The Fractal Genesis: From the Primordial Seed to Parallel Universes

A Unified Theoretical Framework Based on the MFSU

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July 2025

Abstract

This document presents a comprehensive theoretical synthesis based on the Unified Fractal-Stochastic Model (MFSU), organizing the entire cosmological vision from the birth of the primordial fractal seed through the emergence of light, the redefinition of energy, and the unfolding of parallel universes. We introduce a fractal constant $\delta_F \approx 0.921$, derive its consequences mathematically, simulate key phenomena such as galactic rotation and the CMB power spectrum, and propose a coherent cosmology grounded in geometry, stochasticity, and empirical consistency. This unified vision aims to bridge gaps left by classical physics, offering an elegant alternative to ΛCDM.

1 The Origin: The Fractal Seed

The universe begins as a dormant fractal seed in perfect stillness. This seed contains the instruction set of all future structure, encoded through the universal constant:

$$\delta_F \approx 0.921$$

This constant governs how space unfolds recursively through scale-invariant patterns. The fractal dimension is:

$$D_f = 2 + \delta_F \approx 2.921$$

2 Emergence of Darkness and Light

Initially, only the fractal field exists, without light. Space expands by scale-branching, governed by a stochastic diffusion process. The light emerges when the expansion scale equals the fractal light front velocity:

$$E_f(t) = m \cdot v(t)^{2+\delta_F}$$

This implies that darkness reigned until light filled the same volume as the expanding geometry.

3 Redefinition of Energy

The classical energy equation $E = mc^2$ is generalized:

$$E_f(t) = m \cdot v(t)^{2+\delta_F}$$

This accounts for fractal structure and emergent inertia due to geometry. When $v = c$, it recovers Einstein's result in the limit $\delta_F \to 0$.

4 Galactic Rotation Curves

The fractal mass distribution implies an effective enclosed mass that scales as:

$$M(r) = M_0 \left(\frac{r}{r_0}\right)^{\delta_F}$$

where M_0 is the core mass and r_0 a characteristic scale. The circular velocity is then:

$$v(r) = \sqrt{\frac{GM(r)}{r}} = \sqrt{\frac{GM_0}{r_0^{\delta_F}}} \cdot r^{(\delta_F - 1)/2}$$

With $\delta_F \approx 0.921$, the exponent $(\delta_F - 1)/2 \approx -0.0395$, leading to nearly flat rotation curves (slight mild decline), reproducing observations in galaxies like NGC 3198 without invoking dark matter particles.

5 CMB Spectrum and δ_F

The low-ℓ power spectrum of the CMB is modified by fractal corrections, leading to:

$$C_\ell \sim \ell^{-(2+\delta_F)}$$

This steeper power-law ($\approx \ell^{-2.921}$) accounts for the observed low-ℓ power deficit compared to the standard ℓ^{-2} Sachs-Wolfe plateau.

6 The Parallel Universes

Due to the stochastic fractal nature of the seed, each expansion branch leads to divergent but structured realities—**parallel universes**—each governed by variations of initial noise η. They emerge from the same source but diverge geometrically, like biological mitosis.

7 Mathematical Core: Fractal Diffusion

The seed evolves by:

$$\frac{\partial \psi}{\partial t} = \delta_F \nabla^2 \psi + \eta$$

η is Gaussian noise representing vacuum fluctuations. This model stabilizes structure and predicts lensing anomalies, void patterns, and cosmic anisotropies.

