Yoshio Koide Law, Antimatter and Locality

Author : Dominique MAREAU, Engineer formerly from ex DOUAI School of Mines, now IMT Nord Europe. Former physics teacher at Schneider Electric school

Abstract

Yoshio Koide's formula [1] shows a common link between the three leptons: electron, muon and tauon. The accuracy of this formula was improved by a factor of 100 in 2016 [2] by expressing the masses of the particles in the unit "undressed whole electron". The unit "electron" is universal, as it is not based on the arbitrary units [kg, m, s] of the SI system. Without violating the cosmological principle, which states that all localities are equivalent, the results of the paper [2] are interpreted as the possibility of having a duality of locality. This paper suggests that there is an original non-locality caused by inflation. Thus the original electron-positron pairs are different from those extracted with fermion status, in all potential localities. If the locally extracted pairs annihilate immediately in gamma rays, the original pairs, causally separated, are able to condense into composite particles. It is shown that this paradigm immediately resolves: 1) the enigma of antimatter; 2) the enigma of the proton mass; 3) the enigma of the muon mass; 4) the proton spin crisis; 5) the enigma of the equality between the charge of the proton and that of the positron. The concept of antimatter is based only on local experimentation. There is no "elected" matter.

1. Introduction

The origin of the mass of the stable proton remains an enigma for the Standard Model, because quarks represent less than 1% of its mass. The interaction between quarks and the Higgs boson does not really explain this enigma. The absence of matter-antimatter parity remains a mystery for the Standard Model, as does the equality of charge between a proton and a positron. The various interactions of the weak force are very well described by the Standard Model. However, the physical causes are not explained. The cosmological principle

stipulates that all localities are equivalent. However, there is a duality of locality between all potential localities and the non-locality relating to primordial inflation. It is conjectured that this inflation achieves a generalized primordial causal separation, which prevents the annihilation of pairs as observed locally. By injecting about one MeV locally, an electron-positron pair is extracted, which annihilates immediately. But by artificially separating the two opposing elements, we are able to delay their annihilation. Thus, the local status of fermion cannot be projected to the original non-locality. If the original inflation separated the pairs from their common origin, then these electron-positron pairs have a boson status. The results of paper [2] indicate that composite particles are formed of electro-positron pairs of non-local origin and therefore causally separated from their common origin. The same is true for a proton-antiproton pair, which annihilates when it is extracted locally. Yet the original proton forming matter is quite stable. This is the enigma of antimatter. The possibility of a hydrogen atom in which the symmetry is strictly respected between the single positron confined in the nucleus and the orbital electron is studied below. The paradigm developed below is based on the synthesis of these propositions: 1) the hypothesis of John Wheeler [3] [4] [5], which evokes a single original particle, structuring space-time and of which a part would be devoted to matter particles; 2) this single particle would be a variety of the preon [6] [7],, in the form of a dipolar oscillator boson of tachyon type [8] [9] whose superluminal aspect gives it a spatial amplitude on the cosmological scale; 3) Without perturbation, the algebraic sum of the two opposite poles of the preon-tachyons is zero; 4) the inflation proposed by Alan GUTH [10] caused a generalized causal separation (or delocalization) of the electron-positron pairs inherited from the poles of the preons then isolated by crossed relocalization; 5) if the relocation associates neighboring poles from different preons, then the crossing of neighboring pairs has a boson status. This is different from local extraction, whose energy injection relocates the poles of the same preon; 6) the "measured free electron" unit, dressed in virtual particles [11] can be replaced by the "whole naked electron" unit. This is confirmed by the study [2], which indicates that the (unstable) masses of the muon and the tauon are composed of locally extracted electron-positron pairs. The mass of the muon, measured at 206.76 "dressed electron" units, shows a generalized coherence if it is composed of 206 "whole naked" electron units whose fusion masks the charges + 1 single electron or positron. The mass of the tauon, measured at 3479.3 "dressed electron" units, is coherent if it is composed of 3480 "naked and whole" electron units + 1 single electron or positron. The new paradigm presented here extends this coherence to the mesons, the neutron and the proton, by including the physical cause of the presence of quarks. Thus the mass of the

