Cosmos Time Crystals Holography Minimal Ground Publication V1

Abstract

This publication provides a structured synthesis for Cosmos Time Crystals Holography Minimal Ground Publication V1, with claim-to-evidence framing and a validation path for downstream readers.

Keywords

cosmos, research, publication

Main Content

Time Crystals, Holography, and Quantum Information: A Minimal Coherence Framework

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Abstract

We present a compact synthesis connecting Floquet time-crystal dynamics, holographic coarse-graining, and operator-level coherence constraints. Rather than over-claiming unification, we construct a minimal testable scaffold that separates established results from speculative bridges. The framework defines measurable coherence criteria and explicit falsification hooks suitable for numerical and conceptual evaluation.

Keywords   time crystals; Floquet dynamics; holography; quantum information; coherence operators

1   Introduction

Time-crystal discourse often blends distinct layers: equilibrium no-go results, non-equilibrium Floquet order, and broader information-theoretic interpretations. This paper imposes a minimal common language so each claim is tied to assumptions, observables, and failure conditions.

2   Coherence Functional

Let ρ_t denote a reduced state over a bounded operator algebra. We define a periodic coherence witness over one drive period T:

$$\mathcal{C}_T = \frac{1}{T} \int_0^T \mathrm{Tr}(\rho_t \, \mathcal{O}_c) \, dt, \tag{1}$$

where $\mathcal{O}_c$ is a coherence-sensitive bounded observable.

For perturbation family $\{\epsilon\}$, coherence drift is

$$\Delta_\epsilon = |\mathcal{C}_T(\epsilon) - \mathcal{C}_T(0)| . \tag{2}$$

3   Stability Threshold

With stroboscopic map Φ_T, robust regime membership is declared only when

$$\sup_{\epsilon \in [0, \epsilon_0]} \Delta_\epsilon < \delta_*, \tag{3}$$

for pre-registered tolerance δ_*. Violations indicate fragile coherence and block strong interpretive claims.

4 Emergent Geometry Protocol

We compare boundary and reconstructed proxies using a coarse-graining channel $\mathcal{R}$. Consistency is evaluated by

$$\left| \mathcal{C}_T^{\partial} - \mathcal{C}_T^{\text{bulk}} \right| \leq \eta, \tag{4}$$

where η is reported as model error (not absorbed narratively). In local parameter chart θ, geometry diagnostics can be approximated through Fisher information:

$$g_{ab}(\theta) = \sum_x p(x \mid \theta) \, \partial_a \log p(x \mid \theta) \, \partial_b \log p(x \mid \theta). \tag{5}$$

Validation and Falsification

- Sweep drive-noise amplitude and detect breakdown of the stability threshold.

- Replace $\mathcal{O}_c$ with orthogonal witness families to test basis sensitivity.

- Reject holographic interpretations if boundary–bulk coherence mismatch remains high in controlled toy models.

Conclusion

The manuscript provides a cleaner publication baseline: assumptions are explicit, equations are legible, and interpretive claims are paired with concrete failure criteria.