Locality/Stability Duality of the Electron-Positron Pair

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Keywords : law Koide, inflation, original causal separation, electron-positron, duality of locality, duality wave-particle, duality of boson-fermion, radius proton, decays β^+.

Abstract

The unit "electron" is universal, because it is not based on the arbitrary units [kg, m, s] of the SI system. Any other possible civilizations could express a mass, a length or a time, in the form of a (dimensionless) ratio with the electron. But the free and measured electron, is dressed in virtual particles, which slightly increase its bare mass. Its bare mass is not measurable, because of the impossibility of decoupling it from the virtual particles. Starting from Yoshio Koide's formula [1] and by proposing bare and integer values, the paper [2] improves by a factor ≈ 100, the KOIDE relations. This suggests that the original electron-positron pairs have a different status from the locally created pairs. This new paradigm states that the muon mass, measured at 206.768 "dressed electron" units, shows multiple coherence if it is composed of 206 "naked, whole, and fused" electron units + 1 single electron or positron. Similarly, the mass of the tau, measured at 3477.103 "dressed electron" units, exhibits multiple coherence if it is composed of 3480 "naked and whole" electron units + 1 single electron or positron. We propose to extend this coherence for six types of particles from different families, including pions, protons, and neutrons.

1. Introduction

We know that electron-positron pairs, proton-antiproton pairs, muons, and tauons are unstable because they emerge locally. There are no stable muons or tauons, whereas electrons and protons possess a stable state if it does not emerge locally. A link therefore appears between locality and stability. Without violating the cosmological principle, we can say that if all localities are equivalent, the original nonlocality can be characterized by an inflatory-type causal separation, as proposed by Alan Guth [3]. Experimentally, we know how to achieve an artificial causal separation that extends the lifetime of emergent pairs. According to the paper [2], the muon – measured at 206.768 dressed electrons (de) – is not "a large electron" but a fusion of 103 bare electron-positron pairs, or 206 bare units (be) fused + a single electron or positron, forming 207 be. The 206 fused units mask their charges, so that only the charge of the single positron or electron is measurable. This study shows the interest in clearly distinguishing the expression of the dressed mass of virtual particles [4] from the bare mass. The virtual dressing rate is given by: $\tau = 207/206.768 = 1.0011207$. According to the paper [2], the tauon – measured at 3477.1027 dressed electrons (de) – is a fusion of 1740 naked electron-positron pairs, or 3480 fused naked units (be) + one single electron or positron, forming 3481 be. The 3480 fused units mask their charges, so that only the charge of the single positron or electron is measurable. It is remarkable to note that the virtual dressing rate is the same for the tauon and the muon: $\tau = 3481/3477.1027 = 207/206.768 = 1.0011207$. We propose to extend this new structure to pions, protons and neutrons, taking into account the following eight constraints: 1) justify the link between locality and stability, by introducing the concept of original causal separation; 2) justify the absence of quarks in muons and tauons; 3) justify the presence of quarks in pions, protons and neutrons; 4) justify the link between the mass of the proton and its radius; 5) resolve the proton spin crisis; 6) justify the equality between the charge of the proton and that of the positron; 7) be in agreement with the measured effects of the weak force.

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. The aim is to propose a new paradigm that explains the difference between an unstable proton extracted locally and a proton relative to stable matter. The following figure shows the fundamental difference between the fusion of two poles of the same original dipole and the fusion between two opposite poles, but from different dipoles by causal separation. Local emergence amounts to merging the poles of the same dipole, which causes their annihilation. On the other hand, the original non-local emergence amounts to associating the positive pole of dipole A with the negative pole of dipole B. This crossing allows them to merge without annihilating. This is the difference observed between the (stable) protons of the matter of the universe, and the unstable proton-antiproton pair of local emergence. If all localities are indeed equivalent, there may however exist an original non-locality [5], characterized by a causal and crossed separation. By artificially separating the positron from the electron of the locally extracted pair, their lifetime is prolonged. This makes credible the hypothesis of an original causal separation which contradicts the idea that local experimentation can be universal.

