The Non-Singular Core

A TCQS Cosmology of Black Holes and Coherence-Collapse Without Singularity

Abstract

In the Time-Crystalline Quantum Substrate (TCQS), gravitational collapse is a coherence-driven process rather than a divergence of spacetime curvature. This framework eliminates the possibility of singularities by imposing a fundamental lower bound on the coherence density of the substrate, ensuring that no region of the universe can collapse to zero volume or infinite curvature. Black holes are reinterpreted as coherence attractors whose interiors stabilize into finite-radius, maximum-coherence phases rather than singularities. This paper presents the TCQS cosmological description of black holes, explains the coherence-regulated mechanism of collapse, and demonstrates the continuity between non-singular black-hole cores and the broader TCQS principle of a universe without beginning.

1 Introduction

Classical general relativity predicts that gravitational collapse inevitably produces singularities: regions in which spacetime curvature diverges and physical description breaks down. The TCQS framework rejects this outcome on structural grounds. Because the substrate is a time-crystalline coherence field with a non-zero Floquet periodicity and a finite coherence density floor, no collapse process can ever reach a state of infinite curvature or zero spatial extension.

This cosmological reinterpretation aligns naturally with the broader TCQS model of a universe without beginning, in which simultaneous emergence replaces singular origin scenarios. Here, we examine how the same principles apply within gravitationally collapsed regions.

2 Coherence-Based Gravity

In the TCQS, gravity is not a geometric distortion of spacetime but a reconfiguration of the vacuum-coherence field. Matter and energy trace coherence-flow lines; mass generates gradients in the coherence density, and these gradients define gravitational attraction.

Collapse occurs when coherence-flow lines inwardly fold due to extreme gradients, but this folding is limited by the substrate's intrinsic coherence structure. Because every region of the TCQS maintains a finite, irreducible coherence floor, collapse cannot proceed indefinitely. Instead, collapse is *regulated* by coherence.

3 Black Holes as Coherence Attractors

A black hole is understood as a region in which coherence gradients become sufficiently steep that information, radiation, and matter are directed inward toward a stable coherence basin. Rather than collapsing to a mathematical point, the collapsing structure undergoes a phase transition into an ultra-ordered configuration of the vacuum-coherence field.

This reinterprets black holes not as pathological objects but as *coherence attractors*—regions where the substrate reaches a saturated phase of maximum order.

4 The Non-Singular Core

At the center of a TCQS black hole lies not a singularity but a **Coherence-Stabilized Core (CSC)**. This core is characterized by:

- a finite radius determined by coherence-density limits,
- a maximum-coherence phase of the substrate,
- suppressed entropy via coherence-ordering dynamics,
- a breakdown of classical spacetime description and replacement by coherence-metric geometry.

The classical concept of a singularity is replaced by a boundary beyond which the spacetime metric loses physical meaning, and the coherence-metric becomes the dominant descriptor.

5 Information Retention and Re-Encoding

Because the TCQS does not permit collapse to a point, the information paradox does not arise. Information entering a black hole is not destroyed; instead, it becomes encoded into quasi-crystalline coherence structures inside the CSC. These patterns correspond to stable configurations of the vacuum-coherence field that preserve informational content without requiring emission from the horizon.

This mechanism mirrors the global TCQS process in which information across the universe is preserved through coherence cycles rather than erased through entropy.

6 Relation to Simultaneous Emergence

The impossibility of singularities in black holes reflects the same principle that forbids a singular cosmological beginning. In both cases:

- the substrate cannot collapse to zero volume,
- coherence floors limit extremal behavior,
- information is always preserved,
- transitions occur through phase changes, not divergences.

Thus, black holes are not exceptions to cosmic behavior—they are local expressions of the universal coherence rules that govern all TCQS dynamics.

7 Conclusion

The TCQS removes singularities from cosmology by grounding gravitational collapse in coherence dynamics rather than geometric blow-up. Black holes possess finite, non-singular, coherence-stabilized cores whose behavior is continuous with the broader TCQS view of a universe without beginning and without singularities. This reformulation unifies cosmology, gravitation, and information theory within a single coherence-bound framework.

Keywords: TCQS, coherence field, non-singular black holes, vacuum coherence, gravitational collapse, information preservation, cosmology.