

**Part 1**  
**Chapters 1 – 2**

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## Foreword

This paper aims to integrate recent discoveries concerning the scalar boson—commonly known as the Higgs boson—into the framework of contemporary physics. It begins by examining the relationship between the Higgs boson mass and the masses of the neutron, proton, and electron. From this analysis emerges a new conceptual mechanism, referred to as *massification/demassification*, which describes the quantum creation of mass via the Higgs boson, followed by its annihilation a quantum instant later—ultimately resulting in baryonic mass.

This process is iterative in nature: *massification/demassification* is a discontinuous quantum phenomenon, yet endlessly reproducible due to the persistent presence of the Higgs field. This generates a chain of mass - antimass - mass transitions, constantly reinitiated in a non - continuous manner. Through this dynamic, baryonic mass—the type of mass we observe in the classical physical world—is produced and perceived.

The uninterrupted, yet quantized, link between the Higgs boson and baryonic mass gives rise to a brane of positive mass, offset by a corresponding brane of negative mass. This positive/negative mass is not directly observable but underlies baryonic mass like an immaterial thread - a fabric composed of both mass and antimass. This ethereal substratum behaves in a way that defies certain principles of classical physics, notably time and its derivative: space. In the absence of time, space loses its conventional meaning.

This perspective opens the door to a redefinition of fundamental physical quantities: mass, time, and space, as well as electromagnetism, and the weak and strong nuclear interactions. All are re-examined through the lens of the Higgs boson and the Brout-Englert-Higgs mechanism.

The key results are:

- A new structural model for the neutron and proton, in terms of mass and electromagnetism,
- A proposed unification of the weak and strong nuclear forces,
- A novel approach to calculating the binding energy of elements and their isotopes.

Furthermore, these findings may pave the way for technological breakthroughs in several domains: nuclear energy production, antigravity (through the interaction of mass and antimass), and information technology—moving beyond electron-based systems to those utilizing gluons.

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Brussels, Whit Sunday, June 8th, 2025

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# CHAPTER 1

## RELATIONSHIP BETWEEN HIGGS BOSON MASS AND NEUTRON, PROTON, AND ELECTRON MASSES

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### Abstract

The main results presented are:

- a new theoretical framework based on an iterative process of “massification/demassification” of mass-energy leading to the decay of Higgs boson into bottom and charm quarks, and then strange, and up-and down quarks, the latter constituting the nucleon mass.
- the identification of mass-energy structure of Higgs boson and other quarks on the basis of very simple matrices.
- the identification of the mass structure of neutron and proton.
- the identification of the dipolar magnetic moments of neutron and proton and their correlation with their mass, Lande g-factor for neutron and proton.
- the identification of gluons mass and electromagnetism within neutron and proton.
- correlation between mass and dipolar magnetic moment: negative electromagnetism can be described as mass + antimass (case of neutron), positive electromagnetism can be described as antimass + mass (case of proton).
- explanation of the weak force as a “demassification/massification” reaction to the massification/demassification process of the electron.
- explanation of the strong force as a partial demassification/massification reaction to the massification/demassification process of the neutron and proton. This explanation enables to interpret the strong interaction in a new way (see chapter 2).

Keywords: Higgs boson, neutron, proton, electron, dipolar magnetic moment, weak nuclear interaction, strong nuclear interaction.

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### 1. Introduction

The scalar boson called Higgs boson is the fundamental particle associated with the Higgs field, a field that endows with mass other particles of the Standard Model such as electrons and quarks. In the Standard Model of particle physics, there are only three stable particles, the electron, the proton, and the neutron. However, the neutron is only stable when it is confined within a nucleus. Given that these are the only three particles within the Standard Model that are stable, it might be interesting to examine the relationship of the mass of these three particles and how these three particles relate to the mass of the Higgs boson. It will be shown how mass and electromagnetism, as well as the weak nuclear interaction, are yield by the Brout-Englert-Higgs (BEH) mechanism because of the massification /demassification

process discussed in the paper presented. This process is generating the neutron, proton, and electron from the Higgs boson through the bottom, charm, strange, up, and down quarks. According to the theory presented in this paper, the neutron is the first baryonic outcome of the BEH mechanism, prior to the proton and electron. Therefore, the decay of the neutron into proton and electron is part of the BEH mechanism indicating that the electroweak force is involved in that mechanism. This represents a step further to the unification of the four fundamental forces. To determine the process of mass appropriation of the neutron, proton, and electron from the Higgs boson a structure of the Higgs boson mass, on one side, and the neutron, proton, and electron masses, on the other side, is presented. Moreover, the mass structure of the neutron and the proton will be explained, as well as the structure of their dipolar magnetic moments. The weak nuclear interaction will be addressed to explain the mechanism of neutron turning into proton, electron, and antineutrino and to briefly explain the variation of energy values of the expelled electrons. The strong nuclear interaction will be discussed in more detail in chapter 2. It will be shown how the BEH mechanism is unifying the creation of baryonic mass, of electromagnetism, and of weak and strong interactions. This is not the unification of gravitation with the three other forces. Nevertheless, this leads to comparing the process of baryonic mass creation with the gravitation process at quantum level. The similarity between the massification /demassification process and the quantum loop gravity is an issue to take into consideration.

### **1.1. The Brout-Englert-Higgs mechanism endowing particles with mass (1)(2)**

The BEH mechanism describes how fundamental particles get mass. These fundamental particles acquire mass by interacting with a field that permeates the entire Universe. The Higgs boson<sup>(3)</sup> is the quantum particle associated with this field. Since it cannot be observed directly, experiments have searched for the Higgs particle, whose discovery has led to prove the existence of the Higgs field.

### **1.2. Methodology**

Particles exist as massive entities because they acquire their mass from a fundamental scalar field, commonly called the Higgs field. This field fills the entire universe and is associated with the Higgs boson. The Higgs boson itself has a mass; however, the reason for this remains unknown. Moreover, massive particles are composed of only about 1% intrinsic mass; the remaining 99% consists of energy, which is equivalent to mass according to Einstein's equation  $E = mc^2$ . The Higgs boson endows particles with mass, not with energy. Nevertheless, mass and energy are two ways of describing the same physical quantity. Keeping in mind these proportions of 1% mass and 99% energy, I postulated the following. There is 100% mass and 99% "antimass," resulting in 1% observable mass and 99% energy (= 99% mass + antimass). In other words, mass would have an equivalent counterpart that offsets it.

In the material universe, mass prevails over antimass. The explanation I propose is the following: the process that creates mass, which I call *massification*, produces time as a by-product. The opposite process, which I call *demassification*, occurs within this newly created temporal condition, with a quantum delay of about 1%. In that case, the nucleon would simply be a “compressed” Higgs boson, as described below.

According to the theory presented in the present paper the baryonic mass is created through a process of “massification/demassification” which explains the BEH mechanism. As the consequence of mass creation, or massification, the time is created. Both mass and time induce the creation of space as the latter has only significance in the presence of mass and time.

Through the massification/demassification process the mass created is annihilated “immediately” i.e. after a Planck instant. So, this annihilation occurs after the mass creation. The mass and the “antimass”, consequence of the annihilation of mass, are equivalent but of opposed sign. Nevertheless, these two processes differ as they are not occurring at the same time. The Planck time gap, consequence of these processes, leads to create a resulting mass which is the baryonic mass. This is the consequence of demassification occurring after the creation of mass and time. So, mass and antimass are creating the baryonic mass existing in space-time.

One single process called massification/demassification is yielding the mass-energy of all the quarks starting from the Higgs boson and ending with the quarks up and down constituting the neutron and the proton.

Moreover, the nucleon is embedded within the Higgs boson. This means that the nucleon mass should be added to the Higgs boson experimental mass to find its intrinsic mass which should then be about  $(125+1)$  GeV. The CMS collaboration measured the Higgs boson mass to be 125.35 GeV with the precision of 0.15 GeV. Also, ATLAS measured the Higgs boson mass to be 124.97 GeV with the precision of 0.24 GeV.

The nucleon mass could be shaped as follows:  $18 + 1,800 + 18$  or  $(1,800 + 36)$  electron masses. Broken down in the same way as the mass of neutron or proton, the Higgs boson mass is about  $(180,000 + 66,600)$  electron masses. So, a possible relationship between both masses is the ratio 1 to 100 (1,800 to 180,000) and the numerical series from 1 to 36 ( $\times 100$ ), equal to  $(36 \times 37) / 2 (\times 100)$  i.e.  $666 (\times 100)$ . The total is  $(180,000 + 66,600)$  electron masses or  $246.600 \times 0.511 \text{ MeV} = 126.01 \text{ GeV}$ . The mass of the Higgs boson, once nucleon mass deducted, can be described as  $(126.01 - 0.94) \text{ GeV}$  or  $125.07 \text{ GeV}$ .

As already said, the time gap between massification and demassification yields a resulting mass which is the baryonic mass. So, the baryonic mass is embedded within a mass offset by antimass. Also, the value of baryonic mass is about 1% of mass or antimass.

In the paper presented the electron mass is used as a standard measure for the mass of both Higgs boson and nucleon, as well as for the other particles. This is on purpose because the mechanism of “massification/demassification” presented in the following will show that the mass of gluons and quarks is based on modified masses of electrons. According to that mechanism it will be shown how the Higgs boson and BEH mechanism endow gluons and quarks with mass and how these particles retrieve their former mass of one electron once expelled out of the neutron transformed into proton through the weak nuclear force. The gluons and quarks are condensed electrons which are released at the end of that condensation process as electrons again.

## 2. Mass of Higgs boson

According to the theory presented, the Higgs boson has an intrinsic mass of  $1,800 \times 100$  electron masses +  $(171+171+171+153) \times 100$  electron mass and can be described as 246,600 electron masses or 126.01 GeV (see table 1).

### 2.1. Breakdown of Higgs boson mass-energy

On table 1 there is a representation of the mass of scalar or Higgs boson broken down, according to the theory presented, into:

- 1,800 particles of each 100 electron masses, alternating with 1,800 particles of each 100 electron masses, i.e. 1,800 particles of mass 180,000 electron masses at each time. When 1,800 particles are materialized, the other 1,800 particles are dematerialized, hence the alternation.
- these 1,800 particles are broken down into  $18 \times 100$  particles of each 100 electron masses and are called ultimatons.
- these ultimatons are linked to a series of daughter ultimatons.
- the number of the daughter ultimatons is  $(171+171+171+153) \times 100$  (see numbers 1 on table 1), so  $666 \times 100$  in total.
- the mass of each daughter ultimatons can be described as 1 electron mass.
- $(171+171) \times 100$  daughter ultimatons correspond to  $18 \times 100$  ultimatons and  $(171+153) \times 100$  daughter ultimatons correspond to the other  $18 \times 100$  ultimatons.
- The total mass of Higgs boson can be described as  $18 \times 100 \times 100$  electron masses +  $(3 \times 171 + 1 \times 153) \times 100 \times 1$  electron mass.
- According to that hypothesis the mass of Higgs boson can be described as  $[1,800 + 3 \times 171 + 1 \times 153] \times 100$  electron masses = 246,600 electron masses or  $246,600 \times 0.511 \text{ MeV} = 126.01 \text{ GeV}$ . This is the intrinsic mass of the Higgs boson before deduction of neutron mass. As the neutron is embedded within that boson structure, the neutron mass has to be deducted from the intrinsic Higgs boson mass. So, its mass can be described as  $126.01 \text{ GeV} - 0.94 \text{ GeV} = 125.07 \text{ GeV}$ .

Also, this structure shows that the Higgs boson is a composite particle with a core of  $(1,800+1,800)$  particles of 100 electron masses each, i.e., with a mass-energy of  $360,000 \times 0.511 \text{ MeV}$  i.e. 183.96 GeV.

## 2.2. Remark

One notices that there are 153 x 100 daughter ultimatoms which are not increased with 18 x 100 daughter ultimatoms to become 171 x 100 daughter ultimatoms. These 153 x 100 daughter ultimatoms will be increased with 18 x 100 daughter ultimatoms when the neutron is transformed into proton.

## 2.3. Description of table 1 and decay of Higgs boson

On table 1 there are two central columns representing two times 1,800 particles called ultimatoms. Each of these ultimatoms has a mass equal to 100 electrons. One group of 1,800 ultimatoms is alternating with the other group of 1,800 ultimatoms. Only one group of 1,800 ultimatoms is active at each instant at the level of Higgs boson. So, each group of 18 x 100 ultimatoms is producing daughter ultimatoms in turn, nevertheless step by step. The first 100 of first group of 1,800 ultimatoms are producing 36 (18 + 18) x 100 daughter ultimatoms of one electron mass in two steps (see number 1 for one electron mass). The first 100 of the second group are producing 35 x 100 daughter ultimatoms in two steps (18 + 17). Then the second 100 of the first group of 1,800 ultimatoms are producing 34 daughter ultimatoms in two steps (17 + 17). Etc. till 1 x 100 daughter ultimatoms released by the last 100 ultimatoms. In total there are (171 + 171 + 171 + 153) x 100 daughter ultimatoms produced. The second group has only the time to release (171 + 153) x 100 daughter ultimatoms, hence 18 x 100 daughter ultimatoms less than the first group. This is the consequence of the activation in turn of each group. See the succession of 1 and 0 on each line, which is always different from the others. The “0” represent the inactive stage, the “1” the active stage. The second group has only the possibility to release (171 + 153) daughter ultimatoms. This is due to the time shift between the activation of the two groups of 1,800 ultimatoms. On table 1 there are (at the edge of each side) the number of daughter ultimatoms produced at each stage. The total is indicated at the bottom. At that moment the Higgs boson has a mass of 126.1 GeV, broken down as follows: 18 x 100 ultimatoms x 100 electron masses and 666 (i.e. 171 + 171 + 171 + 153) x 100 daughter ultimatoms x 1 electron mass. That is (1,800 x 100 + 66.600 x 1) x 0.511 MeV or 126.01 GeV. This value exceeds the experimental value. Actually, the neutron is embedded in the Higgs boson as a product of many decays of that boson. Indeed, the Higgs boson decays through many steps into up and down quarks, those constituting the nucleon. According to the theory presented, the neutron is the end product of these decay processes. As such, it is embedded in the Higgs boson and its mass should be deducted from the intrinsic mass of the Higgs boson. As the nucleon has a mass of 0.94 GeV the mass of the Higgs boson can be described as (126.01 - 0.94) = 125.07 GeV. The decay steps from the Higgs boson till neutron are studied in the following. One should first consider the bottom quark<sup>(4)</sup>, direct decay product of Higgs boson<sup>(5)</sup> and the charm quark<sup>(6)</sup>, direct product decay of bottom quark.

**Table 1 Intrinsic Higgs Boson Mass  
 Alternation of 2 x 1,800 ultimaton of each 100 electron masses  
 yielding (3 x 171 + 1 x 153) x 100 daughter ultimaton  
 of each 1 electron mass**

1 x 1	1	100				
1 x 1	10	100	1			1 x 1
2 x 1	101	100	01			1 x 1
2 x 1	1010	100	101			2 x 1
3 x 1	10101	100	0101			2 x 1
3 x 1	101010	100	10101			3 x 1
4 x 1	1010101	100	010101			3 x 1
4 x 1	10101010	100	1010101			4 x 1
5 x 1	101010101	100	01010101			4 x 1
5 x 1	1010101010	100	101010101			5 x 1
6 x 1	10101010101	100	0101010101			5 x 1
6 x 1	101010101010	100	10101010101			6 x 1
7 x 1	1010101010101	100	010101010101			6 x 1
7 x 1	10101010101010	100	1010101010101			7 x 1
8 x 1	101010101010101	100	01010101010101			7 x 1
8 x 1	1010101010101010	100	101010101010101			8 x 1
9 x 1	10101010101010101	100	0101010101010101			8 x 1
9 x 1	101010101010101010	100	10101010101010101			9 x 1
10 x 1	1010101010101010101	100	010101010101010101			9 x 1
10 x 1	10101010101010101010	100	1010101010101010101			10 x 1
11 x 1	101010101010101010101	100	01010101010101010101			10 x 1
11 x 1	1010101010101010101010	100	101010101010101010101			11 x 1
12 x 1	10101010101010101010101	100	0101010101010101010101			11 x 1
12 x 1	101010101010101010101010	100	10101010101010101010101			12 x 1
13 x 1	1010101010101010101010101	100	010101010101010101010101			12 x 1
13 x 1	10101010101010101010101010	100	1010101010101010101010101			13 x 1
14 x 1	101010101010101010101010101	100	01010101010101010101010101			13 x 1
14 x 1	1010101010101010101010101010	100	101010101010101010101010101			14 x 1
15 x 1	10101010101010101010101010101	100	0101010101010101010101010101			14 x 1
15 x 1	101010101010101010101010101010	100	10101010101010101010101010101			15 x 1
16 x 1	1010101010101010101010101010101	100	010101010101010101010101010101			15 x 1
16 x 1	10101010101010101010101010101010	100	1010101010101010101010101010101			16 x 1
17 x 1	101010101010101010101010101010101	100	01010101010101010101010101010101			16 x 1
17 x 1	1010101010101010101010101010101010	100	101010101010101010101010101010101			17 x 1
18 x 1	10101010101010101010101010101010101	100	0101010101010101010101010101010101			17 x 1
18 x 1	101010101010101010101010101010101010	100	1010101010101010101010101010101010101			18 x 1
171						153
171						171

Intrinsic Higgs boson mass: 2 x 1,800/2 ultimaton x 100 electron masses + (171+171+171+153) x 100 daughter ultimaton x 1 electron mass = 126.01 GeV

Mass of bottom quark.

$$1,800 + 171$$

$$1,800 + 171$$

$$1,800 + 171$$

$$1,800 + 153$$

$$7,200 + 666 \text{ electron masses or } 4.02 \text{ GeV}$$

The mass of each ultimaton of the bottom quark is divided by 100 compared to the ultimaton of the Higgs boson. One notices the similarity of bottom quark with the Higgs boson structure and mass. Nevertheless, 4 groups of 1,800 ultimaton are active and the mass of each ultimaton has been reduced with a factor of 1/100. So, it is possible to predict the existence of a particle with mass 402 GeV, 100 times that of quark bottom, and having the same structure as this quark. The bottom quark has a basic mass of 4.02 GeV i.e. (4 x 1,800 + 666) electron masses. If the bottom quark mass represents only 1% of another particle mass, this particle would have a mass of (4 x 1,800 + 666) x 100 electron masses. This could explain the existence of a particle of 402 GeV, and also why there are four series (171 + 171 + 171 + 153) x 100 daughter ultimaton within the Higgs boson. This particle, still to be

discovered, could be called Matteron for “Matrix of Matter” (see table 2). Instead of two alternating groups of 1,800 ultimaton there are four groups of 1,800 ultimaton releasing (171 + 171 + 171 + 153) daughter ultimaton.

### 2.3.1. Mass of quark charm.

$$\begin{array}{r}
 1,800 + 171 \\
 + 171 \\
 + 171 \\
 + 153 \\
 \hline
 \end{array}$$

1,800 + 666 electron masses or 1,26 GeV.

One notices that the quark charm structure is quite similar to the Higgs boson structure, the mass of the quark charm being 1/100 of that one of the Higgs boson. The charm quark has a basic mass of 1.26 GeV i.e. (1,800 + 666) electron masses, this being 1% of the Higgs boson mass.

Remark: the mass of the bottom and charm, as well as other quarks have different experimental values. It will be shown in the appendix 1 how these variations of mass occur.

**Table 2 Matteron mass constituted with 4 x 1,800 ultimaton of each 100 electron masses yielding (3 x 171 + 1 x 153) x 100 daughter ultimaton of each 1 electron mass**

1 x 1	1	100	100			
1 x 1	10	100	100	1		1 x 1
2 x 1	101	100	100	01		1 x 1
2 x 1	1010	100	100	101		2 x 1
3 x 1	10101	100	100	0101		2 x 1
3 x 1	101010	100	100	10101		3 x 1
4 x 1	1010101	100	100	010101		3 x 1
4 x 1	10101010	100	100	1010101		4 x 1
5 x 1	101010101	100	100	01010101		4 x 1
5 x 1	1010101010	100	100	101010101		5 x 1
6 x 1	10101010101	100	100	0101010101		5 x 1
6 x 1	101010101010	100	100	10101010101		6 x 1
7 x 1	1010101010101	100	100	010101010101		6 x 1
7 x 1	10101010101010	100	100	1010101010101		7 x 1
8 x 1	101010101010101	100	100	01010101010101		7 x 1
8 x 1	1010101010101010	100	100	101010101010101		8 x 1
9 x 1	10101010101010101	100	100	0101010101010101		8 x 1
9 x 1	101010101010101010	100	100	10101010101010101		9 x 1
10 x 1	1010101010101010101	100	100	010101010101010101		9 x 1
10 x 1	10101010101010101010	100	100	1010101010101010101		10 x 1
11 x 1	101010101010101010101	100	100	01010101010101010101		10 x 1
11 x 1	1010101010101010101010	100	100	101010101010101010101		11 x 1
12 x 1	10101010101010101010101	100	100	0101010101010101010101		11 x 1
12 x 1	101010101010101010101010	100	100	10101010101010101010101		12 x 1
13 x 1	1010101010101010101010101	100	100	010101010101010101010101		12 x 1
13 x 1	10101010101010101010101010	100	100	1010101010101010101010101		13 x 1
14 x 1	101010101010101010101010101	100	100	01010101010101010101010101		13 x 1
14 x 1	1010101010101010101010101010	100	100	101010101010101010101010101		14 x 1
15 x 1	10101010101010101010101010101	100	100	0101010101010101010101010101		14 x 1
15 x 1	101010101010101010101010101010	100	100	10101010101010101010101010101		15 x 1
16 x 1	1010101010101010101010101010101	100	100	010101010101010101010101010101		15 x 1
16 x 1	10101010101010101010101010101010	100	100	1010101010101010101010101010101		16 x 1
17 x 1	101010101010101010101010101010101	100	100	01010101010101010101010101010101		16 x 1
17 x 1	1010101010101010101010101010101010	100	100	101010101010101010101010101010101		17 x 1
18 x 1	10101010101010101010101010101010101	100	100	0101010101010101010101010101010101		17 x 1
18 x 1	101010101010101010101010101010101010	100	100	10101010101010101010101010101010101		18 x 1
171						153
171						171

Matteron mass: 4 x 1,800 ultimaton x 100 electron masses + (171+171+171+153) x 100 daughter ultimaton x 1 electron mass = 402 GeV

**2.3.2. Decay of bottom quark into charm quark.**

Bottom quark	Charm quark
1,800 + 171	1800 + 171
1,800 + 171	+ 171
1,800 + 171	+ 171
1,800 + 153	+ 153
7.866 e-masses or 4.02 GeV	2466 e-masses or 1.26 GeV

**2.3.3. Decay of charm quark into strange quark**

Charm quark	→	Strange quark
1800 + 171	→	171 + (18 + 1.61475)
+ 171	→	171 + (18 + 1.61475)
+ 171	→	171 + (18 + 1.61475)
+ 153	→	153 + (17 + 1.43044)
1800 + 666	→	666 + 71 + 6.27469 e-masses

See tables 3 and 4

The quark strange mass can be described as  $(666 + 71 + 6.27469) / 4 = 185.8187$  e-masses or 94.95 MeV

**2.3.4. Decay of strange quark into neutron<sup>(7)</sup>**

Strange quark	→	Neutron
171 + 18 + 1.61475	→	(18 + 1.61475)
171 + 18 + 1.61475	→	(18 + 1.61475)
171 + 18 + 1.61475	→	(18 + 1.61475)
153 + 17 + 1.43044	→	(17 + 1.43044)
666 + 71 + 6.27469	→	71 + 6.27469 e-masses

See tables 3 and 4

$$666/4 + 71/4 + 6.27469/4 \rightarrow 71/4 + 6.27469/4$$

$$71/4 = 17.75$$

$$6.27469/4 = 1.56867$$

$1800 + 2 \times 17.75 + 2 \times 1.56867 = 1838.63734$  e-masses = 939.544 MeV = neutron mass (see tables 3 and 4).

