

# The original electron-positron pairs are pseudo-bosons because they are causally separated by inflation

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## Abstract

The local experimental production of electron-positron pairs or proton-antiproton pairs clearly indicates their instability. But if positrons are isolated, their annihilation is temporarily avoided. Positrons thus causally separated from ambient particles prolong their lifetime. It is clear that the protons forming the matter of the universe are stable. It is proposed here that the original inflation causally separated the elements of each electron-positron pair. The cosmological principle stipulates the identity between all localities. However, there is a duality of locality between any "Locality-type" and the Original Non-Locality (ONL) caused by inflation proposed by Alan Guth. It is reasonable to think that inflation could have causally separated each element of electron-positron pair from the same original source. Thus relocated, these elements of pairs from different sources can merge without annihilating each other. Thus becoming stable, the ONL type electron-positron pair is a candidate to be the elementary particle suggested by John Wheeler. Beyond the falsification criterion, this paradigm resolves several fundamental enigmas, including the mass of the proton and the strange identity of its charge with that of the positron.

## 1. Introduction

Quantum electrodynamics (QED) predicts the phenomenon of electron-positron pair production via the decay of a high-energy photon in the presence of strong external fields. Such photons can be generated by nonlinear Compton scattering, involving electrons propagating in a strong external background. The Dirac process:  $e^+ e^- \rightarrow 2\gamma$  has been widely verified [1]. Experiments allow the isolation of positrons [2] with devices allowing a provisional causal separation. This new paradigm proposes that a causal separation took place

during the inflationary phase. The motivation of this study is to seek to resolve the following puzzles: 1) origin of the proton mass?; 2) why the proton charge is strictly that of the positron?; 3) origin of the muon mass?; 4) the absence of quark in the muon; 5) the matter-antimatter asymmetry. Based on the experimental evidence of local production of unstable electron-positron pairs, the possibility of a stable state has been ruled out. The cosmological principle stipulates the identity of all localities. However, there is a fundamental duality of locality between a "typical locality" and the original non-locality (ONL) caused by inflation [3] proposed by Alan Guth. This inflation could have causally separated the original electron-positron pairs, making them stable unlike the locally produced ones. This ONL-like variety is a candidate for the elementary particle suggested by John Wheeler [4]. Beyond the standard model, each neutron would then consist of a fused and neutral majority part + a single and confined electron-positron pair. According to this paradigm, the fusion of pairs before neutron inflation generalized the electron ejection according to the reaction:  $n \rightarrow p + e^- + \bar{\nu}$ . This probability 1/2 therefore left the positron confined in the proton. It is this precise charge that is measured. The 3 quarks of the proton would thus be the result of an interaction between the single positron and the neutral shells. The matter-antimatter asymmetry is a typically local artifact. Each locality being causally separated from the others, cannot generalize an identical fusion mode. Thus the probability 1/2 is expressed by the emergence of a neutral pair. Originally, the proton (atomic hydrogen with its peripheral electron) is strictly symmetrical at the level of the frame of reference of the constituent electron-positron pairs. Muons, tauons and mesons, of purely local emergence, alternately present a positive or negative charge. This is again the signature of the probability 1/2, whose symmetry is at the scale of the "composite particle" frame of reference. This quest for the unique original particle, like the preon, is widely shared. In another way, Yoshio Koide [5] and I [6] have worked in this direction. The local production of proton-antiproton pairs [7] is unstable, because the ultimate components have not undergone causal separation. The local symmetry is revealed at the "composite particle" scale while the original symmetry is revealed in the "electron-positron" frame. Besides the fact that the proton charge is measured strictly at that of the positron, several other concordant indices are shown below, which reinforce this paradigm.

## 2. Inflation et séparation causale

Below, simplified figure (1) shows a variety of inflation that explains the fundamental difference between original pairs having undergone inflation (or causal separation) and the creation of pairs, by injection of energy in a type locality:

