

Motion Out of Time: Single Speed Hypothesis

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Abstract

This paper introduces a hypothesis that reinterprets the relationship between motion and time. We propose that all objects possess an intrinsic capacity for instantaneous motion between two points, occurring "out of time," and that observed travel time results from discrete "stops" induced by external forces. Using thought experiments involving a photon and a marble, we illustrate this concept and explore its potential implications for classical mechanics, special relativity, and quantum phenomena. This perspective suggests motion is inherently timeless, with time arising as a consequence of interruptions, offering a new lens on the fundamental dynamics spanning classical laws to quantum effects. While lacking a fully developed mathematical foundation, this framework offers a novel perspective on velocity, time, and quantum superposition, suggesting avenues for future theoretical and experimental investigation. We emphasize its conceptual nature and the need for rigorous development to elevate it from hypothesis to theory, inviting researchers to explore its intriguing possibilities.

Keywords: Time, Superposition, Acceleration, Newton's First Law, Wave Collapse

1. Introduction

The conventional understanding of motion, rooted in Newton's laws of motion [1], defines velocity as the rate of change of position with respect to time, expressed as $v = \frac{d}{dt}$. This relationship underpins classical mechanics and is refined in Einstein's special relativity [2], where the finite speed of light ($c = 299,792,458$ m/s) and time dilation govern the dynamics of moving bodies. Time, in these frameworks, is a continuous parameter over which motion occurs. However, we propose a radical alternative: motion is inherently instantaneous in the absence of interrupting factors, and the time we observe reflects periods of "stopping" rather than continuous traversal.

This hypothesis, termed "Motion Out of Time," posits that all objects—whether massless, like photons, or massive, like macroscopic bodies—share an intrinsic ability to move between points without elapsing time. Observed time arises from intermittent

stops, potentially caused by external forces (e.g., friction, gravity). Inspired by thought experiments, this idea challenges foundational assumptions while it conceptually relates to aspects of relativity and quantum mechanics, as discussed later, drawing on works like Hartle's exploration of spacetime [3] and Rovelli's studies of time in quantum gravity [4].

2. Thought Experiment: Photon vs. Marble

To elucidate this hypothesis, consider a thought experiment in a vacuum: a photon and a marble travel 100 meters in a straight line (see Fig. 1). The photon, moving at c , completes the distance in:

$$t_p = \frac{d}{c} = \frac{100}{299,478,458} \approx 3.336 \times 10^{-7} \text{ seconds}$$

The marble, traveling at $v_m = 40\text{m/s}$, takes:

$$t_m = \frac{d}{v_m} = \frac{100}{40} = 2.5 \text{ seconds}$$

Conventionally, as established in Newton's laws [1] and refined by special relativity [2], the disparity in travel times— $t_m = 2.5 \text{ seconds}$ for the marble and $t_p \approx 3.336 \times 10^{-7} \text{ seconds}$ for the photon—is explained by their differing velocities, where $v = \frac{d}{t}$ treats time as a continuous parameter of motion. In contrast, this hypothesis posits that all objects possess an intrinsic capacity for "instantaneous motion" between two points, occurring "out of time" when unimpeded. The observed travel times, we suggest, arise not from continuous traversal but from discrete "stops" induced by external forces.

We propose that both the photon and the marble could, in an idealized state free of interruptions, cover the 100 meters with no elapsed time. For the photon, the observed $t_p = 3.336 \times 10^{-7} \text{ seconds}$ might reflect minimal stops, potentially linked to the uniform structure of spacetime. For the marble, the 2.5 seconds could result from a greater accumulation of stops, possibly due to mass-related interactions or other unspecified factors in this vacuum scenario.

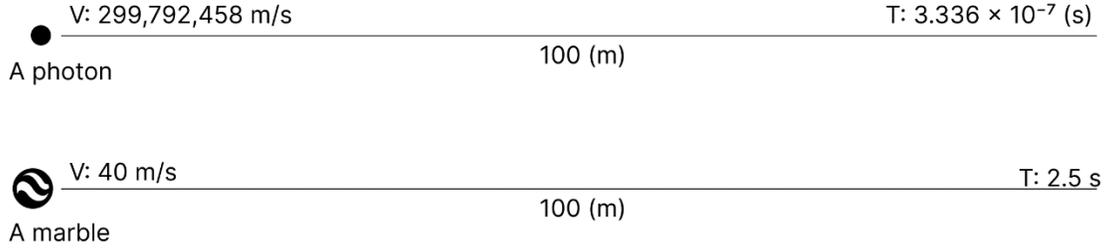


Fig. 1 Representation of the thought experiment in which a photon and a marble are set to travel 100 meters at a specific velocity in the vacuum of space

