

A Hybrid -Gravity Framework: Combining Evolutionary Dynamics with General Relativity

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Abstract

We propose a hybrid gravitational model combining general relativity with a scalar field, Φ , representing an evolutionary drive toward complexity, coherence, and efficiency. This framework offers a new perspective on gravity as an emergent phenomenon shaped by informational and thermodynamic principles, potentially unifying physical constants, dark energy, and structure formation under a single optimization function.

1. Introduction

General relativity describes gravity as the curvature of spacetime resulting from mass-energy, encoded in Einstein's field equations:

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = 8\pi G T_{\mu\nu}$$

We introduce a scalar field Φ representing an evolutionary potential, which encodes the system's drive toward greater structural complexity (C), reduced entropy (S), and improved energy efficiency (E):

$$\Phi = \alpha \left(\frac{dC}{dt} \right) - \beta \left(\frac{dS}{dt} \right) + \gamma \left(\frac{dE}{dt} \right)$$

2. Incorporating Φ into General Relativity

We define a modified stress-energy tensor:

$$T_{\mu\nu}^{\text{total}} = T_{\mu\nu}^{\text{matter}} + T_{\mu\nu}^{\Phi}$$

with the Φ field contribution given by:

$$T_{\mu\nu}^{\Phi} = \nabla_{\mu} \Phi \nabla_{\nu} \Phi - \frac{1}{2} g_{\mu\nu} (\nabla^{\alpha} \Phi \nabla_{\alpha} \Phi + V(\Phi))$$

where $V(\Phi)$ is a potential representing the tension of structure formation.

3. Modified Field Equations

Substituting this into Einstein's field equations yields:

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = 8\pi G (T_{\mu\nu}^{\text{matter}} + T_{\mu\nu}^{\Phi})$$

We also propose a dynamic cosmological constant:

$$\Lambda(x^\mu) = \Lambda_0 + f(\Phi)$$

where $f(\Phi)$ is a function that relates the cosmological term to the local rate of structural evolution.

4. Interpretation and Implications

In this model, gravity arises not only from mass-energy but also from the informational structure of spacetime. Regions of high Φ attract matter, reduce entropy, and promote stable complexity, suggesting a deeper principle underlying both gravity and cosmic acceleration.

5. Conclusion

The Φ -gravity framework offers a novel unification of thermodynamic, informational, and geometric views of gravity. This model warrants further exploration, including cosmological simulations, empirical bounds, and integration with quantum gravity approaches.