### 2.3.5. Quarks up and down, gluons(7)

Constitution of neutron (see tables 3 and 4)

$$\begin{array}{l}
 \text{Alternation of} \\
 4 \times 1,800
 \end{array}
 \left\{ \begin{array}{l}
 \left. \begin{array}{l} 1,800 \\ 1,800 \\ 1,800 \\ 1,800 \end{array} \right\} + \left. \begin{array}{l} \left\{ \begin{array}{l} 18 + 1.61475 \\ 18 + 1.61475 \\ 18 + 1.61475 \\ 17 + 1.43044 \end{array} \right\} \\
 \left\{ \begin{array}{l} 18 + 1.61475 \\ 18 + 1.61475 \\ 18 + 1.61475 \\ 17 + 1.43044 \end{array} \right\} \\
 \left\{ \begin{array}{l} 18 + 1.61475 \\ 18 + 1.61475 \\ 18 + 1.61475 \\ 17 + 1.43044 \end{array} \right\} \\
 \left\{ \begin{array}{l} 18 + 1.61475 \\ 18 + 1.61475 \\ 18 + 1.61475 \\ 17 + 1.43044 \end{array} \right\}
 \end{array} \right\} \begin{array}{l}
 \text{Alternation} \\
 \text{Alternation} \\
 \text{Alternation} \\
 \text{Alternation}
 \end{array}$$

$1,800 + (3 \times 18 + 1 \times 17) / 2 + (3 \times 1.6147475 + 1 \times 1.43044) / 2$   
 $= (1,800 + 38.637343) \text{ e-masses} = 939.544 \text{ MeV}$ . The quarks and gluons are the building blocks of the  $(3 \times 18 + 1 \times 17) \text{ e-masses} + (3 \times 1.61475 + 1 \times 1.43044) \text{ e-masses}$ . These are processing line per line and column per column (see tables 3 and 4).

The total (for all lines) of neutron mass can be described as 1,800 electron masses +  $3/2 \times (19.6147475686664860781049986817531801) \text{ electron masses}$  (corresponding to  $3 \times 171 \times 100$  daughter ultimatons) +  $1/2 \times (18.43044313729355057238118681361701) \text{ electron masses}$  (corresponding to  $1 \times 153 \times 100$  daughter ultimatons) = 939.544 MeV.

### 2.4. Mechanism of massification/demassification

The last line of Higgs boson (see table 1) has produced more mass than the former line; this is in relation with the number of daughter ultimatons occupying those lines ( $1 \times 100$  to  $18 \times 100$  daughter ultimatons). The  $18 \times 100$  daughter ultimatons are occupying 18 quantum locations determined by their columns and are yielding a number of gluons particles in accordance with this location within the neutron (see tables 3 and 4). Each location on tables 3 and 4 has a mass value of  $1/100^{\text{th}}$  compared to the preceding location, this corresponds to the decrease of the mass of the 100 ultimatons. Even if the mass of each gluon is decreasing at the rate of  $1/100^{\text{th}}$ , each gluon contains 100 daughter ultimatons which will be released as one electron once the weak nuclear interaction occurs.

**These particles are submitted to a process of iterative massification /demassification. This process creates baryonic mass. These particles constitute also the system of gluons (mass + antimass). In reality gluons are constituted with baryonic mass induced by the massification process and covered with baryonic antimass induced by the demassification process occurring one instant after the massification process.**

Finally, the Higgs boson of mass 246,600 electron masses yields the neutron mass in the following way:

Figure 1: summary of the massification/demassification process.

Table 1	171	1,800	171	171	1,800	153	x 100
	1.18430443	100	1,18430443	1,18430443	100	1.17257864	1
	1.17257864	100	1,17257864	1,17257864	100	1.16096895	2
	1.16096895	100	1,16096895	1,16096895	100	1.14947421	3
	1.14947421	100	1,14947421	1,14947421	100	1.13809328	4
	1.13809328	100	1,13809328	1,13809328	100	1.12682503	5
	1.12682503	100	1,12682503	1,12682503	100	1.11566835	6
	1.11566835	100	1,11566835	1,11566835	100	1.10462213	7
	1.10462213	100	1,10462213	1,10462213	100	1.09368527	8
	1.09368527	100	1,09368527	1,09368527	100	1.08285671	9
	1.08285671	100	1,08285671	1,08285671	100	1.07213535	10
	1.07213535	100	1,07213535	1,07213535	100	1.06152015	11
	1.06152015	100	1,06152015	1,06152015	100	1.05101005	12
	1.05101005	100	1,05101005	1,05101005	100	1.04060401	13
	1.04060401	100	1,04060401	1,04060401	100	1.030301	14
	1.030301	100	1,030301	1,030301	100	1.0201	15
	1.0201	100	1,0201	1,0201	100	1.01	16
	1.01	100	1,01	1,01	100	1	17
	1	100	1	1	100	0	18

Tables 3 and 4      19.6147475(7) 1,800      19,6147475(7)      19,6147475(7) 1,800      18,4304431(4)

Mass compression: massification/demassification process

	<b>HIGGS BOSON</b>			<b>NEUTRON</b>	
	180,000/2	e-masses	- 99 %	1,800/2	e-masses
	180,000/2	e-masses	- 99 %	1,800/2	e-masses
	17,100	e-masses	See tables 3 and 4	19,6147/2	e-masses
	17,100	e-masses		19,6147/2	e-masses
	17,100	e-masses		19,6147/2	e-masses
	<u>15,300</u>	e-masses		<u>18,4304/2</u>	e-masses
	246,600	e-masses		1838,6373	e-masses
MASS	126.01 GeV			= 939,544	MeV
ANTIMASS	<u>125.07 GeV</u>				
	0.94 GeV		= mass of neutron		
	125.07 GeV		= (mass + antimass) or energy = fundamental strong force		
	⇒ gluons				

One notices that:

$$(1 + 0.01)^0 = 1$$

$$(1 + 0.01)^1 = 1.01$$

$$(1 + 0.01)^2 = 1.0201$$

$$(1 + 0.01)^3 = 1.030301$$

$$(1 + 0.01)^4 = 1.04060401$$

etc till

$$(1 + 0.01)^{16} = 1.17257864\dots$$

$$(1 + 0.01)^{17} = 1.18430443\dots$$

These figures represent the line values (1 to 18) of tables 3 and 4.

The presentation on a matrix, like on tables 3 and 4 is more practical than this mathematical equation presentation: when the neutron is expelling the gluons as electrons, each gluon recovers its former condition of one electron and is expelled from the neutron/proton system with an energy corresponding to its place in the matrix (line and column). When the figures are condensed in an equation, it is no longer possible to perceive that phenomenon.

Actually, every group of 100 daughter ultimatoms of the Higgs boson becomes an electron in losing 99% of its mass. Every electron continues to lose mass at the same rate. After 17 modifications of mass the first 100 daughter ultimatoms have reached the level  $10^{-34}$ .

The other groups of 100 daughter ultimatoms have only reached a level of  $10^{-32}$ ,  $10^{-30}$  etc till  $10^{-2}$ . These differences of level and locations are inducing a difference of energy to expel the electron from the neutron becoming proton through the weak nuclear interaction. Hence the variation of energy of the electrons expelled.

## 2.5. Summary of mass endowing process

Each group of 100 ultimatoms keeps its structure when challenged by a decay process resulting in the loss of 99% of its mass. This process is called massification/demassification. Concerning the Higgs boson decaying eventually into neutron, there is an operation of demassification at the rate of 99%, i.e. its mass is reduced by 99%. This is the stage of the charm quark coming after the stage of the bottom quark. The resulting neutron trunk structure (2 x 1,800) remains the same as the Higgs boson trunk structure (see table 1), but this is not the case for the mass (see tables 3 and 4). Also, a particle of 1 electron mass (which will be an electron once charged) has the same structure, i.e. 100 daughter ultimatoms, as before when it had 100 times its present mass. So, during the whole process, the structure of the various gluons does not change, only their mass. One knows that the charge of particles does not vary accordingly, this variability being a feature of the mass. The mass varies from 1/100 to 1/10,000, etc. The result of that "gluon" process is given for each line of the neutron (1 to 18) on tables 3 and 4. The total mass involved is 2 x (19.614747...) electron masses as far as table 3 is concerned and 1 x (18.430443...) electron masses + 1 x (19.614747...) electron masses as far as table 4 is concerned. This slight difference is due to the asymmetrical structure of the Higgs boson and hence of the neutron. This structure aims to be symmetrical when the neutron turns into proton.

**The massification/demassification force is the fundamental strong force which creates the nucleon structure from the Higgs boson, and also poles of the nucleon, constituted with masses (1 %) and gluons (99 %).**

## 2.6. Process of massification/demassification

This process has not to be confused with matter and antimatter (see point 2.7.2). Mass and antimass have the same value, but mass is created first as the massification process occurs prior to the demassification one. So, demassification operates one instant later since the creation of mass has induced the creation of time, and mass and time have induced the creation of space at quantum level. Also, the process of massification/demassification gives the baryonic matter its quantum feature. The existence of this baryonic matter is linked to the time. Outside time this baryonic matter is energy. The process is an iterative one which is the fundamental process of the universe. Nevertheless, this process is slightly reverted with the decay of neutron into proton as the latter particle is losing a small part of its mass.

## 2.7. Conclusions

The theory presented suggests that there is a phase of creation of mass followed by a phase of annihilation of that mass in total, nevertheless with a time-shift, so as to leave a resulting mass of 1% of the total mass created.

### 2.7.1. *Electromagnetism (see point 6)*

This “massification/demassification” phenomenon is also creating a second effect of electromagnetic origin and resulting in the dipolar magnetic moments of the neutron and proton. This process is linked to the BEH mechanism endowing particles (as the nucleon) with mass.

### 2.7.2. *Discussion about antimass*

If there is a process of creation of mass, considered as “positive mass” nothing prevails this positive mass to be annihilated, passing from positive to zero, and so being an antimass, being negative in comparison to positive mass. Indeed, this negative mass cannot exist before there is a positive mass created and should be considered as a reaction to the creation of positive mass. This phenomenon could also explain the discontinuity of matter, passing from +1 to 0 by “demassification” or “annihilation”, and being remassified through a constant massification/demassification process.

## Mass and antimass versus matter and antimatter

These two concepts are not to be confused. The charged matter is the combination of mass and electromagnetism (= mass + antimass as it will be shown). An electron has an electron mass and an electron negative charge which is the combination of mass + antimass. The positron has a mass and a positive charge which is a combination of antimass + mass. Antimatter is mass + [antimass + mass] = mass 1 and charge + 1, and matter is mass + [mass + antimass] = mass 1 and charge -1.

**So, one is led to consider two states of mass for the matter, positive and negative. As far as electromagnetism is concerned, there are also two states, positive and negative, deriving from the two states of mass.**

### 2.7.3. *Towards the fine - structure constant $\alpha$*

$1,800 \times 137 = 246,600$  e-masses = 126.01 GeV.

246,600 e-masses = primitive mass of Higgs boson (i.e. neutron mass not deducted).

Neutron mass =  $1,800 + 71/2 + 6.27469/2 = 1,838.637343$  e-masses or 939.544 MeV.

71 =  $(3 \times 18 + 1 \times 17)$  e-masses of the neutron.

6.27469 =  $(3 \times 1.6147475 + 1 \times 1.430443)$  e-masses of the neutron.

These two values are the result of the 66,600 e-masses of the daughter ultimatons within the neutron.

One observes that  $246,600 / 137 = 1,800$  e-masses, trunk of the neutron mass.

In other terms  $246,600/1,800 = 137$

$246,600 = 180,000 + 66,600$

$180,000/1,800 = 100$

$66,600/1,800 = 37$

The most precise value of  $\alpha^{-1}$  is 137.0359992. In that hypothesis  $\alpha^{-1} \times 1,800 = 246,664.79856$

So, the significance of the value of about 64.79856 e-masses is to be found.

These results illustrate the massification/demassification process based on the loss of 99% of the mass of the Higgs boson. This shows that the fine structure constant controls the Higgs boson decay mechanism into neutron, proton, and electron, i.e. into baryonic matter.

### 2.7.4. *Dark mass and energy*

The Higgs boson mass can be split into 180,000 e-masses and 66,600 e-masses.

In percentage this is:  $180,000 / 246,600 = 73 \%$

$$66,600 / 246,600 = 27 \%$$

Nevertheless, the mass of the nucleon is only 0.94 GeV or 0.75 % of the Higgs boson mass.

Taking account of the decay stages of the Higgs boson into neutron through bottom quark (4.02 GeV), charme quark (1.26 GeV), strange quark (0.09 GeV), and finally neutron (0.94 GeV), the total mass involved is:

4.02 GeV

1.26 GeV

0.09 GeV

0.94 GeV

6.31 GeV or 5 % of Higgs boson mass.

This could account for the 5 % mass involved in the total mass energy of the universe.

### 2.7.5. Decay of Higgs boson into $Z^0$ and $W$ particles

#### Higgs boson

$$\begin{array}{rcl}
 + & 246,600.0000 & \text{e-masses} \\
 - & \frac{1,838.6373}{244,761.3627} & \text{e-masses = neutron mass} \\
 & & \text{e-masses or 125.0730 GeV}
 \end{array}$$

#### $Z^0$

$$\begin{array}{rcl}
 + & 246,600.0000 & \text{e-masses} \\
 - & 66,600.0000 & \text{e-masses} \\
 + & 666.0000 & \text{- 99% of 66,600} \\
 - & 333.0000 & \text{e-masses} \\
 - & 35.5000 & \text{- 2 strange quarks} \\
 - & 3.1373 & \text{e-masses} \\
 - & \frac{1,838.6373}{178,455.7254} & \text{- Neutron} \\
 & & \text{e-masses or 91.1909 GeV}
 \end{array}$$

#### $W^\pm$

$$\begin{array}{rcl}
 + & 246,600.0000 & \text{e-masses} \\
 - & 66,600.0000 & \text{e-masses} \\
 + & 666.0000 & \text{- 99% of 66,600} \\
 - & 7,866.0000 & \text{- 2 bottom quarks} \\
 - & 7,866.0000 & \text{e-masses} \\
 - & 2,466.0000 & \text{- 2 charm quarks} \\
 - & 2,466.0000 & \text{e-masses} \\
 - & 666.0000 & \text{- 4 strange quarks} \\
 - & 71.0000 & \text{e-masses} \\
 - & 6.2747 & \text{e-masses} \\
 - & 1,800.0000 & \text{- Proton trunk and muon (206.7227 e-masses x 0.511 =} \\
 - & \frac{206.7227}{157,252.0026} & \text{105.6353 MeV)} \\
 & & \text{e-masses or 80,355.77 GeV}
 \end{array}$$

Remark: See in appendix 1 the various masses of each quark. In considering the case of  $W^\pm$ , one notices that in replacing the last two lines (1,800 and 206.7227) with the value of the proton (1,836.1122) the  $W^\pm$  mass is increased by (+ 206.7227 - 36.1122) or 170.6105 e-masses.

In this case the  $W^\pm$  mass is: 157,252.0026

$$\begin{array}{r}
 + 170.6105 \\
 \hline
 157,422.6131 \text{ e-masses or } 80,442.95 \text{ MeV}
 \end{array}$$

One can conclude that the measure of the mass depends on the moment that measure is done and on the performances of the devices.

Table 3: Mechanism of acquisition of neutron mass

$10^0$	trunk	$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°	
1	100	1																			1
1	100	1	1																		2
1	100	1	2	1																	3
1	100	1	3	3	1																4
1	100	1	4	6	4	1															5
1	100	1	5	10	10	5	1														6
1	100	1	6	15	20	15	6	1													7
1	100	1	7	21	35	35	21	7	1												8
1	100	1	8	28	56	70	56	28	8	1											9
1	100	1	9	36	84	126	126	84	36	9	1										10
1	100	1	10	45	120	210	252	210	120	45	10	1									11
1	100	1	11	55	165	330	462	462	330	165	55	11	1								12
1	100	1	12	66	220	495	792	924	792	495	220	66	12	1							13
1	100	1	13	78	286	715	1287	1716	1716	1287	715	286	78	13	1						14
1	100	1	14	91	364	1001	2002	3003	3432	3003	2002	1001	364	91	14	1					15
1	100	1	15	105	455	1365	3003	5005	6435	6435	5005	3003	1365	455	105	15	1				16
1	100	1	16	120	560	1820	4368	8008	11440	12870	11440	8008	4368	1820	560	120	16	1			17
1	100	1	17	136	680	2380	6188	12376	19448	24310	24310	19448	12376	6188	2380	680	136	17	1		18
18	1,800	18	153	816	3060	8568	18564	31824	43758	48620	43758	31824	18564	8568	3060	816	153	18	1		

i.e. +19.6147475686664860781049986817531801 + 1,800 + 19.6147475686664860781049986817531801

Table 4: Mechanism of acquisition of neutron mass

$10^0$	trunk	$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°	
1	100																				1
1	100	1																			2
1	100	1	1																		3
1	100	1	2	1																	4
1	100	1	3	3	1																5
1	100	1	4	6	4	1															6
1	100	1	5	10	10	5	1														7
1	100	1	6	15	20	15	6	1													8
1	100	1	7	21	35	35	21	7	1												9
1	100	1	8	28	56	70	56	28	8	1											10
1	100	1	9	36	84	126	126	84	36	9	1										11
1	100	1	10	45	120	210	252	210	120	45	10	1									12
1	100	1	11	55	165	330	462	462	330	165	55	11	1								13
1	100	1	12	66	220	495	792	924	792	495	220	66	12	1							14
1	100	1	13	78	286	715	1287	1716	1716	1287	715	286	78	13	1						15
1	100	1	14	91	364	1001	2002	3003	3432	3003	2002	1001	364	91	14	1					16
1	100	1	15	105	455	1365	3003	5005	6435	6435	5005	3003	1365	455	105	15	1				17
1	100	1	16	120	560	1820	4368	8008	11440	12870	11440	8008	4368	1820	560	120	16	1			18
18	1,800	17	136	680	2380	6188	12376	19448	24310	24310	19448	12376	6188	2380	680	136	17	1	0		

i.e. +19.6147475686664860781049986817531801 + 1,800 + 18.43044313729355057238118681361701

### 3. Mass of neutron

The mass of the neutron is embedded in the mass of the Higgs boson as assumed before. On table 1 there is a breakdown of Higgs boson the mass of which is mainly constituted out of 18 x 100 ultimaton having each a mass of 100 electron masses. Its trunk is made of 18 x 100 ultimaton, alternating with 18x100 other ultimaton, so that there are 18x100 ultimaton constituting this trunk at each instant. This Higgs boson is also constituted with 666 x 100 daughter ultimaton. These daughter ultimaton have each a mass of 1 electron, so that the intrinsic mass of Higgs boson is 1,800 x 100 electron masses + 666 x 100 x 1 electron mass, or 126.01 GeV. The 666 x 100 daughter ultimaton are broken down into (171+171+171+153) x 100 daughter ultimaton.

#### 3.1. Comparison of Higgs boson mass and neutron mass.

Instead of 18x100 ultimaton of global mass 180,000 electron masses at the level of the Higgs boson there are 18x100 ultimaton of global mass 1,800 electron masses at the level of the neutron. So, there is no structural change between Higgs boson and neutron as far as the trunk is concerned. It is only the mass of each ultimaton which is modified, i.e. divided by 100 between Higgs boson and neutron levels. This is the consequence of the massification and demassification processes. The massification creating mass occurs first, yielding the creation of time; both mass and time are yielding the creation of space. Demassification occurs second and in these new conditions. Even if the mass created by the massification can be described as the antimass created by the demassification there is a time shift between the two processes. These two processes are not equal in time. So, the demassification process depends on the massification one. Mass has always a primacy on antimass as far as the neutron is concerned. At the level of the proton there is a slight primacy of antimass, hence the tiny difference of mass between neutron and proton, as it will be shown. So, the trunk of the neutron can be described as 18x100 ultimaton of each 1 electron mass. Moreover, the alternation of 18 x 100 ultimaton with 18 x 100 other ultimaton at the level of the Higgs boson is also operating at the level of the neutron as only 18 x 100 daughter ultimaton x 1 electron mass are present at each time. The 666 x 100 daughter ultimaton x 1 electron mass of the Higgs boson are losing mass in the same way. So, at that stage the mass of the particle issued from the Higgs boson (through bottom quark intermediary) is (1,800 + 666) x 0.511 MeV or 1.26 GeV, mass of quark charm. The quark charm could be structured in the following way:

$$\begin{array}{r} 1,800 + 171 \\ \quad + 171 \\ \quad + 171 \\ \quad + 153 \\ \hline 1,800 + 666 \end{array} = 2,466 \text{ e-masses or } 1,26 \text{ GeV.}$$



of  $10^0$ ,  $10^{-2}$ ,  $10^{-4}$ , etc till  $10^{-34}$ . So, 100 daughter ultimatons of 100 electron masses of Higgs boson are 100 daughter ultimatons of 1 electron mass at level  $10^0$ . The aggregating phenomenon works as follows (see figure 2). At level  $10^{-2}$  the 100 daughter ultimatons have a mass of 0.01 electron, but “occur” 17 times. At level  $10^{-4}$  the 100 daughter ultimatons have a mass of 0.0001 electron and occur 136 times (numerical series from 1 to 16), etc.

Figure 2: breakdown of neutron mass value.

Broken down, line 18 mass value of table 3 is:

Stages	$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$
18		1	16	120	560	1820	4368	8008	11440	12870	11440	8008	4368	1820	560	120	16	1
17		1	15	105	455	1365	3003	5005	6435	6435	5005	3003	1365	455	105	15	1	
16		1	14	91	364	1001	2002	3003	3432	3003	2002	1001	364	91	14	1		
15		1	13	78	286	715	1287	1716	1716	1287	715	286	78	13	1			
14		1	12	66	220	495	792	924	792	495	220	66	12	1				
13		1	11	55	165	330	462	462	330	165	55	11	1					
12		1	10	45	120	210	252	210	120	45	10	1						
11		1	9	36	84	126	126	84	36	9	1							
10		1	8	28	56	70	56	28	8	1								
9		1	7	21	35	35	21	7	1									
8		1	6	15	20	15	6	1										
7		1	5	10	10	5	1											
6		1	4	6	4	1												
5		1	3	3	1													
4		1	2	1														
3		1	1															
2		1																
1	1																	
Total of line 18	1	17	136	680	2380	6188	12376	19448	24310	24310	19448	12376	6188	2380	680	136	17	1

### 3.4. Mass value of neutron

This is the total as seen at line 18 of table 3. There are also 17 other lines. The total of the 18 lines of table 3 is the mass of one of the four sides or poles of the neutron which are alternating two by two. The total mass on table 4 concerns one pole of the neutron mass which is slightly inferior to the mass indicated on table 3. This is due to the break of symmetry between the two phases of the massification of the neutron (see tables 3 and 4) showing the exact numbers.

The total (for all lines) of neutron mass can be described as:

- + 1,800 electron masses
- +  $3/2 \times (19.6147475686664860781049986817531801)$  electron masses (corresponding to  $3 \times 171 \times 100$  daughter ultimatons)
- +  $1/2 \times (18.43044313729355057238118681361701)$  electron masses (corresponding to  $153 \times 100$  daughter ultimatons) = 939.544 MeV.