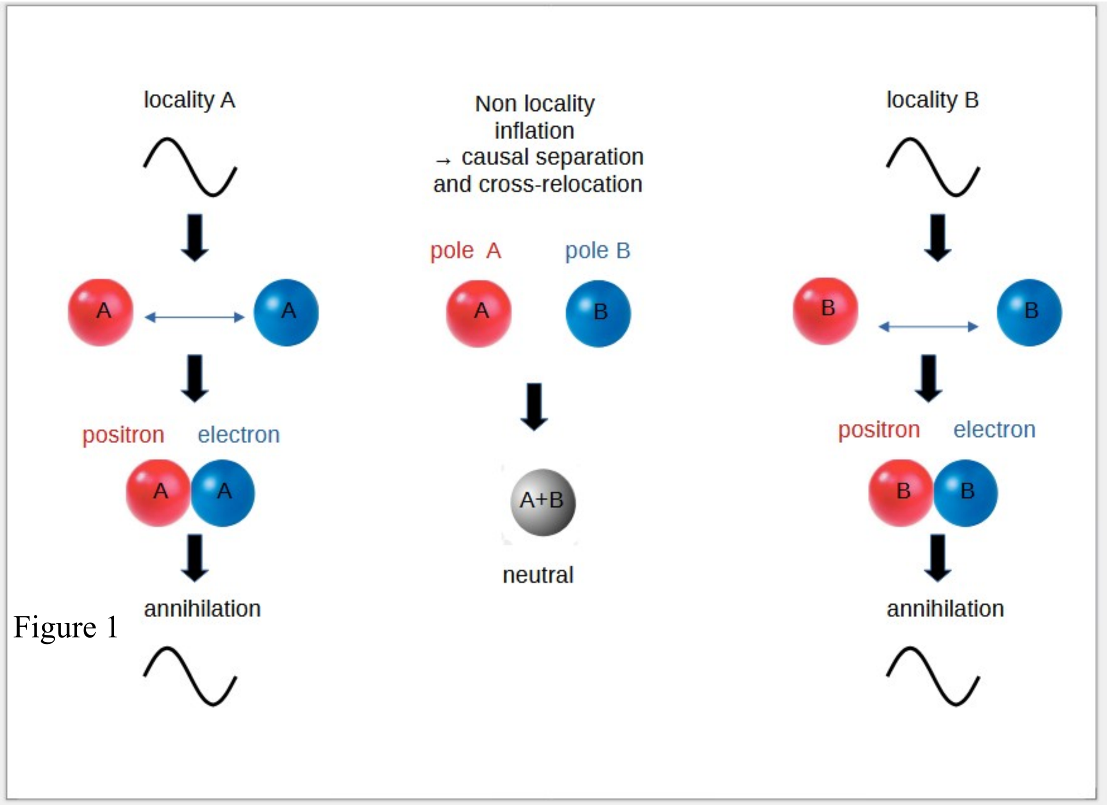

Figure 1 : In all potential localities, the extraction from a bound pair amounts to the relocation of its two opposite poles. This non-causal separation causes their annihilation. On the other hand, the process (in the center of the figure) amounts to merging two crossed elements, because they come from different original pairs. The boson-fermion dichotomy only makes sense in the case of local extraction. The original causal separation confers boson status to electron-positron pairs, contrary to what local experience suggests.

3. Extended coherence to six particles

The mass of the muon and the absence of quarks are two questions not resolved by the standard model. According to the paradigm developed here, we can see that the number of 103 electron-positron pairs (206 units) does not have an integer divisor to form subdivisions into even groups. The concept of subdivision into groups is confirmed in chapter (3). If we express the mass of the proton, measured at 1836.15 dressed units (*de*), according to 1841 naked units (*be*), we see that the neutral part (1840) can be subdivided into 4 groups, presenting 3 intervals. The following table shows a coherence between the number of groups and the number of quark-intervals. Everything happens as if the positron or the single electron polarizes the intervals, to materialize the quarks. Table (3) shows the coherence relative to the possible divisors to form even groups. This is the imperative condition for canceling the charges of the neutral party.

