Pristine Duration at the Event Horizon: Taking the Measure–Constituent Entanglement to Its Logical Conclusion

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Theoretical Proposal

The event horizon presents an extreme epistemological problem: the measures used to describe a physical condition have become entangled with the condition itself. The Schwarzschild radius is treated as though it were the event horizon, while the apparent cessation of exterior time is treated as though unfolding itself had ceased. In both cases, a successful metric expression acquires the ontological status of what it measures. This proposal takes these two measure–constituent entanglements to their logical conclusions and uses the event horizon as the limiting condition through which they can be untangled.

Throughout this proposal, entanglement refers exclusively to the epistemological fusion of measure and constituent. It does not refer to quantum entanglement, nonlocal correlations, or any proposed quantum mechanism at the event horizon. Measure–constituent entanglement identifies the conceptual conflation through which the Schwarzschild radius is treated as the event horizon and time is treated as duration.

For a non-rotating, uncharged black hole, the Schwarzschild radius is expressed as:

$r_s = 2GM/c^2$ (Schwarzschild, 1916). This equation identifies the radius at which the event horizon occurs. It does not follow, however, that the calculated radius and the causal-geometric condition are identical: $r_s \neq H$

Radius ≠ Horizon.

The Schwarzschild radius is the spatial measure of the event horizon. The event horizon is the causal-geometric condition being measured. The radius specifies where the boundary occurs; it does not constitute the boundary. The event horizon is not a material surface or a numerical value. It is the condition beyond which future-directed signals can no longer reach the exterior Finkelstein, 1958). Treating the Schwarzschild radius as the event horizon entangles the metric location of the condition with the condition itself.

The same epistemological entanglement occurs between time and duration. At the event horizon, the rate of an infalling clock approaches zero relative to the temporal coordinates of observer (Einstein, 1939). From that exterior description, the infalling object appears to approach the horizon asymptotically without completing the crossing. Yet the object crosses the horizon in finite proper time, and its local physical unfolding continues (Oppenheimer & Snyder, 1939; Finkelstein, 1958). The exterior temporal measure reaches its limiting condition without the measured unfolding reaching an equivalent limit.

Therefore:

$t \neq D$

Time ≠ Duration.

Time measures unfolding; duration constitutes it (Martinez, 2026a, 2026b). Coordinate time measures the relationship between an event and an exterior frame of reference. Proper time

measures the unfolding along the local worldline. Neither coordinate time nor proper time produces, contains, or causes the unfolding it measures. They are different temporal metrics applied to a duration that remains constituent.

This distinction exposes a contradiction concealed within the common statement that "time stops at the event horizon." If space and time constitute an indivisible spacetime, and time literally ceases at the event horizon, then spacetime—and therefore spatial existence—should also cease there. The object should not cross the horizon because there would be no continuing spacetime within which crossing could occur. Yet local existence and physical unfolding continue across the horizon. What reaches its limit cannot therefore be the constituent of existence. It is the exterior temporal measure and its capacity to maintain correspondence with the continuing event.

The event horizon consequently takes both entanglements to their limiting expressions. Spatially, the Schwarzschild radius becomes fused with the horizon it measures. Temporally, the apparent cessation of exterior clock time becomes fused with the duration it measures. Untangling them reveals a parallel architecture:

$r_s \neq H$

$t \neq D$

The Schwarzschild radius measures the spatial location of the event horizon without constituting the horizon. Time measures the temporal relations of duration without constituting duration. In both cases, the measure remains valid within its descriptive jurisdiction. The epistemological error occurs when measurement is converted into ontology.

A related measure–constituent separation appears at the gravitational–kinematic temporal equivalence threshold. At this threshold, the gravitational and kinematic effects on comparative clock rate are equal and opposite, producing a zero net difference (Ashby & Nelson, 2010):

$\Delta\dot{\tau} = 0$

Gravity and velocity remain active, and both systems continue unfolding; only the difference between their temporal measurements becomes zero. The threshold is therefore a durational equivalence expressed through time, not a condition caused by time. It provides an intermediate limit case: at the threshold, temporal difference becomes zero while duration continues in both systems; at the event horizon, exterior temporal correspondence approaches zero while local duration continues. In both cases, zero belongs to the measure, not the constituent.