3. Conceptual Framework

We define "intrinsic motion" as the capacity of an object to traverse a distance instantaneously when unimpeded. Observed time t is the sum of discrete stop times τ_i , where stops are induced by external forces:

$$t = \sum_{i=1}^n \tau_i$$

The effective velocity becomes:

$$v = \frac{d}{t} = \frac{d}{\sum_{i=1}^n \tau_i}$$

Here, n represents the number of hypothetical stops, and τ_i denotes the duration of each stop. For a photon traveling at the speed of light ($c = 299,792,458$), the observed coordinate time $t_p \approx 3.336 \times 10^{-7}$ second over 100 meters (as calculated in Section 2) is proposed, within this hypothesis, to result from the cumulative effect of discrete stops. While the photon's proper time in relativity is zero ($\tau = 0$) [2], we speculate that this coordinate time might arise from a constant series of interruptions attributed to the uniform structure of spacetime, possibly linked to vacuum fluctuations or the discrete nature of spacetime suggested by loop quantum gravity [4]. These interruptions are hypothesized to be uniform across space, involving a large number of extremely brief events (n is large, τ_i is small), such that:

$$t_p = \sum_{i=1}^n \tau_i \approx 3.336 \times 10^{-7} \text{ seconds}$$

which could, in this speculative model, contribute to the invariant speed of light $c = d/\sum \tau_i$. For massive objects like the marble, the total observed time is significantly larger, amounting to 2.5 seconds over the same distance, which we attribute to the cumulative effect of stops influenced by external factors. The photon's interruptions, if real, would differ, possibly reflecting a fundamental spacetime property, though this remains unverified. This framework is entirely conceptual and not a predictive theory; rigorous experimental evidence and quantification of n and τ_i are needed, potentially through quantum field theory or quantum gravity [4, 6].

To complement the discrete formulation $t = \sum_{i=1}^n \tau_i$, we propose a continuous model where stops occur across the distance d , with the total observed time derived from integration over the path (see Fig. 2). At each infinitesimal segment dx , an object may experience either zero stop time — corresponding to instantaneous motion "out of time" — or a finite duration due to physical interactions, contributing to the observed time. We define $\tau(x)$ as the stop duration per unit distance (in s/m), such that:

$$t = \int_0^d \tau(x) dx$$

The effective velocity is then:

$$v = \frac{d}{\int_0^d \tau(x) dx}$$

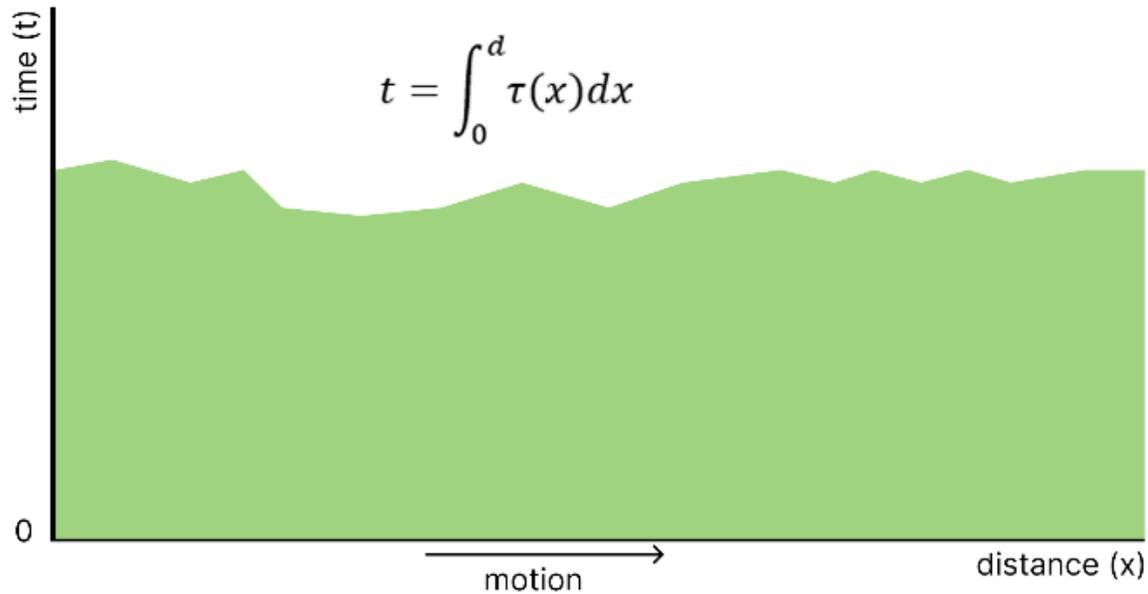


Fig. 2 Illustration of the integral representation of time (t) as a function of distance (d) in a dynamic environment for a moving object. The shaded region represents the accumulated effect of $\tau(x)$ indicating the relationship between motion and elapsed time