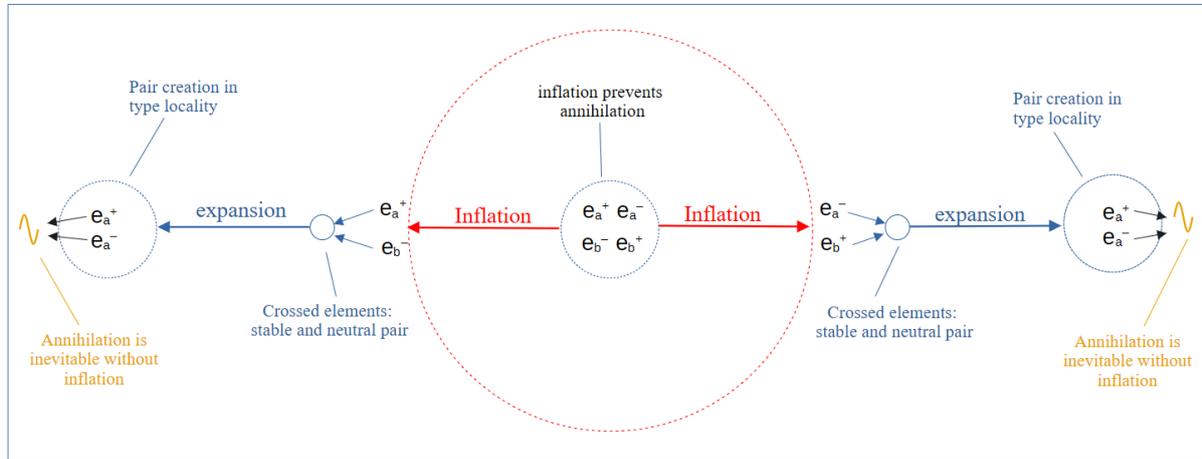


Fig.1: Simplified view of two original pairs in the center: the elements of the two original pairs (index a and index b) are saved from annihilation by the causal separation achieved by inflation. At the end of inflation, neighboring and opposite elements can merge into stable and neutral pairs, because they are different original pairs. Radial causal separation (inflation) results in stable and neutral tangential fusions. On the other hand, the creation of a pair in a type locality – not followed by inflation – results in annihilation. The original pairs are stable unlike those created locally.

According to this paradigm, the proton (the basis of stable matter) is composed of stable electron-positron pairs, because it is of the ONL type. Its mass is measured at 1836.15 “dressed electron” units. But this unit includes a minority of virtual particles [8]. Table (2) below shows a general consistency between leptons for a proton comprising 1841 “naked and whole electron” units [6]. It includes a neutral part of 1840 naked units and a single positron, which gives it its charge. Thus the neutron is made up of a neutral part of 1840 elements (electron or naked positron) + 1 single electron-positron pair. According to the reaction:  $n \rightarrow p + e^- + \nu^-$ , and figure (3), the proton retains the single positron which gives it its charge. In post-inflation fusion, there is a 1/2 probability that the electron's position will be generalized further outward than the positron's. Tangential clustering after inflation has made not only distant parts of the universe homogeneous, but also the generalization of electron ejection and thus positron confinement. Thus, the original fusion produced only stable protons and no unstable proton-antiproton pairs. There is no antimatter, nor is there any eluted matter. The symmetry is real at the level of the "electron-positron" frame.

### 3. Radius of the proton, according the law: $\Delta m \cdot \Delta l = Cte$

The proton charge radius is measured at 0.84184(67) fm [9]. Considering that it is comparable to the Compton radius of the electron, based on the inverse of the mass ratio between the electron ( $m_e$ ) and the proton ( $m_p$ ), we obtain this agreement with the measurement:

$$r_p = \lambda_e \frac{4 m_e}{m_p - m_e} = 0,841694 \text{ fm}, \quad (1)$$

This agreement indicates that the neutral (majority) part of the proton is divided into four concentric neutral shells and that only the mass  $m_{pc}$  of the outer shell controls the radius. The four shells form three intervals polarized by the interaction of the positron with the neutral shells. The charge radius coincides with the radius of the outer neutral shell. Equation (1) highlights the constant:  $m_{pc} r_p = m_e \lambda_e = Cte$ . Its generalization appears as  $\Delta m \cdot \Delta l = Cte$ . in the expression for the Heisenberg uncertainty:

$$\Delta x \Delta p \geq \frac{\hbar}{2} = m_e \lambda_e \frac{c}{2} \Rightarrow \Delta m \Delta l = Cte \quad (2)$$

The moment  $m_e \lambda_e = Cte$ , also governs the standard definition of the square of the elementary charge, to within 2 constants:

$$e^2 = \frac{m_e \lambda_e}{10^{-7} \alpha}, \quad (3)$$

The moment  $m_e \lambda_e = Cte$ , also fixes Planck's constant, by the parameters of the electron:

$$\hbar = m_e \lambda_e c \quad (4)$$

The solution to the Schrodinger equation also includes Planck's constant and therefore the constant  $\Delta m \cdot \Delta l$ .

$$i \hbar \frac{d}{dt} |\Psi(t)\rangle = \hat{H} |\Psi(t)\rangle \quad (5)$$

According to this paradigm, the following table (1) is consistent with particles consisting of a neutral part divided into  $n$  layers.

