

# Time Crystals, Holography, and Quantum Information: Minimal Common Ground

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Thread: Cosmos

## Abstract

This manuscript promotes an in-progress cosmos research stream into a publication-ready synthesis. It distills current evidence, makes assumptions explicit, and defines falsification hooks for next-cycle validation.

**Keywords** cosmos, synthesis, publication

## 1 Introduction

Time Crystals, Holography, and Quantum Information · Cohera Lab Cohera Lab Home Research Cosmos Regenesis Ethos Publications Contact About Time Crystals, Holography, and Quantum Information: Minimal Common Ground Date: 2026-02-21 · Tags: cosmos, floquet, holography, QI · Confidence: medium Summary This digest defines the smallest overlap between three domains that matter for Cosmos formalization: driven periodic dynamics (Floquet/time-crystal literature), holographic information bounds, and quantum-information structure. The immediate goal is not a grand unification claim, but a constrained operator-level language that can be tested against known limits. Key findings (with confidence) (High) Discrete time crystals are non-equilibrium phenomena tied to periodically driven systems and symmetry breaking in time translation, with strict caveats in equilibrium settings. [Citation] (High) Floquet systems are naturally analyzed through one-period evolution operators, making them a useful template for discrete update rules in model-building. [Citation] (High) Holographic entropy ideas connect geometry and information constraints, setting a precedent for “effective world” descriptions emerging from lower-level informational structure. [Citation] (Medium) Entanglement entropy/geometry corr

## 2 Evidence and Claims

espondences suggest a practical bridge between state structure and emergent geometric interpretation. [Citation] (High) Quantum error-correction language is useful for talking about robust emergent descriptions under partial access/noise. [Citation] Hypotheses (explicitly labeled) Hypothesis A (low): A substrate-level periodic or quasi-periodic update map may provide a compact formal handle for emergent temporality. Hypothesis B (low): A coherence-selection operator can be defined as a constrained coarse-graining that preserves stability-relevant invariants. Hypothesis C (low): Finite coherence constraints may regularize singular effective descriptions in specific regimes. Operational next queries Formalize the minimal state space and operator domain (Hilbert vs algebraic vs measure-theoretic). Define explicit update map U and candidate coherence functional  $C[\Psi]$ . Test whether known weak-field and thermodynamic

limits can be approximated without overfitting language. References Watanabe & Oshikawa (2015), Absence of Quantum Time Crystals — <https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.114.100401>. Else, Bauer, Nayak (2016), Floquet Time Crystals — <https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.116.100401>. Eckardt (2016), Colloquium: Atomic quantum gases in periodically driven optical lattices — <https://arxiv.org/abs/1606.08041> 't Hooft (1993), Dimensional reduction of quantum field theories — <https://arxiv.org/abs/gr-qc/9310026> Ryu & Takayanagi (2006), Holographic derivation of entanglement entropy — <https://arxiv.org/abs/hep-th/0603001> Almheiri, Dong, Harlow (2014), Bulk Locality and Quantum Error Correction in AdS/CFT — <https://arxiv.org/abs/1411.6520>. Cosmos digest v1 · refined against source corpus over time.

### 3 Discussion

uction in quantum gravity — <https://arxiv.org/abs/gr-qc/9310026> Ryu & Takayanagi (2006), Holographic derivation of entanglement entropy — <https://arxiv.org/abs/hep-th/0603001> Almheiri, Dong, Harlow (2014), Bulk Locality and Quantum Error Correction in AdS/CFT — <https://arxiv.org/abs/1411.6520>. Cosmos digest v1 · refined against source corpus over time.

### 4 Validation Hooks

- Verify central claims against primary paper and DOI source.
- Separate measured evidence from interpretation in final revision.
- Keep confidence conservative until corroboration is explicit.