

Article

Not peer-reviewed version

Towards a New Physics of Space: Experimental Test via Asymmetric Ion Collisions

[Gui Furne Gouveia](#) *

Posted Date: 12 November 2025

doi: 10.20944/preprints202511.0658.v1

Keywords: special relativity; Lorentz invariance; space-medium; absolute reference frame; asymmetric ion collisions; kinetic energy; standing waves; crucial experimental test



Preprints.org is a free multidisciplinary platform providing preprint service that is dedicated to making early versions of research outputs permanently available and citable. Preprints posted at Preprints.org appear in Web of Science, Crossref, Google Scholar, Scilit, Europe PMC.

Copyright: This open access article is published under a Creative Commons CC BY 4.0 license, which permit the free download, distribution, and reuse, provided that the author and preprint are cited in any reuse.

Disclaimer/Publisher's Note: The statements, opinions, and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions, or products referred to in the content.

Article

Towards a New Physics of Space: Experimental Test via Asymmetric Ion Collisions

G. Furne Gouveia

Independent Researcher; furnegouveia@gmail.com

Abstract

Special Relativity (SR), founded on the postulate of the invariance of the speed of light, rejects the existence of an absolute reference frame. This work proposes to test an alternative paradigm where Space is a substantial physical medium, light is a vibration of this medium, and matter is constituted of standing waves within it. This model is empirically equivalent to SR for a wide class of phenomena but predicts a fundamental difference: kinetic energy is a physical deformation of the wave structure of matter, stored relative to the absolute medium. We propose a crucial experiment to test this difference: measuring the asymmetry between collisions of an accelerated H^+ ion with a stationary He^+ ion, and the reverse scenario. SR predicts perfect symmetry, whereas our paradigm predicts a measurable asymmetry if the internal binding energy is affected by the absolute velocity. The detection of such asymmetry would invalidate the relativity postulate concerning the absence of a medium, validate the existence of a spatial medium, and open the way to an unexplored field of research on the manipulation of the physical properties of Space, with major potential technological implications. Nevertheless, this model does not advocate for the rejection of SR, as it remains perfectly suitable for the use of relative velocities, the only ones we are able to utilize.

Keywords: special relativity; Lorentz invariance; space-medium; absolute reference frame; asymmetric ion collisions; kinetic energy; standing waves; crucial experimental test

1. Introduction

The debate on the existence of an ether as a support for light propagation has shaped modern physics. The null result of the Michelson-Morley experiment [1] and the emergence of Einstein's Special Relativity (SR) [4] led to the consensus abandonment of this concept. SR postulates that the laws of physics are identical in all inertial frames of reference and that the speed of light in vacuum is constant, independent of the motion of the source.

However, it is crucial to distinguish the mathematical predictions of a theory from its underlying ontology. We defend here an alternative paradigm, physically more intuitive and ontologically simpler, where:

1. Space is a physical medium with substantial existence.
2. Light is a wave propagating in this medium.
3. Matter is constituted of standing waves within this medium, confined and stabilized.
4. Kinetic energy manifests as a deformation of the standing wave structure of a particle, proportional to its velocity relative to the medium.

This model, developed in our previous work [2,3], is capable of reproducing the time dilation formula and length contraction, accounting for the observational successes of SR. The Michelson-Morley experiment does not invalidate this model; it only imposes a specific relation between the deformations of bodies moving within the medium. Consequently, the two paradigms are currently empirically equivalent for many experiments. This article aims to propose an experiment capable of distinguishing between them.

Beyond resolving this fundamental conceptual dispute, validation of our paradigm would have considerable heuristic scope. By reintroducing Space as a dynamic physical entity, it would legitimize and stimulate research aimed at understanding and potentially manipulating its properties, a path currently unexplored due to the restrictive postulates of SR.

2. The Fundamental Theoretical Conflict: Kinetic Energy and Absolute Reference Frame

A fundamental point of divergence between the two paradigms lies in the nature of kinetic energy.

2.1. Within the Framework of Special Relativity

The energy of a particle is a relative observable, dependent on the observer’s reference frame. The energy of a composite system in motion is a function of its mass invariant (which includes the binding energy) and its relative velocity. A collision between two particles is entirely described by their relative velocity and their rest masses. Symmetric configurations (A fast on B at rest vs. B fast on A at rest) are physically equivalent.

2.2. Within our Paradigm (Space-Medium)

Kinetic energy is a real energy, stored as a deformation of the wave structure of the particle, and it is defined relative to the absolute reference frame of the spatial medium. Consequently, the state of a particle moving at 0.9c relative to the medium is physically different from that of the same particle at rest in the medium, beyond a simple change of viewpoint.

This ontological difference has a crucial observational consequence: it is plausible that the deformation of the particle due to its absolute motion affects its internal properties, such as its effective binding energy or its coupling constants. SR forbids such an effect, as the binding energy is an invariant.