### 4. The structure of the proton is consistent with 5 others particles

The measured mass of particles includes a minority share of virtual particles [8]. This share varies depending on the composite particles studied. Thus the following table expresses the masses of particles in two types of units: 1) “dressed electron” unit; 2) “naked and whole electron” unit [6]. According to this paradigm the muon is made up of elements (naked electron or positron) whose charges are neutralized + 1 single electron or positron. Thus the

muon, measured at 206.76 “dressed electron” units, is also expressed in whole “naked electron” units, i.e. 207 [6]. The table below shows multiple coherences relative to the link between the number of neutral layers and the number of polarized intervals and of quarks.

mass in electron units	muon	pion $\pi^0$	pion+/-	proton	taupon	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

Tab. 2 : Muons and taupons have a single group and therefore no polarized interval forming quarks. The neutrality of the neutron is ensured by a lone pair, whose electron is ejectable, because it is located at the periphery. The 206 units of the muon can only be divided by unity to form an even number (neutrality condition). The only possible divisor of pions is 3, to obtain even groups. The taupon is ambiguous, because it has a multiple divisor (3,4,5). This ambiguity results in decay modes that can include quarks.

Relation (1) and the consistency of table (2) indicate that: 1) the proton is composed of 4 neutral concentric shells of 460 bare units each. The three intervals are polarized by the interaction between the positron and the neutral shells. The intervals materialize the quarks; 2) the quarks do not explain the mass of the proton and are induced; 3) the elementary particle is the electron-positron pair; 4) there is a probability 1/2 that the single electron of the neutron is ejected, because it is placed less at the center than the positron

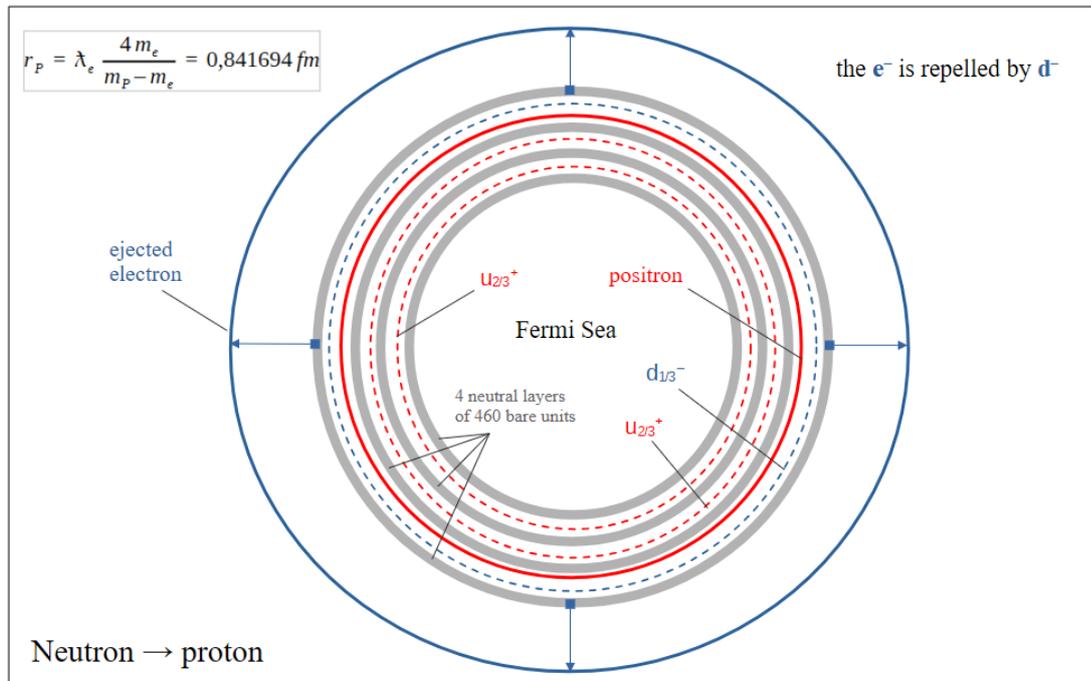


Fig.3 : Simplified 2D drawing of a proton. The mass of the outer shell determines its radius, according to the law  $m_p r_p = m_e \lambda_e = Cte$ . The 3 polarized intervals materialize the quarks. In the neutron, the original causal link homogenized the external position of the electron which was repelled by the d quark, of the same negative sign.

