

## Section 11. Horizon Emergence and Boundary Physics

The previous sections established that the relevant boundaries in Paper A-12 are state boundaries rather than geometric walls, and that cosmological evolution in the CUWF framework is governed by coherence, accessibility, collapse, and recordability rather than by spacetime picture alone. On that basis, the concept of horizon must also be reformulated.

In standard cosmology, horizons are often treated primarily as geometric or causal limits—surfaces beyond which signals cannot reach a given observer. CUWF shifts the interpretive level. A horizon is not first a spatial edge. It is a state boundary: a limit of coherence, compatibility, and recordability within the wave field.

### 11.1 Boundary Redefined: from Geometry to State

CUWF distinguishes sharply between spatial boundaries and state boundaries. A spatial boundary would be a geometric edge, an enclosing shell, or a literal outer surface of the universe. A state boundary, by contrast, is a limit beyond which coherent structure and stable records can no longer be sustained.

In Paper A-12, the universe has no spatial wall. There is no literal rim of space, no external shell, and no geometric container beyond which the universe simply stops. What appears as a cosmological boundary is instead the outer limit of sustained coherence within the field.

Beyond this limit, the wave field does not disappear. Rather, phase-relations fail to remain mutually compatible, collapse cannot complete into stable record-bearing outcomes, and persistent structure ceases to be maintainable. The boundary is therefore not the edge of existence. It is the edge of recordable structure.

## 11.2 Horizon Emergence as a Coherence Limit

A horizon emerges when the wave field passes from a regime in which phase-locking and collapse can generate persistent records into a regime in which coherence can no longer be maintained strongly enough for compatible closure.

This transition is not best imagined as a sharp line drawn in geometric space. It is better understood as a gradual change in state support. On one side of the transition, coherent structures remain sufficiently stable for records, awareness, and structured history to exist. Beyond it, fluctuations continue, but they fail to close into mutually compatible recordable configurations.

The horizon therefore marks the boundary of recordability, not the boundary of being. Reality does not end at the horizon. Recordable, coherent accessibility does.

## 11.3 Horizons as Observer-Independent but Awareness-Limited

In CUWF, the horizon is not created by an observer. It is a field-property. The coherence limit exists whether or not a specific observer is present to recognize it. In that sense, the horizon is observer-independent.

Yet the horizon is experienced as an awareness limit because awareness can operate only where stable records exist. Observers do not generate the horizon, but they are bounded by it. Awareness cannot access what the field itself does not support as persistent, compatible structure.

The correct formulation is therefore: horizon equals the boundary of coherent accessibility, not the boundary of reality. This distinction is crucial because it prevents the common slide from observational inaccessibility to ontological non-existence.

## 11.4 Horizon Dynamics across the Cosmic Breathing Cycle

Horizons are not static. They evolve across the Cosmic Breathing cycle because the field's ability to sustain coherence changes with entropy accumulation, configurational accessibility, and collapse pressure.

During phases of increasing entropy, compatible configurations are progressively exhausted and effective DOF becomes increasingly constrained. As this happens, the region over which the field can sustain coherent recordable structure contracts in state-space terms. This inward movement should not be mistaken for a literal geometric contraction of the universe. It reflects a reduction in coherence support, not a shrinking of a spatial container.

As entropy accumulates, more families of configurations become closed. The remaining accessible space capable of supporting stable phase compatibility narrows. The field can therefore maintain coherent structure only within increasingly constrained regions of its state architecture.

At the limiting case, the horizon approaches coincidence with a state boundary: effective DOF approaches a minimum, entropy approaches saturation relative to the accessible domain, and recordability breaks down. Beyond this threshold, the wave field remains real, but stable coherence can no longer close and records can no longer persist.

The horizon thus marks not the end of the universe, but the limit of recordability imposed by entropic saturation and coherence failure within the wave field.

### 11.5 Why “Outside the Horizon” Is the Wrong Question

From the CUWF perspective, the question “what exists outside the horizon?” is already framed misleadingly if it suggests a literal outside analogous to the far side of a wall. What lies beyond the horizon is not a separate spatial region in the ordinary sense, but a regime beyond the limit of recordability.

The correct answer is therefore not “nothing.” It is the wave field in a state where coherent closure cannot be sustained. Existence continues, but it is no longer available in recordable structured form.

This reframing matters because it preserves a strict distinction between inaccessible structure and non-existence. The horizon does not divide being from non-being. It divides recordable coherence from non-recordable field-regime.

## Closing Synthesis

Horizon physics in Paper A-12 therefore completes an important conceptual loop. Horizons are state boundaries, not spatial walls. They emerge from coherence and collapse dynamics rather than from geometry alone. They limit recordability and awareness, not existence itself. And they evolve throughout the Cosmic Breathing cycle as entropy accumulates and the field's coherence-supporting capacity changes.

Once reformulated in this way, horizon emergence becomes a direct consequence of the same ontology that governs cosmogenesis, collapse, near-stillness, and re-excitation. The next sections can therefore build on this result without reverting to wall-like or purely geometric intuitions of cosmic boundary.