A Unified Theory of Everything

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Abstract

This paper proposes a unified framework integrating all four fundamental forces—gravity, electromagnetism, the strong nuclear force, and the weak nuclear force—within a String/M-theory-based higher-dimensional model. The Big Bang is reinterpreted as a higher-dimensional supernova or brane collision, naturally resolving the singularity problem and connecting cosmology with quantum gravity. The model yields testable predictions, including unique gravitational wave spectra, cosmic microwave background imprints, and potential dark matter/energy explanations.

1. Introduction

The pursuit of a 'Theory of Everything' has been a central goal in physics, aiming to reconcile general relativity with quantum mechanics. Traditional approaches have struggled with the incompatibility between gravity and the quantum field framework. This work introduces a brane cosmology approach grounded in String/M-theory that embeds our 4-dimensional universe in a higher-dimensional space, allowing all forces to emerge from a single geometry.

2. Core Equation

The unification is encapsulated in a modified Friedmann equation derived from the brane-world scenario: (H^2) = (8πG/3)ρ (1 + ρ / 2λ) + (Λ_4 / 3) + (■ / a^4) - (k / a^2) Here, λ is the brane tension, Λ■ the 4D cosmological constant, and ■/a■ represents dark radiation from bulk graviton effects.

3. Predictions and Implications

1. Distinct gravitational wave background with a broken power-law spectrum from the brane blast. 2. Natural emergence of dark radiation and possible explanation of extra relativistic degrees of freedom. 3. High-energy corrections to early universe expansion (t^(1/4) scaling) as direct quantum gravity signatures. 4. Potential resolution of the hierarchy problem via warped extra dimensions.

4. Conclusion

This framework not only unifies all four forces under one consistent mathematical structure but also provides experimentally testable predictions, bridging the gap between cosmology and quantum gravity. If validated, it could represent a major leap toward understanding the ultimate laws governing our universe.

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