3. Experimental Proposal: Asymmetric High-Energy Ion Collisions

To test this prediction, we propose a collision experiment involving simple ions, feasible with current particle accelerator technologies.

3.1. Experimental Protocol

1. **Configuration 1:** A hydrogen ion (proton, H⁺) is accelerated to a relativistic velocity *v* (close to *c*) and collides head-on with a helium ion (He⁺) maintained at rest in the laboratory.
2. **Configuration 2:** The experiment is repeated with the roles reversed: a helium ion (He⁺) is accelerated to the same velocity *v* and collides with a hydrogen ion (H⁺) at rest.

The velocity *v* is chosen to be sufficiently high (e.g., $\beta = v/c > 0.9$) to maximize the relativistic deformation effect.

3.2. Observable and Predictions

The observable is not the total energy released, but a quantity sensitive to the internal structure of the colliding ions, such as:

- The production cross-section of a specific reaction channel.
- The energy or angular spectrum of photons emitted during the de-excitation of the collision products.
- The branching ratio between different reaction channels.

3.2.1. Prediction of Special Relativity

The two configurations are perfectly symmetric. No statistically significant difference should be observed in the measured observables between Configuration 1 and Configuration 2. The energy in the center of mass is identical.

3.2.2. Prediction of our Paradigm (Space-Medium)

An asymmetry is expected if the energy distribution within an accelerated particle (and its binding energies) is not equivalent to that of a particle at rest. The binding energy of the electron in the He^+ ion (which is stronger than in H^+ due to the nuclear charge $Z = 2$) could be modified differently depending on whether the He^+ nucleus is at rest or in rapid motion within the absolute medium. If the bound state of the electron in an "absolute" moving nucleus is altered, the reaction thresholds and interaction probabilities during the collision will be affected. Consequently, the results of Configuration 1 and Configuration 2 should show a measurable difference.

4. Discussion

The strength of this proposal lies in its conceptual simplicity and technical feasibility. H^+ and He^+ ions are perfectly understood systems and easily producible in accelerators. The control of their velocity is extremely precise.

The detection of an asymmetry, even a weak one, would be a clear violation of Lorentz invariance and the principle of relativity, refuting a fundamental postulate of SR. It would provide direct experimental evidence in favor of the existence of an absolute reference frame linked to a spatial medium.

It is important to note that this experiment does not require knowledge of the absolute velocity of the laboratory relative to the medium. It tests the *existence* of an effect dependent on absolute velocity by seeking an asymmetry between two configurations that are symmetric in the relativistic framework.

Finally, the validation of our paradigm would have implications that extend far beyond the theoretical framework. By establishing Space as a dynamic physical medium, it would open an entirely new field of experimental and technological research, currently obscured by the postulates of SR. Instead of considering the properties of spacetime as fixed and immutable backgrounds, they would become potentially manipulable physical variables. This could inspire research programs aimed at locally modifying the properties of Space, with potentially revolutionary applications such as the local cancellation or amplification of fields, the modulation of inertia, or the development of new propulsion modes. The experimental confirmation of our model would therefore not only be a conceptual advance; it would constitute the starting point of a new technological frontier based on the mastery of the properties of the spatial medium.

5. Conclusions

We have presented a physically intuitive paradigm where Space is a substantial medium. Although it is mathematically equivalent to Special Relativity for many phenomena, it leads to a unique falsifiable prediction concerning the nature of kinetic energy.

The asymmetric H^+/He^+ collision experiment we propose constitutes a crucial test to distinguish between these two descriptions of reality. If the symmetry predicted by Special Relativity is violated, it would invalidate the postulate of invariance and open the way to a new physics based on the dynamic properties of Space. Such a discovery would transcend the field of fundamental physics. It would establish a new framework for applied research, centered on the engineering of the properties of the spatial medium. Long-term prospects, such as the control of inertia or the local modulation of force fields, would become legitimate scientific objectives, potentially rich in revolutionary technological advances. We strongly encourage the particle physics community to consider the implementation of this experiment.

References

1. Michelson, A. A., Morley, E. W. *On the Relative Motion of the Earth and the Luminiferous Ether*. American Journal of Science, 34, 333 (1887).
2. G. Furne Gouveia *A Generalized Contraction Framework for the Michelson-Morley Null Result in a Medium-Based Theory*. Preprints 2025, 2025092283. <https://doi.org/10.20944/preprints202509.2283.v2>
3. G. Furne Gouveia *Deriving Relativistic Kinematics from a Medium-Based Paradigm: A Complete Geometric Demonstration*. Preprints 2025, 2025092412. <https://doi.org/10.20944/preprints202509.2412.v2>

4. Einstein, A. *Zur Elektrodynamik bewegter Körper*. Annalen der Physik 17, 891 (1905).
5. Lorentz, H. A. *Electromagnetic phenomena in a system moving with any velocity smaller than that of light*. Proceedings of the Royal Netherlands Academy of Arts and Sciences, 6, 809 (1904).

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.