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Complete Theory of Simplicial Discrete Informational Spacetime: Towards a Predictive and Testable Theory of Quantum Spacetime

This paper introduces the Complete Theory of Simplicial Discrete Informational Spacetime. This meticulously constructed and self-contained theoretical framework is designed to address the profound challenges at the intersection of quantum mechanics and gravity. It offers a novel perspective on cosmology and the emergence of spacetime. The framework is rigorously developed and exhaustively defined, proposing a paradigm shift beyond the classical continuum to a fundamentally discrete and informational spacetime. At its core is the concept of simplicial chronotopes, indivisible quanta of spacetime and information, mathematically realized as regular 4-simplices. This work provides a complete and detailed exposition of the theory, from its primitive definitions rooted in Planck-scale quantization to its dynamical laws, emergent phenomena, and testable predictions. Crucially, the framework provides detailed derivations for key parameters, such as the Poisson ratio and spacetime stiffness, grounded in the symmetry and elastic response of the 4-simplex and linked to Planckian energy density and holographic entropy scaling. Through a synergistic combination of Non-commutative Geometry and Quantum Information Theory, the theory addresses the quantum-to-classical transition, singularity avoidance, and the emergence of classical gravity. It offers a mathematically rigorous and physically plausible pathway towards a predictive and testable theory of quantum spacetime and gravity

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