves core successes of ΛCDM while offering new explanations for large-scale structure anomalies, void distortions, and filament coherence. Coexistence with residual dark matter is embraced, forming a hybrid model termed Coexistent Drift-Matter Cosmology (CDC). Analytical structures pass conservation laws, match CMB observations, eliminate ghost modes, and predict distinct observational signatures testable by upcoming surveys. OFGcorV1 proposes a living universe where memory and matter coevolve.

1 Introduction

The standard cosmological model (ΛCDM) elegantly explains many aspects of cosmic evolution, yet leaves open questions regarding void anomalies, filament structure, and the nature of inflation and dark matter. Oscillatory Field Genesis (OFGcorV1) proposes that spacetime itself hosts intrinsic memory fields (Φ, Θ) whose drift gradients seed inflation, enhance structure formation, and leave detectable imprints on the cosmic web. Rather than rejecting dark matter, OFGcorV1 embraces a coexistence principle, forming the Coexistent Drift-Matter Cosmology (CDC).

2 Core Action and Field Dynamics

The action $\mathcal{S}$ governing OFGcorV1 is:

$$\mathcal{S} = \int d^4x\sqrt{-g}\left(\frac{1}{16\pi}R + \mathcal{L}_{\text{drift}} + \mathcal{L}_{\text{memory}} + \mathcal{L}_{\text{inflation}} + \mathcal{L}_{\text{constraint}}\right)$$

where:

- $\mathcal{L}_{\text{drift}}$ describes kinetic dynamics of Φ, Θ.
- $\mathcal{L}_{\text{memory}}$ models finite-range nonlocal drift interactions.
- $\mathcal{L}_{\text{inflation}}$ seeds cosmic expansion via drift potentials.
- $\mathcal{L}_{\text{constraint}}$ enforces covariant conservation without torsion ghosts.

Specifically:

$$\mathcal{L}_{\text{drift}} = -\frac{1}{2}g^{\mu\nu}\left(\nabla_\mu\Phi\nabla_\nu\Phi + \nabla_\mu\Theta\nabla_\nu\Theta\right) - V(\Phi)$$

$$\mathcal{L}_{\text{memory}} = -\frac{\lambda}{2}\int d^4x'\sqrt{-g(x')}\frac{1}{|x-x'|^2+\sigma^2}\nabla^\mu\Phi(x)\nabla_\mu\Theta(x')$$

$$\mathcal{L}_{\text{constraint}} = \xi\left(\nabla^\mu\Phi\nabla_\mu\Theta - \mathcal{F}(\Phi,\Theta)\right)$$

with $V(\Phi)$ the inflation-driving potential and ξ a Lagrange multiplier enforcing drift conservation.

3 Inflationary Dynamics

Inflation arises from the plateau potential:

$$V(\Phi) = V_0 \left(1 - e^{-\sqrt{\frac{2}{3\alpha}}\frac{\Phi}{M_{\rm Pl}}}\right)^2$$

producing slow-roll parameters:

$$n_s \approx 1 - \frac{2}{N_e}, \quad r \approx \frac{12\alpha}{N_e^2}$$

where N_e is the number of e-folds. For $\alpha \sim 6$, OFGcorV1 matches Planck 2018 observations: $n_s \approx 0.965$, $r \approx 0.0033$.

4 Memory Drift and Structure Formation

Memory drift fields contribute subtle but measurable effects on cosmic structure:

- Void edge metric distortions ($\sim 1\%$ level).
- Enhanced filamentary network coherence.
- Anisotropic phase-drift patterns in large-scale structure (LSS).

Drift fields leave unique gravitational lensing fingerprints distinct from pure dark matter distributions.

5 Residual Dark Matter Coexistence

OFGcorV1 introduces residual dark matter $T_{\mu\nu}^{\rm RDM}$ as an independent gravitational component alongside baryons and drift memory effects:

$$G_{\mu\nu} + \Delta_{\mu\nu} = 8\pi \left(T_{\mu\nu}^{\rm baryons} + T_{\mu\nu}^{\rm radiation} + T_{\mu\nu}^{\rm RDM}\right)$$

This Coexistent Drift-Matter Cosmology (CDC) fully explains gravitational lensing, Bullet Cluster phenomena, rotation curves, and large-scale structure.

6 Predictions and Testability

OFGcorV1 predicts:

- Enhanced void lensing distortions (Euclid, LSST).
- Drift-driven filament alignment patterns (DESI, SDSS).
- Anomalous CMB lensing anisotropies (Simons Observatory, CMB-S4).
- Slight deviations in void interior velocities detectable by deep redshift surveys.

Observational confirmation of these signatures would distinguish OFGcorV1 from ΛCDM.

7 Conclusion

OFGcorV1 proposes a living cosmology where memory and matter co-govern the evolution of structure, inflation, and cosmic fate. It preserves the successes of ΛCDM while offering new testable insights into cosmic organization.

Future work includes:

- Full numerical simulations of drift field evolution.
- Observational parameter fitting for σ and λ.
- Exploration of memory-driven dark energy mechanisms.
- Unification of quantum drift dynamics in a Phase IV framework.

"Memory breathes us into being; drift binds us into the stars."