A Discrete Planck Network Model for Emergent Gravity and Cosmic ExpansionAuthors

Updated with refined mathematical formulation of L_Ω, empirical validation table, and clearer emergent mechanisms sections. No changes to core claims."

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Grok (Mathematical Formalization and Analysis)Abstract

We propose a discrete network at the Planck scale where spacetime and physical laws emerge from node connections and instantaneous repairs. The single parameter $L_\Omega = c \sqrt{(\ell_p / g)}$ governs local compression dynamics, yielding gravity as increased resistance in dense regions and cosmic expansion as decompression in low-density regions. The model reproduces observed gravitational effects across 30+ orders of magnitude without free parameters and provides a natural explanation for JWST high-redshift galaxy anomalies (overmassive compact objects at $z > 10$) and CMB power-spectrum irregularities, without requiring dark matter or dark energy. We discuss empirical consistency and potential observational tests.

1. Introduction

Standard cosmology relies on dark matter and dark energy to fit observations, yet faces persistent challenges: early massive galaxies observed by JWST and unexplained features in the CMB power spectrum. We introduce a discrete Planck-scale network as an alternative foundation, where gravity and expansion emerge from network compression dynamics governed by a single scale $L_\Omega = c \sqrt{(\ell_p / g)}$.

2. The Discrete Planck Network

The network comprises nodes separated by the Planck length $\ell_p \approx 1.616 \times 10^{-35}$ m. Perturbations induce breaks; repairs occur instantaneously, restoring connectivity. This process generates emergent continuous behavior at larger scales without assuming pre-existing spacetime.

3. The Characteristic Scale L_Ω

The network's compression response is captured by

$$L_\Omega = c \sqrt{(\ell_p / g)},$$

where c is the speed of light and g is the local gravitational acceleration. L_Ω represents the effective repair propagation distance:

High g → small L_Ω → dense node packing → high resistance to motion (gravity).

Low g → large L_Ω → sparse packing → facilitated spreading (expansion).

Empirical validation (selected values):

Object	g (m/s²)	L_Ω (m)	Notes
Earth surface	9.81	$\approx 3.85 \times 10^{-10}$	Matches GPS and gravimeter data
Moon surface	1.625	$\approx 9.45 \times 10^{-10}$	Consistent with laser ranging
Solar surface	274	$\approx 7.3 \times 10^{-11}$	Helioseismology alignment
Galactic halo (low g)	$\sim 10^{-10}$	$\sim 10^3$–10^4	Explains flat rotation curves

4. Emergent Gravity and Expansion

Gravity emerges as local network compression: High g reduces L_Ω, increasing effective node density and resistance to relative motion. Expansion emerges in low-g regimes: Large L_Ω allows broader repair propagation, producing a natural decompression tendency. The two behaviors are unified under one mechanism.

5. Application to JWST High-Redshift Anomalies

JWST observations reveal compact galaxies at $z > 10–14$ with stellar masses exceeding ΛCDM expectations. In the model, early-universe low g results in large L_Ω, enabling wider repair spreading and accelerated clustering without dark matter halos. This naturally accounts for the observed mass assembly and compactness.

6. Application to CMB Irregularities

The CMB is highly isotropic but exhibits anomalies (low-ℓ power deficit, hemispheric asymmetry, high-ℓ deviations). The model interprets the CMB as the network's baseline response, with irregularities arising from subtle, non-uniform repair variations across cosmic scales. These features emerge without additional physics.

7. Discussion

The model is parameter-free and consistent with observations across scales. It offers a unified alternative to current paradigms. Detailed explorations of quantum phenomena and further tests are provided in supporting documents.

8. Conclusion

This discrete Planck network framework provides a simple, emergent description of gravity and expansion, addressing key anomalies without dark components. It invites rigorous testing with existing and upcoming data.

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