Particles	Muon	Tauon	Pion π°	Pion $\pi^{+/-}$	Proton	Neutron
dressing mass	206,76	3477,79	264,76	273,13	1836,15	1838,72
bar mass	207	3481	270	277	1841	1842
single element local	1±	1±	1±	1±	1+	2±
Nb neutral	206	3480	270	276	1840	1840
dressing rate	1,00112	1,00112	1,0198	1,0142	1,00264	1,0018
group number	1	1	3	3	4	4
intervals-quarks	0	0	2	2	3	3
quarks-types	-	-	$u\bar{u}-d\bar{d}$	$u\bar{d}$ or $\bar{u}d$	u u d	u d d
Nb per group	206	3480	90	92	460	460

Table 2 : The neutral part of the muon (206) can only form one group of an even number. It therefore has no polarized interval that would form quarks. The 1840 neutral units of the neutron have the possibility of dividing into 4 even groups. They therefore generate 3 polarized intervals forming the uud quarks. At the origin of the causal separation, the electron of the single pair had a probability in 2 for the electron to occupy a more off-center place than the positron. Thus the positron always remains confined and gives the charge of the proton. The neutral part of the pions (270 and 276) can only be divided by 3 to obtain even numbers for each concentric group (& 3). There are therefore 2 quarks intervals. The tauon is ambiguous, because it cannot choose between its multiple potential divisors (3, 4, 5). It therefore forms a single group, but this ambiguity is reflected in its decay modes which can include quarks [6].

4. Internal structure of particles in table 3

The fusion of the neutral part is in a 2D spherical wave-particle state with charge masking. The EM force is therefore zero. The neutral pairs form a very stable condensate. The single charge polarizes the gaps between the neutral shells and generates the quarks. In the proton, the positron's attempt to cross the neutral sphere causes a partial unmasking of the charges, which increases the internal Coulomb energy. This potential well is responsible for the confinement of the electron. This spherical symmetry allows the use of Gauss's theorem. The field flux crossing the closed surface is equal to the total charge contained in the volume divided by εo. Its general form is:

$$\iiint_v \operatorname{div} \vec{E}\, dv = \iint_S \vec{E} . d\vec{S} \tag{1}$$

In the case of the neutral sphere, the charges cancel each other out and: ρ = 0. If the confined charges disturb the neutral spherical stacking, the potential difference between two points is obtained by integrating the electric field between these two points.

$$\iiint_v \operatorname{div} \vec{E}\, dv = \iiint_v \frac{\rho}{\epsilon_0} dv = \iint_S \vec{E} . d\vec{S} \tag{2}$$

5. Confirmation of the 4-groups structure of the proton

The origin of the proton mass remains an enigma [7] for the standard model. Indeed, the quark masses represent: u = 2.24311 MeV = 4.38965 de and d = 4.82977 MeV = 9.451624 *de* [8]. The total (2u + d) is worth 0.9929% of the proton mass or 18.2309 *de* (dressed electron equivalents). The interaction between the quarks and the Higgs boson does not explain the enigma of the proton mass. According to the paradigm developed here, the quark charge is not a cause but the consequence of the interaction between the 3 polarized intervals and the single electron. The inter-particle consistency of table (2) concerning the number of groups is confirmed by two relations, the first of which concerns the proton radius:

$$r_p = \frac{4\, m_o\, \lambda_e}{P} = 0.84123\, fm \tag{3}$$

With m_o = 1, the mass of an electron expressed in its own unit and P = 1836.15267 *de* (dressed electron). This physical radius is expected to be slightly larger than that of the charge radius: r_p = 0.84075(64) fm [9] carried out with the muonic hydrogen scattering method. The physical radius – compared to the Compton radius of the electron – is inversely proportional to the mass of the proton's outer group: $m_{gp} = m_p/4$. The difference between the physical radius and that of the positron's charge should be materialized by the thickness of the outer neutral group. If this thickness is fixed at: $e_{pg} = r_p / 4\pi\alpha = 4.88509629\times10^{-19}$ m, with α = 137.03599, the fine structure constant, then we obtain a more precise agreement with the measurement, i.e.: r_p = 0.84074130 fm for 0.84075(64) fm.