The last line of Higgs boson has produced more mass than the former line; this is in relation with the number of daughter ultimatons occupying those lines. The 18 x 100 daughter ultimatons constituting the 18 electron masses are occupying a quantum location determined by their line and columns ( $10^0$ ,  $10^{-2}$ ,  $10^{-4}$ , etc.) and are yielding a number of particles in accordance with this location within the neutron. These locations have a mass value of 1/100th compared to the preceding location. Even if the mass is decreasing at the same rate of 1/100 each created gluon contains 100 daughter ultimatons and will be released as one electron once the weak nuclear interaction occurs. **These particles are submitted to a process of iterative massification /demassification. This process and these particles constitute the system of gluons. These gluons are giving its mass to the neutron part (pole) which is outside the trunk of 1,800 electron masses.**

#### 4. Relationship between neutron, proton and electron masses

The relationship between neutron and electron masses is expressed in tables 3 and 4. The mass relation between neutron and electron is expressed, in the frame of the present hypothesis, by the following sum to be divided by two:

$$\Sigma = 1/2 \left( \begin{array}{l} 1.6147475(7) + 18 + 1,800 + 18 + 1.6147475(7) \\ 1.6147475(7) + 18 + 1,800 + 17 + 1.4304431(4) \end{array} \right)$$

i.e. a neutron mass equal to  $1,800 + 35.5 + 3.13734 \dots$  electron masses.

##### 4.1. Mass of proton

Through this expression, it is possible to induce a simple mathematical relation between the masses of neutron and proton by introducing a mass of 1.913 electrons. So, the following expression:  $1,800 + 35.5 + (3.13734 - 1.913) / 2 = 1,836.11216$  electron masses, which is a possible expression of the proton mass. In the present hypothesis that the neutron would be composed of an external layer equal to 3.13734 electron masses, the mass of the proton could therefore be deduced from that of the neutron by the intervention of a mass of 1.913 electron.

##### 4.2. Dipolar magnetic moments of neutron and proton

The value 1.913 represents also a charge of 1.913 electron, since the charge of the electron equals 1. The dipolar magnetic moment of the neutron, which should be equal to 0, due to the fact that the neutron is not charged, can be described as -1.913 nuclear magnetons. It is possible to find a simple relation between the value of 3.13734 and dipolar magnetic moments of the neutron and the proton:  $(3/2) \times 3.13734 - 1.913 = 2.793$  (for the explanation of factor 3/2 see point 7.2.2).

### 4.3. The nucleon

Neutron and proton appear in this hypothesis as alternatives of the same particle, the nucleon, where it is only the external part (a mass equivalent to 3.13734 electron mass) which is modified to differentiate them. Masses of neutron and proton could be expressed as follows, as a function of the mass of the electron:

Mass of neutron:  $1,800 + 35.5 + 3.13734\dots = 1,838.63734$  electron masses

Mass of proton:  $1,800 + 35.5 + (3.13734 - 1.913) / 2 = 1,836.11216$  electron masses

i.e. taking 0.511 MeV as value of the electron mass, respective masses of neutron and proton of 939.544 MeV and 938.253 MeV, values which are compatible with the experimental results. As regards the dipolar magnetic moments of neutron and proton, they are related to the value of the mass of the neutron which is outside the (1,800 electron + 35.5) masses by the following formula:  $(3/2) \times 3.13734 = |1.913| + |2.793|$

### 5. Interconnection of baryonic particles with Higgs boson and Matteron particles

Baryonic particles are linked to Higgs boson and Matteron particles. This is the case for each neutron, proton, and electron in nature. This means that these particles are yielded by the Higgs boson and are not produced by the vacuum.

This means also that the human body, especially the human brain, is interconnected with the Higgs boson particles through the neutrons, protons, and electrons out of which this brain is constituted. So, our process of thinking is influenced by that interconnection. This phenomenon could explain some properties of the human brain and deserves special interest. So, every cell of the human brain and body is made out of molecules, themselves made out of neutrons and protons - electrons. Each of the latter particles is generated by a Higgs boson and Matteron particle as the result of the massification/demassification process. This means that the human brain and body are finally constituted with a brane of positive mass offset by a brane of negative mass, both forming an aura of no-mass substance intimately linked to the mass of those brain and body. This is the case for every mass or matter. Nevertheless, only human beings are conscious of this phenomenon.

## 6. The electromagnetic interaction

### 6.1. Recall of the massification /demassification process

According to tables 3 and 4 the mass of 3.13734... electron masses is obtained as follows:  $(3 \times 1.614747 + 1.430443) / 2$ . This sum follows from the addition of lines 2 to 18 (3 times) [see table 3] and of lines 3 to 18 (once) [see table 4], column by column, starting with the column corresponding to  $10^{-2}$ . Tables 3 and 4 are constructed to suggest a continual creation of neutron, line after line, corresponding to a progression of 1 % at each stage. For example, line 18 of table 3 has first had the value of line 1, then 2, etc., i.e.:

	$1(x10^0)$			
	$1(x10^0)$	$1(x 10^{-2})$		
	$1(x10^0)$	$2(x 10^{-2})$	$1(x 10^{-4})$	
	$1(x10^0)$	$3(x 10^{-2})$	$3(x 10^{-4})$	$1(x 10^{-6})$
etc. until				
	$1(x10^0)$	$17(x10^{-2})$	$136(x10^{-4})$	$680(x10^{-6})$ etc.

As regards line 17, it has been created one instant after line 18, which enables it to reach at the end of the process, a value inferior to that of line 18. Line 16 has been created one instant after line 17, etc. Table 3 represents the whole of lines 1 to 18, **at instant 18**. So, at instant 17, there were only 17 lines, at instant 16 only 16 lines, etc. In fact, the hypothesis suggested by table 3 is that at each instant, from 1 to 18, there has been a material creation, annihilated at the following instant, and recreated. This creation /annihilation/recreation would be realized as follows:

Figure 3: progressive constitution of line 18 of table 3.

100	0							
	+1				instant 1, mass =	+1		
	-1				instant 2, resulting mass =	+1	+1	
	+1	+1			instant 3, resulting mass =	+1	+2	+1
	-1	-1			instant 4, resulting mass =	+1	+3	+3
	+1	+2	+1		instant 4, resulting mass =	+1	+3	+3
	-1	-2	-1		instant 4, resulting mass =	+1	+3	+3
	+1	+3	+3	+1	instant 4, resulting mass =	+1	+3	+3
etc until					instant 18, resulting mass =	+1	+17	+136
	-1	-16	-120	-560	instant 18, resulting mass =	+1	+17	+136
	+1	+17	+136	+680 etc	instant 18, resulting mass =	+1	+17	+136

So, the annihilation by antimass, as suggested by the previous example, has always taken place at the instant following the creation of mass. Mass and antimass would therefore be equivalent, but the action of mass would take place one instant before the one of antimass, which would impart it a primacy over the latter. The baryonic mass would be the resultant of the action of primitive mass, with a deduction of the primitive antimass being made.

**This introduces the notion of antimass. The Higgs mechanism endowing particles with mass could also yield a reaction of antimass, nevertheless limited to the mass created before. In other terms, there is no absolute “negative” mass, but only a process of reaction to the mass creation aiming at annihilating that mass, hence the existence of an “antimass” generated by the opposite phenomenon of that of mass creation. This opposite phenomenon cannot create more antimass than the existing mass.**

## 6.2. Mass versus electromagnetism

### 6.2.1. The dipolar magnetic moment of neutron

As regards electromagnetism, let us make the hypothesis that, starting from the column corresponding to  $10^{-2}$  of table 3, each creation of mass is accompanied by a negative electromagnetism and that each annihilation of mass is accompanied by a positive electromagnetism (e-m). Let us look at the result in the frame of the preceding example (see figure 3):

Figure 4: progressive constitution of dipolar magnetic moment of line 18 of table 3.

100	0				instant 1, e - m =	0			
	+1								
	- 1				instant 2, e - m =	0	1 <sup>-</sup>		
	+1	+1 <sup>-</sup>							
	- 1	- 1 <sup>+</sup>			instant 3, e - m resulting =	0	1 <sup>-</sup>	1 <sup>-</sup>	
	+1	+2 <sup>-</sup>	+1 <sup>-</sup>						
	-1	- 2 <sup>+</sup>	- 1 <sup>+</sup>		instant 4, e - m resulting =	0	1 <sup>-</sup>	2 <sup>-</sup>	1 <sup>-</sup>
	+1	+3 <sup>-</sup>	+3 <sup>-</sup>	+1 <sup>-</sup>					
etc until									
	-1	- 16 <sup>+</sup>	- 120 <sup>+</sup>	- 560 <sup>+</sup>	instant 18, resulting mass =	0	1 <sup>-</sup>	16 <sup>-</sup>	120 <sup>-</sup> etc
	+1	+17 <sup>-</sup>	+136 <sup>-</sup>	+ 680 <sup>-</sup>					
				etc					

In this hypothesis, line 18, at instant 18, should have the following electromagnetism resulting value:

0      1<sup>-</sup>      16<sup>-</sup>      120<sup>-</sup>      560<sup>-</sup>      etc

The other lines of the neutron, **at instant 18**, should have respective resulting electromagnetism of:

0	0					line 1
0	1 <sup>-</sup>					line 2
0	1 <sup>-</sup>	1 <sup>-</sup>				line 3
0	1 <sup>-</sup>	2 <sup>-</sup>	1 <sup>-</sup>			line 4
0	1 <sup>-</sup>	3 <sup>-</sup>	3 <sup>-</sup>	1 <sup>-</sup>		line 5
etc until						
0	1 <sup>-</sup>	16 <sup>-</sup>	120 <sup>-</sup>	560 <sup>-</sup>	etc	line 18
i.e. in total						
0	17 <sup>-</sup>	136 <sup>-</sup>	680 <sup>-</sup>	2380 <sup>-</sup>	etc	

**This total electromagnetism is, by convention, called direct electromagnetism.** In tables 5 and 6, direct electromagnetism is shown under the form of a negative rest, resulting from the negative and positive electromagnetism which annihilate themselves, for the greater part, in energy.

Example: an electromagnetic effect of [-1 -2 -1] can be described as:

$$\left( \begin{array}{l} + 2 + 1 \\ - 3 - 3 - 1 \end{array} \right) \begin{array}{l} \text{positive electromagnetism} \\ \text{negative electromagnetism} \end{array}$$

and the energy released by annihilation can be described as [2 1], conjunction of

$$\left( \begin{array}{l} + 2 + 1 \\ - 2 - 1 \end{array} \right)$$

**This energy accumulates in the neutron according to the “mass appropriation” operations and will be released in the frame of the reverse operation when the neutron will transform itself into proton; it will serve to eject the electron created.**

**Direct electromagnetism corresponds therefore to each massified line. But, when the line is demassified, the electromagnetism of this line subsists (contrary to mass) and becomes alternatively negative and positive. This electromagnetism is called “indirect” since it is indirectly created by the phenomenon of creation/annihilation of mass.**

Tables 5 and 6 are essentially dedicated to indirect electromagnetism. In these tables, only a simplified mechanism is indicated, which leads to the known result of the dipolar magnetic moment of neutron equal to -1.913 nuclear magnetons. Indeed, table 5 shows the result of the appropriation of the electromagnetism in 17 instants (the coefficient goes until 16, since at instant 1 [see line 1 of table 3] there is yet no creation of mass at level 10<sup>-2</sup>). The results of tables 5 and 6 always indicate negative numbers. In fact, it is the balance between negative and positive electromagnetism, as shown in the following examples (see figure 5).

Figure 5: mechanism of acquisition of indirect electromagnetism.

Examples for the lines a, b, and c of table 5:

	$10^{-2}$	$10^{-4}$	$10^{-6}$
line 1	0		
line 2	- 1		
resultant (line a)	- 1		

	$10^{-2}$	$10^{-4}$	$10^{-6}$
line 1	0		
line 2	+ 1		
line 3	- 2	- 1	
resultant (line b)	- 1	- 1	

	$10^{-2}$	$10^{-4}$	$10^{-6}$
line 1	0		
line 2	- 1		
line 3	+ 2	+ 1	
line 4	- 3	- 3	- 1
resultant (line c)	- 2	- 2	- 1

Each line of table 5 is the result of the annihilation of the lines which preceded in the constitution of the neutron, lines which have either a negative value, or a positive one, the resultant being always negative. The total obtained in table 5 is -0.982884... corresponding to a mass of 1.614747... [see table 3]. As regards the mass of 1.430443 of table 4, table 6 provides the following result: -0.877392... One remarks that:  $(- 0.982884 \times 3 - 0.877392) / 2 = -1.913022$ , i.e. a possible value of the dipolar magnetic moment of the neutron.

### **6.2.2. *Gluons and quarks behavior***

**The process of massification/demassification results in the baryonic mass of the 18 lines of the neutron. Moreover, the process of mass + antimass is yielding the dipolar magnetic moment of the neutron, also line per line. These two processes are resulting in the gluons and quarks behavior. The neutron is constituted with a trunk of 1,800 electron masses i.e. 1/100 of the trunk mass of the Higgs boson, and with a number of electron masses modified by the massification/ demassification process so as to result in a mass of 38.6373 electron masses and a negative “charge” of 1.9130 nuclear magnetons.**

**This process shows also the total correlation between the massification/demassification process and that one of the creation of the anomalous dipolar magnetic moment of the neutron (and the proton). Consequently, to the mass of each gluon is added an electromagnetic charge.**

See hereunder tables 5 and 5(1), as well as tables 6 and 6(1), dedicated to the acquisition of dipolar magnetic moment of neutron. These tables show the results for the 18 lines of the neutron. At appendix 2 the details line per line are displayed.

Table 5: Acquisition of dipolar magnetic moment of neutron

	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$
line 1 - line 2 = a	-1																
- a - line 3 = b	-1	-1															
- b - line 4 = c	-2	-2	-1														
- c - line 5 = d	-2	-4	-3	-1													
- d - line 6 = e	-3	-6	-7	-4	-1												
- e - line 7 = f	-3	-9	-13	-11	-5	-1											
- f - line 8 = g	-4	-12	-22	-24	-16	-6	-1										
- g - line 9 = h	-4	-16	-34	-46	-40	-22	-7	-1									
- h - line 10 = i	-5	-20	-50	-80	-86	-62	-29	-8	-1								
- i - line 11 = j	-5	-25	-70	-130	-166	-148	-91	-37	-9	-1							
- j - line 12 = k	-6	-30	-95	-200	-296	-314	-239	-128	-46	-10	-1						
- k - line 13 = l	-6	-36	-125	-295	-496	-610	-553	-367	-174	-56	-11	-1					
- l - line 14 = m	-7	-42	-161	-420	-791	-1106	-1163	-920	-541	-230	-67	-12	-1				
- m - line 15 = n	-7	-49	-203	-581	-1211	-1897	-2269	-2083	-1461	-771	-297	-79	-13	-1			
- n - line 16 = o	-8	-56	-252	-784	-1792	-3108	-4166	-4352	-3544	-2232	-1068	-376	-92	-14	-1		
- o - line 17 = p	-8	-64	-308	-1036	-2576	-4900	-7274	-8518	-7896	-5776	-3300	-1444	-468	-106	-15	-1	
<b>Total a → p</b>	-72	-372	-1344	-3612	-7476	-12174	-15792	-16414	-13672	-9076	-4744	-1912	-574	-121	-16	-1	
<b>Coefficient</b>	x 1	x 2	x 3	x 4	x 5	x 6	x 7	x 8	x 9	x 10	x 11	x 12	x 13	x 14	x 15	x 16	
<b>(Total a → p) x coefficient</b>	-72	-744	-4032	-14448	-37380	-73044	-110544	-131312	-123048	-90760	-52184	-22944	-7462	-1694	-240	-16	
<b>Total direct e-magnetism</b>	-17	-136	-680	-2380	-6188	-12376	-19448	-24310	-24310	-19448	-12376	-6188	-2380	-680	-136	-17	-1
<b>General total</b>	-89	-880	-4712	-16828	-43568	-85420	-129992	-155622	-147358	-110208	-64560	-29132	-9842	-2374	-376	-33	-1

i.e. -0.9828847235356306665652306577763301

Table 5 (1): Acquisition of dipolar magnetic moment of line 18 of table 5: Indirect electro-magnetism

	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°
																		1
	+1																	2
	-2	-1																3
	+3	+3	+1															4
	-4	-6	-4	-1														5
	+5	+10	+10	+5	+1													6
	-6	-15	-20	-15	-6	-1												7
	+7	+21	+35	+35	+21	+7	+1											8
	-8	-28	-56	-70	-56	-28	-8	-1										9
	+9	+36	+84	+126	+126	+84	+36	+9	+1									10
	-10	-45	-120	-210	-252	-210	-120	-45	-10	-1								11
	+11	+55	+165	+330	+462	+462	+330	+165	+55	+11	+1							12
	-12	-66	-220	-495	-792	-924	-792	-495	-220	-66	-12	-1						13
	+13	+78	+286	+715	+1.287	+1.716	+1.716	+1.287	+715	+286	+78	+13	+1					14
	-14	-91	-364	-1.001	-2.002	-3.003	-3.432	-3.003	-2.002	-1.001	-364	-91	-14	-1				15
	+15	+105	+455	+1.365	+3.003	+5.005	+6.435	+6.435	+5.005	+3.003	+1.365	+455	+105	+15	+1			16
	-16	-120	-560	-1.820	-4.368	-8.008	-11.440	-12.870	-11.440	-8.008	-4.368	-1.820	-560	-120	-16	-1		17
Total	-8	-64	-308	-1036	-2576	-4900	-7274	-8518	-7896	-5776	-3300	-1444	-468	-106	-15	-1	0	

Table 6: Acquisition of dipolar magnetic moment of neutron

	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$
line 2 - line 3 = a'	-1															
- a' - line 4 = b'	-1	-1														
- b' - line 5 = c'	-2	-2	-1													
- c' - line 6 = d'	-2	-4	-3	-1												
- d' - line 7 = e'	-3	-6	-7	-4	-1											
- e' - line 8 = f'	-3	-9	-13	-11	-5	-1										
- f' - line 9 = g'	-4	-12	-22	-24	-16	-6	-1									
- g' - line 10 = h'	-4	-16	-34	-46	-40	-22	-7	-1								
- h' - line 11 = i'	-5	-20	-50	-80	-86	-62	-29	-8	-1							
- i' - line 12 = j'	-5	-25	-70	-130	-166	-148	-91	-37	-9	-1						
- j' - line 13 = k'	-6	-30	-95	-200	-296	-314	-239	-128	-46	-10	-1					
- k' - line 14 = l'	-6	-36	-125	-295	-496	-610	-553	-367	-174	-56	-11	-1				
- l' - line 15 = m'	-7	-42	-161	-420	-791	-1106	-1163	-920	-541	-230	-67	-12	-1			
- m' - line 16 = n'	-7	-49	-203	-581	-1211	-1897	-2269	-2083	-1461	-771	-297	-79	-13	-1		
- n' - line 17 = o'	-8	-56	-252	-784	-1792	-3108	-4166	-4352	-3544	-2232	-1068	-376	-92	-14	-1	
<b>Total a' → o'</b>	-64	-308	-1036	-2576	-4900	-7274	-8518	-7896	-5776	-3300	-1444	-468	-106	-15	-1	
<b>Coefficient</b>	x 1	x 2	x 3	x 4	x 5	x 6	x 7	x 8	x 9	x 10	x 11	x 12	x 13	x 14	x 15	
<b>(Total a' → o') x coefficient</b>	-64	-616	-3108	-10304	-24500	-43644	-59626	-63168	-51984	-33000	-15884	-5616	-1378	-210	-15	
<b>Total direct e-magnetism</b>	-16	-120	-560	-1820	-4368	-8008	-11440	-12870	-11440	-8008	-4368	-1820	-560	-120	-16	-1
<b>General total</b>	-80	-736	-3668	-12124	-28868	-51652	-71066	-76038	-63424	-41008	-20252	-7436	-1938	-330	-31	-1

i.e. -0.87739217917032763611265541303101

Table 6 (1): Acquisition of dipolar magnetic moment of line 18 of table 6: indirect electro-magnetism

	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°	
																			1
	-1																		2
	+2	+1																	3
	-3	-3	-1																4
	+4	+6	+4	+1															5
	-5	-10	-10	-5	-1														6
	+6	+15	+20	+15	+6	+1													7
	-7	-21	-35	-35	-21	-7	-1												8
	+8	+28	+56	+70	+56	+28	+8	+1											9
	-9	-36	-84	-126	-126	-84	-36	-9	-1										10
	+10	+45	+120	+210	+252	+210	+120	+45	+10	+1									11
	-11	-55	-165	-330	-462	-462	-330	-165	-55	-11	-1								12
	+12	+66	+220	+495	+792	+924	+792	+495	+220	+66	+12	+1							13
	-13	-78	-286	-715	-1.287	-1.716	-1.716	-1.287	-715	-286	-78	-13	-1						14
	+14	+91	+364	+1.001	+2.002	+3.003	+3.432	+3.003	+2.002	+1.001	+364	+91	+14	+1					15
	-15	-105	-455	-1.365	-3.003	-5.005	-6.435	-6.435	-5.005	-3.003	-1.365	-465	-105	-15	-1				16
Total	-8	-56	-252	-784	-1792	-3108	-4166	-4352	-3544	-2232	-1068	-376	-92	-14	-1	0	0		

### **6.2.3. Relationship between mass and electromagnetism**

The mass of the neutron and its dipolar magnetic moment are, in this hypothesis of the constitution of neutron, related in a simple mathematical way: the value of the magnetic moment is obtained by modifying tables 3 and 4 (which characterize the mass of the neutron) as shown in tables 5 and 6. These relations are purely mathematical and cannot induce a physical relation between the two forces. However, one can imagine that the external mass of the trunk of the neutron is produced in a progressive manner, line by line, and that each line is annihilated in order to make place for the following until arriving at a stable stage. Massification and demassification would produce a negative and a positive electromagnetic state.

That is what is suggested by the operation presented in tables 5 and 6. The massification of a line, followed by a demassification of the following line would have a null balance as regards the value of the mass, but not as regards the value of the magnetic moment. Moreover, the coefficients presented in tables 5 and 6, suggest a repetition of operations in a progressively increasing numbers as the process of massification/demassification is older (see line "coefficient"), since the coefficient progresses with the number of columns concerned.

These operations of mass creation external to the neutron trunk, followed by mass annihilation and new creation as suggested in tables 3 to 6, represent a hypothesis. However, the transformation of neutron into proton, with annihilation of a part of the mass and modification of the dipolar magnetic moment, can corroborate this hypothesis. Moreover, the massification/demassification process could be the mechanism allowing for the discontinuity of matter, provided this process applies to the whole matter and not only to the "peripheral" mass of the nucleon. As seen before, the Higgs boson mass as well as the trunk of the neutron are also submitted to a process of massification/demassification. Also, one can conclude, in the frame of this general hypothesis, that:

**Mass + antimass = negative electromagnetism**

**Antimass + mass = positive electromagnetism**

### **6.2.4. Density of space**

Electromagnetism can be described as mass + antimass at quantum level. Also, negative added to positive electromagnetism are creating energy at quantum level. This energy is the result of the condensation of mass and antimass at all the steps of the massification/demassification of all neutron lines. On tables 3 and 4 one can see the scope of quantum massification and demassification. It stretches from  $10^2$  to  $10^{-34}$ .