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  $\epsilon_0$ . Its general form is as follows:

$$\iiint_v \operatorname{div} \vec{E} dv = \iint_s \vec{E} \cdot d\vec{S} \quad (6)$$

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

$$\iiint_v \operatorname{div} \vec{E} dv = \frac{\iint_v \rho}{\epsilon_0} dv = \iint_s \vec{E} \cdot d\vec{S} \quad (7)$$

The majority and neutral part of the proton is similar to a Bose Einstein condensate.

## 5. Koide's extended relations

The consistency of table (1) is confirmed by the following exact relationships:

$$e \quad \mu \quad \pi^0 \quad n \quad \tau \quad \pi^{+/-} \\ 1 + 207 + 270 + 1842 - \frac{3480 \times 276}{2 \times 207} \equiv 0 \quad (8)$$

From left to right: an electron (or positron), a muon, a  $\pi^0$  pion, a neutron, the neutral part of a tauon; a charged pion. Hereinafter the muon is linked to the  $\pi$  pion and the neutral pion.

$$207 \equiv \mu = \frac{3}{4} \pi^{+/-} \equiv \frac{3}{4} 276 \equiv 270 - 2^6 + 1 \quad (9)$$

Below are other exact connections between the neutron and the neutral parts: muon, tauon and proton.

$$1842 \equiv \frac{206 + 3480 + 1840}{3} \equiv 2^{11} - 206 \quad (10)$$

$$3480 \equiv \frac{3}{2}(-2 + 206 + 276 + 1840) \quad (11)$$

$$\frac{1840}{4} \equiv \frac{5}{3}(276) \quad (12)$$

Ces relations exactes confirment les liens entre les six particules du tableau (2).

## 6. Conclusion

The principle of locality duality (ONL) does not violate the cosmological principle, since it considers that all localities are equivalent, as formulated by Friedmann-Lemaître-Robertson-Walker (FLRW) cosmology. However, there is indeed a duality of locality between any

locality type and the non-locality relating to the causal separation of the original inflationary phase. Indeed, the experiment of creation of electron-positron pairs in all potential localities shows their instability, because they annihilate each other since there is no causal separation. It is the same for proton-antiproton pairs, which do not exist as such in stable matter. Local creation is incapable of creating stable particles. In no case can it represent the original process leading to the stable matter of the universe. It is on this misleading basis that the possibility of considering original and stable electron-positron pairs as pseudo-bosons, being the fundamental elements of composite particles, has been excluded.

The single particle proposed by John Wheeler makes sense with the idea that nature prefers symmetry and simplicity [10]. The complexity that followed is linked to the observed growth of entropy. It is clear that the protons forming the original matter have a different status than that relating to local emergence. The antimatter crisis is resolved if we consider that symmetry is judged at the level of the ONL manifold of the electron-positron pair. Beyond the falsification criterion (suffering from locality), this paradigm solves important puzzles: 1) the mass of the proton is explained by considering the quarks as secondary actors and induced as the virtual particles of the Fermi sea; 2) the neutral mass of the proton is correlated with its radius, under the condition of division into 4 groups according to the law  $\Delta m \cdot \Delta \ell = Cte$ . Relations (1 to 5) show the importance of the inertial moment of the electron ( $\Delta m \cdot \Delta \ell$ ); 3) the number of quarks, and the number of polarized intervals, is correlated for 6 composite particles. 4) the equality of the charge of the proton with that of the positron is finally justified; 5) the (local) mass of the muon is explained as well as its instability; 6) the absence of quark in the muon is explained and correlated in table (1). Thus 206 units, therefore 103 pairs, cannot be divided into an integer shadow; 7) the symmetry of the muon, ( $e^+$  or  $e^-$ ), is alternating, because there are no links between the different localities, except the spin state [11]. Again, these are the charges of the positron or the electron; 8) the apparent matter-antimatter asymmetry is explained. There is no “elect” matter. The generalized confinement of the positron in the proton of ONL origin, simply had a probability 1/2. Local production, not having the power to generalize one option, displays both options: 1) the pair for the proton; 2) the charge alternation for the muon. As described by Alan Guth, inflation was preceded by a general homogenization. This explains the homogeneity of the distant parts of the universe and also the non-causality between localities (on a cosmological scale). There is therefore a correlation between the duality of locality and the duality of stability. In this respect, the local experiment is misleading [12]. It is possible that the proton spin crisis [13] can be resolved by the 4-layer architecture, proposed in chapter (3).

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## Conflicts of Interest

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

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