International Journal of Science Academic Research
Vol. 07, Issue 03, pp.478-480, March 2026
Available online at http://www.scienceijsar.com
ISSN: 2582-6425

Research Article

RESHAPE THE INVARIANCE OF LIGHT SPEED: MEDIUM TRANSLATE REFLECTION INTERPRETATION IN INFORMATION TELEPORTATION

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Received 27th January 2026; **Accepted** 20th February 2026; **Published online** 27th March 2026

Abstract

This research paper reinterprets the speed of light travel through a medium. Our innovative conceptual approach reshapes the understanding of the invariance of the speed of light. This Medium Translate Reflection (MTR) interpretation aims to address the century-old question posed by Albert Einstein: "the spooky action at a distance." Our MTR interpretation may offer a clue to a breakthrough regarding Einstein's question. Using experiments [1][2][3][4][5][6][7], we depict light propagation altered by matter in different medium and moving media. Departing from the notion of medium invariance, we derive a framework where the effective light speed v equals c over n u times (1 minus 1 over n squared), which always emerges in the distance between A and B, matching Fizeau's observations. These implications challenge Galilean physics. Additionally, our suggestion of partial entrainment in dense frames causes light deviation. This deviation process might allow information to travel faster than the speed of light. Moreover, we discover when light passes through the medium, it may slow down initially (upon impact), but since the light must continue along path (C), it could experience moments of acceleration during its breakthrough. In other words, light can momentarily move faster than its normal speed (at special moment). This interpretation aligns logically consistence with the applications in modern interferometry and quantum mechanics concepts.

Keywords: Invariance of light speed, Medium translate reflection, MTR Interpretation, Information Teleportation, Teleportation.

INTRODUCTION

The invariance of the speed of light in vacuum is a cornerstone of modern physics, underpinning special relativity, quantum field theory, and contemporary cosmology. Yet, the behavior of light in material media and moving frames continues to raise conceptual questions about the nature of propagation, information transfer, and nonlocal correlations. In particular, the classic Fizeau experiment on light propagation in moving water and later precision interferometry have constrained possible deviations from Einstein's velocity-addition law while leaving space for alternative interpretive frameworks. [1][3][5][7][8][9][11]. Albert Einstein famously described quantum entanglement as "spooky action at a distance" in a 1947 letter to Max Born, expressing discomfort with apparent instantaneous influences between distant systems. Standard quantum theory resolves this tension by distinguishing between nonlocal correlations and superluminal signaling, maintaining that entanglement cannot be used to transmit information faster than light. However, the intuitive unease remains: why do correlated outcomes appear to adjust instantaneously despite relativistic constraints on causal propagation. [4][6][10]. This paper proposes a new conceptual framework, the Medium Translate Reflection (MTR) interpretation, to reinterpret how light propagates through medium and how effective velocities should be understood in that context. Within this interpretation, the usual invariance of the vacuum speed c is preserved as a limiting process, but the operationally measured speed between two events A and B in the presence of material medium is recast in terms of a medium-dependent translation–reflection process. Our MTR framework introduces the concept of an effective light speed, which may temporarily exceed the conventional speed of light under specific conditions. At such moments, information could propagate faster than light through processes involving medium translation and reflection. This research paper formalizes model $V = \frac{c}{n}(1 - \frac{1}{n})$, which aim to bridging classical drag intuition with relativistic principles. The constancy of the speed of light, c, equals 299792458 m/s in vacuum, underpinning relativity. Our research innovatively reinterpretate the light traversing a "medium" proposing $V = c/n(1 - R)$ ([R] Refer to Reflective Index Ratio by the medium) for stationary cases and modifications $cT + V$ =speed with light travel through medium, in addition, $V_H = V/(1 - R)$ echoes aberration or frame-dragging([R] Refer to Reflective Index Ratio by the medium). Gaps persist in intuitive models for non-vacuum propagation, where analogy visualizes conduit-potential paths. Which alongside with spacetime.

