

Special Project 14 Zero-Sum Model of Cosmic Evolution: From Potential Energy to Entropy

Abstract

This paper presents a zero-sum model of cosmic evolution, proposing that the universe began in a high-entropy, balanced state of potential energy. Through an inflationary-like phase, this potential shifts into structured forms, generating space, time, forces, and matter. As entropy increases, the universe returns to its initial state, completing a cycle from equilibrium back to equilibrium. Space and time, in this view, are emergent properties of this process. This model offers an alternative framework to traditional inflationary theory by positioning the universe as a self-contained, zero-sum system.

1. Introduction

The standard cosmological model describes the universe's formation as an inflationary expansion from an extremely dense, low-entropy state. However, the origin of matter, energy, and space-time remains uncertain, with fundamental questions about how the universe could emerge from "nothing." This paper offers an alternative approach: a zero-sum model, where the universe cycles from a balanced, high-entropy state of potential energy, through inflation, to the formation of structure and forces, and ultimately back to equilibrium.

2. Initial High-Entropy Balance of Potential Energy

In this model, the universe begins in a state of high entropy, balanced as potential energy. This potential energy exists as a latent, neutral field, holding all possible states without distinct forms. This balanced state represents a "zero" starting point, where all possibilities are held in equilibrium.

3. Inflationary Period: Breaking Equilibrium

The inflationary phase marks the transition from balanced potential to structure, "stretching" this potential into space and time and initiating the break-

down into distinct forms of energy. The energy requirements for creating space and time are inherently uncertain, but inflation here represents the smooth unfolding of potential into dynamic forms.

4. Emergence of Forces, Matter, and Space-Time

As inflation slows, distinct forces, particles, and space-time emerge, driven by the breakdown of equilibrium. In this model, space and time are viewed as emergent properties, appearing naturally from the initial balanced state of potential energy.

5. Entropy Increase and Return to Balance

As matter and energy evolve within space-time, entropy increases, reflecting the universe's movement back toward the initial high-entropy balance. Entropy serves as the mechanism that gradually restores the universe to a zero-sum state.

6. Comparison with Standard Inflationary Theory

A critical distinction between the Standard Inflationary Model and the Zero-Sum Potential Energy Model lies in their explanations of the universe's origins and fundamental processes:

6.1 Origins and Initial Conditions

Standard Inflationary Theory: Begins with a dense singularity containing all energy, mass, and physical laws. However, the origin of this singularity, along with its energy and laws, remains unexplained.

Zero-Sum Potential Energy Model: Posits that the universe begins in a balanced, high-entropy state of potential energy, requiring no singularity or external energy source. This model provides a defined source for the universe's energy and laws, as they emerge naturally from the transition of potential energy to structured form.

6.2 Role of Entropy

Standard Inflationary Theory: Entropy begins in a low state after inflation, increasing as the universe evolves, without an expected return to balance.

Zero-Sum Potential Energy Model: Entropy starts in a balanced, high-entropy state. After the creation of structured forms, entropy increases over time, returning the system to a zero-sum state.

6.3 Space and Time Creation

Standard Inflationary Theory: Assumes pre-existing space-time that inflates rapidly. The origin of space-time itself is not explained.

Zero-Sum Potential Energy Model: Views space and time as emergent properties that unfold naturally during the inflationary-like expansion of potential energy.

7. Key Difference: Explanation of Origins

The Zero-Sum Potential Energy Model provides a foundational explanation for the origins of the universe's energy, structure, and laws, positioning them as natural outgrowths of balanced potential energy. Unlike the standard model, which assumes an unexplained singularity, this model suggests that the universe's evolution is a closed-loop cycle, beginning and ending in a balanced state without needing arbitrary initial conditions.

Conclusion

This zero-sum model of cosmic evolution proposes a universe beginning in balanced potential energy, transitioning through inflation, and returning to equilibrium through entropy. This framework presents a self-contained, cyclic model that addresses the origin of matter, energy, and physical laws, offering an alternative to the Standard Inflationary Theory.