neutron, measured at 1838.72 dressed electron units, comes back to 1842 whole and naked units. Generalized coherence is verified if the neutron is composed of 1840 units with masked charges + a single electron-positron pair, extracted locally. By the play of polarized intervals (quarks) this pair is kept causally separated. Then, the β– reaction leaves in place the positron which materializes the charge of the proton. The proton, by the β+ reaction, generates the neutral part of the neutron (1840). The weak force locally extracts an electron-positron pair that restores the neutron to 1842 bare units. According to this paradigm, there are three types of locality: 1) external locality through the extraction of an unstable pair; 2) confined locality that provides a temporary causal separation between the elements of the neutron lone pair; 3) the original non-locality generated by the causal separation relative to inflation. The expression of masses with the unit "electron" is universal, because it does not rely on arbitrary units, such as kg, meter and second. However, the mass of the free electron (measured) is considered "dressed" in virtual particles [11]. Thus the coherence of this paradigm implies that the proton, measured at 1836.15264 of (dressed electron), is constrained to be composed of an integer number of naked units (be). The multiple coherence shown below, constrains the proton to be composed of 4 neutral groups of 460, i.e. 1840 units with masked charges + 1 single positron, i.e. 1841 be. The quarks are materialized by the interaction between the 3 polarized intervals and the single positron. Atomic hydrogen has perfect symmetry between its orbital electron and its confined single positron. This paradigm immediately resolves: 1) the mystery of antimatter, 2) the enigma of the proton mass [12]; 3) the enigma of its radius; 4) the proton spin crisis; 5) the enigma of the equality between the charge of the proton and that of the positron. During the original and generalized relocation, the more centered confinement of the positron was equi-probable with that of the electron. There is no antimatter any more than there is "elected" matter.

2. Duality of locality and antimatter
Problem statement: Quantum mechanics is an effective theory that seeks to make all observables consistent, including those that have no physical explanation. Thus, the Schrödinger wave function $\Psi(r,t)$ is interpreted as a probability density, without giving a physical explanation. Other enigmas relating to locality remain, such as Heisenberg uncertainty, the phantom link of entangled particles, the tunnel effect, and wave-corpuscle duality. In line with Abdus Salam's preon proposal and John Wheeler's single particle [3] [4] [5], it is proposed that the preon is the elementary dipole particle that structures spacetime. During inflation, the part of the preon poles that became matter were first causally separated.