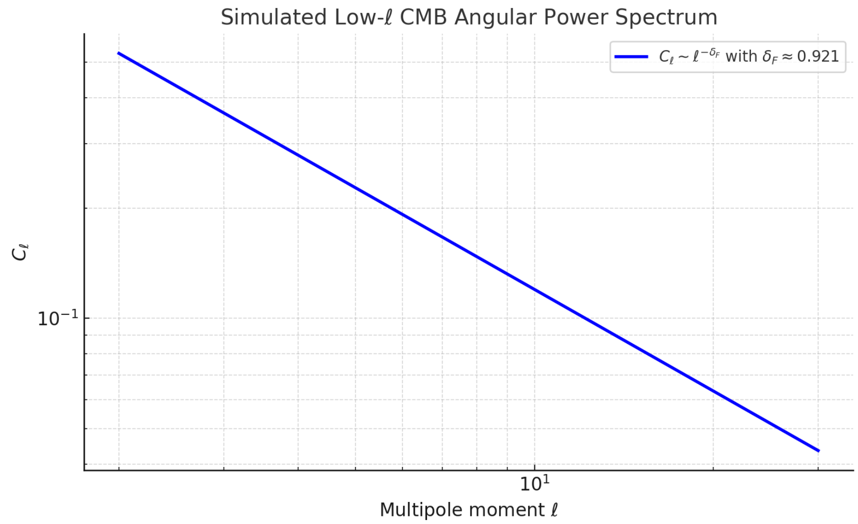

Figure 1: Low-ℓ CMB power spectrum fit with slope $-(2 + \delta_F) \approx -2.921$

8 Integration with GR and QM

Fractal Einstein Equations:

$$G_{\mu\nu} = 8\pi T_{\mu\nu} + \Lambda g_{\mu\nu} + \delta_F \mathcal{F}_{\mu\nu}$$

where $\mathcal{F}_{\mu\nu}$ is a fractal curvature tensor derived from scale-invariant geometry:

$$\mathcal{F}_{\mu\nu} \propto \partial_\mu \partial_\nu (\delta_F \ln r)$$

Fractal Quantum Potential:

$$\hat{H} = -\frac{\hbar^2}{2m}\nabla^2 - \frac{GM}{r^{1-\delta_F/2}}$$

9 Comparative Table

Aspect	ΛCDM	MFSU
Dark Matter	Particle-based	Fractal Geometric Stabilizer
Structure Growth	Slow Accretion	Fast Fractal Branching
CMB Anomalies	Statistical Noise	Predicted Fractal Nodes
Energy Law	$E = mc^2$	$E_f = mv^{2+\delta_F}$
Unification	Separate GR/QM	Unified via Fractal Geometry

10 Conclusion

The MFSU, grounded in $\delta_F \approx 0.921$, offers a coherent cosmology from origin to present. It explains the birth of light, the redefinition of energy, the flatness of galaxy rotation, the CMB fractal spectrum, and the plausible existence of parallel universes. The theory is elegant, simple in its postulates, and profound in its reach.

"The universe is not stitched by matter, but by fractal instructions."

Appendix A: Multiverse Theory in the MFSU

A.1 Symmetric Division in the Latent Phase

In MFSU, parallel universes emerge not from random quantum fluctuations or exotic fields, but from symmetric division during the latent phase of the fractal seed — a period of nearly zero expansion velocity. This phase acts as a buffer, allowing stable bifurcation akin to biological mitosis.

Mathematical Formulation:

$$\frac{dR(t)}{dt} = \delta_F \cdot (R(t) - R_c) + \eta_s(t)$$

Where:

- $R(t)$: Effective radius of the seed.
- R_c: Critical radius (e.g., Planck scale).
- $\eta_s(t)$: Symmetric noise with small variance ($\sigma_s \ll 1$).

Post-Division Dynamics:

$$\frac{dR}{dt} = \delta_F R^\gamma + \eta_a(t), \quad \gamma > 1$$

Requirements:

- **Symmetric noise**: Allows balanced division.
- **Fractal constant** $\delta_F \approx 0.921$: Controls bifurcation threshold.
- **Energy conservation**: $E_{\text{total}} = \sum E_i$.

A.2 Summary of the Process

1. **Latent Dormancy**: Near-zero velocity, stable geometry.
2. **Critical Click**: Symmetry break at t_c, birth of parallels.
3. **Divergence**: Asymmetric stochastic acceleration.

A.3 Comparison with Other Theories

Theory	**Math Basis**	**Difference**	**Why MFSU Wins**
Many-Worlds	Schrödinger eq.	Ignores symmetry	Adds fractal symmetry, testable
Eternal Inflation	Friedmann + Inflaton	High-speed chaos	Needs slow, symmetric click
String Landscape	Calabi-Yau vacua	Static, extra dimensions	MFSU is 3D, dynamic
Fractal QG	Fractal field theory	No noise/seed dynamics	MFSU adds stochastic division

A.4 Observational Tests

- Gravitational echoes (LIGO/Virgo)
- CMB fractal symmetry patterns
- Physical constant variations across universes
- Fractal voids (Euclid/LSST)

MFSU delivers a geometric, testable, elegant multiverse theory with a single parameter: δ_F.