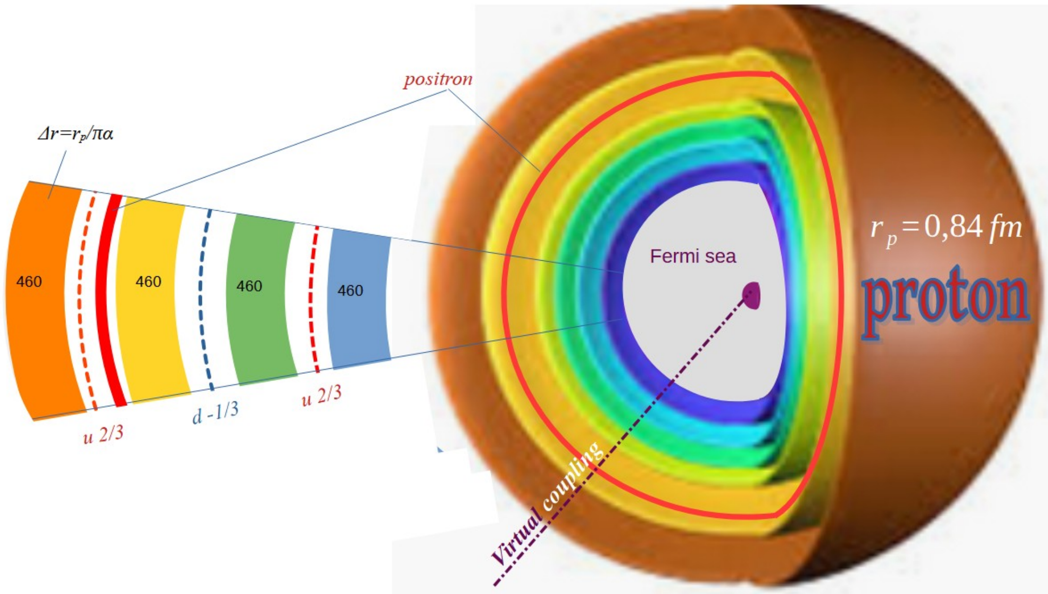

Fig.3: The positron is confined by the balance between two opposing radial forces. The force that tends to deconfine it towards its natural Compton length is counterbalanced by: 1) the repulsive Coulomb force relating to its interaction with the u quark; 2) the attractive Coulomb force relating to its interaction with the d quark. In the nucleus, the confined positron, forced to reduce its radius to: ƛe/α, is compensated by the increase in the radius of the orbital electron to the Bohr radius: ƛe α. According to relation (4), i.e. ML = Cte, the mass of the external group (M) fixes the radius (L) of the proton.

Relation (3) clearly indicates the equality

$$m_{gp}\, r_p = m_e\, ƛ_e = Cte \tag{4}$$

The third clue that confirms the division into 4 groups of the proton concerns the proton spin crisis for which CERN [10] has shown that the quarks seem to orient themselves in such a way that their spins only explain a quarter of the value of that of the proton. The proton spin crisis is resolved if we apply the law: ML = Cte.

$$\frac{m_e\, ƛ_e\, c}{2\hbar} = \frac{m_{gp}\, r_p\, c}{2\hbar} = \frac{1}{2} \tag{5}$$

Relation (5) clearly shows the equality of spins between the proton and the electron, taking into account the division of the neutral part of the proton into 4 groups. The ML = Cte law is also the source of the Heisenberg uncertainty applied to an electron, according to:

$$\Delta x\, \Delta p \geq \frac{\hbar}{2} = m_e\, ƛ_e\, \frac{c}{2} = f(\Delta m\, \Delta \ell) = Cte \tag{6}$$

This uncertainty relation not only concerns the relationship between the state of the particle and the observer, but reveals a deep law relating to wave-particle duality. This law states that the smaller the mass, the greater its spatial uncertainty.

6. KOIDE's relationships expanded and accurate

Publication [2], limited to relations between leptons proposes exact relations, when expressed in the bare integer number (*be*) of electron-positrons. Table (3) shows a coherence for 6 particles of different families, between the possible divisors and the number of quarks. Below, the coherence of table (3) extends to these exact relations between, from left to right:
- an electron, materializing the whole and bare unit.
- a muon (207 *be* → 206.76 *de*),
- a π° pion (270 *be* → 264.76 *de*),
- a neutron (1842 *be* → 1838.72 *de*),
- neutral part of a tauon (3480 *be*) with total measurement = 3479.3 *de*,
- neutral part of a π± pion (276 *be*) with total measurement = 273.13 *de*.