Then they underwent a generalized and crossed relocation so that the positive pole of preon A is close to the negative pole of preon B. Thus, Figure 1 shows the principle of fusion of crossed pole pairs in front of electron-positron pairs fused in bosonic mode. If all localities are indeed equivalent, there is however an original non-locality [13], characterized by a causal separation. It is known that locally, the artificial separation of the positron and the electron prolongs their lifetime. This makes credible the hypothesis of an original causal separation which contradicts the generalization of the local experiment.
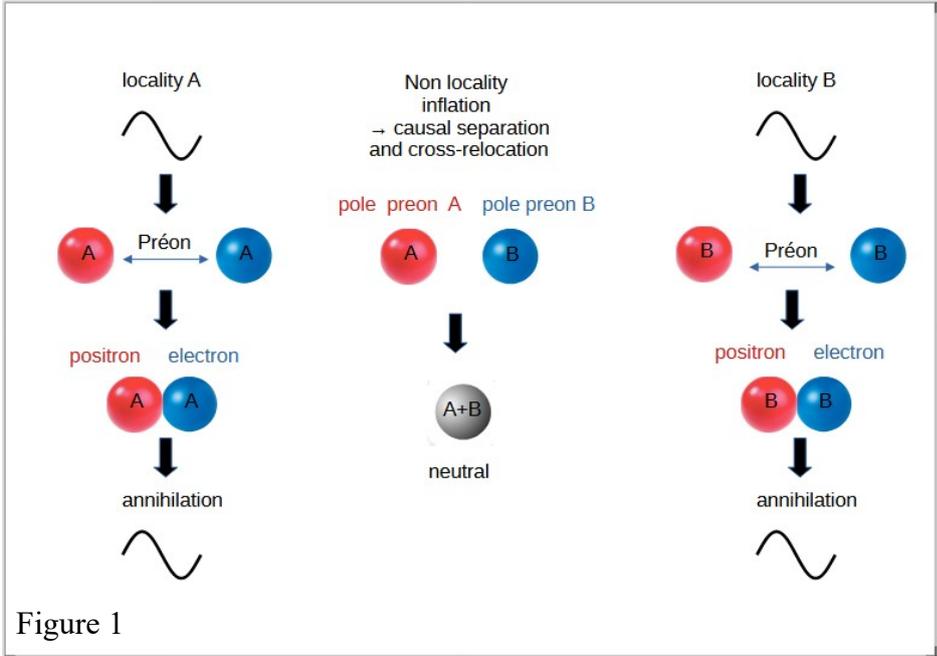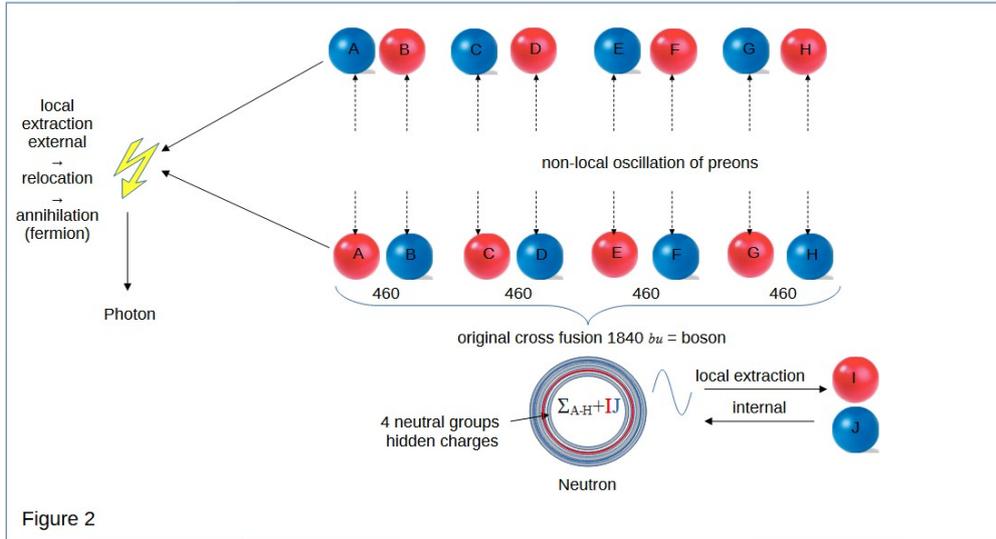

Figure 1

Figure 1 shows that in all potential localities, the extraction of a pair from the same preon amounts to a relocalization of the two opposing elements of the same preon. This results in annihilation. However, the central process amounts to merging two crossed elements, since they come from different preons. The boson-fermion dichotomy only makes sense in the case of local extraction. This means that in the general case, electron-positron pairs are bosons. Figure 2 below schematizes the difference between the local extraction of a pair (valid for all potential localities, since there is no elected locality) and original fusion. Local extraction, which amounts to relocalizing the two poles of the same preon, can only annihilate. In contrast, original fusion (after delocalization by inflation) relocalizes opposing poles from different preons.

