On the variable nature of the electric charge of subatomic particles

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November 28, 2023

Abstract

In this paper, we propose a variable modeling for the electric charge of subatomic particles, postulating that the charge of some subatomic particle with charge is dependent on its relativistic speed, with the speed of light as the main inertial reference frame, and can be calculated with the formula

$$q_s = \frac{1}{c^2 \cdot \gamma}$$

where c is the speed of light in vacuum, and

$$\gamma = \frac{1}{\sqrt{1 - \frac{v_s^2}{c^2}}}$$

is the Lorentz factor, where we have that v_s is the speed of the subatomic particle in the inertial reference frame where the charge is measured.

1 Introduction

The idea that subatomic particles with charge possess an intrinsic constant charge is one of the fundamental pillars of modern physics, supported by a large number of observations and experiments dating back to the end of the 19th century. However, in this article, we propose to reconsider this notion and hypothesize that the constant electric charge as an intrinsic property of the subatomic particle is an unproven assumption rather than a demonstrated fact.

The history of physics has been closely linked to the discovery and understanding of subatomic particles and their properties. The observation of electrical and magnetic interactions, as well as the development of Maxwell's electromagnetic theory in the mid-19th century, laid the foundation for the concept of subatomic particless with electric charge. Millikan's oil drop experiment [1], performed in 1909, provided an accurate measurement of the elementary electric charge of the electron and contributed to the consolidation of the notion of the subatomic particles with charge.

However, it is important to note that these experiments were performed under conditions in which the subatomic particles were in the same inertial reference frame (Earth). No direct experiment has been carried out that conclusively demonstrates that the inertial reference frame where the subatomic particle is has no impact on its electric charge.

The main proposal of this article is to present a theory that questions the existence of the intrinsic constant electric charge of subatomic particles, and suggests that this charge could be a consequence of its motion at relativistic velocities. This is consistent with the Balloon expansion model recently proposed by Waugh [2], according to which every observer (or every frame of reference) is moving with a velocity c in one single direction (the real time/universal time direction) irrespective of its location or velocity in the 3D Field-Particle HyperSheet.

2 Main Postulate

Our main postulate states that the charge of the subatomic particle is dependent on its relativistic speed, with the speed of light as the main inertial reference frame. Concretely, we postulate that the charge of the subatomic particle is non-constant, and can be calculated with the following formula:

$$q_s = \frac{1}{c^2 \cdot \gamma} \tag{1}$$

Where c is the speed of light in vacuum, and $\gamma = \frac{1}{\sqrt{1-\frac{v_s^2}{c^2}}}$ is the Lorentz factor. Here, v_s is the speed of the subatomic particle in the inertial reference frame where the charge is measured, which is approximately equal to the speed of expansion of the universe (c) adjusted by the local inertial reference frame.

We can check that this formula is consistent with the charge $q_s = 1,6021766 \times 10^{-19}$ that has been measured through various experiments performed on Earth. The most accurate measurements of the speed of light in vacuum is $c = 299.792.458$ m/s. We can approximate v_s taking into account that the Earth has a translation movement of approximately $v_t = 29.800$ m/s around the Sun, so we have that the approximate speed of the subatomic particle in the local inertial reference frame on an experiment performed in the Earth would be of $v_s = c - v_t = 299.762.658$ m/s.

As a result, using (1), we get that

$$q_s = \frac{1}{c^2 \cdot \gamma} = 1.5687747 \times 10^{-19} \tag{2}$$

Note that the difference with the measured charge $1,6021766 \times 10^{-19}$ could be due to a variety of facts that should have been incorporated to derive correctly v_s, such as the obliquity of the elliptic of the Earth, the local curvature of the 3D Field-Particle HyperSheet relative to the center of expansion of the universe, the possibility that the speed of expansion of the universe is locally slightly lesser than c,... Any tiny variation on v_s or c could make the formula yield the experimentally measured charge of subatomic particles with charge, as the difference adjusting v_s just with the translation velocity of Earth is of approximately 2.08%. For instance, setting $v_s = c - (29.800 \times \cos(23.5 - 1.57)) = 32.124$, where 23.5 is the approximate obliquity of the elliptic, and 1.57 is the inclination to the invariable plane of the Earth orbit around the Sun, yields $q_s = 1.628795 \times 10^{-19}$, which is 1.66% greater than the experimentally measured charge of subatomic particles with charge.

From (1), it can be deduced the following corollary:

$$q_s = \frac{m_s}{E_s} \tag{3}$$

Where m_s is the relativistic mass of the subatomic particle, and E_s is the relativistic kinetic energy of the subatomic particle. This is so because we can calculate the relativistic mass of the subatomic particle with the speed of light as the main inertial reference frame as $m_s = m_0 \cdot \gamma$, where m_0 is the mass of the subatomic particle at rest, and we can calculate the relativistic kinetic energy of the subatomic particle as $E_s = m_s \cdot c^2 \cdot \gamma$.

3 Final Remarks

Note that our postulate needs to be checked performing some experiment where the components of the local inertial reference frame change. For instance, the postulate predicts that the charge of some subatomic particle measured in outer space in some vehicle moving slow in the vicinity of Earth could be significantly lesser than the charge of that subatomic particle measured in Earth. As an example, plugging $v_s = 299.792.000$, for some inertial reference frame very close to the speed of light in vacuum, would yield $q_s = 1.94528 \times 10^{-20}$, a charge which would be approximately $12,14\%$ of the currently assumed constant charge of the subatomic particles with charge.

Sadly, performing such an experiment to confirm our postulate is beyond of our current financial capabilities, so we shall wait to some experiment to be performed under different local inertial reference frames to confirm our postulate.

References

[1] R. Millikan. The isolation of an ion, a precision measurement of its charge, and the correction of stokes's law. *Science. 32 (822): 436–448*, 1910.

[2] S. Waugh. Unified physics and cosmology: the theory of everything. *SSRN: https://ssrn.com/abstract=4211207*, 2022.