ABSTRACT

Einstein's introduction of time as the fourth dimension reshaped our understanding of the universe. Building on that foundation, this paper presents an emergent dimensional framework for unified physics, in which three foundational constraints—Zero (collapse), Infinity (expansion), and Chance (probability)—arise as structural dimensions alongside space and time. These emergent dimensions address long-standing gaps in physics, including quantum randomness, cosmic acceleration, and the resolution of singularities, by embedding probabilistic and entropic behavior directly into the metric.

The resulting model augments general relativity through an expanded metric tensor, yielding modified Einstein field equations and reformulated Friedmann equations. This geometric approach explains the universe's accelerated expansion without invoking dark energy and preserves curvature continuity through singularity collapse.

Crucially, the Chance dimension provides a geometric basis for quantum uncertainty, bridging probabilistic and deterministic descriptions within a unified system. The model predicts testable, falsifiable deviations in gravitational wave polarization, quantum interference, and vacuum fluctuation profiles—offering a path to quantum gravity without requiring field quantization.

A formal proof is provided demonstrating that general relativity is recovered as a limiting case of this framework under dimensional collapse (see Appendix 11). Supporting appendices include detailed derivations and scaling laws. This work recasts space-time not as a backdrop, but as a consequence of deeper geometric and probabilistic necessity.