Figure 2

On the left, figure (2) shows that the local injection of an adequate level of energy amounts to relocating the two opposing poles of the same preon. The inherited electron-positron pair annihilates immediately. On the other hand, the original fusion of the preon poles, after inflation and relocation between neighboring poles from different preons, forms the majority part (1840) of the neutrons. On the other hand, the origin of the single pair is local and therefore reputed to be unstable. However, it appears possible that the internal polarizations generate a potential barrier, playing the role of causal separation.

3. Internal structure of neutrons and protons

The origin of the mass of the stable proton remains an enigma [12] for the standard model, because the quarks represent less than 1% of its mass. The interaction between the quarks and the Higgs boson does not really explain this enigma. The absence of matter-antimatter parity remains a mystery for the standard model. Moreover, the equality of charge between a proton and a positron remains a mystery. The mass of the proton is given by: P = 1836.15267 of (dressed electron). The following relationship shows that the radius of the proton is proportional to the Compton radius of an electron for a quarter of its mass. This result is consistent with the measurement: r_p = 0.84184(67) *fm* [14] with the muonic hydrogen scattering method.

$$r_p = \frac{4\, m_o\, \lambda_e}{P} = 0.84123\, fm \tag{1}$$

With m_o the mass of an electron expressed in de. The mass of the proton divided into 4 neutral groups, is confirmed by the consistency of table (3) below. The radius relative to a quarter of the mass of the proton is to be compared with the proton spin crisis for which CERN [15] showed that the quarks seem in fact to orient themselves in such a way that their spins only

explain a quarter of the value of that of the proton. This subject is discussed in chapter (5). The following table (3) shows a consistency between the number of groups and the number of quarks for 6 types of particles, according to an extension of the publication [2] and the relations of chapter 4:

mass in electron units	muon	pion $\pi°$	pion+/-	proton	tauon	neutron
measured mass	206,76	264,76	273,13	1836,15	3479,3	1838,72
total bare mass	207	270	277	1841	3481	1842
entire neutral part	206	270	276	1840	3480	1840
dressing rate	1,00112	1,01979	1,01416	1,00264	1,00048	1,00180
group number	1	3	3	4	1	4
number of quark intervals	0	2	2	3	0	3
number per neutral group	206	90	92	460	3480	460

Table 3: The generalized consistency of this table constrains a single group to muons and tauons and therefore do not have a quark gap. The neutron has a lone pair (Figure 6), where the electron (spherical wave) occupies a more off-center position than the positron. This (generalized) position was equi-probable with that of the positron. The electron is arranged to be ejected after more than 800 seconds. It is the lone positron that gives the proton its charge. The 206 neutral units of the muon cannot be divided into an even number, forming only a single group, without a quark gap. The only possible divisor of the pions (to form even groups) is 3. These 3 groups form de facto, 2 quarks gaps. The tauon is ambiguous, because it potentially has multiple divisors (3, 4, 5). It therefore forms a single group, but this ambiguity results in decay modes that can include quarks.

4. KOIDE's relationships expanded and made exact

Publication [2], limited to relations between leptons, proposes exact relations, when expressed in bare mass and entire (*be*) electron-positrons. Table (3) shows a coherence for 6 particles of different families, between the possible divisors and the number of quarks. Below, the consistency of table (3) extends to these exact relationships between, from left to right:
- an electron (become massive by the causal separation of the preon poles),
- a muon (207 *be* → 206.76 *de*),
- a pion $\pi°$ (270 *be* → 264.76 *de*),
- a neutron (1842 *be* → 1838.72 *de*),
- neutral part of a tauon (3480 *be*) with global measure = 3479.3 *de*,
- neutral part of a pion (276 *be*) with global measure = 273.13 *de*.
With *be* = bare mass electron and *de* = dressing mass electron.

$$e \quad \mu_n \quad \pi^\circ \quad n \quad \tau \quad \pi^{+/-}$$
$$1 + 207 + 270 + 1842 - \frac{3480 \times 276}{2 \times 207} \equiv 0 \tag{2}$$

