the general science journal

The Minimalist Approach to Neutrino Helicity

Branko Zivlak, bzivlak@gmail.com

Keywords: Bošković, Neutrinos, Helicity

1. Introduction

No problem can be solved from the same level of consciousness that created it[1], Albert Ajnštajn

The aim of this work is to provide a new, although essentially already three centuries old, approach to the neutrino helicity problem, based on the teachings of Ruđer Bošković's Theory of Natural Philosophy [1]. Given that it is a capital work of human civilization, I believe that its detailed explanation would be superfluous, since it would exceed the scope of the topic itself from the title. A key aspect relevant to this discussion is the term "*non-extended*", which is thoroughly elaborated in more than thirty places in Bošković's work [1], from where I quote:

7. The primary elements of matter are in my opinion perfectly indivisible & non-extended points; they are so scattered in an immense vacuum that every two of them are separated from one another by a definite interval; this interval can be indefinitely increased or diminished, but can never vanish altogether without compenetration of the points themselves; for I do not admit as possible any immediate contact between them.

I also quote from the book of Dragoslav Stoiljković [2, p 4-11]:

"Also, in some of these classes (of particles), the absence of any force may be admitted; then the substance of one of these classes will pass perfectly freely through the substance of another without any collisions" /8, Section 518/. We only need to call these particles "neutrinos", and then Boscovich's idea is the same as contemporary understanding.

In short, what is known about the helicity of neutrinos is as follows:

The main reason why right-handed neutrinos are not observed in nature (i.e., why neutrinos are always left-handed, and antineutrinos right-handed) is related to the fundamental assumption of the **Standard Model** and the way it describes neutrinos **as massless particles (or particles with extremely small mass)**. In the original version of the Standard Model, neutrinos were considered **massless**, which means they travel at the speed of light. For massless particles, **helicity** (the projection of spin onto the direction of motion) is equivalent to **chirality** (the property that determines how a particle participates in weak interactions). Weak interactions (which involve neutrinos) only support **left-handed particles and right-handed antiparticles**.

If a neutrino is massless, it can only have one helicity: left-handed helicity (spin opposite to the direction of motion) for neutrinos, or right-handed helicity (spin in the direction of motion) for

[1] https://www.jagranjosh.com/general-knowledge/albert-einstein-quotes-1698299107-1

antineutrinos. Experiments have shown that neutrinos do indeed possess a very small mass. However, the Standard Model does not include right-handed neutrinos, as they would not participate in weak interactions. If they exist, such neutrinos would be sterile, meaning they would not interact except through gravity.

In the context of extended theories, such as the Seesaw mechanism, right-handed neutrinos would be extremely massive and practically undetectable in low-energy processes.

2. "Non-extensible" as a source of neutrinos

Here we assert: neutrinos arise from Bošković's "non-extended" (infinitely small point with no spatial extension), so their appearance in space-time requires only one helicity. The other helicity would represent a "collapse" back into a non-extended state – meaning the particle could not manifest.

Left-handed helicity (for neutrinos) and right-handed helicity (for antineutrinos) become **mandatory conditions for existence** in the extended world. The opposite helicity would be equivalent to a "return to nothingness." This concept provides a metaphysical basis for why the Standard Model does not account for right-handed neutrinos – they would be a "return to the non-extended."

There is no natural process that would generate neutrinos of the opposite helicity - which is consistent with observations. Existence requires certain **boundary conditions**.

Neutrinos do not "emerge from" the inextensible, *but are manifestations of the very process of transition from the inextensible to the extensible*. Left helicity for neutrinos and right for antineutrinos represent the minimum condition for separation from the *inextensible*, while the opposite helicity would be a logical contradiction (return to non-existence).

A concept is a self-consistent logical structure that does not require additional postulates, relates metaphysical principles to observable phenomena, and offers ontological explanation instead of mere description. In this way, we understand elementary particles - not as "things" but as "**boundary phenomena**" between the inextensible and the extensible. Neutrinos are borderline phenomena on the threshold of existence, where Left helicity is the minimum condition for stable manifestation. The concept is simple which is a sign of deep truth.

There is no need for Sterile Neutrinos, Exotic Mechanisms and Space-Time Modifications, but nature itself imposes this asymmetry.

3. Conclusion

An innovative concept was proposed to understand the asymmetry in neutrino helicity - the question of why neutrinos with right helicity have not been observed in nature, i.e. why neutrinos exclusively possess left helicity, and antineutrinos have right helicity.

The paper establishes a bridge between empirical facts and the fundamental nature of reality, based on Bošković's Theory.

Novi Sad 9.4 2025.

Literatura

[1] Boscovich, R.: 1758, *Philosophiae naturalis theoria redacta ad unicam legem virium in natura existentium*, Beč (prvo izdanje; 1763, Venecija, (drugo izdranje); 1922 i 1966, A Theory of natural philosophy, Open Court, London i The Massachusetts Institute of Technology, M.I.T. Press, Cambridge (redom); 1974, *Teorija prirodne filozofije svedena na jedan jedini zakon sila koje postoje u prirodi*, (dvojezično: latinski i hrvatski), Liber, Zagreb, 1974.

[2] Stoiljković, D.: 2010, *Ruđer Bošković – utemeljivač savremene nauke*, Istraživačka stanica Petnica, Valjevo, https://www.researchgate.net/publication/260297371 (English translation: Stoiljkovich, D.: 2014, *Roger Boscovich – The Founder of Modern Science*, LULU Publishing, https://www.researchgate.net/publication/281489710)