UNNS Space–Time Geometry: Metrics, Curvature, and Dynamics

Abstract

We develop a space–time geometry within the UNNS (Unbounded Nested Number Sequences) substrate. In UNNS, space emerges from recursive embeddings of lattices, while time arises as recursion depth governed by operators. This paper defines UNNS metrics, introduces a notion of curvature for recursive lattices, and sketches an analog of Einstein's equations in the UNNS framework.

1 Introduction

Classical geometry treats space–time as a smooth manifold equipped with a metric. In UNNS, both space and time emerge discretely: time as operator recursion depth, space as lattice embedding spread. The challenge is to unify these into a geometric substrate with metric and curvature.

2 UNNS Space–Time Substrate

Definition 1 (UNNS Space–Time)**.** *The UNNS space–time substrate is*

$$\mathcal{ST} = \{(\Lambda_k, T_i) \mid k \in \mathbb{N}, i \in \{1, \dots, 8\}\},$$

where Λ_k is the k-th lattice layer from recursive embedding and T_i is the temporal measure induced by operator O_i.

Thus, space is horizontal lattice spread, time is vertical recursion depth. Each operator contributes its own arrow of time.

3 Metrics in UNNS

Definition 2 (UNNS Metric)**.** *Let x, y be two events in $\mathcal{ST}$. Define*

$$d_{\mathcal{ST}}(x, y) = \alpha \cdot d_{\text{time}}(x, y) + \beta \cdot d_{\text{space}}(x, y),$$

where d_{time} is recursion depth distance, d_{space} is lattice embedding distance, and α, β are operator-dependent weights.

This metric generalizes Minkowski distance by combining vertical and horizontal recursion measures.

Remark 1. *Unlike Minkowski space, where the metric is fixed, in UNNS the weights α, β may vary depending on operator choice (inletting, repair, etc.), producing multiple coexisting metrics.*

4 Curvature of Recursive Lattices

Definition 3 (Recursive Curvature)**.** *Given a lattice embedding Λ_k, define curvature at level k as*

$$\kappa_k = \frac{\Delta d}{\Delta k},$$

where d measures adjacency distortion as new lattice layers are added.

Intuitively, $\kappa_k > 0$ indicates expansion (as in inletting), while $\kappa_k < 0$ indicates contraction (as in repair).

5 UNNS Einstein Analog

Theorem 1 (UNNS Field Equation, informal)**.** *Let $\mathcal{G}$ denote recursive curvature and $\mathcal{T}$ denote operator time stress. Then the UNNS field equation is*

$$\mathcal{G} = \gamma \cdot \mathcal{T},$$

where γ is a universal scaling constant.

Sketch. Recursive curvature measures how embeddings distort adjacency. Operator time stress measures how deep recursion flows. The proportionality reflects conservation: distortion of space arises from operator-time flows. □

Remark 2. *In physics language:* operator recursion generates curvature in UNNS space, just as energy–momentum generates curvature in Einstein's theory.

6 Visualization

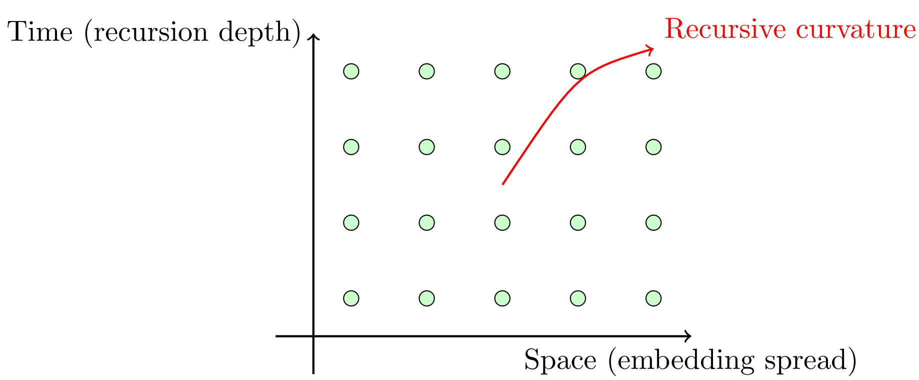

Figure 1: UNNS space–time: vertical recursion as time, horizontal embedding as space, curvature as lattice distortion.

7 Applications

- **Physics:** Inletting curvature may correspond to dark energy expansion; Repair curvature to entropy-driven contraction.

- **Mathematics:** Connects algebraic number theory lattices with geometric curvature.
- **Philosophy:** Suggests that space–time is emergent from recursion rather than fundamental.

8 Conclusion

UNNS defines space–time as a duplex of recursion depth and lattice embedding. With metrics and curvature, one obtains a UNNS field equation: recursive time stress generates recursive curvature. This framework provides a number-theoretic, recursion-based alternative to Einsteinian geometry, potentially explaining large-scale physical phenomena such as dark matter and dark energy.