Below is the link in whole units between the muon and the neutral part of the $\pi^{+/-}$ pion:

$$207 \equiv \frac{3}{4} \quad 276 \equiv 270 - 2^6 + 1 \tag{3}$$

Below is the relationship in bare and whole units of the neutron, muon, tauon and the neutral part of the proton. Note that the neutron is equal to the difference between 2^{11} and the neutral part of the muon.

$$1842 \equiv \frac{206 + 3480 + 1840}{3} \equiv 2^{11} - 206 \tag{4}$$

Below is the link in whole units of the tauon with 3/2 of the sum (muon+pion+proton).

$$3480 \equiv \frac{3}{2}(-2 + 206 + 276 + 1840) \tag{5}$$

and:

$$3480 \equiv 5! \times 2^5 \tag{6}$$

These 5 exacts relationships reinforce John Wheeler's hypothesis, namely a single original particle, but in dipolar form.

5. Discussion

According to this paradigm, the neutral part of the massive composite particles is made up of a stack of electron-positron pairs fused in concentric layers, which masks the charges. In the reaction $\beta^+ : 2P^+ \rightarrow$ deuterium, we observe that one of the protons loses a positron to become a neutron (reduced to 1840).
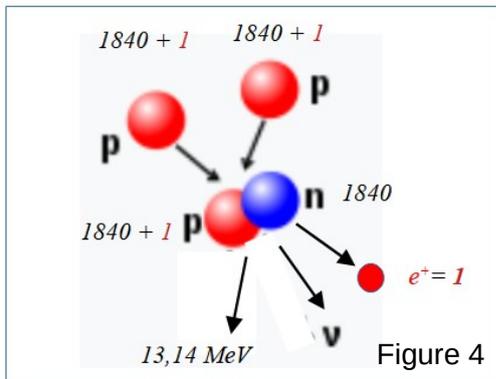
Figure 4

This positron emission coincides with the transformation of a proton into a neutron. Figure (5) reveals the two positrons of the protons in this reaction: $4P^+ \rightarrow {}^4He$.
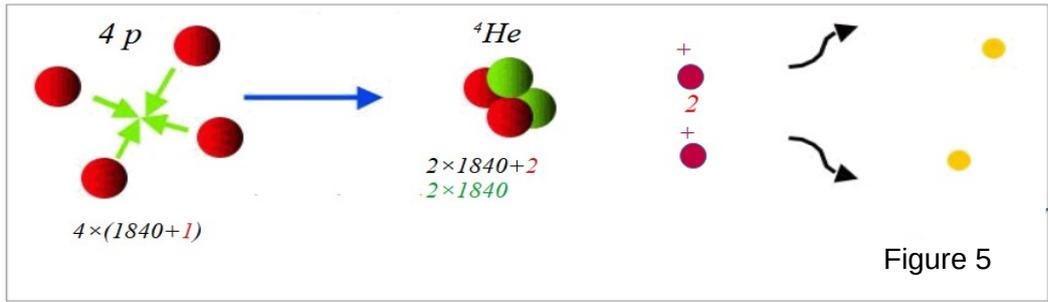
Figure 5