This model posits that $\tau(x)$ may vanish in an idealized, unimpeded state, consistent with the hypothesis of instantaneous motion (Section 1), or take positive values in real spacetime due to properties such as mass or energy interactions.

4. Reinterpretation of Quantum Phenomena

The "Motion Out of Time" hypothesis, initially formulated through classical thought experiments involving a photon and a marble (Section 2), extends its speculative reach into quantum mechanics, offering novel reinterpretations of foundational phenomena. This framework posits that all motion occurs instantaneously "out of time" in the absence of interruptions, with observed temporal effects arising from "stops" induced by external forces or intrinsic properties. In the quantum domain, these stops align with measurement or interaction events, providing a qualitative lens through which to view wave-particle duality, superposition, and entanglement. Building on the continuous stop model from Section 3, where travel time is expressed as:

$$t = \int_0^d \tau(x) dx$$

4.1 Wave-Particle Duality

The double-slit experiment exemplifies wave-particle duality: a quantum particle, such as an electron, produces an interference pattern when unobserved, yet manifests as a discrete entity when measured at a slit [7]. Conventionally, this behavior is attributed to the wavefunction's evolution, governed by:

$$i\hbar \frac{\partial \psi}{\partial t} = -\frac{\hbar^2}{2m} \frac{\partial^2 \psi}{\partial x^2} + V(x)\psi$$

and subsequent collapse (see Fig. 3). Within the "Motion Out of Time" hypothesis, the particle is conceived as moving "out of time" across all possible paths simultaneously when unimpeded. The interference pattern reflects this timeless exploration of trajectories. This resonates with Wheeler's delayed-choice experiments [8], where the choice of measurement retroactively influences behavior. The particle's state remains undefined across all paths until a stop, induced by observation, determines its trajectory.

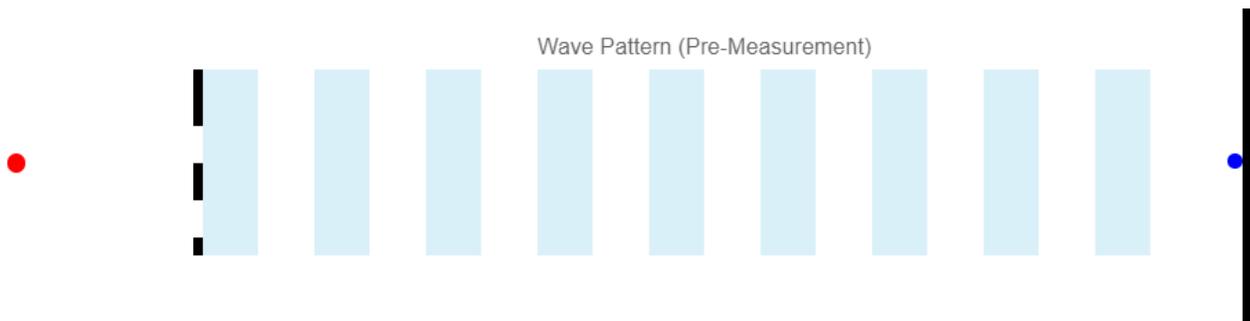


Fig. 3 Double-Slit Experiment: A diagram showing a particle source, two slits, and a screen, with a wave pattern pre-measurement and a particle position post-measurement (stop induced)

4.2 Superposition

Quantum superposition permits a system to occupy multiple states concurrently until measurement resolves it into a definite state [9], described as:

$$|\psi\rangle = c_1|x_1\rangle + c_2|x_2\rangle$$

Where $|c_1|^2 + |c_2|^2 = 1$. Under the hypothesis, a particle in superposition exists in a timeless condition, instantaneously encompassing all possible states, much like the marble's capacity to traverse its path "out of time" absent interruptions (Section 2).

From the particle's perspective, we consider that it always occupies a single position; the illusion of multiple locations arises from its motion "out of time." This suggests time manifests through interruptions, not as a backdrop to state evolution, offering a qualitative analogy to the quantum-classical transition.