As our conceptual experiment notes: light traveling through a medium may appear to move "faster than constant C" at the particular breakthrough moment, but is measured slower than expected, consistent with partial dragging. We reinterpretation this into a unified interpretation model framework.

$$v_{\text{eff}} = \frac{c}{n} u \left(1 - \frac{1}{n^2}\right),$$

which emerges in the displacement observed between A and B, and is constructed so as to connect to the Fresnel drag coefficient and to Fizeau's interferometric observations. [1][2][3][5][9][11].The MTR interpretation departs from strict "medium invariance translative reflection" and embraces partial entrainment as a dynamical property of dense frames. In this process, the medium does not merely slow light uniformly; rather, under certain conditions it partially drags the effective propagation front, leading to measurable deviations and, in extreme situations, to transient regimes in which the local

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propagation of the front appears to exceed the nominal vacuum speed. The central claim of this work is that such transient, localized superluminal segments, arising at specific interfaces or during "breakthrough" events, may offer a conceptual bridge between classical propagation limits and the nonlocal character of quantum correlations, potentially illuminating Einstein's "spooky action at a distance" as an emergent phenomenon of structured media at a deeper level.

Theoretical Background

Fizeau's experiment and partial entrainment

In 1851, Hippolyte Fizeau performed a landmark experiment to determine how the motion of water affects the speed of light propagating through it. Light was split into two beams that traversed opposite directions through moving water, and the interference fringes were observed as the water's flow speed changed. Classical pre-relativistic expectations based on a fully dragged luminiferous. We suggested that the measured speed should be simply $c/n \pm u$, where c is the vacuum speed of light, n is the refractive index, and u is the water speed, and [R] is the reflective index, which is support by the reference of, [1][3][5][9][11][12][13].

We introducing the renew drag coefficient $f = 1 - 1/n^2$ by introducing an innovative assumption of [R], which [R] mean reflective index, in which the medium entrains and thereby reflect the light wave. Although later developments in Lorentz's electron theory and Einstein's special relativity dispensed with a mechanical attribute, our renew coefficient emerged with R is coherent naturally from the relativistic velocity applied to light in a refractive medium, which is alignment with special relativity. [1][2][3][5][7][9][11].

Invariance of light speed and modern critiques

Special relativity elevates the constancy of the vacuum speed of light c to a postulate, asserting that all inertial observers measure the same speed for light in vacuum, independent of their state of motion. This postulate is tightly linked to the Lorentz transformations and to the relativistic law of velocity addition, which prevents any massive particle from exceeding c. Nonetheless, the behaviour of light in media is more nuanced: the phase velocity and group velocity depend on the refractive index, dispersion, and absorption, and in certain engineered materials (e.g. metamaterials or anomalously dispersive media) group velocities exceeding c have been observed without genuine superluminal information transfer [8].

Some critiques of strict, global light-speed invariance argue that the experimental situation primarily constrains an average or path-integrated speed rather than a pointwise constant speed in all conditions. In this view, Michelson–Morley–type interferometric results are interpreted as showing that the average speed of light of fixed frequency over closed paths is independent of the laboratory's motion, without necessarily forbidding spatial or medium-dependent variations in local propagation speed. This perspective opens conceptual space for alternative frameworks in which c remains a limiting invariant but effective velocities in structured media display richer behaviour [8].

The Medium Translate Reflection (MTR) Interpretation

Conceptual motivation

Our MTR interpretation starts from the observation that experiments such as Fizeau's demonstrate that the measured transit of light between points A and B in a moving medium is not determined solely by the static refractive index but also by how the medium dynamically translates and reflects the propagation front. Rather than treat the medium as a passive background providing a fixed refractive index, the MTR regards the medium as an active frame that (i) partially entrains the light's effective front and (ii) induces reflection-like adjustments in phase and path, especially at interfaces and during acceleration or deceleration events. [1][2][3][5][9][11]. Within this sketch, the invariance of c is preserved as a property of the underlying electromagnetic field in an idealized vacuum, butmeasured propagation between A and B through a medium is a composite: part vacuum-like transport and part medium-induced translation and reflection. The "speed of light" reported in experiments is then an emergent effective speed v_{eff}, shaped by medium properties, motion, and boundary interactions, rather than the fundamental c itself.

Effective speed relation and connection to Fizeau

We introduce an effective light speed in a moving refractive medium of index n and bulk speed u as

$$v_{\text{eff}} = \frac{c}{n} u \left(1 - \frac{1}{n^2}\right).$$

The structural resemblance of the factor $(1 - 1/n^2)$ to the Fresnel drag coefficient is intentional, as it encodes partial entrainment in the MTR framework. In contrast to the classical expression $c/n \pm u(1 - 1/n^2)$, which directly modifies the medium-reduced speed c/n by an additive drag term, the MTR form treats the effective speed as a product of three contributions:

- c/n: the baseline reduction due to propagation in a stationary medium;
- u: the translational influence of the medium's motion;
- $1 - 1/n^2$: the reflection of partial entrainment, modulating how strongly the medium's motion couples into the propagation front.