Relations (2 and 4) indicate that the neutron is made up of 1842 naked and whole units. However, figure (5) shows a reduction of the neutron to 1840 naked and whole units. The lone pair has disappeared. But the energy of this reaction can extract a local pair in the confinement of the neutron. It would then be stabilized by the internal polarizations which would materialize a potential barrier playing the role of causal separation. However, this stability is temporary since the neutron disintegrates into a proton with the emission of its electron. On the other hand, the emitted positrons (figures 5), immediately annihilate with an electron. The weak force process is capable of materializing a pair in the confinement of the neutron. Under these conditions, antimatter exists only in the restricted framework of the local extraction of a pair. According to this paradigm, the hydrogen atom has parity between positrons and electrons. The positron giving the nucleus charge is balanced by the orbiting electron.
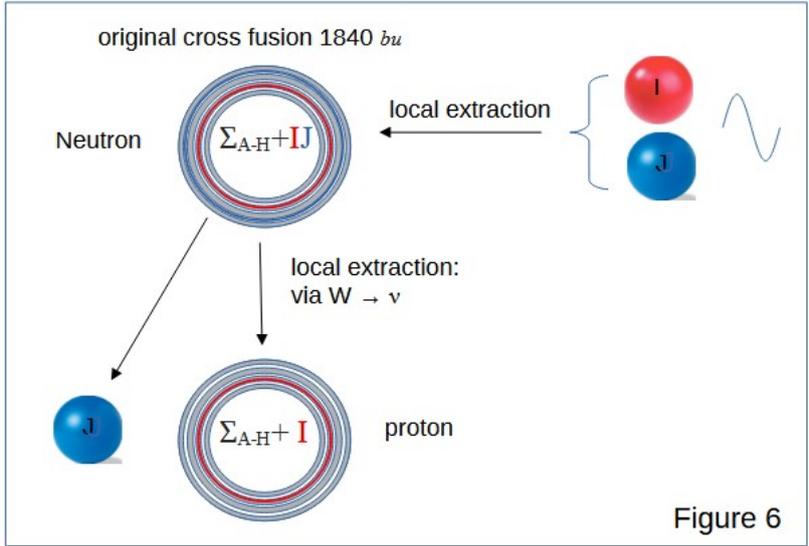

Figure 6

Figure (6) indicates that the fused neutral layers, like the single layers, are in the form of a spherical and concentric wave. This type of stacking masks the charges. According to this paradigm, the neutrino is of the Majorana type. It is extracted – via the W boson – from the coupled preon, but remaining in its form in two opposite, oscillating and canceling poles. These two poles are quanta or integer values of electron-positron pairs. On the other hand, we

can assume that each of the two poles of a photon is in the form of an unquantized wave. These waves, in phase opposition, cancel each other out of perturbation. The proton spin crisis is resolved if we return to the origin of the Planck constant in which it is fundamental to note: ML = Cte.

$$\hbar = m_e \, \lambdabar_e \, c = 1.054718 \times 10^{-34} \, kg \, m^2 \, s^{-1} \tag{8}$$

Thus the relation (1) of the radius of the proton, takes the form:

$$m_{gp} \, r_p = m_e \, \lambdabar_e \tag{9}$$

With m_{gp} the mass of a group representing a quarter of the mass of the proton. It is the external group which constrains the radius according to ML = Cte. The 3 other groups are contained inside via the polarized intervals. Relation (9) shows that the ML product of the proton is equal to the ML product of the electron. Thus, the spin of the proton is equal to the spin of the electron, i.e.:

$$\frac{m_e \, \lambdabar_e \, c}{2 \, \hbar} = \frac{m_{gp} \, r_p \, c}{2 \, \hbar} = \frac{1}{2} \tag{10}$$

Quarks only play a marginal role in calculating the proton spin. The notion of causal separation plays a fundamental role in explaining that antimatter is a decoy relative to locality. This notion of original causal separation, linked to inflation, could explain the cause of gravitation. Indeed, this force varies in 1/r² like the Coulomb force. However, the electron-positron pairs forming matter have undergone a causal separation of limited length. This ratio of lengths is in agreement with:

$$\frac{F_C}{F_G} = \frac{\left(-\dfrac{e^2 \, \alpha}{4 \, \pi \, \epsilon_o} \right)}{- G \, m_e \, m_p} = \frac{\lambdabar_e^2}{\ell_P^2} = 5{,}71 \times 10^{44}, \tag{11}$$

Relation (11) indicates that the ratio between the squares: [Compton length of the electron / Planck length] is equal to the ratio of the forces [Coulomb / Gravitation], applied to an electron-positron pair. Hereafter, relation (12) clearly indicates that the square of the elementary charge of the electron is equal to the ML product of the electron (to within two constants). Thus the electron-positron pairs forming matter, have a very small remainder of Coulomb charge which manifests itself in 1/r², in the gravitational form.