4.3 Entanglement

Entanglement manifests as instantaneous correlations between spatially separated particles, defying classical locality [10], with the state:

$$|\psi\rangle = \frac{1}{\sqrt{2}}(|\uparrow\rangle_A|\downarrow\rangle_B - |\downarrow\rangle_A|\uparrow\rangle_B)$$

The hypothesis proposes that entangled particles share a timeless connection "out of time" until a measurement imposes a stop, resolving their properties simultaneously, transcending temporal separation. Travel times to detectors are:

$$t_A = \int_0^{d_A} \tau(x)dx, \quad t_B = \int_0^{d_B} \tau(x)dx$$

This likens entanglement to the marble's instantaneous motion between stops (Section 2), with the entangled state persisting timelessly until halted, offering a conceptual analogy for non-locality.

4.4 Conceptual Note

These reinterpretations are speculative, designed to provoke discussion rather than supplant established quantum theory [7, 9, 10]. By positing that quantum phenomena occur "out of time" until stops impose temporal structure, the hypothesis aligns with inquiries into time's role in quantum mechanics [12]. Lacking the precision and

grounding for a formal theory, it invites exploration of emergent time frameworks [12], building on the paper's earlier arguments.

5. Implications and Challenges

If the "Motion Out of Time" hypothesis proves valid, it offers a transformative perspective on motion, time, and their interplay across classical and quantum domains. However, its development into a robust theory faces substantial conceptual and practical hurdles.

5.1 Implications

- *Velocity as a Reflection of Stop Distribution:* The hypothesis redefines velocity not as a measure of continuous motion but as an emergent property determined by the distribution and duration of stops along a path. For instance, in the thought experiment from Section 2, the marble's slower effective speed ($v = 40m/s$) compared to the photon's ($v = c$) arises from a greater accumulation of stop durations, as modeled by $\tau(x)$, rather than a difference in intrinsic motion capability. Acceleration, in turn, becomes a mechanism that reduces the stop duration per unit distance, thereby increasing an object's effective speed.
- *Energy and Stop Mitigation:* Energy, particularly relativistic energy, may play a critical role in mitigating stops, akin to overcoming inertia in classical mechanics, decreasing total travel time.
- *Quantum Measurement as Stops:* Building on Section 4's exploration of quantum phenomena, the hypothesis posits that measurement events act as stops, collapsing quantum superpositions or resolving entangled states. This provides a speculative lens on the measurement problem, framing stops as the points where timeless quantum behavior interfaces with observable temporality, entering the time domain we perceive.

5.2 Challenges

- *Mathematical Representation:* A primary obstacle is developing a mathematical framework to quantify $\tau(x)$ across diverse systems. For macroscopic objects, this

might involve parameters like mass, velocity, or external interactions, while in quantum systems, stops could correlate with quantum states or decoherence effects.

- *Testability and Distinction from Standard Physics:* Experimental validation requires detecting stop-like behaviors, such as anomalies in high-precision timing of particle motion or quantum state transitions. Distinguishing these from established phenomena—like quantum fluctuations or relativistic time dilation—is a significant hurdle. The hypothesis must propose unique, observable signatures, potentially tied to variations in $\tau(x)$, to differentiate itself from current theories.

5.3 Future Research Directions

Future investigations could explore connections to quantum gravity [4], where discrete spacetime structures might naturally accommodate stop-like interruptions, or emergent time theories [12], which question time's fundamental status. Advances in particle physics [5], particularly regarding mass-energy interactions, may elucidate the mechanisms driving stops, enhancing the hypothesis's theoretical foundation.

6. Conclusion

The "Motion Out of Time" hypothesis argues that objects possess an intrinsic capacity for instantaneous motion, with observed travel times arising from stops modeled continuously across a path, as demonstrated by thought experiments with a photon and a marble (Section 2). Despite its potential to bridge classical and quantum perspectives and align with emergent time theories [12] and quantum gravity [4], the hypothesis is in its preliminary phase and calls for the empirical validation essential for its development into a robust scientific theory. Advancing it requires a rigorous model for $\tau(x)$, potentially leveraging quantum field theory [6] or discrete spacetime concepts [4], alongside experiments using ultra-precise particle timing or quantum transitions to detect interruptions influenced by mass and energy. Building on foundational works [1, 2] and modern inquiries [4, 11, 12], this hypothesis invites further exploration of its implications for motion and time

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