Gravitational interaction occurs only at macroscopic level, outside quantum level. The figures on tables 3 and 4 could explain the gap of  $10^{-38}$  between the two types of interaction. Also, there is a huge gap concerning the density of energy in space. The divergence between measures and observations is about  $10^{122}$ .

The baryonic matter is massified and demassified many times before being stabilized. The coefficients seen in tables 5 and 6, i.e. (1 to 16 and 1 to 15) could contribute to solving that problem. The results of the numerical series from 1 to 16 are 136 and that one from 1 to 15 is 120. This corresponds to the discrepancy of the values of density of energy in space.

**In other terms, the nucleon is the result of the decay of the Higgs boson and the Matteron. No mass is lost, it is just offset with antimass, the outcome being apparent loss of mass converted into energy and electromagnetism. This is the result of the massification/demassification process. On the other hand, the outcome of the demassification/massification process results eventually into reconstitution of the Higgs boson and Matteron again.**

**Nevertheless, that process of demassification/massification stops at the level of the creation of the proton. The proton is partly a neutron as it will be seen and there is an equilibrium at the level of the  $\alpha$  particle containing two neutrons and two protons.**

### 6.2.5. *Schema of the neutron (mass and electromagnetism)*

In this hypothesis the neutron can be considered as a quadrupolar system, schematized as follows:

+ 1,835.5 (mass)			
+ 1.614747		+ 1.614747	mass
- 0.982884		- 0.982884	electromagnetic effect
- 0.982884		- 0.877392	electromagnetic effect
+ 1.614747		+ 1.430443	mass
+ 1,835.5 (mass)			

One notes that the masses and the dipolar magnetic moments are doubled. In fact, the neutron expresses itself in a dipolar manner by alternation of 4 poles, 2 by 2.

One notes also that the electromagnetic effect can be described as the value of the g factor of the neutron:  $- 3 \times 0.982884 - 1 \times 0.877392 = - 3.826044$ .

Taking into account the averages, the neutron could also be considered in the following way:

$$\begin{array}{r|l}
 + 1,835.5 \text{ (mass)} & \\
 + 1.5686715 & +1.5686715 \text{ mass} \\
 - 0.9565116 & -0.9565116 \text{ electromagnetic effect} \\
 \hline
 - 0.9565116 & -0.9565116 \text{ electromagnetic effect} \\
 + 1.5686715 & +1.5686715 \text{ mass} \\
 + 1,835.5 \text{ (mass)} &
 \end{array}$$

i.e. a mass of 1,838.63734 electrons or 939.544 MeV and a dipolar magnetic moment of -1.913023 nuclear magnetons.

### 6.2.6. Conclusion

The preceding hypothesis suggests that there is a phase of creation of mass followed by a phase of annihilation of that mass in total, nevertheless with a time-shift, so as to leave a resulting mass of 1% of the total mass created. Moreover this “massification/demassification” phenomenon is also creating a second effect of electromagnetic origin and resulting in the dipolar magnetic moments of the neutron and proton. This process is linked, as seen before, to the Higgs boson endowing particles (as the nucleon) with mass.

Is antimass possible? If there is a process of creation of mass, considered as “positive mass” nothing prevails positive mass to be annihilated, passing from positive to zero, and being an antimass, being negative in comparison to positive mass. Indeed, this negative mass cannot exist before there is a positive mass and should be considered as a reaction to the creation of positive mass. This phenomenon could also explain the discontinuity of matter, passing from +1 to 0 by “demassification” or “annihilation”, and being remassified through a constant massification/demassification process.

Mass and antimass versus matter and antimatter: these two concepts are not to be confused. The charged matter is the combination of mass and electromagnetism which can be described as mass + antimass. An electron has an electron mass and an electron negative charge which is the combination of mass + antimass.

So:

- electron mass 1
- electron charge -1 = mass 1 + antimass 1

For the positron it is the following:

- positron mass 1
- positron charge +1 = antimass 1 + mass 1

Antimatter is mass + [antimass + mass] = mass 1 and charge + 1

and matter is mass + [mass + antimass] = mass 1 and charge -1

One is led to consider two states of mass for the matter, positive and negative. As far as electromagnetism is concerned, there are also two states, positive and negative, deriving from the two states of mass. At the quantum level the matter is constituted with gluons whose mass and charge behavior is compatible with the hypothesis presented.

## 7. The weak nuclear interaction: from neutron to proton (mass and dipolar magnetic moment)

In the preceding pages one observed a connection between the values of mass and magnetic moment of the neutron and of the proton. It is therefore interesting to search for a simple transformation allowing it to pass from neutron to proton, which respects these values.

### 7.1. Operations necessary for such a transformation

Let us first remark the following equivalences:

- a)  $1.5686715 - 0.9565116 = 0.6121599$  (see point 6.2.5)  
 $1,835.5 + 0.6121599 = 1,836.1121599$  (or 938.253 MeV) i.e. a possible expression of the mass of the proton as compared to the mass of the electron.
- b)  $0.6121599 \times 2 = 1.2243198$   
 $1.2243198 + 1.5686715 = 2.7929913$  i.e., marked with a positive sign, a possible expression of the dipolar magnetic moment of the proton.

These equivalences do not consider the difference in nature between mass and magnetic moments. Nevertheless, one has already seen a relation between mass, antimass and magnetic moment in the case of the neutron.

### 7.2. Massic and electromagnetic balance of the nucleon

Let us suppose a massic and electromagnetic balance of neutron (the mass of 1,835.5 electron mass not being taken into consideration, since it is common to the neutron and the proton) expressed according to the following (see point 6.2.5):

<u>Massic balance</u>	<u>Electromagnetic balance</u>
+ 1.5686715	- 0.9565116
+ 1.5686715	- 0.9565116
+ 1.5686715	- 0.9565116
<u>+ 1.5686715</u>	<u>- 0.9565116</u>
+ 6.274686 (i.e. 2 x 3.137343)	- 3.8260464 (i.e. 2 x -1.913023)

And the massic and electromagnetic balance of the proton expressed the same way:

<u>Massic balance</u>	<u>Electromagnetic balance</u>
+ 1.5686715	+ 1.5686715
<u>- 0.9565116</u>	+ 1.5686715
+ 0.6121599	+ 1.5686715
	- 0.9565116
Rest 0.9565116	<u>- 0.9565116</u>
	+ 2.7929913

One remarks first that 4 poles of neutron are needed to form 2 poles of proton (with a rest of 0.9565116). The massic and electromagnetic balance of the neutron must be divided by two in order to be comparable with the massic and electromagnetic balance of the proton. This is only a final balance, since certain conversion operations (annihilation of mass, creation of positive electromagnetism from antimass + mass) are required. These operations are as follows.

### 7.2.1. *Annihilation of mass*

One has seen that the mechanism of electromagnetic energy creation is concomitant with the mechanism of creation/annihilation of mass. The phenomenon is the same in the case of transformation of neutron into proton. The remaining lines of the neutron not yet annihilated are destined to be annihilated as the lines formerly created and annihilated. At instant 18 the mass of the neutron external to its trunk has arrived at the end of its course, but this is not the case of antimass which has a phase delay on the mass.

There is thus the mass of line 18 at instant 18 (see table 3)

+1    +17    +136    +680    etc

and line 18 at the following instant, when mass is caught up by antimass

+1    +17    +136    +680    etc  
 - 1    - 17    - 136    - 680    etc

From this results the annihilation of line 18. The same is true for the other lines (1 to 17) to which one can extrapolate the phenomenon, with the result that the neutron is demassified by the external parts of the trunk. The mass is then 1,800 electron masses. The nucleon is automatically “remassified” by 35.5 electron masses due to the Higgs boson mass endowing process. The mass is therefore 1,835.5 electron masses, and the loss is 3.13734 electron masses (in fact the double, i.e. 6.274686 if one takes into consideration the four poles of neutron).

**Remark: The annihilation of all the lines of the neutron is the consequence of the annihilation of the strange quark and of the 666 electron masses of the charm quark. In other terms the nucleon can be described as 1,800 electron masses or 1/100<sup>th</sup> of 180,000 electron masses of the trunk of Higgs boson. This means that the Higgs boson has lost 66,600 electron masses and this happens when 18 daughter ultimatons, each**

**one having a mass of 1 electron, are added to the 153 daughter ultimatons. So, there are 4 x 171 daughter ultimatons which are annihilating each other.**

From  $10^{-2}$  on, the antimass bears positive electromagnetism for a quantity equivalent to the mass. The nucleon created this way will therefore bear a positive electromagnetism of +3.13734 electron charges (in fact the double, i.e. + 6.274686).

At this stage the balance of the nucleon is the following (from  $10^{-2}$  on):

<u>Massic balance</u>	<u>Electromagnetic balance.</u>	
0	+ 1.5686715	- 0.9565116
0	+ 1.5686715	- 0.9565116
0	+ 1.5686715	- 0.9565116
<u>0</u>	<u>+ 1.5686715</u>	<u>- 0.9565116</u>
0	+ 6.274686	- 3.8260464

i.e. + 2.44864 or  $2 \times (3.137343 - 1.913023)$  (see following figure 6, phase 1).

### ***7.2.2. Functioning of the various poles of the nucleon***

However, the four poles of the nucleon do not operate in phase. See the various phases on the following figure 6. In a first phase (phase 1), there is a demassification of the four poles through antimass, bringing positive electromagnetism in. In a second phase (phase 2), one pole (pole 1) is again remassified (+ 1.5686 electron mass), which is a continuous phenomenon since the nucleon tends to recover the configuration of the neutron (the same is true for the 35.5 masses). The proton thus retrieves the neutronic form but limited to one pole. This is because lines 1 to 18 continue to be massified/demassified. This remassification is accompanied by negative electromagnetism of 1.5686. The addition of a value of 1.5686 electron charges explains that  $\frac{3}{2} \times 3.137443$  electron charges are necessary to equal the dipolar magnetic moments of neutron and proton (see point 4.2):  $1.5686 + 3.1373 = \frac{3}{2} (3.1373) = |1.913| + |2.793|$ . In the third phase (phase 3), there is creation of positive electromagnetism (+ 0.9565) and mass (+ 0.6121) as the negative magnetism (- 0.9565) and the positive magnetism retrieve the form of mass and antimass (see 3 a). An antimass (- 0.9565) and a mass (+ 1.5696) enter in resonance to create positive electromagnetism (+ 0.9565). The rest of the mass (+ 0.6121) is added to 1,835.5 to create the mass of the proton (1,836.1121 electron masses or 938.253 MeV). In the same phase (see 3 b), the positive electromagnetism (+ 0.9565) of pole 1 which was just created before and the negative electromagnetism (- 0.9565) of pole 2 annihilate. The operation leaves a residual positive electromagnetism of + 1.5686 (see 3 c). The poles 3 and 4 have each a residual electromagnetism of (+ 1.5686 - 0.9565 = + 0.6121). This electromagnetism is the one of the proton (+ 1.5686 + 0.6121 + 0.6121 = + 2.793). After phase 3, the proton has acquired its mass of 1,836.1121 electron masses (938.253 MeV) and its positive electromagnetism (+ 2.793). In phase 4, there are 3 residual masses/antimasses coming from phase 3a.

- + 0.9565 electron masses
- - 1.5686 electron masses
- + 1.5686 electron masses

These masses/antimasses are the basis for the creation of the electron and the antineutrino. There is also a charge of  $-1.5686$ , a residual charge composed of negative and positive charges which will charge the electron and the proton.

Remark: Each of the three other poles plays the role of pole 1 a quantum instant later. So, the proton forms also a quadrupole like the neutron but four by four instead of two by two.

Figure 6: functioning of the various poles of the nucleon.

Phases	Pole 1 e-magn	Pole 1 mass/antimass	Pole 2 e-magn	Pole 2 mass/antimass	Pole 3 e-magn	Pole 3 mass/antimass	Pole 4 e-magn	Pole 4 mass/antimass	Remarks
<b>1</b>	- 0.9565 + 1.5686	$\left\{ \begin{array}{l} + 1.5686 \\ \leftarrow - 1.5686 \end{array} \right\}$	- 0.9565 + 1.5686	$\left\{ \begin{array}{l} + 1.5686 \\ \leftarrow - 1.5686 \end{array} \right\}$	- 0.9565 + 1.5686	$\left\{ \begin{array}{l} + 1.5686 \\ \leftarrow - 1.5686 \end{array} \right\}$	- 0.9565 + 1.5686	$\left\{ \begin{array}{l} + 1.5686 \\ \leftarrow - 1.5686 \end{array} \right\}$	Demassification Creation of positive e-m 1.5686
<b>2</b>	$\overbrace{\hspace{10em}}^{- 1.5686}$	$\overbrace{\hspace{10em}}^{+ 1.5686}$	↓		↓		↓		Remassification of one pole Creation of negative e-m
<b>3</b>	<b>a</b>	$\leftarrow - 0.9565$ + 0.9565 ↓ $\leftarrow + 1.5686$ - 1.5686 ↓ + 1.5686 ↓ ----- + 0.6121	↓		↓		↓		Creation of positive e-m. + 0.9565  Rest mass + 0.6121 to be added to proton 0.6121 = 1836.1121
		<b>b</b>	↓	- 0.9565	↓		↓		Annihilation of e-m
	<b>c</b>	↓	↓ + 1.5686		- 0.9565 + 1.5686 ----- + 0.6121		- 0.9565 + 1.5686 ----- + 0.6121		e-m of proton =  + 1.5686 + 0.6121 + 0.6121 = + 2.79
<b>4</b>	- 1.5686	+ 0.9565 - 1.5686 + 1.5686							Mass and antimass to create the electron and the anti- neutrino. Residual charge of electron and proton

### 7.3. The creation of the electron and the antineutrino

One saw that the residual masses/antimasses of the transformation of neutron into proton took three forms: (see figure 6, phase 4)

+ 0.9565 electron masses  
 - 1.5686 electron masses  
 + 1.5686 electron masses

Also: 1.5686 electron masses is the average of  $3 \times 1.614747 + 1 \times 1.430443$  (see tables 3 and 4) and 0.9565 is the average of  $3 \times 0.982884 + 1 \times 0.877392$  (see tables 5 and 6). Moreover, 0.982884 or 0.877382 are composed of masses and antimasses giving a tail of electromagnetism. Taking these values, the creation of electron works as follows.

#### 7.3.1. Creation of the electron

Let us consider the various lines of the neutron (from  $10^{-2}$  on):

1.614747 lines 2 to 18  
 1.430443 lines 2 to 17  
 1.257864 lines 2 to 16  
 etc. until

0.0301 lines 2 and 3  
 0.01 line 2

which are successively created and annihilated several times, i.e.:

1.614747 lines 2 to 18, once  
 1.43044304 lines 2 to 17, twice  
 1.25786449 lines 2 to 16, thrice  
 etc.

which corresponds to the operations of tables 5 and 6. According to tables 3 and 4 one can see that the mass of 1.614747 is composed of a multitude of particles.

Indeed:

100								
100	which "creates"	1,				i.e.	100	1
100	1	which "creates"	1	1,		i.e.	100	1 1
100	1	1	which "creates"	1	2	1,	i.e.	100 1 2 1
etc. until								
100	1	16	120	which "creates"	1	17	136,	i.e. 100 1 17 136
							Total	/ / 153 816 etc
							i.e. 1.614747	

Actually, everything occurs as if the oldest particles were retarded by one place with a mass 100 times inferior to before. This phenomenon is due to the retarded action of antimass. Indeed, all the particles in the beginning had a mass equivalent to 1 electron. They are compressed in the neutron until the moment they are due to retrieve their original condition in order to recover their equilibrium. These particles are then expelled one by one by an electronic phenomenon. In other terms, these gluons are recovering the form of electrons. Why are they ejected? One reminds that the nucleon goes on with its massification/demassification process for each line. So, when one particle is retrieving its former state, the only way to conserve stability is to expel it. All these particles return thus to their initial mass of one electron before being expelled. Only one electron is retrieved at each moment at each line. It is immediately ejected and replaced by another "retrieved" electron.

The electron expelled is accompanied with the rest of the "created mass" (1.61477 electron masses, then 1.430443 electron masses, etc.) in a coordinated way, the same as the one of the mass creation exterior to the trunk of the neutron, but the process is reverted. The mass accompanying each electron is converted in energy to expel the electron. That energy is different according to the location of the particle due to becoming electron again and consequently the quantity of the "created mass-energy" is also different. Where does the energy come from? Indeed, the mass/antimass of the massification/demassification process of neutron enters in resonance with the antimass/mass of the demassification/massification of proton process to create pure energy to eject the electron. The ejection energy of the electron is comprised between 1.56867 electron mass and 0 (see tables 3 and 4), i.e. thus between 0.802 MeV and 0 MeV, or also adding the proper energy of the electron between 1.313 MeV, i.e. (0.802 + 0.511) MeV, and 0.511 MeV, i.e. (0 + 0.511) MeV.

This is the reason of the differentiated expel energy of the electron.

### 7.3.2. *Conclusion drawn from this process*

- The neutron "empties" itself progressively, line by line and column by column, from the masses external to the trunk of the neutron which it had accumulated during the process of "mass appropriation". This process of mass expulsion is thus the counterpart of the process of mass appropriation and allows for the equilibrium of the nucleon between neutron and proton.
- The electrons are ejected from the neutron/proton 1 by 1 according to a quantized phenomenon. The observer sees "an electron which carries out a trajectory on an orbit": in fact, the number of electrons is very important on an "orbit" but only one is detectable at any one time since each of them is annihilated by antimass (to create an antineutrino as one will see) immediately after having been ejected.
- The phenomenon indicates also that the electron does not "travel" over the whole orbit but that there are empty spaces: in fact, it is each time another electron that appears and disappears by annihilation.
- This electron has no tangential speed: it is radially ejected, remains immobile, in equilibrium in a position determined by its ejection energy (between 0.802 MeV and 0 MeV) and disappears immediately by annihilation through antimass in order to make place for the following one, which will place itself in another position, depending on its proper ejection energy.
- The neutronic phenomenon "mass appropriation" conserves all its force, but it is challenged by the protonic phenomenon "mass annihilation". This leads to a constant renewal of the nucleon in its neutronic form and a quasi-instantaneous annihilation in protonic form. The proton is therefore the result of this equilibrium, which one observes by the "appearance" of positive electromagnetism and antimass. One has seen that these two phenomena exist also in the neutron, but that they are hidden by the negative electromagnetism and by the mass, (and the positive arrow of time).

The electronic process is schematized here only with the purpose of completing the explanation of the phenomenon of transformation of neutron into proton. It obviously deserves a particularly refined study. But the essence of the paper presented is not to demonstrate the electronic phenomenon, but the fact that a single process is at the origin of the whole of material creation and of natural forces.

One has seen that a link between mass and electromagnetism is possible in the framework of the constitution of the neutron and in that one of the transformation of neutron into proton.

### 7.3.3. *Creation of the antineutrino*

One has seen that the mass of the "noria" of electrons comes from the masses of  
1.61477  
1.430443  
etc.

This is true for the antimass of  
1.614747  
1.430443  
etc.

This antimass is expelled one instant later than the electron mass. It combines with the electron mass just expelled before. As a result, a particle is created with an electron mass and an electron antimass, with resultant zero mass. This is the antineutrino. Hence a neutrino has a mass but also an antimass equivalent to the mass. (The slight mass of antineutrino is due to the time shift of the combination of mass and antimass).

The process is then:

- creation of electron mass
- creation of electron antimass

This process is continuous, but the electron mass was created one quantum instant before the electron antimass.

### 7.3.4. *Remark*

One has seen that the remassification of a mass of 1.5686 electron mass is accompanied by negative electromagnetism of 1.5686 electron charges (see figure 6, phase 4). This is a resultant of the electromagnetic process parallel to the massification/demassification process and is made up of negative and positive charges as well as the mass of 1.5686 is the resultant of positive and negative mass.

So, the creation of electron mass as well of electron antimass is accompanied by the creation of two charges (+ and -) which are issued from the resultant global charge of -1.5686 electromagnetism. This magnetism retrieves also the form of charge (positive or negative) of one electron and is distributed between the electron (-) and the proton (+). Once the electron antimass annihilates the electron mass these charges are also annihilated. Of course, one quantum instant later these charges are reconstituted with the next electron. This is a continuous phenomenon.

## 7.4. **Conclusion**

The electromagnetic phenomenon is a consequence of the massification /demassification process, as well as the weak nuclear force. The electroweak interaction is part of the BEH mechanism. The electromagnetism is a condensation of mass and antimass since the beginning of the process. It reflects to the total of the mass and antimass set in motion. This could explain the value of the density of space.

## 8. **Overall conclusions**

The creation of mass, especially that one of neutron, proton, and electron, is linked to the process of "massification" induced by the Higgs boson endowing particles with mass. As there is a process of mass creation, an opposite process of mass annihilation should be considered. This is resulting in a global phenomenon of "massification/demassification" of the various particles. The stable particles have the particularity to be massified, demassified and remassified in the frame of an iterative process. The non-stable ones are massified and demassified.

This phenomenon leaves a resulting baryonic mass due to the time shift occurring between the massification and the demassification of the particles.

This has several consequences:

- The baryonic mass is the result of a creation of mass  $M$  at instant  $t$  and the annihilation of that same mass  $M$  an instant later,  $t + 1$ . The baryonic mass can be described as  $M - M' = 1/100 M$ .  $M$  can be described as  $M'$  as far as mass is considered, but there is a time shift between creation and annihilation of the mass  $M$  resulting in a difference of mass of  $1/100 M$ . So, baryonic mass is the consequence of time.
- Therefore, baryonic mass cannot exist outside time and mass  $M$  can be described as energy when existing outside time. Mass and energy are equivalent; nevertheless, these two notions are not the same as regards time.
- The Higgs boson is part of the matrix of matter (Matteron) which endows particles with mass.
- The mechanism of massification/demassification is responsible for the discontinuity of matter as the mass is positive at one instant and equal to zero at one instant later. So, the mass is acting as antimass one instant after having acted as mass.
- Mathematically, one observes a positive mass and a negative mass immediately after, this resulting in null mass. Nevertheless, the physical reality is about creation of mass and annihilation of that same mass an instant later.
- This process is iterative as far as it concerns stable mass. So, in practice there is a mass at instant  $t$ , no mass at  $(t+1)$ , again a mass at  $(t+2)$  and no mass at  $(t+3)$ , this process endowing the mass with its property of discontinuity, the mass being “alive” at one instant, and “dead” one instant later.

Mass and antimass combine to create electromagnetism:

- mass + antimass = negative electromagnetism.
- antimass + mass = positive electromagnetism.

Mass and antimass do not have to be confused with matter and antimatter. The electron is constituted out of an electron mass + an electron negative charge (= mass + antimass), the positron is constituted out of an electron/positron mass + a positive charge (= antimass + mass).

## 9. Acknowledgements

**I express my deepest acknowledgements to CERN, the European Organization for Nuclear Research, whose the identification of the Higgs boson mass-energy enabled me to relate the mass of the nucleon to that particle.**

# Appendix 1: VARIOUS MASSES OF QUARKS

## 1.1. The bottom quark

<b>18 x 100 ultimatoms x 1 electron mass</b> 171 x 100 daughter ultimatoms x 0.01 electron mass	<b>18 x 100 ultimatoms x 1 electron mass</b> 171 x 100 daughter ultimatoms x 0.01 electron mass
<b>18 x 100 ultimatoms x 1 electron mass</b> 171 x 100 daughter ultimatoms x 0.01 electron mass	<b>18 x 100 ultimatoms x 1 electron mass</b> 153 x 100 daughter ultimatoms x 0.01 electron mass

The bottom quark mass equals 1/100<sup>th</sup> of the Matteron mass: 4 x 1,800 electron masses + (171 + 171 + 171 + 153) electron masses or 7,866 electron masses or 4.02 GeV. This mass value is the basic one for the bottom quark. There are varying mass values. The following variants include masses which are constituting eventually the neutron mass. The mass of the neutron equals 1,800 + (3 x 18 + 1 x 17) / 2 + (3/2 x 1.61475 + 1/2 x 1.43044) e-masses or (1,800 + 71/2 + 6.27469/2) e-masses. Also, 6.27469 e-masses equal (3 x 1.61475 + 1 x 1.43044) = (3.13734 x 2) e-masses. 19.61475 = (18 + 1.61475) e-masses and 18.43044 = (17 + 1.43044) e-masses (see tables 3 and 4 which show the details of these masses).