To connect with Fizeau, one considers the displacement between A and B as inferred from interferometric phase shifts when the medium is set into motion and then reversed. In that context, what matters is not the instantaneous speed at every point but the net shift accumulated along the path. By identifying the MTR effective velocity with the coefficient governing this net shift, the framework recovers the same dependence on refractive index and flow speed that Fizeau observed, while recasting the interpretation: the medium does not simply add or subtract its speed to the light; it translates the effective propagation front while a partial entrainment factor reflects the degree of coupling between medium and field. [1][3][5][9].

Departure from Galilean invariance

In the Galilean image, velocities add linearly: the speed of light in a moving medium would be $c/n \pm u$, independent of any additional coefficients. Fizeau's result already challenges that view, implying that the medium's motion is only partially transmitted to the light. Our MTR interpretation pushes this departure further by embedding the entrainment factor directly into the effective velocity relation and by treating the measured speed between A and B as inherently frame-dependent, not merely only of Lorentz transformations but because of medium-specific translation and reflection processes. Thus, Galilean invariance fails not only because the universal constant c resists naive velocity addition but also because the medium itself plays an active role in shaping how propagation is registered between frames. In this sense, our MTR interpretation offers a dynamic, medium-centred extension of quantum relativistic kinematics that maintains the central status of c while allowing a richer hierarchy of effective velocities in matter.

Partial Entrainment and Light Deviation in Dense Frames

Partial entrainment as a physical principle

The notion of partial aether dragging has a long history, with Fresnel's coefficient proposed to reconcile stellar aberration and Fizeau's experiment within a quasi-mechanical aether model. Modern electrodynamics, devoid of mechanical aether, nonetheless retains the mathematical residue of partial dragging in the form of refractive index-dependent corrections to propagation in moving media. Our MTR interpretation abstracts this idea into a more advance and general principle: dense frames partially entrain light may cause reflection in the special moment, which may cause the information travel faster than light.

A "dense frame" here refers not only to materials with high refractive index but to any configuration in which the electromagnetic field interacts strongly with structured matter such as waveguides, optical fibres, interferometers, or condensed-matter environments with significant polarization or scattering. In such frames, the field's effective trajectory between A and B is not a straight line in the vacuum sense; it is a convolution of free propagation and repeated medium-induced translations and reflections. Partial entrainment quantifies the fraction of medium motion that is imprinted on this effective trajectory [8].

Light deviation and information-bearing paths

When partial entrainment operates in a non-uniform or strongly structured medium, the effective path of light can deviate from naive geometric expectations, especially if the medium's motion or refractive properties vary along the path. This deviation has two key implications:

1. The geometric path length between A and B may differ significantly from the effective optical path length, which incorporates partial entrainment and phase accumulation. [1][3][5][8][9].
2. Certain segments of the path, particularly near interfaces or regions of rapid medium variation, can exhibit transient effective velocities that exceed the naive medium-reduced value, and in extreme constructions, may appear to exceed c for brief intervals, even while the global causal structure remains consistent.

In our MTR interpretation, these deviations are not mere artefacts of group velocity definitions but potential information-bearing phenomena. When a signal is encoded in the timing or phase of a light front traversing such a medium, it might exploit segments where partial entrainment and medium motion conspire to produce an effective displacement that is superluminal with respect to a simple vacuum-light-cone estimate. The critical question is whether such superluminal segments can be arranged in a way that allows controllable, frame-independent superluminal signaling, or whether they remain confined to local, frame-dependent reconstructions that do not violate overall relativity constraints.

Transient Superluminality and "Breakthrough" Dynamics

Impact, slowdown, and acceleration in a medium

In conventional optics, when a light pulse enters a medium with refractive index $n > 1$, its phase velocity decreases to c/n, and the pulse envelope may experience distortion or delay depending on dispersion and absorption. At the boundary, boundary conditions on the electromagnetic field enforce continuity of certain components, and energy conservation governs the partition into reflected and transmitted parts. This transition is often described kinematically as a simple change in speed and wavelength. [8].