$$\begin{matrix} e & & \mu_n & & \pi^{\circ} & & n & & \tau\ \ \pi^{+/-} & \\ 1 & + & 207 & + & 270 & + & 1842 & - & \dfrac{3480\times 276}{2\times 207} & \equiv 0 \end{matrix} \qquad (7)$$

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

$$207 \equiv \frac{3}{4}\ 276 \equiv 270 - 2^{6}+1 \qquad (8)$$

Below is the exact link in units (bare and whole) of the neutron, muon, tauon and the neutral part of the proton. the bare mass of the neutron is equal to the difference between 2^{11} and the neutral part of the muon.

$$1842 \equiv \frac{206+3480+1840}{3} \equiv 2^{11}-206 \qquad (9)$$

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

$$3480 \equiv \frac{3}{2}(-2+206+276+1840) \qquad (10)$$

and:

$$3480 \equiv 5\,!\times 2^{5} \qquad (11)$$

8. Conclusion

This paradigm 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 space-time, specific to the Cold Dark Matter (Lambda-CDM) model. But if all potential localities can be 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 (Fig. 1). Thus the enigma of antimatter rests only on local experience. Indeed, the electron-positron pairs extracted in all potential localities, not undergoing causal separation, are immediately annihilated. The same fate is true for the proton-antiproton pairs. However, it is clear that the protons forming the original matter have a different status from that relating to local emergence. The antimatter crisis is resolved if we consider that the energy injected during the local extraction of an electron-positron pair relocates two paired opposite poles. On the other hand, as shown in fig. (1), the original fusion, after causal separation, takes place between elements of different pairs. The generalization of fusion into a proton had a probability of two, to confine the positron and eject the electron. Symmetry is restored by considering that the elementary particles are the electron-positron pairs. The hydrogen atom has perfect symmetry between the confined positron and the orbital electron. The antimatter crisis is resolved if we place ourselves at the level of the elementary electron-positron pair. Nature prefers symmetry and simplicity [11]. The locally extracted proton-antiproton pairs are composed of unstable electron-positron pairs. This article indicates that there is only one type of original and elementary particle, in the form of electron-positron pairs. This pair is unstable if it is extracted locally, whereas the original proton which contains a positron, is stable. However, it remains to justify the chronic instability of the positron emitted in the β^+ reaction. The only possible explanation is to consider that the lone pair of the neutron is of local emergence and therefore unstable. The confined potential of the neutron generates a causal separation which prevents the annihilation of the lone pair. Thus the instability of the emitted electron cannot be expressed in a medium of stable electrons. On the other hand, an emitted positron can only annihilate, as observed. The results obtained take into account the eight constraints mentioned in the introduction: 1) the link between locality and stability is confirmed; 2) Table (2) shows that the muon can only have one group and therefore no quark gap; 3) The numbers of possible groups imply the number of quark gaps; 4) The link is confirmed between the mass of the proton and its radius, fixed by the number of groups; 5) The crisis of its spin is also resolved by taking into account the number of groups; 6) The equality between the charge of the proton and that of the positron is resolved; 7) This paradigm is consistent with the measured effects of the weak force. The antimatter crisis is resolved by taking into account the phenomenon of causal separation relative to the elementary status of the electron-positron pair. There was a probability in two that the positron would always be confined in all the protons, during the relocation which followed the original causal separation. This causal separation is to be compared with the original inflation proposed by Alan Guth [3]. It is possible that the original poles are preons [12], common to space-time and matter as suggested by John Wheeler[13]. Finally, it is possible that causal separation is at the origin of gravitation. Indeed, everyone can verify that the ratio between the Coulomb force and the gravitational force (exerted on an electron-positron pair) is equal to the ratio (squared): Compton length electron / Planck length.

$$\frac{F_C}{F_G} = \frac{\left(-\frac{e^2\alpha}{4\pi\epsilon_o}\right)}{-G\ m_e m_p} = \frac{\lambda\!\!\!^{-}{}_e^2}{\ell_P^2} = 5{,}71 \times 10^{44}, \qquad (12)$$

With m_p, the mass of the positron. The experiments of Alain Aspect [14] are consistent with a duality of locality relative to space-time.

Conflicts of Interest

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

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