**Variant 1**

$$\begin{array}{r} 7,866 \text{ e-masses} \\ 156.867 \text{ (=313.734/2) e-masses} \\ \hline 8,022.867 \text{ e-masses} = 4.1 \text{ GeV} \end{array}$$

**Variant 2**

$$\begin{array}{r} 7,866 \text{ e-masses} \\ 313.7343 \text{ e-masses} \\ 38.6373 \text{ (mass of neutron - 1,800 e-masses)} \\ \hline 8,218.3716 \text{ e-masses} = 4.2 \text{ GeV} \end{array}$$

**Variant 3**

	171	+	171	+	1,800	+	171	+	153	} 2 masses of Higgs boson / 100 = 2 quarks charm masses
	171		171		1,800		171		153	
	19.6147				1,800		19.6147			} 2 masses of neutron
	19.6147				1,800		18.4304			
	8,609.2746e-masses = 4.399 GeV									

**Variant 4**

$$\begin{array}{r} 1,800 \\ 1,800 \\ 1,800 \\ 1,800 \\ \hline 7,200 \\ + 35.5 \quad 1,800 \quad + 35.5 \\ \hline + 3.1373 \quad \quad \quad + 3.1373 \\ \hline + 38.6373 \quad + 9000 \quad + 38.6373 = 9077.2746 \text{ e-masses} = 4.638 \text{ GeV} \end{array}$$

These results explain the differences found when determining the mass of bottom quark. The various values of bottom quark depend on what is measured by the devices. The bottom quark is part of the process of “massification” of the neutron on basis of Higgs boson, which occurs quasi instantly and through several stages. So, the measure of mass depends on the moment that measure is done and on the performance of the devices.

## 1.2. Charm quark mass variants

$$\begin{array}{l} 1,800 + 666 - 38.6373 = 2,427.3627 \text{ e-masses} \quad \text{or } 1.24 \text{ GeV} \\ 1,800 + 666 = 2,466 \text{ e-masses} \quad \text{or } 1.26 \text{ GeV (see point 2.3.1)} \\ 1,800 + 666 + 18 = 2,484 \text{ e-masses} \quad \text{or } 1.269 \text{ GeV} \\ 1,800 + 666 + 71 + 6.2747 = 2,543.2747 \text{ e-masses} \quad \text{or } 1.3 \text{ GeV} \end{array}$$

This explains the mass variations of the charm quark (see tables 3 and 4 where these figures are displayed).

### 1.3. Strange quark variants (see point 2.3.4)

$$\begin{array}{r}
 171 + 18 + 1.61475 \\
 171 + 18 + 1.61475 \\
 171 + 18 + 1.61475 \\
 \hline
 153 + 17 + 1.43044 \\
 \hline
 666 + 71 + 6.27469 \text{ e-masses}
 \end{array}$$

The quark strange mass can be described as:  
 $(666 + 71 + 6.27469) / 4 = 185.8187$  e-masses or 94.95 MeV

Variations of strange quark mass:  
 $166.5 (666/4) + 2 \times 17.75 (=71/2) + 1.56867 (=6.27469/4) = 203.56867$  e-masses or 104 MeV.  
 Also,  $166.5 + 17.75 - 2 \times 1.56867 (=3.13734) = 181.113$  e-masses = 92.5 MeV.

### 1.4. Quark Top and particle Tau masses

(Value of  $W^\pm$ : 157,252.0026 e-masses)

#### 1.4.1. Quark Top mass

$$\begin{array}{l}
 \text{Variations of quark Top mass:} \\
 + 180,000 \text{ e-masses} \\
 + 157,252 \text{ e-masses} \\
 \hline
 337,252 \text{ e-masses or } 172.33 \text{ GeV} \\
 \\
 + 180,000 \text{ e-masses} \\
 + 1,800 \text{ e-masses} \\
 + 157,252 \text{ e-masses} \\
 \hline
 339,052 \text{ e-masses or } 173.25 \text{ GeV} \\
 \\
 + 180,000 \text{ e-masses} \\
 - 1,800 \text{ e-masses} \\
 + 157,252 \text{ e-masses} \\
 \hline
 335,452 \text{ e-masses or } 171.42 \text{ GeV} \\
 \\
 + 180,000 \text{ e-masses} \\
 - 1,800 \text{ e-masses} \\
 - 666 \text{ e-masses} \\
 + 157,252 \text{ e-masses} \\
 \hline
 334,786 \text{ e-masses or } 171.08 \text{ GeV}
 \end{array}$$

Actually, the mass of Quark Top should be  $2 \times 180,000$  e-masses or 183.96 GeV and  $(2 \times 180,000 + 66.600 \text{ e-masses})$  or 218 GeV.

#### 1.4.2. Particle Tau mass

$$\begin{array}{r} + 1,800 \\ - 279.3 \\ + 1,800 \\ + 156.867 \quad (= 313.734 / 2) \\ \hline 3,600 - 122.433 = 3,477.567 \text{ e-masses or } 1.777 \text{ GeV} \end{array}$$

The number 279.3 is the value of 2.793, value of the dipolar magnetic moment of proton, multiplied by 100. An antimass of  $-279.3$  and a mass of  $+279.3$  are releasing a magnetic value of  $1/100^{\text{th}}$  of their value, i.e.  $+2.793$ . In that case one sees the antimass of 279.3.





**Schema 3: Acquisition of direct and indirect electro-magnetism (the last line corresponds to the direct electro-magnetism)**

		$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°		
	-																				1	
	-			1																		2
	-	0	1	1																		3
	-	0	1	2	1																	4
	-																					
	-																					
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**Schema 4: Acquisition of direct and indirect electro-magnetism (the last line corresponds to direct electro-magnetism)**

		$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°		
	-																				1	
	-				1																	2
	-			2	1																	3
	-	0	2	2	1																	4
	-	0	1	3	3	1																5
	-																					
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**Schema 5: Acquisition of direct and indirect electro-magnetism (the last line corresponds to direct electro-magnetism)**

		$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°	
	-																				1
	-					1															2
	-				3	1															3
	-			4	3	1															4
	-	0	2	4	3	1															5
	-	0	1	4	6	4	1														6
	-																				
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	-																				

**Schema 6: Acquisition of direct and indirect electro-magnetism (the last line corresponds to direct electro-magnetism)**

		$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°	
-																					1
-							1														2
-						4	1														3
-					7	4	1														4
-				6	7	4	1														5
-		0	3	6	7	4	1														6
-		0	1	5	10	10	5	1													7
-																					
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-																					

**Schema 7: Acquisition of direct and indirect electro-magnetism (the last line corresponds to direct electro-magnetism)**

		$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°	
-																					1
-								1													2
-							5	1													3
-						11	5	1													4
-					13	11	5	1													5
-				9	13	11	5	1													6
-		0	3	9	13	11	5	1													7
-		0	1	6	15	20	15	6	1												8
-																					
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**Schema 8: Acquisition of direct and indirect electro-magnetism (the last line corresponds to direct electro-magnetism)**

		$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°	
	-																				1
	-								1												2
	-							6	1												3
	-						16	6	1												4
	-					24	16	6	1												5
	-				22	24	16	6	1												6
	-			12	22	24	16	6	1												7
	-	0	4	12	22	24	16	6	1												8
	-	0	1	7	21	35	35	21	7	1											9
	-																				
	-																				
	-																				
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	-																				
	-																				

**Schema 9: Acquisition of direct and indirect electro-magnetism (the last line corresponds to direct electro-magnetism)**

		$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°	
-																					1
-										1											2
-									7	1											3
-								22	7	1											4
-							40	22	7	1											5
-						46	40	22	7	1											6
-					34	46	40	22	7	1											7
-			16	34	46	40	22	7	1												8
-	0	4	16	34	46	40	22	7	1												9
-	0	1	8	28	56	70	56	28	8	8	1										10
-																					
-																					
-																					
-																					
-																					
-																					
-																					

**Schema 10: Acquisition of direct and indirect electro-magnetism (the last line corresponds to direct electro-magnetism)**

		$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°	
-																					1
-											1										2
-										8	1										3
-									29	8	1										4
-								62	29	8	1										5
-							86	62	29	8	1										6
-						80	86	62	29	8	1										7
-					50	80	86	62	29	8	1										8
-				20	50	80	86	62	29	8	1										9
-		0	5	20	50	80	86	62	29	8	1										10
-		0	1	9	36	84	126	126	84	36	9	1									11
-																					
-																					
-																					
-																					
-																					
-																					

**Schema 11: Acquisition of direct and indirect electro-magnetism (the last line corresponds to direct electro-magnetism)**

		$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°	
	-																				1
	-											1									2
	-										9	1									3
	-									37	9	1									4
	-								91	37	9	1									5
	-							148	91	37	9	1									6
	-						166	148	91	37	9	1									7
	-					130	166	148	91	37	9	1									8
	-				70	130	166	148	91	37	9	1									9
	-			25	70	130	166	148	91	37	9	1									10
	-	0	5	25	70	130	166	148	91	37	9	1									11
	-	0	1	10	45	120	210	252	210	120	45	10	1								12
	-																				
	-																				
	-																				
	-																				
	-																				

**Schema 12: Acquisition of direct and indirect electro-magnetism (the last line corresponds to direct electro-magnetism)**

		$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°	
-																					1
-													1								2
-												10	1								3
-											46	10	1								4
-										128	46	10	1								5
-									239	128	46	10	1								6
-								314	239	128	46	10	1								7
-							296	314	239	128	46	10	1								8
-						200	296	314	239	128	46	10	1								9
-					95	200	296	314	239	128	46	10	1								10
-				30	95	200	296	314	239	128	46	10	1								11
-		0	6	30	95	200	296	314	239	128	46	10	1								12
-		0	1	11	55	165	330	462	462	330	165	55	11	1							13
-																					
-																					
-																					
-																					

**Schema 13: Acquisition of direct and indirect electro-magnetism (the last line corresponds to direct electro-magnetism)**

		$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°	
-																					1
-														1							2
-													11	1							3
-												56	11	1							4
-											174	56	11	1							5
-										367	174	56	11	1							6
-									553	367	174	56	11	1							7
-								610	553	367	174	56	11	1							8
-							496	610	553	367	174	56	11	1							9
-						295	496	610	553	367	174	56	11	1							10
-					125	295	496	610	553	367	174	56	11	1							11
-				36	125	295	496	610	553	367	174	56	11	1							12
-		0	6	36	125	295	496	610	553	367	174	56	11	1							13
-		0	1	12	66	220	495	792	924	792	495	220	66	12	1						14
-																					
-																					
-																					
-																					

**Schema 14: Acquisition of direct and indirect electro-magnetism (the last line corresponds to direct electro-magnetism)**

		$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°	
-																					1
-															1						2
-														12	1						3
-													67	12	1						4
-												230	67	12	1						5
-											541	230	67	12	1						6
-										920	541	230	67	12	1						7
-									1163	920	541	230	67	12	1						8
-								1106	1163	920	541	230	67	12	1						9
-							791	1106	1163	920	541	230	67	12	1						10
-						420	791	1106	1163	920	541	230	67	12	1						11
-					161	420	791	1106	1163	920	541	230	67	12	1						12
-				42	161	420	791	1106	1163	920	541	230	67	12	1						13
-		0	7	42	161	420	791	1106	1163	920	541	230	67	12	1						14
-		0	1	13	78	286	715	1287	1716	1716	1287	715	286	78	13	1					15
-																					
-																					
-																					

**Schema 15: Acquisition of direct and indirect electro-magnetism (the last line corresponds to direct electro-magnetism)**

		$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°	
-																					1
-																1					2
-															13	1					3
-														79	13	1					4
-													297	79	13	1					5
-												771	297	79	13	1					6
-											1461	771	297	79	13	1					7
-										2083	1461	771	297	79	13	1					8
-									2269	2083	1461	771	297	79	13	1					9
-								1897	2269	2083	1461	771	297	79	13	1					10
-							1211	1897	2269	2083	1461	771	297	79	13	1					11
-						581	1211	1897	2269	2083	1461	771	297	79	13	1					12
-					203	581	1211	1897	2269	2083	1461	771	297	79	13	1					13
-				49	203	581	1211	1897	2269	2083	1461	771	297	79	13	1					14
-		0	7	49	203	581	1211	1897	2269	2083	1461	771	297	79	13	1					15
-		0	1	14	91	364	1001	2002	3003	3432	3003	2002	1001	364	91	14	1				16
-																					
-																					

**Schema 16: Acquisition of direct and indirect electro-magnetism (the last line corresponds to direct electro-magnetism)**

		$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°	
-																					1
-																		1			2
-																14	1				3
-															92	14	1				4
-														376	92	14	1				5
-													1068	376	92	14	1				6
-												2232	1068	376	92	14	1				7
-											3544	2232	1068	376	92	14	1				8
-										4352	3544	2232	1068	376	92	14	1				9
-									4166	4352	3544	2232	1068	376	92	14	1				10
-								3108	4166	4352	3544	2232	1068	376	92	14	1				11
-							1792	3108	4166	4352	3544	2232	1068	376	92	14	1				12
-						784	1792	3108	4166	4352	3544	2232	1068	376	92	14	1				13
-					252	784	1792	3108	4166	4352	3544	2232	1068	376	92	14	1				14
-			56	252	784	1792	3108	4166	4352	3544	2232	1068	376	92	14	1					15
-	0	8	56	252	784	1792	3108	4166	4352	3544	2232	1068	376	92	14	1					16
-	0	1	15	105	455	1365	3003	5005	6435	6435	5005	3003	1365	455	105	15	1				17
-																					

**Schema 17: Acquisition of direct and indirect electro-magnetism (the last line corresponds to direct electro-magnetism)**

		$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°	
-																					1
-																			1		2
-																	15	1			3
-																106	15	1			4
-															468	106	15	1			5
-														1444	468	106	15	1			6
-													3300	1444	468	106	15	1			7
-												5776	3300	1444	468	106	15	1			8
-											7896	5776	3300	1444	468	106	15	1			9
-										8518	7896	5776	3300	1444	468	106	15	1			10
-									7274	8518	7896	5776	3300	1444	468	106	15	1			11
-								4900	7274	8518	7896	5776	3300	1444	468	106	15	1			12
-							2576	4900	7274	8518	7896	5776	3300	1444	468	106	15	1			13
-						1036	2576	4900	7274	8518	7896	5776	3300	1444	468	106	15	1			14
-					308	1036	2576	4900	7274	8518	7896	5776	3300	1444	468	106	15	1			15
-				64	308	1036	2576	4900	7274	8518	7896	5776	3300	1444	468	106	15	1			16
-		0	8	64	308	1036	2576	4900	7274	8518	7896	5776	3300	1444	468	106	15	1			17
-		0	1	16	120	560	1820	4368	8008	11440	12870	11440	8008	4368	1820	560	120	16	1		18

### Appendix 3: DIPOLAR MAGNETIC MOMENT FOR SOME ELEMENTS

At point 6.2. tables 5 and 6 display the identification of the dipolar magnetic moment of neutron. The results are the following:

- - 0.982884 on table 5 concerning 3/4 of that magnetic moment
- - 0.877392 on table 6 concerning 1/4 of that magnetic moment

The total value can be described as:  $(- 0.982884 \times 3 - 0.877392 \times 1) / 2 = -1.913022$ , dipolar magnetic moment of neutron.

These figures are used to determine the dipolar magnetic moment of the following nuclides. To do so, the factor 0.25 (for one quarter) is used as a consequence of the structure in four parts of the dipolar magnetic moment. Also, the factor 1/100 is used as it is necessary to use the factors  $10^{-2}$ ,  $10^{-4}$ , etc for the identification of the mass and dipolar magnetic moment of the neutron. The factor 1/100 is enough to obtain the necessary precision: 1/10,000 etc is superfluous at that stage of the calculation.

In that document P equals the dipolar magnetic moment of proton, and N that of neutron.

#### 3.1. DEUTERIUM (1P, 1N)

Magn. Moment

+P -N

-0.99 P /100 + 1.01 x 0.25 P /100 to alternate with

-1.01 N /100 - 1.01 x 0.25 N /100

+0.879804

-0.022375

+0.857429

#### 3.2. HELIUM 3 (1P, 1N, 1P)

Magn. Moment

+P -N -P

-0.25 P + 0.25 N

+P /100 + 0.25P /100 to alternate with

-N /100 - 0.25N /100

- 1.913043

- 0.219951

+0.005499

- 2.127495

### 3.3. TRITIUM (1P, 1N, 1N)

Magn. Moment

$$\begin{aligned} &+P -N + N \\ &+0.25 P - 0.25 N \\ &-P /100 + 0.25 P /100 \\ &-N /100 - 0.25 N /100 \\ &+P /100 + 0.25 P /100 \text{ (see Helium 3)} \\ &-N /100 - 0.25 N /100 \text{ (see Helium 3)} \end{aligned}$$

$$\begin{aligned} &+2.792847 \\ &+0.219951 \\ &- 0.038261 \\ &+0.004399 \\ &+2.978936 \end{aligned}$$

The similarities between the magnetic moments of Deuterium, Helium3 and Tritium are obvious.

It is to notice that the dipolar magnetic moment of the huge majority of nuclides has a dipolar magnetic moment value between those ones of H-3 and He-3. Consequently, it is possible to determine these values on the basis of the factors presented above (0.25 and 1/100).

### 3.4. LITHIUM 6 (1 Alpha particle, 1P, 1N)

Magn. Moment

$$\begin{aligned} &+P -N \\ &-P /100 \\ &(-P /100 - 0.25 P /100 + 0.25 N /100) \times 0.99 \end{aligned}$$

$$\begin{aligned} &+0.879804 \\ &- 0.055857 \\ &- 0.0021995 \\ &+0.0002793 \\ &+0.0000220 \\ &+0.822049 \end{aligned}$$

### 3.5. LITHIUM 7 (1 Alpha particle, 1P, 2N)

Magn. Moment

$$\begin{aligned} &+P \\ &-0.25 N + 0.25 P \\ &-0.25 N + 0.25 P \\ &+0.5 N /100 + 0.5 P \times 1.01 /100 \end{aligned}$$

$$\begin{aligned} &+2.792847 \\ &+0.439902 \\ &+0.023530 \\ &+0.000140 \\ &+3.256419 \end{aligned}$$

### 3.6. BERYLLIUM 7 (1 Alpha particle, 2P, 1N)

Magn. Moment

$$\begin{aligned}
 & -P \\
 & -0.25 N + 0.25 P \\
 & +0.25 N + 0.25 P \\
 & (-0.25 P / 100 + 0.25 N / 100) \times 0.99 \\
 & +1.01 P / 100 - 0.99 P / 100 \\
 \\ 
 & - 1.396423 \\
 & - 0.0021995 \\
 & +0.0005586 \\
 & \underline{- 0.000022} \\
 & - 1.397998
 \end{aligned}$$

In comparing Li 7 and Be 7 a relationship between them is appearing:

I 3.256419 I magn. moment of Li 7  
I 1.397998 I magn. moment of Be 7  
 I 4.654417 I

$$\begin{array}{r}
 N + P \qquad \qquad 4.705890 \\
 (-0.5 N - 1.5 P) / 100 \quad \underline{- 0.051458} \\
 \qquad \qquad \qquad \qquad 4.654432
 \end{array}$$

### 3.7. Magnetic moments of P and N

Why are they alternatively negative and positive?

Let us take N for example:

	Sequence.	Result
Instant1.	- N.	-N
Instant2.	+N.	0
Instant3.	- N.	-N
Instant4.	+N.	0
	Etc.	Etc.

Actually -N is constantly challenged by +N. As a result, there is an alternate of -N and 0. As the sequence is very rapid one sees -N in continuous. Nevertheless, the process is discontinuous.

The same process applies to P:

	Sequence.	Result
Instant 1.	+P.	+P
Instant 2.	- P.	0
Instant 3.	+P.	+P
Instant 4.	- P.	0
	Etc.	Etc.

In the case of alpha particles containing 2N and 2P the sequence is the following:

N1.	N2.	Result
- N.	+N.	0
+N.	- N.	0
- N.	+N.	0
+N.	- N.	0

Etc.

The same happens in the case of P 1 and P 2.

So, the magnetic moment of alpha particle is constantly equal to zero.

$$- N. + N. = 0$$

$$+N. - N. = 0$$

$$+P. - P. = 0$$

$$- P. + P. = 0$$

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## CHAPTER 2

### NUCLEAR INTERACTION AND BINDING ENERGY BETWEEN NUCLEONS

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#### Abstract

The description of a atomic nucleus system is presented. This system is based on the structure of the neutron and proton presented in chapter 1 on the relationship between the Higgs boson mass and neutron, proton, and electron masses. The main results are:

- breakdown of binding energy of any nuclide into the following clusters: He4, He3, H2, H3 and dineutron binding energies.
- the identification of the structural differences between the binding energy of these clusters, and between alpha particle and He4 binding energies.
- many examples of nuclei structures are displayed to illustrate this theory.

Keywords: strong interaction, nuclear interaction, net binding energy, mass defect,  $\alpha$  particle, He4, He3, H2, H3, dineutron.

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#### 1. Introduction

This paper provides new arguments in favor of an alpha - cluster model of atomic nuclei. This theory is ancient, nevertheless not totally accepted by the community of researchers in that domain. Already in 1936 Bethe and Bacher<sup>(1)</sup> and later Hafstad and Teller<sup>(2)</sup> argued in favor of alpha particle structures within atomic nuclei. In 1965 Linus Pauling presented a model of nuclear structure with some clusters within the nucleus he called Spherons, namely alpha particle (He4), He3, H3, H2, and dineutron<sup>(3)</sup>. Also, in 1968 K. Ikeda and al. presented convincing arguments in favor of alpha clusters within nuclei<sup>(4)</sup>. More recently many other authors advocate in favor of the alpha-cluster model, as Z. Sosin and al. in 2015<sup>(5)</sup>. The nuclei structure presented in this paper is very close to the Spherons clusters proposed by Linus Pauling. Nevertheless, the arguments advanced are new as they are based on the structure of neutron and proton the author proposed in chapter 1 on the relationship between the Higgs boson mass and neutron, proton, and electron masses.

The methodology consists in determining the value of He4 net binding energy on the basis of the structure of neutron displayed in tables 1 and 2 (see point 2). Then to analyze the nucleosynthesis of He4, deducing the net binding energies of H2, H3, He3, alpha particle, and dineutron (NN). Once the net binding energy of these clusters is determined, it is to use them to calculate the net binding energy of all nuclides. In a stable nucleus the number of He4 clusters is determined by the number of protons to be divided by 2, so that any nuclide has not more than one proton outside He4 clusters within its structure. This proton, as well as the neutrons not included in the He4 clusters are bound to the He 4 structures with H2, H3, He3 and dineutron bonds. The He4 clusters are bound together alternately with H2 bonds and dineutron bonds as it will be shown. It functions for hundreds of nuclides the author has calculated their net binding energy. Some of them are displayed in the appendix and some in the following chapters.

