Concept of Electric Field Standing Waves and the Possible Mechanism Behind the Constancy of Light Speed

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ABSTRACT

This paper proposes a concept of an electric field standing wave that does not radiate energy, using it to speculate on the nature of fundamental particles and the reason why the speed of light appears to be constant. Through a mechanism involving the reflection of a spherically symmetric electric field variation, this study explains how electric field energy can be confined to a specific space, leading to the formation of quasi-fundamental particles with mass. Furthermore, it is theorized that if both time and distance are defined by the internal oscillations of such particles, then even if the actual speed of light varies, the observed value of light speed would remain constant. This idea also provides a possible explanation for why material objects cannot exceed the speed of light.

Keywords:

Standing electric wave, Radiation-free field oscillation, Spherical symmetry, Electromagnetic radiation, Light speed invariance, Fundamental particle model, Matter wave.

1. Introduction

A varying electric field usually radiates energy outward as electromagnetic waves, preventing the formation of a stable standing wave. However, if there exists a form of electric field variation that does not radiate electromagnetic waves, the energy could be confined in space in the form of a standing wave. This paper proposes an idea of a spherically symmetric oscillating electric field standing wave, further theorizing that this structure may offer a new perspective on understanding the constancy of light speed.

2. Concept of Electric Field Standing Waves

As shown in Figure 1, if an electric field exhibits a spherically symmetric structure similar to how an electron's electric field radiates outward from its center—and varies at different radii over time, the resulting magnetic fields, due to symmetry, would cancel each other out and fail to form an effective magnetic field. Without a generated magnetic field, the varying electric field cannot form electromagnetic waves to radiate outward. Instead, due to the resistance caused by the opposing magnetic field in space, the electric field would exhibit reflective boundaries, causing it to rebound.



Figure 1: Schematic diagram of magnetic field cancellation due to spherically symmetric variations in the electric field.

This reflection mechanism could turn the outward-moving electric field inward, while the inward-moving field would again reflect outward. Repeating this cycle, the field may form a spherically symmetric standing wave that alternates between inward and outward motions. Since no energy is radiated outward, the energy remains confined in space. According to relativity, the presence of energy implies mass, meaning that the electric field standing wave would also possess energy and could be considered a quasi-fundamental particle.

3. Standing Wave Electric Fields and the Definition of Time

Figure 2 shows the variation of this type of electric field standing wave over one oscillation cycle T, showing different time states. Each small diagram includes: A graph in the upper right corner illustrating the electric field variation over time, with different colors representing direction (magenta for outward, green for inward). The upper left corner depicts the induced spatial charge distribution (red for positive charges, blue for negative charges). Below, a graph showing the relationship between electric field intensity, charge density, and radius.

If the oscillation of this particle is governed by the speed of light, the time required for each reflection would also be related to light speed. Suppose the speed of light were doubled then the oscillation frequency of the particle would also double. However, since the distance traveled by light within one cycle remains fixed, the measured speed of light based on the oscillations of this particle would still be unchanged. In other words, even if the actual speed of light varies—such as near a black hole where space is distorted—using the internal oscillations of this particle as the standard for time and space would still yield a constant observed speed of light.

Moreover, because this fundamental particle itself takes the form of an electric field wave, when moving at high speeds, it essentially behaves as an electromagnetic wave propagating in space. It is therefore constrained by the transmission and reflection timing of light speed, preventing its velocity from exceeding the speed of light.



Figure 2: Diagram of electric field and induced charge variations at different times within an oscillation period T. Each small diagram in the upper right corner represents the temporal variation of the electric field, with different colors indicating field direction (magenta for outward, green for inward). The upper left corner illustrates the spatial charge induction distribution (red for positive charge, blue for negative charge). Below, a graph presents the relationship between electric field intensity, charge density, and radius, where N is a positive integer.

4. A Natural Explanation for the Constancy of Light Speed

Based on the above assumptions, if fundamental particles are a type of electric field standing wave, then both time and spatial units are defined by their internal oscillations. Regardless of the actual external speed of light, an observer using such particles as a reference for measurement would always obtain the same speed of light. Thus, the constancy of light speed may not be an absolute law of the universe, but rather a result of the fact that our definitions of time and space units share the same origin as light speed itself.

5. Conclusion

This paper presents a concept of a spherically symmetric electric field standing wave that does not radiate energy, and theorizes that it could serve as a model for fundamental particles. Furthermore, if the units of time and distance arise from the internal structure of this standing wave, then regardless of changes in the actual speed of light, the observed speed of light would remain constant. It is also theorized that matter itself consists of waves that reflect at the speed of light, meaning that when in motion, it behaves as electromagnetic waves propagating in space, making it impossible to exceed the speed of light. This concept provides a new natural mechanism for the constancy of light speed and an explanation for why velocities cannot surpass the speed of light, while also offering insights into the relationship between mass and wave.

DATA AVAILABILITY STATEMENT

Not applicable

DECLARATIONS

Conflict of interest statement

The author has no conflicts of interest to disclose.

Author Contributions

Kuo Tso Chen designed the study, performed the experiments, analyzed the data, and wrote the manuscript.

Ethics Approval

I confirm that the manuscript has been approved by the author for publication. I declare that the work described herein is original research and that it has not been published previously.

REFERENCES