$$e^2 = \frac{m_e \, \lambdabar_e}{10^{-7} \alpha}, \tag{12}$$

Which clearly shows that the square of the elementary charge is equal to the ML product of the electron. The ratios in relation (11) confirm the link between inflation and causal separation. The process of separation is common to the resolution of the mystery of antimatter

and the root cause of gravitation. The ML = Cte law is also the source of the Heisenberg uncertainty applied to an electron, according to:

$$\Delta x \, \Delta p \geq \frac{\hbar}{2} \geq m_e \, \lambda_e \, \frac{c}{2} \;\; \Rightarrow \Delta m \, \Delta \ell = Cte \tag{13}$$

According to this paradigm, the uncertainty law is inherited from the preon-tachyons, from which the mass particles emerge. We prefer the term extraction to the current terminology "creation" when referring to an electro-positron pair. Indeed, if the mass-energy equivalence is real, there is no reason why the notion of inertia can be created from $\hbar \nu$. Thus, the ML = Cte law suggests that the mass of the poles of the preon-tachyon dipolar oscillators oscillates between the near-absolute zero of the zero point and the mass of the electron at the cusp. The smaller the mass at the zero point, the greater its uncertainty (or spatial amplitude). This fundamental variation solves the enigma of the origin of inertial mass. Indeed, absolute zero for inertia would result in an infinite spatial amplitude, which would destroy the notion of oscillation. The very existence of the inertial mass of the poles of preon-tachyon oscillators is justified by its variation and the prohibition of absolute zero. In the 1D dipolar oscillator (elementary constituent of space-time), everything happens as a sort of annihilation with rebound, caused in the blur of the zero point. During the expansion phase (1D), the slowing down is caused by the increase in the moment of inertia ML. Relation (12) indicates that the charge is a function of ML. Its increase causes the reversal and the return to the zero point. Its positioning uncertainty gives it the same spatial potential (1D), thus continuing the oscillatory cycle. Thus, the local extraction of an electron-positron pair is not a "creation" of inertia but just a way of fixing it at its optimal value. Thus the local injection of approximately one MeV amounts to relocating the poles of the same preon-tachyon. This relocation is the physical cause of the annihilation of emerging electron-positron pairs. Preon-tachyons are bosons. The physical cause of inflation is perhaps the last cycle of superluminal expansion of a cosmological BEC formed of synchronized preon-tachyons whose number is saturated. Thus, the radial and generalized causal separation could have resulted in a tangential relocation between poles separated from their origins. Regardless of all speculation, the notion of inertia must have pre-existed at least in a stochastic and variable form.

6. Conclusion

The paradigm developed here is a coherent solution to the antimatter crisis. The principle of locality duality does not violate the cosmological principle, since it considers that all localities are equivalent. This idea that the Universe is spatially isotropic and homogeneous on a large