**Moreover, after the creation of He-4 by nucleosynthesis activated by the Higgs Boson, the nucleosynthesis goes on creating a two  $\alpha$  particles cluster, i.e. Be 9, then C12 and O16. This is the reason for having isotopes of elements, in order to gain neutrons, one of which is transformed eventually into proton. There is a constant chain of  $\alpha$  particles creation through the intervention of the Higgs boson.**

In chapter 1 one saw that the electromagnetic and weak nuclear interactions are a consequence of the massification/demassification process and that these two forces are part of the Brout-Englert-Higgs (BEH) mechanism. The mass of 3.13734 electron masses is essential in the case of electromagnetism. It is now to see if the nuclear force is also part of the same mechanism, and which masses are at stake. In the case of binding energy, it seems that not only the mass of 3.13734 electron masses is implemented, but also the  $71 \times 1$  electron masses. This is suggested by the fact that the net binding energy per nucleon is maximum 8.7 MeV, i.e. about 17 electron masses, a mass corresponding to the part of the mass (called pole) external to the trunk of the neutron. In chapter 1 the hypothesis was made of a mass of 1.56867 ( $3.13734/2$ ) electron masses composed out of multiple particles which are destined to retrieve their original mass equivalent to one electron mass each. Their mass is multiplied by 100, which was divided by 100 in the process of creating the neutron (due to action of mass and antimass creating gluons). Let's go one step further. If the whole of a nucleon pole was multiplied by 100 (see tables 1 and 2 which correspond to the tables 3 and 4 in chapter 1), one would find back a new nucleon with the loss of one of the preceding nucleon poles, a pole which would be converted into this new nucleon by demassification/massification, the opposite process of that one of massification/demassification.

The strong fundamental force acts directly between quarks, holding the quarks together to form neutrons and protons. This interaction is mediated by the exchange of massless particles called gluons. According to the author the fundamental strong force acts as a force of massification/demassification leaving 1% mass and 99 % gluons, i.e. mass + anti mass. This force acts at the level of the poles of neutrons and protons.

Residual strong force, also called nuclear force, acts to hold neutrons and protons together in a nucleus. This force acts against the repulsive electromagnetic force of the protons. The result of the action of nuclear force minus the action of electromagnetic force is the net binding energy or the mass defect.

So, there is also a force counterbalancing that fundamental strong force going down, or massification /demassification force. That opposite force is going up, and acts in a reverse way creating mass from the gluons. According to that process a whole pole of nucleon recovers its former mass of one neutron or proton. This pole is the basis for a new nucleon and is no more a pole of the mother nucleon. As a result, this mass is lacking within the mother nucleon, hence the mass defect. This operation is only possible within a nucleon. So, in a classical fusion, when several nuclei have to be fused together, this process cannot occur. Also, electromagnetism is limited to a pole of neutron or proton and is created as a side product of massification/demassification (see chapter 1, point 6).

**To summarize, the strong force creates particles of 1% mass and 99% gluons without mass (i.e. mass + anti mass) through the massification/demassification process. The reverse force of demassification/massification restores the former state, so that particles and gluons become again one mass particle by removing the anti-mass. This process creates a daughter nucleon issued from a part of the mother nucleon, hence the loss of that mass for the mother nucleon. This is the mass defect or net binding energy of the mother nucleon or more generally mass defect of the newly created nucleus. This process is the same as that one of the weak interactions, nevertheless applied to a bigger particle than the electron.**

Moreover, the massification /demassification process creates the particles and the gluons, and also the electromagnetism (see chapter 1). The reverse process is operating in the opposite way, also in the case of electromagnetism as the latter is totally correlated with the mass/anti-mass. One can conclude that in the case of nucleon creation in the way described above, there is no Coulomb barrier to be overcome as everything operates in correlation. This is not the same in case of classical fusion as the issue consists in merging two separate nuclei. In that case it is to remove a part of one nucleus to be replaced by the second nucleus. This is only possible in expelling that part in the form of a nucleon or gamma particles. Even if there is a Coulomb barrier it is not that latter which is the biggest obstacle, but the removal of a part of the nucleus.

Indeed, in case of classical fusion, when two nuclei are fused together, there is a Coulomb barrier, and poles have to be annihilated to make room for the nucleus to be fused.

In the following, this hypothesis of ongoing nucleosynthesis is used for calculating the net binding energy of all the nuclei. The net binding energies are additive for each nucleus structure studied as the mass defect is a static consequence of the dynamic process of nuclear interaction.

## 2. Net binding energy of ${}^4_2\text{He}$ and ${}^2_1\text{H}$

The value of the neutron mass is 1,838.63734 and the value of the proton mass is 1,836.11216 electron masses in the hypothesis presented in chapter 1. If the basic value, i.e. 1,800 electron masses is deducted, there are respectively 38.63734 and 36.11216 electron masses left (see tables 1 and 2). One notices that  $(38.63734) / 2 + 36.11216 = 55.43083$ , a possible value of net binding energy of  ${}^4_2\text{He}$ ; indeed  $55.43083 \times 0.511 = 28.325$  MeV. This concerns helium-4, where the net binding energy is implemented by entire poles. One neutron pole and two proton poles are annihilated, and three nucleons are “created” instead.

The net binding energy of nuclei such as deuterium is due to the implementation of partial poles, i.e. of lines (see tables 1 and 2). For example, the net binding energy of  ${}^2_1\text{H}$  may be considered as a multiple of  $38.63734 / 35.5$ , i.e. 1.0883758 electron mass, average of the mass value of the  $(3 \times 18 + 1 \times 17) / 2$  lines of the neutron.

Indeed  $1.0883758 \times 0.511 = 0.55616$  MeV and  $0.55616 \times 4 = 2.22464$  MeV i.e. the net binding energy of deuterium.

**Table 1: Mechanism of acquisition of neutron mass**

$10^0$	trunk	$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°	
1	100	1																			1
1	100	1	1																		2
1	100	1	2	1																	3
1	100	1	3	3	1																4
1	100	1	4	6	4	1															5
1	100	1	5	10	10	5	1														6
1	100	1	6	15	20	15	6	1													7
1	100	1	7	21	35	35	21	7	1												8
1	100	1	8	28	56	70	56	28	8	1											9
1	100	1	9	36	84	126	126	84	36	9	1										10
1	100	1	10	45	120	210	252	210	120	45	10	1									11
1	100	1	11	55	165	330	462	462	330	165	55	11	1								12
1	100	1	12	66	220	495	792	924	792	495	220	66	12	1							13
1	100	1	13	78	286	715	1287	1716	1716	1287	715	286	78	13	1						14
1	100	1	14	91	364	1001	2002	3003	3432	3003	2002	1001	364	91	14	1					15
1	100	1	15	105	455	1365	3003	5005	6435	6435	5005	3003	1365	455	105	15	1				16
1	100	1	16	120	560	1820	4368	8008	11440	12870	11440	8008	4368	1820	560	120	16	1			17
1	100	1	17	136	680	2380	6188	12376	19448	24310	24310	19448	12376	6188	2380	680	136	17	1		18
18	1,800	18	153	816	3060	8568	18564	31824	43758	48620	43758	31824	18564	8568	3060	816	153	18	1		

i.e. +19.6147475686664860781049986817531801 + 1,800 + 19.6147475686664860781049986817531801

**Table 2: Mechanism of acquisition of neutron mass**

$10^0$	trunk	$10^0$	$10^{-2}$	$10^{-4}$	$10^{-6}$	$10^{-8}$	$10^{-10}$	$10^{-12}$	$10^{-14}$	$10^{-16}$	$10^{-18}$	$10^{-20}$	$10^{-22}$	$10^{-24}$	$10^{-26}$	$10^{-28}$	$10^{-30}$	$10^{-32}$	$10^{-34}$	line n°	
1	100																				1
1	100	1																			2
1	100	1	1																		3
1	100	1	2	1																	4
1	100	1	3	3	1																5
1	100	1	4	6	4	1															6
1	100	1	5	10	10	5	1														7
1	100	1	6	15	20	15	6	1													8
1	100	1	7	21	35	35	21	7	1												9
1	100	1	8	28	56	70	56	28	8	1											10
1	100	1	9	36	84	126	126	84	36	9	1										11
1	100	1	10	45	120	210	252	210	120	45	10	1									12
1	100	1	11	55	165	330	462	462	330	165	55	11	1								13
1	100	1	12	66	220	495	792	924	792	495	220	66	12	1							14
1	100	1	13	78	286	715	1287	1716	1716	1287	715	286	78	13	1						15
1	100	1	14	91	364	1001	2002	3003	3432	3003	2002	1001	364	91	14	1					16
1	100	1	15	105	455	1365	3003	5005	6435	6435	5005	3003	1365	455	105	15	1				17
1	100	1	16	120	560	1820	4368	8008	11440	12870	11440	8008	4368	1820	560	120	16	1			18
18	1,800	17	136	680	2380	6188	12376	19448	24310	24310	19448	12376	6188	2380	680	136	17	1	0		

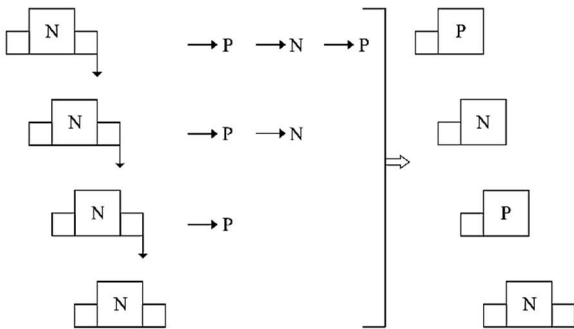
i.e. +19.6147475686664860781049986817531801 + 1,800 + 18.43044313729355057238118681361701

### 3. Study of the net binding energy

Let us study in more detail the net binding energy of some nuclei; one observes that the values of this energy are compatible with the general hypothesis concerning the implementation of the external envelope of the nucleon trunk (1,800 electron masses). In considering  ${}^4_2\text{He}$ , there has been a "disappearance" of a neutron pole and two proton poles for 4 nucleons constituting the  ${}^4_2\text{He}$  nucleus. Moreover, in an arbitrary nucleus, there is a preferential cohesion within a particle  $\alpha$  (actually  ${}^4_2\text{He}$  nucleus), of which the total net binding energy corresponds to a neutron pole and two proton poles, as one will see. Nevertheless, to achieve cohesion in a nucleus containing several  $\alpha$  particles, it is necessary that the  $\alpha$  particles are bound together. This is not the case for  ${}^8_4\text{Be}$  where there are 2  $\alpha$  particles without link between themselves. On the contrary for  ${}^{16}_8\text{O}$  there is implementation of supplementary lines for keeping the  $\alpha$  particles together (see appendix, point 2 figure 1). Let us examine the details of these operations.

#### 3.1. The internal structure of ${}^4_2\text{He}$

The following schema figures the transformation of 19.31867 electron masses (pole of a neutron), or  $38.63734/2$  into a new neutron, and then a proton in order to arrive at the formation of an  $\alpha$  particle:



The process takes place three times in order to achieve that result, i.e. an  $\alpha$  particle composed of 2 neutrons and 2 protons. Indeed,  $38.63734/2$  electron masses transform themselves into N. The preceding N transforms itself into P. The created neutron loses a pole, which will transform itself in a new N. Simultaneously the preceding P will transform itself in N and the preceding N in P. The N created in the third place also loses one of its poles, which will become an N. At that same time the preceding nucleons will transform themselves again, either into P, or into N. In total there is a configuration equal to the one at the right of the schema with a loss of:

- one pole of N
- two poles of P

i.e.  $38.63734/2 + 36.11216 = 55.43083$  or  $28.325$  MeV, net binding energy of  ${}^4_2\text{He}$ . This energy has been calculated on the basis of the following mass loss for the N and P which form this particle (N = 939.544 MeV, P = 938.253 MeV, e = 0.511 MeV):

$$\text{N} - 1,800 \times 0.511 \text{ MeV} = 19.744 \text{ MeV}$$

$$\text{P} - 1,800 \times 0.511 \text{ MeV} = 18.453 \text{ MeV}$$

Net binding energy of  ${}^4_2\text{He} = 18.453 \text{ MeV} + 19.744/2 \text{ MeV}$ , that is  $28.325 \text{ MeV}$ . A mass equal to 1,800 electrons (mass e = 0.511 MeV) was deducted from the respective mass of N and P in order to determine the net binding energy of  ${}^4_2\text{He}$ . To respect the symmetry inside the nucleons, the lost masses of N and P are divided in two masses of equal size.

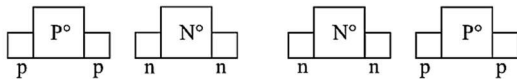
N mass:  $9.872 \text{ MeV} + 1,800 \times 0.511 \text{ MeV} + 9.872 \text{ MeV} = 939.544 \text{ MeV}$

P mass:  $9.226 \text{ MeV} + 1,800 \times 0.511 \text{ MeV} + 9.226 \text{ MeV} = 938.253 \text{ MeV}$

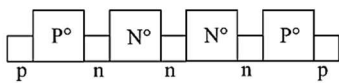
That is:  $N = n + N^\circ + n$       ( $N^\circ$  and  $P^\circ = 1,800 \times 0.511 \text{ MeV}$ )  
 $P = p + P^\circ + p$       ( $n$  and  $p =$  poles of neutron and proton)

Actually, the energy stored during the massification/demassification process of a nucleon (strong fundamental force) is restored through the inverted process of demassification/massification or nuclear force.

The  $\alpha$  particle is therefore composed of the following nucleon masses:



but its mass is:



that is  $1n$  and  $2p$  less than the mass of  $N$  and  $P$  which compose this  $\alpha$  particle.

Therefore, everything happens as if the creation of each  $\alpha$  particle from  $2N$  and  $2P$  had generated a loss of mass of  $(n + 2p)$ , which is  $28.325 \text{ MeV}$ . The 4 nucleons would have been fused together, sharing one  $n$  and two  $p$  which have been transformed into net binding energy. The hypothesis is therefore that the  $\alpha$  particle loses a mass of  $28.325 \text{ MeV}$  from the moment of its constitution as a result of the “fusion” between  $2N$  and  $2P$ .

### 3.2. Important remark

One notices that there is a difference between this type of “fusion” and the classical fusion. In the “classical” type of fusion poles of neutron and proton have to disappear in neutrons or gamma particles ( $e^- + e^+$ ) to make place for the nucleons “imported”. The process proposed is different: it modifies a pole of neutron or proton into a new neutron or proton without having to expel any pole, hence no neutron, proton or gamma rays are expelled. The process of creation of a new neutron or proton from one pole of neutron or proton is exactly the same phenomenon than that one of the creation of an electron from the gluon. The gluon is an electron which lost  $99/100^{\text{th}}$  of its mass, to get a mass of  $10^{-2}$  of an electron, then  $10^{-4}$ , etc (see tables 1 and 2). It recovers its former mass at the end of its course and becomes again an electron which is expelled. This is the explanation of the weak force. The electron is expelled with the energy coming from the accumulation of mass and antimass into energy during the “down” process (electron losing its mass). During the “up” process the electron is recovering its mass. The nuclear force is the same interaction. Nevertheless, it concerns a whole pole of nucleon and not only one electron. So, weak and nuclear forces are part of the same phenomenon. Moreover, both interactions are the consequence of the BEH mechanism, and both are the inverse forces of strong fundamental interaction.

There are three “classical” deuterium fusion reactions:

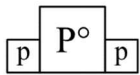
- $D2 + D2 \longrightarrow$  high-energy helium -4  $\longrightarrow$  helium -3 + high-energy neutron
- $D2 + D2 \longrightarrow$  high-energy helium -4  $\longrightarrow$  tritium + high -energy proton
- $D2 + D2 \longrightarrow$  high-energy helium -4  $\longrightarrow$  helium-4 + gamma rays

The result of the reactions is helium-4, nevertheless nonstable. The classical explanation is that the two protons are repelling each other because of the Coulomb barrier. Nevertheless, the reaction is resulting either in helium-3 or in tritium in equal quantity and in helium-4 and gamma rays in rare cases. Tritium which should be stable as containing only one proton is decaying slowly into helium-3 which is stable as it should not be.

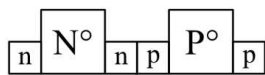
According to the constant nucleosynthesis theory proposed, the massification/demassification process is reverted and remassification occurs. Instead of a constant demassification there is a new constant massification. That process is the same as that one of the gluons returning to the state of electrons. In other terms the weak nuclear force and the nuclear force behave in the same way. The difference is only that the first applies to one electron and the second to the whole part outside the 1,800 electron masses trunk. This reaction is about a process where energy is transformed again into mass, called remassification. That same mass was transformed formerly into energy through the process of demassification. See below the He-4 nucleosynthesis according to the theory presented.

### 3.3. Nucleosynthesis of He4

${}^1_1\text{H}$

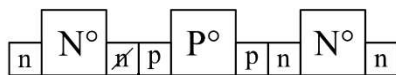


${}^2_1\text{H}$



↓ - 4 lines of neutron (see point 2)

${}^3_1\text{H}$

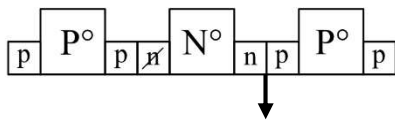


- 17.75 lines	+ 1
of neutron	+ 2
= one pole	+ 3
	<u>+ 4</u>
	+10/4 = + 2.5 lines of neutron

Total: - 17.75 + 2.5 = - 15.25 lines = 8.4818 MeV, i.e. H-3 net binding energy. 17.75 lines = 1 pole of neutron.

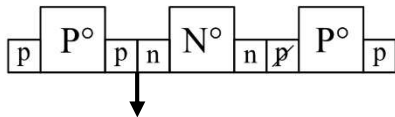
### ${}^3_2\text{He}$

1)



-17.75 lines of neutron + 4 lines of neutron

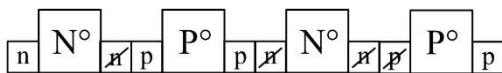
2)



+ 4 lines of neutron - 18 lines of neutron  
(= 1 pole of neutron transformed into proton)

Total:  $\frac{-17.75 - 18 + 2 \times 4}{2} = -17.875 + 4 = -13.875$  lines of neutron = 7.718 MeV, i.e. He-3 net binding energy.

### $\alpha$ particle

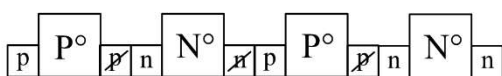


- 17.75 + 2.5 - 17.75 -  $\frac{17.75 - 18}{2}$  (alternately)

Total:  $(-17.75 - 17.75 + 2.5 \text{ lines}) - (17.75 + 18) / 2 \text{ lines} = 50.875 \text{ lines of neutron} = 28.295 \text{ MeV}$ , i.e. net binding energy of  $\alpha$  particle.

The neutrons have lost 2.5 poles  $(2 \times 17.75 + 17.75 / 2)$ . The protons have lost 0.5 pole  $(18/2)$  (see point 3.4).

### ${}^4_2\text{He}$



(see point 3.1)

The neutrons have lost one pole, the protons have lost two poles = 28.325 MeV, i.e. net binding energy of He-4.

### 3.4. Net binding energies of ${}^2_1\text{H}$ , ${}^3_1\text{H}$ , ${}^3_2\text{He}$ , ${}^4_2\text{He}$ , and $\alpha$ particle

The former operations indicate the EB value of each of these nuclei.

$$EB_1^2\text{H} = \text{NP} = 4 \text{ lines} = 4 \times 0.55616 = 2.2246 \text{ MeV}$$

$$EB_2^3\text{He} = \text{NPP} = 13.875 \text{ lines} = (17.75 + 18) / 2 - 4 = 13.875 \times 0.55616 = 7.717 \text{ MeV}$$

$$EB_1^3\text{H} = \text{NNP} = 15.25 \text{ lines} = 17.75 \text{ lines} - (1 + 2 + 3 + 4) / 4 = 15.25 \times 0.55616 = 8.4815 \text{ MeV}$$

$E_B \alpha = 50.875 \text{ lines} = 17.75 \quad (2 \text{ NN})$ $\quad \quad \quad 4 \quad (NP)$ $\quad \quad \quad 15.25 \quad (NNP)$ $\quad \quad \quad \underline{13.875} \quad (NPP)$ $\quad \quad \quad 50.875 \text{ lines}$ $E_B = 50.875 \times 0.55616 = 28.295 \text{ MeV}$ $(17.75 = \text{one pole of neutron} = 2 \text{ dineutrons})$	$E_B \text{ } ^4_2\text{He} = 1 \text{ pole of neutron and}$ $\quad \quad \quad 2 \text{ poles of 2 protons}$ $E_B = 28.325 \text{ MeV}$
--	--

Slight differences with the experimental values can be noticed (1 keV for  $^3_2\text{He}$  and 0.3 keV for  $^3_1\text{H}$ ). A more important difference exists between the net binding energies of the particle  $\alpha$  and of  $^4_2\text{He}$ . Actually, for the  $\alpha$  particle only the neutron lines are considered. For  $^4_2\text{He}$  the neutron and proton lines (whole poles) are taken into account. So, there is a slight difference between the net binding energy of  $\alpha$  particle and that one of  $^4_2\text{He}$  because the structure of the net binding energy is different even if the loss of mass is practically the same.

### 3.5. Stability of $^4_2\text{He}$ : what about the Coulomb barrier?

In chapter 1, one sees that the electromagnetism is concentrated in the poles of the nucleon.

At point 3.1, one sees that the loss of mass of  $^4_2\text{He}$  can be described as:

$$[\text{Neutron mass} - 1,800 \text{ electron masses}]/2 + [\text{Proton mass} - 1,800 \text{ electron masses}].$$

One of the two neutrons has lost half of its mass outside the trunk of the neutron, but the two protons have each lost half of their mass outside the trunk of the proton. These two protons are in opposite phase, i.e. not in the same quantum state. It is indeed the same for the two electrons they are expelling. These two protons are each expelling half of the electrons number compared to a free proton. One sees two electrons at the same time in case of  $^4_2\text{He}$  instead of one in the case of the proton or deuteron. This is due to the iterative process of expelling the electrons: in case of one proton one electron is expelled every quantum instant. In the case of two protons the electron of the first proton is expelled, then the electron of the second proton is expelled, and then the first proton expels its second electron, etc. The expelling process of the first proton is not in phase with the expelling process of the second proton, they are not in the same quantum state. This is the explanation for the difference of quantum state: they do not exist at the same quantum time, one being “alive” the other not. Nevertheless, the continuum (iterative) process of expelling electrons gives the impression they exist at the same continuum time. Each half proton expels a series of electrons but only one at each quantum instant. This electron disappears into antineutrino and is replaced by a new electron (see chapter 1 point 7.3.3.). Hence the quantization. One sees two different series of electrons at quantum level in the case of Helium-4. At the continuum level one sees two electrons which are not in the same quantum state.

## 4. Conclusions

One can now start the study of all the other nuclei. It will be seen that the bonds of type,  $^2_1\text{H}$ ,  $^3_1\text{H}$  and  $^3_2\text{He}$  and  $^4_2\text{He}$  are sufficient to explain the net binding energy of all nuclei, which pleads also for the predominance of the  $^4_2\text{He}$  structure within a nucleus. These nuclei are represented in the following as a snapshot at a given instant, being understood that the various nucleons are in different positions at each instant and are exchanging roles between N and P passing through the Higgs boson stage. The atomic nuclei are therefore constituted of sub-nuclei, essentially  $^4_2\text{He}$  but also  $^2_1\text{H}$ ,  $^3_2\text{He}$  and  $^3_1\text{H}$  or simply of N or P. This explains that the nucleus can expel spontaneously preformed combinations of nucleons as  $\alpha$  particles. It is to organize the atomic nucleus in

a way similar to Pauling's model of nuclear structure <sup>(3)</sup>, with some clusters within the nucleus Pauling called Spherons.

