The Propagation of Time at c: A New Hypothesis on Observer-Defined Reality and Its Quantum Effects

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The nature of time and its interaction with observation remains one of the deepest questions in physics. In this paper, we propose a new hypothesis: time itself propagates at velocity c, rather than being a static coordinate. The present moment is not pre-existing but emerges dynamically at the intersection of an observer's frame with the advancing front of time [1,2]. We formalize this idea with two key equations. First, we define the motion of time itself as: $dT/dt = c$, where T represents absolute time, t is the local time experienced by an observer, and c is the speed of time's propagation. This equation suggests that even when an object is at rest in space, it still moves through time at c [3]. It naturally explains why objects traveling at c (such as photons) experience no time flow—they fully match the motion of time itself [4]. Additionally, we describe how observation defines the present moment with: $O(x, t) = \delta(T(x, t) - t)$, where $O(x,t)$ represents the act of observation, $T(x,t)$ is absolute time at location x, and δ is the Dirac delta function, ensuring observation occurs only when local and absolute time align. This implies that observation does not passively record time but actively defines it, selecting a specific present from multiple possible time flows. This model provides new insights into: Why an object at rest still experiences motion through time ; Why photons experience no time passage ; How measurement defines time, potentially explaining quantum state collapse ; How observation alters past time structures, offering an alternative to retrocausality. We propose experimental tests involving temporal evolution in varying energy conditions, delayed-choice quantum interference, and gravitational influences on time perturbations. If validated, this model could unify quantum mechanics, relativity, and cosmology under a single framework where time is an evolving physical entity rather than a passive parameter.

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