Our MTR interpretation refines this picture by emphasizing three distinct stages:

1. **Medium Impact**: Upon encountering the medium boundary, the incoming light front experiences a sudden interaction that reconfigures its effective degrees of freedom, corresponding to a rapid slowdown relative to the vacuum speed must have some part of the distance of acceleration, afterwards, resulting in a constant speed between the whole distances.
2. **Translation**: Within the medium, the front is partially entrained by the moving dense frame, which translates the effective propagation in a manner dependent on u and n.
3. **Reflection-Breakthrough**: At subsequent boundaries or structural in homogeneities, the partially entrained front can undergo a release or reconfiguration that results in local acceleration, potentially producing segments where the instantaneous effective displacement exceeds the nominal vacuum speed.

This last stage the "breakthrough" is where transient superluminality may arise in the MTR framework. Because the front remains constrained to ultimately respect the global causal structure defined by the underlying field, these superluminal segments are brief and localized, embedded within a longer trajectory that, on average, respects the usual experimental bounds.

Special moments of superluminal effective speed

The statement that "light can momentarily move faster than its normal speed" in MTR should be understood in the operational, path-integrated sense: for carefully prepared configurations, the inferred local effective speed between closely spaced events may exceed c when reconstructed from phase or timing data. Such a configuration might involve, for example:

- A medium with medium n, refractive index R and speed u;
- An interface whose geometry concentrates the phase front in a narrow region;

- Partial entrainment characterized by the factor $1 - 1/n^2$, amplifying the contribution of medium motion to the local displacement.

At a "special moment" during breakthrough, the combination of medium translation and release can produce an effective velocity that, when naively interpreted, appears superluminal. Within MTR, this is not a violation of fundamental invariance but a manifestation of how translation and reflection in dense frames re-encode propagation information between A and B. The invariance of c is preserved at the level of underlying field dynamics, while the measured speed becomes a derived, context-dependent quantity.

Relation to Interferometry and Quantum Nonlocality

Consistency with modern interferometry

Modern optical interferometry, building on the designs of Michelson, Fizeau, Sagnac, and many others, has extensively tested the dependence of light propagation on medium motion, rotation, and gravitational fields. Observed fringe shifts in moving media, rotating platforms (Sagnac effect), and gravitational redshift experiments can all be interpreted within standard relativity, but they also naturally fit into the MTR narrative as evidence that medium and frame structure shape the effective paths between A and B. [1][3][5][7][8][9][11][12][13].

In particular, the Sagnac effect shows that counter-propagating beams on a rotating platform return with different arrival times, which can be understood in terms of effective path differences induced by rotation. In our MTR, this is viewed as another instance of medium- or frame-induced translation and reflection of the propagation front. Because interferometry detects extremely small phase differences, it is sensitive to the subtle deviations introduced by partial entrainment and dynamic media, providing a natural testing ground for MTR-motivated refinements [11].

Toward an innovative Medium Translate Reflection (MTR) view of "spooky action at a distance"

Einstein's concern about "spooky action at a distance" arose from the EPR argument, where entangled particles appear to influence each other instantaneously when one is measured. Standard quantum mechanics explains this by noting that the correlations are established at the source and that no usable information can be transmitted faster than light; the apparent instantaneity reflects a nonlocal wave function rather than a physical signal. Yet, this explanation remains philosophically unsettling for many [4][6][10].

Our MTR interpretation suggests a differentpoint of view: perhaps the nonlocal correlations in quantum mechanics emerge from a deeper level of structured "medium" that underlies the apparent vacuum andan effective dense frame in which information is stored and propagated via mechanisms akin to the translation-reflection processes described for optical medium. If so, the effective superluminal segments seen in specialized optical configurations might be classical analogues of how quantum correlations are "communicated" within this deeper medium, while respecting an invariant causal structure at the fundamental level.

In view of this, entanglement does not require true superluminal signaling; instead, correlations are maintained by a medium-like structure that enforces relational constraints between distant events. The "spooky" character arises because our usual macroscopic description treats the vacuum as empty and homogeneous, ignoring the hidden translations and reflections occurring in the underlying medium. MTR provides a quantum physics language in which to model such process potential (information), potentially offering new routes to reconcile nonlocal quantum correlations with relativistic causality.

Innovative Concept

Our Medium Translate Reflection (MTR) interpretation proposed here explore the role of media and moving frames in shaping effective light propagation between events A and B. By introducing an effective speed relation $v_{\text{eff}} = (c/n)\, u(1 - 1/n^2)$ and with [R-index] by emphasizing partial entrainment and translation reflection processes in dense frames, MTR offers an innovative conceptual framework that is qualitatively aligned with classic assumption understanding such as Fizeau's measurements while departing from both Galilean invariance and the simplest readings of special relativity. Which is welly support by [1][2][3][5][7][9][8][10][11].