The clusters or sub-nuclei taken into consideration are the  $\alpha$  particles (actually  ${}^4_2\text{He}$ ) according to K. Ikeda, N. Takigawa and H. Horiuchi<sup>(4)</sup>, and four types of bonds, determined in the following way:

- deuterium-like bond, called NP with value 2.2246 MeV, linking a neutron of one  $\alpha$  particle with a proton of a second  $\alpha$  particle, or a neutron or proton outside an  $\alpha$  particle to that  $\alpha$  particle.
- tritium-like bond, called NNP with value 8.4818 MeV, linking three nucleons of three different  $\alpha$  particles, or one or two nucleons outside an  $\alpha$  particle to one or two  $\alpha$  particles.
- helium-3 like bond, called NPP with value 7.718 MeV, having a similar function as NNP.
- a dineutron bond, called NN with value 4.9365 MeV, linking two neutrons not being located within the same  $\alpha$  particle. This bond value is deduced from the  $\alpha$  particle net binding energy and can be described as  $9.872 \text{ MeV}/2$ , half of a neutron pole ( $= 17.75/2 = 8.875$  lines, see point 3.1 and 3.3).

So, the net binding energy (EB) of any nuclide is composed of the EB of the  $\alpha$  particles, in fact  ${}^4_2\text{He}$  (28.325 MeV each) together with the EB's of the four bonds determined above. See papers already published by the same author <sup>(6)</sup>.

In other terms, the net binding energy of any nuclide is based on the net binding energy of He-4 particles and other net binding energies called NN, NP, NNP, NPP. The net binding energy of He-4 can be described as the mass of one pole of neutron and two poles of protons.

Moreover, 2NN mass can be described as the mass of one pole of neutron, and NP, NNP, NPP masses are equal to parts of neutron poles called lines.

There are  $(3 \times 18 + 1 \times 17)$  lines in four poles of neutron (see tables 1 and 2). When the last pole of neutron has 18 lines instead of 17 ones, the neutron is about to be transformed into proton.

The masses of  $(2 \text{ NN} + \text{NP} + \text{NNP} + \text{NPP})$  are equal to the net binding energy of alpha particle.

So, as far as an  $\alpha$  particle is concerned, its net binding energy can be described as the addition of all other particles net binding energies.

2 NN can be described as the mass of one neutron pole  $(3 \times 18 + 1 \times 17) / 4$ , NP = 4 lines  $(3 \times 18 + 1 \times 17) / 71 \times 4$ , NNP = 15.25 lines, and NPP = 13.875 lines (see point 3.4. of chapter 2).

The poles and lines are composed out of gluons and are behaving as the electrons. In other terms, the weak nuclear interaction process is the same as the nuclear interaction one. The difference of intensity is the consequence of the quantity of gluons/electrons involved.

**The net binding energy is equal to the mass defect. That one is a static consequence of the dynamic process of nuclear reaction. As such the mass defects are additive in a nucleus.**

In the following appendix there are many examples displayed in order to illustrate this theory:

- on point 2, there are Oxygen and Carbon,
- on point 3, Ne, Mg, Si, Ar, Ca, and Sc are displayed,
- on point 4, there are the nuclei from  $Z = 22$  to  $Z = 40$ ,
- on point 5, some conclusions,
- on point 6, there is a comparison study between Hydrogen and Helium nuclei, the huge difference of net binding energy being explained by the presence or absence of an alpha particle,
- on point 7, there is a study of Ni and Cu isotopes in order to determine why some are stable, others not,
- on point 8, there is an attempt to build some nuclei on the basis of Oxygen and Neon nuclides.

## Appendix

### 1. Introduction

The author's hypothesis aims at challenging the liquid-drop model in finding an easier way to determine the net binding energy of a given nucleus. So, he looked for an alternative model in clustering the nucleons in the way described in the following. With net binding energy the author means the total binding energy minus the presupposed Coulomb energy.

Actually, there is a chance to simplify the liquid drop system in implementing the clustering model which also allows to use fixed net binding energy values. That model has the advantage to simplify the structure of the nucleus - instead of nucleons there are clusters which are much less numerous -but also there are fixed net binding energy values for each cluster.

#### 1.1. Recall of the basics of the author's theory.

At point 3.4 of chapter 2 the following values are determined.

$$2 \text{ NN} = 9.873 \text{ MeV}, \text{ NP} = 2.2246 \text{ MeV}, \text{ NNP} = 8.4818 \text{ MeV}, \text{ NPP} = 7.718 \text{ MeV (AME 2016)}.$$

The total of these four net values can be described as  $\alpha$  particle net binding energy value (see chapter 2, point 3.4).

$$\begin{array}{r} 9.8730 \text{ MeV} \\ 2.2246 \text{ MeV} \\ 8.4818 \text{ MeV} \\ \hline 7.7180 \text{ MeV} \\ \hline 28.2974 \text{ MeV} \end{array}$$

The 2 NN value is new and unusual. So, it is necessary to test it.  
It can be described as one pole of neutron (see chapter 2, point 3.4).

Applied to the value of O16:  $\text{EB} = 4 \text{ EB } \alpha + 2 \text{ NN} + 2 \text{ NP}$ , so that the four  $\alpha$  are bound together with 4  $(\text{NN}/2 + \text{NP}/2)$ .

$\text{EB of O16} = 4 \text{ EB } \alpha + 4 (\text{NN}/2 + \text{NP}/2)$  (see point 2 of that appendix, figure 1).

Also, O17:  $\text{EB} = 4 \text{ EB } \alpha + 3 (\text{NN}/2 + \text{NP}/2) + \text{NPP}$ , one NPP replacing one  $(\text{NN}/2 + \text{NP}/2)$  due to the presence of one supplementary neutron (see point 2 of that appendix, figure 2).

Concerning C12,  $\text{EB} = 3 \text{ EB } \alpha + 2 (\text{NN}/2 + \text{NP}/2)$  i.e. half of the bonds values between the  $\alpha$  as for O16.

Also,  $\text{EB C13} = \text{EB C12} + \text{NP}/2 + \text{NPP}/2$ . Actually, the supplementary neutron is bound any other time with NP to one  $\alpha$  particle and with NPP to two  $\alpha$  particles like for O17 (see point 2 of that appendix, figures 3 and 4).

For Be 8 and Be 9 there is the following:

Be 8	2x28.325 =	56.6500	2x28.325 =	56.6500
	NN/2 =	2.4683	-NPP/2 =	- 3.8590
	NP/2 =	<u>1.1123</u>		<u>          </u>
		60.2306 MeV		52.7910 MeV

Average:  $60.2306/2 + 52.7910/2 = 56.511$  MeV (+ 0.011 MeV compared with AME 2016 value)

The balance between (NN/2 + NP/2) and NNP/2 is negative ( $2.4683 + 1.1123 - 3.8590 = - 0.2784$  MeV). As a consequence, there is no bonding possibility between the two  $\alpha$  particles and the nucleus is unstable.

Be 9	2 x 28.325 =	56.6500	2 x 28.325 =	56.6500
	3 NN/2 =	7.4048	-NPP =	- 7.7180
	3 NP/2 =	<u>3.3369</u>		<u>          </u>
		67.3917 MeV		48.9320 MeV

Average:  $67.3917/2 + 48.9320/2 = 58.1640$  (+0.002 MeV compared with AME 2016 value)

The introduction of one neutron has occurred two more (NN/2 + NP/2) bonds and also a negative NPP bond double as for Be8. Nevertheless, the balance is positive ( $7.4048 + 3.3369 - 7.7180 = 3.0237$  MeV). The nucleus is stable.

So, in these cases (Be, C, O), it is possible to express the net binding energy value for these elements and their isotopes with the basic values determined by the author.

The difference between He4 and Be9 net binding energies can be explained as the net binding energy between the two He4 nuclei constituting the Be9 nuclide. The same for C12 and O16. Moreover, one has seen that NP, NN, NNP and NPP are additive within the  $\alpha$  particle.

## 1.2. Discussion

The net binding energy per nucleon is not uniform as far as the first elements are concerned. Nevertheless, this is roughly the case from  $Z = 22$  on. The author looked for the reasons of the discrepancy between the net binding energy per nucleon of the first nuclei of the Periodic Table of Elements and the others and found that the bonds between the  $\alpha$  of the group of  $Z = 22$  and more are double of these of O16. Instead of a (NN/2 + NP/2) bond the bond can be described as (NN + NP), (see examples in the following points 2 to 8).

Indeed, the linearity concerns the net binding energy or mass defect and not the whole binding energy (nuclear interaction). Nevertheless, each cluster,  $\alpha$  particle, NN, NP, NNP, NPP has a given net binding energy and these are additive in the same way as for He4 (see points 3.3 and 3.4 of the chapter 2). This net binding energy is equal to the mass defect. Also, the mass defect is additive in one nucleus.

The strong force and the nuclear force are two opposite sides of the same phenomenon, that of massification /demassification creating mass and antimass within a nucleon and hence within a nucleus.

The consequence is the creation of massless particles (gluons) and of mass defects within a nucleon.

The author concluded that the net binding energy value of any element and its isotopes could be determined on the basis of these clusters. This is a huge simplification. When the structure of the nuclei is more or less uniform (case for  $Z > 22$  to  $Z < 41$ , see point 4) the linearity and additivity of the clusters are obvious. For

the other elements the linearity is not respected as the structure of the various nuclei is not uniform. Nevertheless, the additivity of the net binding energy between clusters exists, as one will see in the following.

In chapter 1 dedicated to the relationship between Higgs boson and neutron, proton and electron masses, the hypothesis was made of the creation of baryonic mass, consequence of primitive positive and negative mass, prior to electromagnetism which is a consequence of that primitive, positive and negative mass. As such electromagnetism appears after mass and antimass appearance and is a consequence of mass and antimass. Also, electromagnetism is limited to poles of neutron and proton (see chapter 1, point 6). If these poles are annihilated, electromagnetism is annihilated either.

So, the Coulomb barrier question issue is not decisive in the case of an ongoing nucleosynthesis,  $\alpha$  after  $\alpha$ .

Moreover, the net binding energy solution has the advantage of simplifying the determination and calculation of the net binding energy of any nucleus in two ways:

- compared to the liquid drop model the clustering system reduces the number of nucleons to be taken into consideration for the calculation of the net binding energy.
- the clusters form their own bonds, and they link each other; so, there is no other link between the nucleons outside that one of each cluster they are part of.

As well as Linus Pauling hypothesis describes the cluster system as a simplified model of the structure of the nucleus, there is also a simplification obtained for the calculation of the net binding energy, limited to five types of clusters:  $\alpha$  particle one, as well as NN, NP, NNP, NPP. Also, there is only one proton outside the  $\alpha$  particles in case of odd atomic numbers.

Moreover, one should consider the following:

- if there is a Coulomb barrier there are at minimum two protons repelling each other. So, when two deuterons are to fuse the result should unlikely be 50 % of H3 and 50% of He3, what is the case.
- H3 should be more stable than He3, both protons repelling each other, what is not the case.
- if He3 is stable, what about the necessity of the huge binding energy of He4 in comparison with that one of He3 to stabilize this element? Something different must intervene.

Let us consider the steps of constitution of an  $\alpha$  particle (see point 3.4 of chapter 2):

1. Two neutrons create an NN bond, and then NP, one neutron decaying into proton,
2. A third neutron is added, so as to have NN +NP, and then NNP,
3. A fourth neutron, decaying into proton, enters the nucleus, so as to have NPP.

$$\text{So NN} = 8.875 \times 0.5561589 = 4.9360 \text{ MeV}$$

$$\text{NN + NP} = (8.875 + 4) \times 0.5561589 = 4.9360 \text{ MeV} + 2.2246 \text{ MeV}$$

$$\text{NNP} = 15.25 \times 0.5561589 = 8.4814 \text{ MeV}$$

$$\text{NPP} = 13.875 \times 0.5561589 = 7.7167 \text{ MeV}$$

$$\text{Total} = 50.875 \times 0.5561589 = 28.2946 \text{ MeV}$$

This result is very close to that one of the net binding energy of  $\alpha$  particle. One can consider that the net binding energy of  $\alpha$  particle contains all the other net binding energies taken into consideration in the author's theory. So, the  $\alpha$  particle is a cluster of two neutrons and two protons bound with the following bonds: 2 NN, NP, NNP, NPP. Each time the bonding conditions are favorable an  $\alpha$  particle is created.

To summarize, the calculation of any net binding energy value is based on the net binding energy of  $\alpha$  particle, and on NN, NP, NNP, NPP net values. The value taken for the  $\alpha$  particle net binding energy is 28.325 MeV, a bit higher than 28.2957 MeV, value of the literature. This is due to the fact that the PP bond is a bit higher than the NP + NNP + NPP bonds it is initially constituted.

In chapter 3 the way from  ${}^4_2\text{He}$  to  ${}^{16}_8\text{O}$  is shown to illustrate that hypothesis.

### 1.3. Grand Unified Theory

A Grand Unified Theory (GUT) merges the electromagnetic, weak, and strong forces into a single force. In chapter 1, the massification/demassification force is identified as the fundamental strong force creating core and poles of the nucleon from the Higgs boson.

These poles are constituted with 1% mass and 99% (mass + anti mass) or gluons.

In chapter 1, the electromagnetic interaction is identified as a sub product of the massification /demassification process. In chapter 2 the residual strong force, or nuclear force, is identified as a force recreating a neutron mass from a pole of a former existing neutron. This force is the reverse force of the massification/demassification force, i.e. a demassification/massification force retrieving the mass of a neutron pole in a new neutron. The consequence of that process is the loss of mass pole of the mother neutron, mass which is the basic mass of the daughter neutron constituted with that mass and the gluons masses associated. That mass defect is identified as the net binding energy of the nucleus. So, this net binding energy is not the residual energy of nuclear and electromagnetic forces.

As a conclusion, the massification/demassification force is at the origin of the fundamental strong force, the nuclear force, and the electromagnetic force, and can be identified as the interaction of the GUT.

## 1.4. The gravitational force

**1.4.1.** One sees that the neutron passed through the stages of materialization and dematerialization during its constitution and that it transformed itself into a proton : all the lines of the nucleon were materialized and dematerialized through the massification/demassification process.

The neutron core (i.e. 1.800 electron masses) also passes itself through the phases of materialization /dematerialization starting from Higgs boson. Moreover, quantization shows that the material nucleon has an energetic twin and that there was alternation between them, passing from 0 to 1 and 1 to 0.

So, a given material neutron is part of space-time at quantum instant  $t$ , part of another system of reference outside space-time at quantum instant  $(t + 1)$  as non-material neutron (immaterial, energetic neutron) and again material neutron as part of space- time at quantum instant  $(t + 2)$ . The anti-neutron is part of space-time at quantum instant  $(t + 1)$  and part of another system of reference at  $t$  and  $(t + 2)$ , etc.

However, matter is not only part of space-time but also creates space-time around it each time it materialized, and immatter (energy) is evolving in a system of reference located outside space-time : within that system of reference space-time is abolished as well as distances and also speed. Indeed, as the "material objects" become energetical ones in this system of reference and evolve at the same speed, which is the speed of light, the speed of every "object" is abolished.

As there is no matter in that system of reference there is also no gravitation effect between "material – energetical" objects. Nevertheless, there are relations between them as the phenomenon of entanglement shows it.

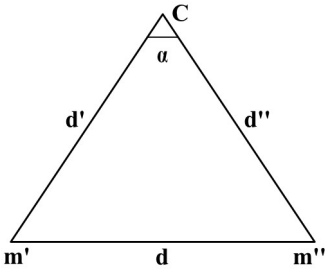
This theory suggests that gravitation is only a consequence of the massification/demassification of matter, and that it is this massification/demassification process which presides over the creation of matter-energy, space-time and implementation of the four natural forces.

One observes that the massification/demassification of neutron entails a force of magnitude  $10^{36}$  of the one of gravitation since the latter is only tangible outside the nucleon and even outside the atomic nucleus. It is therefore tempting to imagine that gravitation is the result of a massification which involves forces which are  $10^{36}$  stronger than that of gravitation and of a demassification which concerns quasi equal forces, hence the weakness of gravitation force in comparison to quantized forces.

**1.4.2.** Let us assume a mass  $m$  and imagine a centre in the universe which is located within the Higgs field. Everything happens as if this mass was attracted to this centre by dematerialization, since once under this form, this "mass" is not subjected anymore to laws of space-time, and immediately rejected from this center by rematerialization, this operation recreating space-time around this mass, at the same time as the mass itself, and therefore the distance  $d$  at this centre.

1.4.2.1. So, this "circular" gravitational force is governed by a rule equivalent to  $\frac{m}{d}$ , m being the resultant of M-M, i.e. 1% of M (mass in spacetime).

Let us assume two masses m' and m'' located at d' and d'' from the centre C of the universe. The distance between them is d.



At the time of materialization, they are ejected from that centre as an inverse function, for m' this force is  $\frac{1}{d'}$ , for m'' it is  $\frac{1}{d''}$ . What an observer can see is not d' or d'' but the distance d between m' and m''. At the time of dematerialization m' and m'' are attracted to the centre C and as a consequence attracted one to the other, as a function  $m' m''$ . The distances d' and d'' are also abolished but what the observer "sees" is the "disappearance" of d and not that of d' and d''. As a consequence, the observer sees a phenomenon described by a function  $\frac{m' m''}{d^2}$  and not  $\frac{m' m''}{d' d''}$ . However, this last function governs what happens in reality, called circular gravitation.

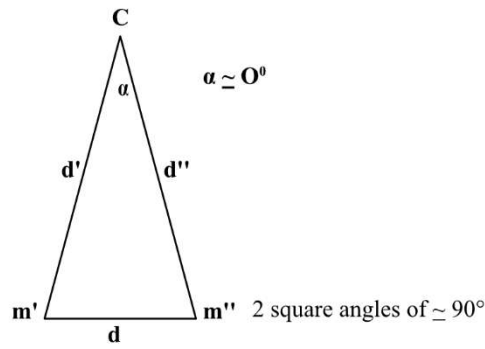
Why do we not notice this circular gravitation ? As observer and as "material object", the human being is submitted to the same laws of materialization/dematerialization as the objects he is observing. The pace of materialization/dematerialization of an object is nearly the same as the one of the observer when that object is close to the observer. If the object is far away it is because its pace of materialization/dematerialization is not in phase with our own materialization/dematerialization. The objects which are submitted to materialization/dematerialization in opposition of phase to us are never visible because they evolve at the speed of light in the opposite sense to us compared to the centre C.

Actually, our horizon is constituted by the stars evolving at the speed of light and being submitted to materialization/dematerialization at a pace which is compatible with our own pace of materialization /dematerialization.

1.4.2.2. Let us assume two masses m' and m'' located at d' and d'' from the centre C of the universe. At the time of materialization, they are ejected from that centre as an inverse function, for m' this force is  $\frac{1}{d'}$ , for m'' it is  $\frac{1}{d''}$ .

They are also "ejected" one from the other as the following function :  $\frac{1}{d' d''}$  or  $\frac{1}{d'' d'}$  and are returning to the centre C according to the same function.

As the distances d' and d'' at the centre C are quasi-identical in the case that the masses m' and m'' are close the one to the other, one can accept, as an approximation, that  $d' d'' = d^2$  and  $d'' d' = d^2$ . Actually, the situation in space-time of masses m' and m'' is the following :



These two masses form a triangle with centre C. Angle  $\alpha$  is close to  $0^\circ$ , so angle  $m'$  is nearly  $90^\circ$ , as well as angle  $m''$ .

One knows that the two masses are attracted the one towards the other as a function  $\frac{m' m''}{d^2}$  in a

local material universe, in a local space-time, according to Newton's law.

So one can assume that the function  $\frac{m' m''}{d^2} = \frac{m' m''}{d'^2 - d''^2}$  or  $\frac{m'' m'}{d''^2 - d'^2}$ ,  $d^2$  being the square

difference between  $d'^2$  and  $d''^2$  or  $d''^2$  and  $d'^2$ , and  $d$  being the distance between  $m'$  and  $m''$  in a local space-time.

As  $m'$  and  $m''$  are close each from another they are appearing in phase in spacetime. So, they are part of the same local spacetime. This is the reason why we perceive gravitation only in its ejecting/attracting function, i.e.  $\frac{m' m''}{d'd'' - d''d'}$  or by approximation  $\frac{m' m''}{d^2}$ .

**1.4.2.3.** So, two masses  $m'$  and  $m''$  located the one from the other at a "Newtonian" distance are distant from the centre of the universe on an infinite and quasi equal manner. In our hypothesis these two masses are attracted to the centre by dematerialization and then ejected from this centre by rematerialization, so  $\frac{m'}{d'}$  and  $\frac{m''}{d''}$ .

Actually, the two masses are first ejected from the centre by effect of materialization, creating at the same time the space-time, as massification is anterior to demassification, and then attracted to the centre.

So, gravitation consists of:

- a force pushing a "mass-energy" into space-time, creating a distance (and space-time) between that "mass-energy" and the center of universe, and materializing the mass.
- a force pulling that "mass-energy" outside the space-time by way of dematerialization and annihilating the distance (and space-time) between that "mass-energy" and the center of universe.

The distance we are perceiving is actually the distance between two masses (linear gravitation) and not the distances to the centre of universe of these two masses (circular gravitation).

As there is no distance outside space-time, one can consider that the centre of universe is everywhere (Higgs field) but that this center is far away from every material object.

**1.4.3.** The preceding phenomenon corresponds to the case of two masses, one close to the other. If they are much more distant one from the other, angle  $\alpha$  is more open and not negligible anymore. In this case, one observes that the two masses draw away the one from the other at a speed which can reach the speed of light by creation of space-time between themselves according to the materialization/dematerialization principle. Consequently, one sees the very distant celestial objects speed growing according to their distance to earth.

If the speed of a mass differs considerably from that of another mass, the phenomenon is similar. If a mass is driven away from the other at a speed close to the speed of light, the phenomenon of gravitation between these masses is modified according to the laws of Einstein. The laws of Einstein therefore govern the passage of matter and space-time towards the immaterial and atemporal world, in which this matter and this space-time are immersed, and which corresponds to what one could call "ether", this ether being formed with the energetic counterpart of mass (in fact all the masses together). This is the Higgs field.

So, when a mass is reaching the speed of light, and hence is approaching the centre C, the distance between that mass and the centre C is abolished and mass  $m$  becomes infinite according to  $\frac{m}{d}$  if  $d = 0$ .

But before being infinite the mass  $m$  is dematerialized at instant  $t$  according to the massification /demassification principle and cannot be rematerialized at the quantized instant  $t + 1$  because that mass has reached the speed of light. So, at the speed of light the mass-energy is demassified and becomes energy-energy, or only energy.

A mass whose speed is not absolute is constantly massified and demassified. As each mass is massified in another space, hence in another time than another mass the space-time we know is created; this space-time is based on all the space-time created around each of these masses. When the massification of a given object is close in space- time to the massification of another object (our body) we do not notice that phenomenon of materialization/dematerialization but only the discontinued characteristic of matter.

Actually the "massic observer" does not notice his own massification/demassification, as well as that one of the other objects.

But there is obviously a link between quantum phenomena and macro-physical phenomena, the macro-physical phenomena being the "stroboscopic" result of an infinity of quantized operations implemented in quantized instants. It has not been possible until now to put in evidence this "stroboscopic" aspect, whereof the dichotomy of the present physical science between "discontinuous" and "continuous" phenomena.