The event horizon offers the most stringent theoretical condition for testing this distinction because temporal measurement and causal accessibility reach their exterior limits there while local unfolding continues. Duration does not begin at the horizon, nor does it become independent of all measurement. Proper time continues to measure the local process. What changes is that duration can no longer be mistaken for the exterior time previously used to represent it. The horizon reveals duration without the appearance of universal temporal correspondence.

This is pristine duration: not timelessness, but unfolding disentangled from the assumption that time is its constituent.

Pristine duration remains present before, at, and beyond the event horizon for as long as physical unfolding continues. The event horizon does not create this condition; it exposes it. Under ordinary circumstances, time and duration appear to proceed together, allowing their ontological difference to remain concealed. At the horizon, their apparent equivalence collapses. Exterior time loses correspondence while duration continues locally. The measure reaches the boundary of its jurisdiction; the constituent does not.

Recent work independently approaches this distinction from another direction. Cangiotti (2026) joins Ellis's Evolving Block Universe with Bergson's durée, arguing that physical temporal

parameters culminate in, but cannot capture, the first-person experience of duration. This recognizes that temporal measurement does not exhaust lived duration and locates the remaining gap at the epistemological level. It does not, however, extend duration to physical unfolding itself: durée remains the terminal experiential level beyond brain time. Space/duration makes that further move. Duration constitutes physical unfolding; lived duration is its biological and contextual organization; time measures both without constituting either.

This proposal does not modify Einstein's field equations or dispute their capacity to describe gravitational relations. It introduces an epistemological distinction within their interpretation. Einstein's spacetime explains how velocity and gravity alter temporal and spatial measurement. Space/duration asks what continues to unfold when those measurements dilate, diverge, or become inaccessible.

The same epistemological problem extends into biology when chronological time is treated as the constituent or cause of biological unfolding. The biological implications—including experienced duration and the Internal Duration Setting heuristic—are developed elsewhere (Martinez, 2026a, 2026b). The present proposal isolates the event horizon as the physical limit case at which measure–constituent entanglement becomes unavoidable.

The event horizon thereby becomes the ultimate heuristic for untangling measurement from constituent. It reveals that a measure can reach its logical limit without the constituent reaching its limit. Radius can identify the horizon without being the horizon. Time can measure duration without being duration. At the boundary where both entanglements become most visible, duration appears in its pristine form: the continuing constituent of unfolding after exterior time can no longer disclose it.

Conclusion

This theoretical proposal does not modify Einstein's field equations or dispute their capacity to describe gravitational relations. It identifies a measure–constituent entanglement within their interpretation. The Schwarzschild radius identifies where the event horizon occurs without constituting the causal-geometric condition itself. Likewise, time measures the temporal relations of unfolding without constituting duration. The distinctions can be expressed succinctly:

$r_s \neq H$

Radius ≠ Horizon.

$t \neq D$

Time ≠ Duration.

If time literally ceased at the event horizon while remaining an inseparable constituent of spacetime, spacetime existence should cease there as well. Yet the infalling object crosses the horizon in finite proper time, and its local physical unfolding continues. What reaches its limit is therefore not duration, but the exterior temporal measure and its capacity to maintain correspondence with the continuing event.

The event horizon takes both measure–constituent entanglements to their logical conclusions. Spatial measurement identifies the horizon without becoming the horizon; temporal measurement approaches arrest without terminating unfolding. A measure can consequently reach the boundary of its jurisdiction without the constituent reaching an equivalent boundary.

The event horizon thereby reveals pristine duration: not timelessness, but unfolding disentangled from the assumption that time is its constituent. Duration does not begin at the horizon, nor does the horizon create it. The horizon exposes what ordinary temporal correspondence conceals. After exterior time can no longer disclose the continuing event, duration remains as the constituent of its unfolding.

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