Several key implications follow from our (MTR) reinterpretation:

- The vacuum speed c retains its status as a fundamental invariant, but the operationally measured speed of light in medium is an emergent, context-dependent quantity shaped by medium dynamics and partial entrainment.
- Dense frames can introduce light deviation and transient superluminal segments during impact and breakthrough, allowing local effective speeds to exceed c in a controlled, non-violating manner.
- Modern interferometric experiments are naturally rephrased in the physics language of light translation and the reflection of information from propagation fronts, thereby enabling the potential teleportation of MTR-specific information predictions.
- By analogy, the nonlocal correlations of quantum mechanics may be reinterpreted as manifestations of deeper medium-structured processes, which MTR interpretation potentially offering new insight into Einstein's "spooky action at a distance."

Future work must address several open questions. First, a fully quantitative development of MTR requires embedding the effective speed relation into a consistent field-theoretic model, ensuring compatibility with Maxwell's equations is well process in medium and with Lorentz covariance where appropriate. Second, explicit experimental proposals are needed to distinguish MTR predictions from those of standard relativity in realistic setups, particularly in regimes where partial entrainment is strong or where breakthrough dynamics can be isolated. Third, any attempt to connect MTR to quantum nonlocality will require careful modeling of how a deeper medium could reproduce known entanglement statistics without enabling exploitable superluminal signaling information. Which is support by [8][11].

Our innovative interpretation can be outlined as follows: based on the above experiment, we propose that the peak of a light wave may propagate faster than the standard constant speed of light under certain conditions. If these peak points are connected, they could trace the complete pathway of information transmission. This suggests that, since the light peaks travel faster than the conventional light speed, information associated with future states may already be effectively projected alongside by the pathway. Our interpretation, which may reshape the invariance of the speed of light, incorporates medium translation and reflection processes. Within this MTR framework, such mechanisms could potentially be applied to information teleportation. (Appendix 1, 2).

In conclusion, this study highlights the active role of media and moving reference frames in shaping light propagation. By formalizing the novel concept that light may momentarily exceed its standard speed during specific translation^_^ reflection ^_^ processes at critical transition points, the Medium Translation Reflection (MTR) framework offers a new conceptual pathway. It seeks to bridge classical wave propagation, relativistic invariance, and quantum nonlocality within a medium-centered perspective.

Furthermore, our MTR interpretation provides a potential avenue for re-examining the long-standing puzzle that inspired Einstein's description of "spooky action at a distance." Phenomena that appear nonlocal at the macroscopic level may instead reflect underlying mechanisms of light and information propagation within a reflective, partially entraining medium embedded in the fabric of space. In this sense, the MTR framework suggests a possible reinterpretation of light-speed invariance and points toward prospective applications in information transmission, including the conceptual basis for information teleportation. Hope this research paper can contribute to the world and the mankind.

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Appendix 1:

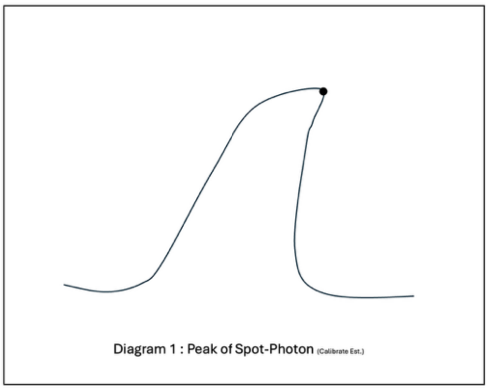

Diagram 1 : Peak of Spot-Photon (Calibrate Est.)

Appendix 2:

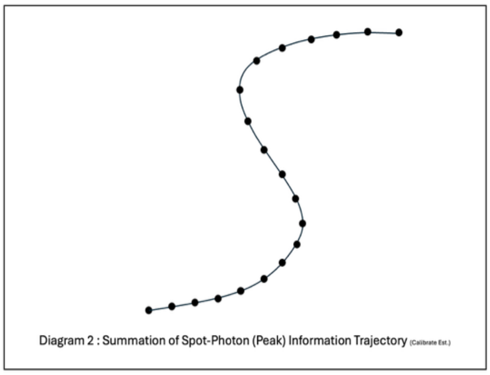

Diagram 2 : Summation of Spot-Photon (Peak) Information Trajectory (Calibrate Est.)

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