scale is formulated through the Friedmann-Lemaître-Robertson-Walker (FLRW) cosmologies as a metric of spacetime, and culminates in the predictive model of Cold Dark Matter (Lambda-CDM). But if all potential localities are equivalent, this is not the case for the non-locality relative to the original inflationary phase. The latter could have caused a generalized causal separation (Figure 1). The enigma of antimatter rests only on local experience. Electron-positron pairs extracted in all potential localities, not undergoing causal separation, are immediately annihilated. The same fate befalls proton-antiproton pairs. However, it is clear that the protons forming the original matter have a different status than that of local emergence. If the causal separation of the opposing poles of preons was followed by a relocation between poles from different preons, then the inherited electron-positron pairs can merge between neighbors. These are the elementary bosons of all composite particles in the universe. Relations (1 and 9) show the importance of ML = Cte. With the constant c, it determines Planck's constant. It also determines the radius of the proton, relative to that of the electron. The structure of the proton in 4 concentric groups also determines the spin of the proton. The crisis of its spin is resolved by considering that quarks play only a minor role in its determination. Table (3) provides relative coherence to the structure of the six particles studied. To this coherence are added those of relations (2 to 6). The consequences of the original causal separation provide explanations for the following enigmas: 1) antimatter; 2) the mass of the proton; 3) the mass of the muon; 4) the radius of the proton; 5) the proton spin crisis. Incidentally, relation (11) provides a beginning of an explanation for the cause of gravitation. The ASPECT experiments [16] on the non-locality of previously entangled spins, point in the direction of a space-time structured by preon-tachyons. According to this approach, all mass particles are coupled with preon-tachyons. The virtual particles that dress the particles are sub-harmonics relative to the coupling. The W boson is thus the transactional vector between the particles and the preon-tachyons, dear to Abdus Salam and by extension, to John Wheeler. In agreement with the latter, there is not a multitude of elementary particles but only one. There is no antimatter, nor would there be a "chosen" matter. Nature prefers symmetry and simplicity [17].

Conflicts of Interest

The author declares that this paper is not subject to any conflict of interest.

References

[1] Yoshio KOIDE ; New view of quark and lepton mass hierarchy Phys. Rev. D 28, 252–1 ; (July 1983).

[2] Dominique Mareau, Improving the Accuracy of Yoshio's Formula Koide, Journal of Physical Mathematics ; (2 Feb 2016).

[3] Su-Peng Kou ; Quantum Spacetime – Unification of Matter and Spacetime ; arXiv:1907.13436v3 ; 5 May 2025

[4] Alexander Blum and Stefano Furlan ; How John Wheeler lost his faith in the law ; arXiv:2206.14664v1 ; 29 Jun 2022.

[5] Jennifer L Nielsen ; Is Bit It ? On the Theme of Wheeler's It From Bit ; arXiv:1910.13280 ; 28 Oct 2019.

[6] Risto Raitio ; String phenomenology with preon models; arXiv:2310.01463; 2/10/2023.

[7] Chitta Ranjan Das, Larisa V. Laperashvili ; Preon Model Family Replicated E-6 Unification; arXiv:0707.4551; 02 Feb 2008.

[8] Rajat K. Pradhan∗† and Lambodar P. Singh ; On Reality of Tachyonic de Broglie Waves ; arXiv:0908.1365v2 ; 11 Aug 2009.

[9] Mark Davidson ; Motions of Classical Charged Tachyons ; Physics Essays V14.pp.66-75,2001.

[10] Alan H. Guth, David l. Kaiser ; Inflationary cosmology: Exploring the Universe from the Smallest to the Largest scales; arXiv:astro-ph/0502328; 16 Feb 2005.

[11] Eugene V. Stefanovich ; Renormalization and dressing in quantum field theory ; arXiv:hep-th/0503076; 11 Apr 2005.

[12] Craig D. Roberts ; Origin of the Proton Mass; arXiv:2211.09905; 17Nov 2022.

[13] Jeff Murugan, Zayd Pandit, Hendrik J.R. van Zyl ; On Complexity and Duality ; arXiv:2411.02546 ; 4 Nov 2024.

[14] Carl E. Carlson ; The Proton Radius Puzzle ; arXiv:1502.05314; 18 Feb 2015.

[15] G.M Shore ; The Proton-Spin Crisis : another ABJ anomaly?; Department of Physics, University of Wales Suansea; CERN-TH/98-398; 1998.

[16] M. D. Reid, Q. Y. He, P. D. Drummond; Entanglement and nonlocality in multi-particle systems; arXiv:1112.0378; 2 Dec 2011.

[17] Symmetry and simplicity spontaneously emerge form the algorithmic nature of evolution; lain G. Johnson et al; Department of ecology & Evolutionary Biology, Yale University:119(11)e2113883119; March 11, 2022.