The "continuous reality" is only the resultant of relativity between discontinuous phenomena outside the observer, on one hand, and discontinuous phenomena concerning the observer himself, on the other hand. Indeed, we ourselves, taken as matter, participate in the phenomenon and our appreciation of reality is the more "relative".

**1.4.4.** As regards the constant of gravitation, one must suppose that it is the resultant of materialization/dematerialization operations of all objects taken globally, i.e. it is the reflection of a general massification/demassification field or Higgs field.

The universal "constant" of gravitation is therefore the resultant of the universal gravitational field, or rather, the resultant of the general process of materialization/dematerialization and the creation of space-time, the resultant of a quasi-infinite number of waves fluxing and refluxing from and back to the Higgs field.

According to that hypothesis the "constant" G depends on the global mass of all the objects in the universe. So, subtracting one of these objects in order to measure its mass has an incidence on the whole of the other masses and hence on the "constant" G. Moreover, the Newtonian attraction between two objects varies according to their distance as angle  $\alpha$  is modified (see point 1.4.2.). Even if the magnitude of that angle is negligible at short distances between two objects in interaction, it has an incidence on "constant" G.

**1.4.5.** How does it come to be that a given massic object always "falls back" at the same place after the passage out of space-time ?

One has seen that matter was alternatively mass and energy. In fact, a massic object has always its energetic double outside space-time, this double taking the place of the massic object at the following instant, whilst the massic object will play the role of the double. There is therefore a constant link (a string) between matter in space-time and its "immaterial" (or "etheric") representation outside space-time (at the level of Higgs field and Higgs boson). It is therefore not astonishing that "matter" always falls back at the same place after its passage outside space-time.

**1.4.6.** The gravitational force is thus only the resultant of two opposite forces, the one of massification, on the one hand, and the one of demassification, on the other hand, forces which are of the same magnitude (there is only a slight time shift between the action of the one and that of the other). This explains the relative weakness of the gravitational force.

As the theory presently describes the gravitation as being a deformation of space-time, it is impossible to include the latter in a quantum theory. Once mass and antimass are introduced in the description of gravitation it is obvious that "massons" and "antimassons" (gravitons and antigravitons) enable that easily.

The theory of relativity explains that gravity is the consequence of the curvature of space-time yield by the mass of matter. Actually, it is the mass and energy (mass + antimass) which create the space-time as a consequence of creation of matter through the mechanism described in the present document.

**1.4.7. Remark**

According to the function  $\frac{m' m''}{d^2}$  the gravitation force increases as d diminishes.

However as seen before, that function is based on an approximation only valid in a local universe. Actually, two masses are attracted and ejected at quantum level according to the following formula (see point 1.4. 2.) :  $\frac{m' m''}{d' d''}$  where d' and d'' are infinitely larger than d.

Consequently, the gravitation force diminishes when  $m'$  and  $m''$  are at a quantic distance one from the other in the phase of materialization. Indeed, in that case  $d$  is close to zero and  $d' d''$  is quasi-infinite. When  $m'$  and  $m''$  are at that distance, minimum distance at quantic level, the gravitation force becomes null and  $m'$  and  $m''$  tend to be separated again due to the fact that the materialization/dematerialization quantic process becomes preponderant over the attraction valid in a "continued" universe. So, at a quantic distance the phenomenon of gravitation is inverse to the one valid at the "continued" level.

In a continued universe the gravitation attraction is the "stroboscopic" aspect of an iterative quantic phenomenon called "materialization/dematerialization" which governs the discontinued universe and is the reason for the discontinuity of matter.

When  $m'$  and  $m''$  are materialized they are ejected from a centre  $C$  at a large distance and also rejected the one from the other. When  $m'$  and  $m''$  are dematerialized, they are attracted by that centre  $C$  and also the one to the other till the distance the one to the other has reached the quantic minimum distance. From that moment they are again ejected into the continued universe. So it is only at that moment that the phenomenon of separation is perceived because the minimum distance possible between  $m'$  and  $m''$  is reached.

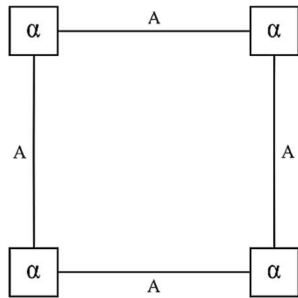
**1.4.8.** As a conclusion, the gravitational phenomenon is also governed by the massification/demassification process.

So, that massification/demassification process is the fundamental and unique force within the universe.

It is generated by the Higgs field empowering mass and antimass to any object in the universe, this mass and antimass creating in turn time and space around the massified objects.

## 2. Oxygen and Carbon

Figure 1:  $^{16}_8\text{O}$

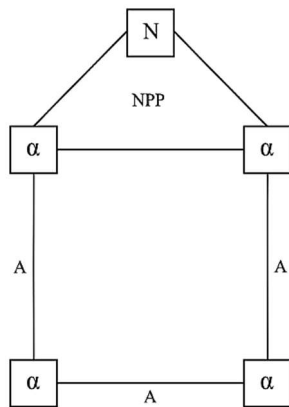


$$EB\ ^{16}_8\text{O} = 4 EB\ \alpha + 2 NP \text{ (NP = EB of deuterium = } 2.2246 \text{ MeV)} + 2 NN \text{ (= } 9.872 \text{ MeV = one pole of neutron mass)}$$

4 x 28.325	113.3000 MeV
2 NP	4.4492
2 NN	9.8720
	127.6212 MeV
	(+0.002 MeV, AME 2016)

Remark: 2 NP + 2 NN = 4A (by convention)

Figure 2:  $^{17}_8\text{O}$



$$EB\ ^{17}_8\text{O} = 4 EB\ \alpha + 1.5 NP + 1.5 NN + NPP$$

4 x 28.325	113.3000 MeV
1.5 NP	3.3369
1.5 NN	7.4040
1 NPP	7.7180
	131.7589 MeV
	(- 0.003 MeV, AME 2016)

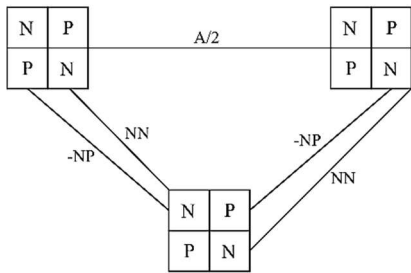
Remarks: NPP is equal to  $^3_2\text{He}$  binding energy.

$$1.5 NP + 1.5 NN = 3A$$

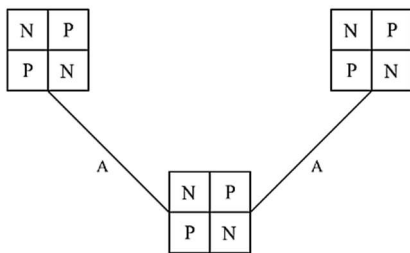
The presence of a N within  $^{17}_8\text{O}$  occurs the modification of an A bond (= NN/2 + NP/2) into a NPP bond. The “A” bond is the average of (NP/2) + (NN/2) or (4 + 8.875)/2 = 6.4375 lines. This bond is of peculiar importance, as the neutron is constantly modified into proton, and the proton modified into neutron. The NN bond, i.e. neutron – neutron link is modified into neutron – proton or proton – neutron, i.e. NP bond. When the proton becomes again a neutron the link NP becomes NN, etc. This assures the stability of the  $\alpha$  particle but also the stability between the  $\alpha$  particles within the nucleus. This is the case of the majority of nuclei.

**Important remark: the geometrical shapes displayed in this appendix do not necessarily correspond to the physical shapes of the nuclei concerned. The author’s purpose is to illustrate the binding energy calculations.**

Figure 3:  $^{12}_6\text{C}$  First phase



second phase

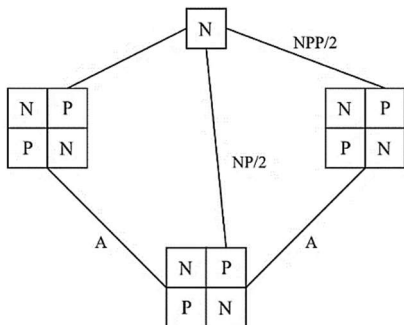


$E_B = ^{12}_6\text{C}$	3 $E_B \alpha$	84.9750 MeV
	1.625 NN	8.0218
	- 0.375 NP	<u>- 0.8342</u>
		92.1626 MeV
		- 0.001
		AME 2016

$$A = NN/2 + NP/2$$

In the second phase, the three  $\alpha$  particles are linked with two A bonds. See the case of O16 which is similar. See also next figure for C13.

Figure 4:  $^{13}_6\text{C}$



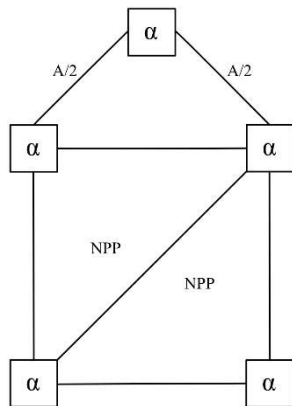
$E_B = ^{13}_6\text{C}$	3 $E_B \alpha$	84.9750 MeV
	NN	4.9365
	1.5 NP	3.3369
	0.5 NPP	<u>3.8590</u>
		97.1074 MeV
		/
		AME 2016

$$A = NN/2 + NP/2$$

This nucleus is stable. It is similar to C12. The supplementary N is once linked to one  $\alpha$  particle through a NP bond, and once to the two other  $\alpha$  particles through one NPP bond. The links between N and  $\alpha$  particles are alternatively NP and NPP (see the case of O17 on figure 2).

### 3. Some more examples

Figure 5:  $^{20}_{10}\text{Ne}$



$$EB = 5 EB_{\alpha} + 2 NPP + A = 5 EB_{\alpha} + 34.1875 = 160.6416 \text{ MeV} - 0.003$$

or

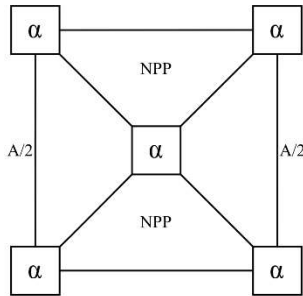
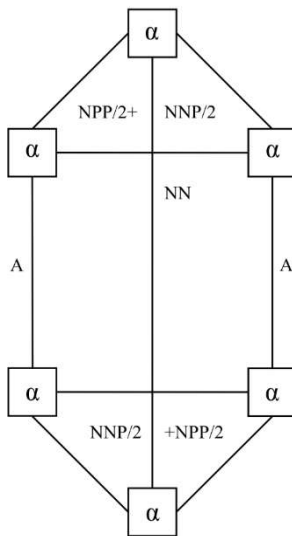
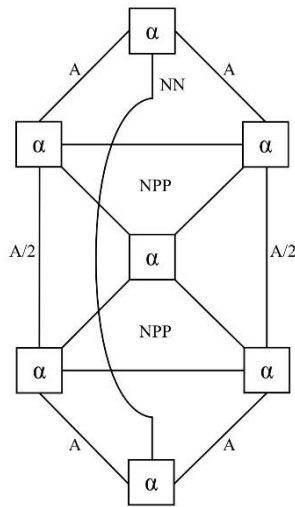


Figure 6:  $^{24}_{12}\text{Mg}$



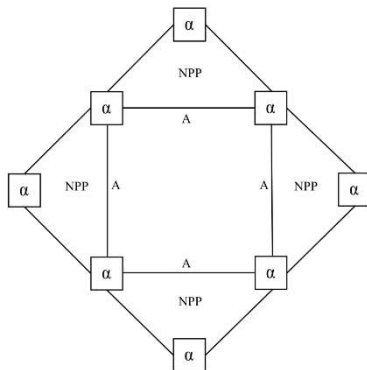
$$EB = 6 EB_{\alpha} + 2A + NN + NNP + NPP = 6 EB_{\alpha} + 50.875 = 198.2474 \text{ MeV} - 0.010$$

Figure 7:  $^{28}_{14}\text{Si}$



$$EB = 7 E_B \alpha + 5A + NN + 2 NPP = 7 E_B \alpha + 68.8125 = 236.5503 \text{ MeV} + 0.013$$

Figure 8:  $^{32}_{16}\text{S}$

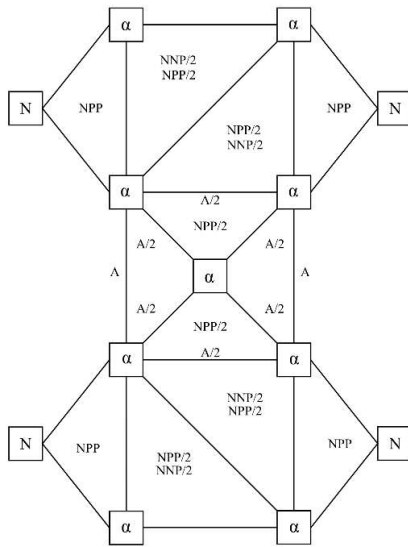


$$EB = 8 E_B \alpha + 4A + 4NPP = 8 E_B \alpha + 81.25 = 271.7942 \text{ MeV} + 0.014$$

Structure of  $S_{32} = O_{16} + 4 \alpha + 4 NPP$



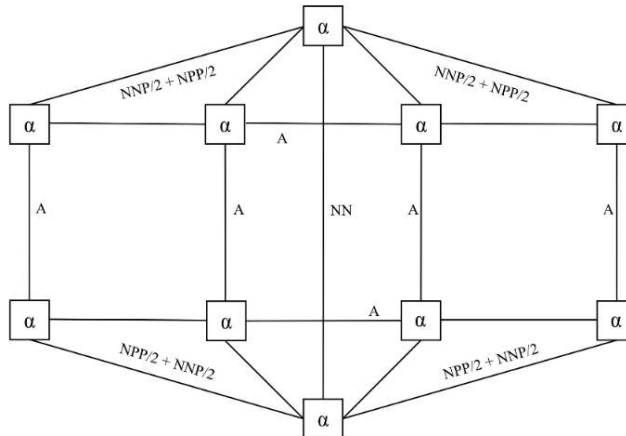
Figure 10: <sup>40</sup><sub>18</sub>Ar



$$EB = 9 EB_{\alpha} + 5A + 2NNP + 7NPP = 9 EB_{\alpha} + 159.8125 \text{ lines} \\ = 343.8174 \text{ MeV} \\ + 0.007$$

Compared to Ar36, 4 neutrons are added with each time one NPP bond. Also 2 NNP bonds are added so that 3A (6 x A/2) bonds are superfluous.

Figure 11: Ca40



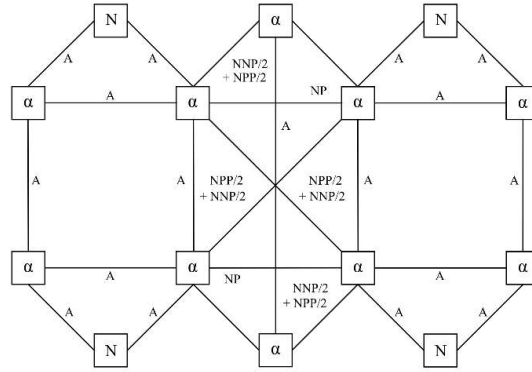
$$EB = 10 EB_{\alpha} + 6A + NN + 2NNP + 2NPP = 10 EB_{\alpha} + 105.75 \text{ lines} = 342.0694 \text{ MeV} \\ + 0.017$$

This structure has a core equal to that one of O16. The rest is similar to Mg24. Actually, the addition of O16 bonds and Mg24 bonds is the following:

O16	4 EB α	4A			
Mg24	6 EB α	2A	NN	NNP	NPP
<b>Total</b>	<b>10 EB α</b>	<b>6A</b>	<b>NN</b>	<b>NNP</b>	<b>NPP</b>
Ca40	10 EB α	6A	NN	2NNP	2NPP

So, Ca40 bonds represent the O16 bonds plus the Mg24 bonds, with addition of one NNP and one NPP bonds. One NNP and one NPP bonds are added to link the two structures. To link the six α particles of Mg24 2A, 1 NN, 1 NNP and 1 NPP are necessary. To link that structure to O16 (4A) 1 NNP and 1 NPP more are necessary.

Figure 12:  $^{44}_{20}\text{Ca}$



$$EB_{20}^{44}\text{Ca} = 10 EB \alpha + 175.6875 = 10 EB \alpha + (105.75 + 69.9375) \text{ lines}$$

$$\text{Difference between Ca40 and Ca44} = 69.9375 \text{ lines} = 11A + 2 NP - NN$$

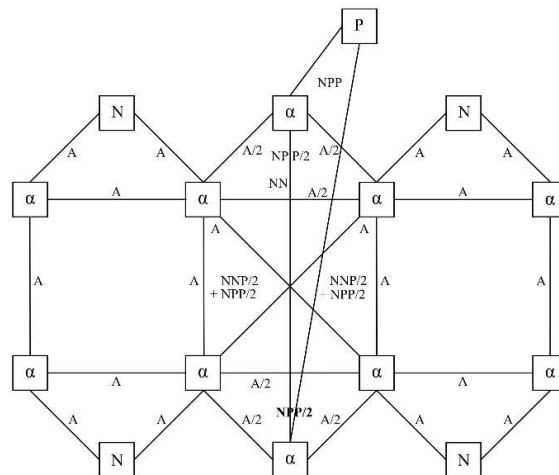
$$EB_{20}^{44}\text{Ca} = 10 EB \alpha + 6A + NN + 2 NNP + 2 NPP + 11A + 2 NP - NN$$

$$EB_{20}^{44}\text{Ca} = 10 EB \alpha + 17A + 2 NP + 2 NNP + 2 NPP = 380.9682\text{MeV} + 0.008$$

The introduction of four neutrons has modified the structure of Ca40, A bonds replacing the NNP and NPP bonds.

Nevertheless, these four neutrons do not consolidate the structure of Ca40 as it is already stable. It is not necessary to add 4 neutrons to create more stability and to compensate for the so-called Coulomb barrier influence. In general, the addition of neutrons to a nucleus does not stabilize it but rather weakens it as one of these neutrons is transformed into proton, creating a new element.

Figure 13:  $^{45}_{21}\text{Sc}$



$$EB_{21}^{45}\text{Sc} = 10 EB \alpha + 188.0625 = 10 EB \alpha + (175.6875 + 12.3750) \text{ lines}$$

$$= 10 EB \alpha + 17A + 2 NP + 2 NNP + 2 NPP + 12.375 \text{ lines}$$

$$12.375 \text{ lines} = NPP - 1.5 \text{ lines} = NPP - (2.375 - 0.875) \text{ lines}$$

$$NNP = 15.25 \text{ lines} = 2A + 2.375 \text{ lines}$$

$$2 NP = 8 \text{ lines} = NN - 0.875 \text{ lines}$$

$$\text{So, } EB_{21}^{45}\text{Sc} = 10 EB \alpha + 19A + NN + NNP + 3 NPP = 387.8528 \text{ MeV} + 0.002$$

Compared with Ca40 13A are added and one NNP is transformed into NPP.

#### 4. Cases of nuclei from $Z = 22$ to $Z = 40$

According to the author's theory:

- the  $E_B$  of a given nucleus is proportionate to the number of  $\alpha$  particles and to the number of neutrons and protons supplementary to those ones constituting the  $\alpha$  particles.
- this proportion is the same for nuclei, which  $Z$  is between 22 and 40 due to the structure of the nuclei.
- for nuclei having  $Z$  inferior the structure of the nuclei depends on the number of  $\alpha$  particles, and hence their binding energy.
- for nuclei having  $Z$  superior the structure of the nuclei changes, and hence their binding energy.

##### 4.1. Examples for Ti to Cu ( $22 \leq Z \leq 29$ ):

###### ${}^{48}_{22}\text{Ti}$

${}^{48}_{22}\text{Ti} = 11 \alpha$  particles and 4 supplementary neutrons.

$$E_B = 11 E_B \alpha + 11 NN + 11 NP + 4 NN + 4 NP = 418.9915 \text{ MeV.}$$

Compared to the experimental value (418.7033 MeV) there is a negative difference of 0.2882 MeV or 0.5 line. One line can be described as 0.5561589 MeV.

So, the  $E_B$  is modified in the following way:

$$E_B = 11 E_B \alpha + 11 NN + 11 NP + 2 NN + 2NP + NPP + (NPP/2 + NN/2) = 418.7146 \text{ MeV}$$

###### ${}^{51}_{23}\text{V}$

${}^{51}_{23}\text{V} = 11 \alpha$  particles, 6 supplementary neutrons and 1 supplementary proton

$$E_B = 11 E_B \alpha + 11 NN + 11 NP + 6NN + 6NP + NPP = 441.0317 \text{ MeV}$$

Compared to the experimental value (445.8469 MeV) there is an excess of 4.8152 MeV or 8.625 lines.

So, the  $E_B$  is modified in the following way:

$$E_B = 11 E_B \alpha + 11 NN + 11 NP + 3 NNP + 1.5 NPP + 1.5 NN + 1.5 NP + NPP = 445.8292 \text{ MeV}$$

###### ${}^{52}_{24}\text{Cr}$

${}^{52}_{24}\text{Cr} = 12 \alpha$  particles and 4 supplementary neutrons

$$E_B = 12 E_B \alpha + 12 NN + 12 NP + 4 NN + 4NP = 454.4776 \text{ MeV}$$

Compared to the experimental value (456.3503 MeV) there is an excess of 1.8727 MeV or 3.375 lines.

So, the  $E_B$  is modified in the following way:

$$E_B = 12 E_B \alpha + 12 NN + 12 NP + NNP + NPP + 2NN + 2 NP = 456.3552 \text{ MeV}$$

###### ${}^{55}_{25}\text{Mn}$

${}^{55}_{25}\text{Mn} = 12 \alpha$  particles, 6 supplementary neutrons and 1 supplementary proton

$$E_B = 12 E_B \alpha + 12 NN + 12 NP + 6NN + 6NP + NPP = 476.5178 \text{ MeV.}$$

Compared to the experimental value (482.0755 MeV) there is an excess of 5.5577 MeV or 10 lines.

So, the  $E_B$  is modified in the following way:

$$E_B = 12 E_B \alpha + 12 NN + 12 NP + 4 NNP + 0.5 NPP + 1.5 NN + 1.5 NP + NPP = 482.0791 \text{ MeV}$$

**$^{56}_{26}\text{Fe}$** 

$^{56}_{26}\text{Fe} = 13 \alpha$  particles and 4 supplementary neutrons

$$\text{EB} = 13 \text{EB } \alpha + 13 \text{NN} + 13 \text{NP} + 4\text{NN} + 4\text{NP} = 489.9637 \text{ MeV.}$$

Compared to the experimental value (492.2592 MeV) there is an excess of 2.2955 MeV or 4.125 lines.

So, the EB is modified in the following way:

$$\text{EB} = 13 \text{EB } \alpha + 13 \text{NN} + 13 \text{NP} + 0.5 \text{NNP} + 0.5 \text{NPP} + \text{NN} + 2.5 \text{NN} + 2.5 \text{NP} = 492.2585 \text{ MeV.}$$

 **$^{59}_{27}\text{Co}$** 

$^{59}_{27}\text{Co} = 13 \alpha$  particles, 6 supplementary neutrons and 1 supplementary proton.

$$\text{EB} = 13 \text{EB } \alpha + 13 \text{NN} + 13 \text{NP} + 6 \text{NN} + 6 \text{NP} + \text{NPP} = 512.0039 \text{ MeV}$$

Compared to the experimental value (517.3135 MeV) there is an excess of 5.3096 MeV or 9.5625 lines.

So, the EB is modified in the following way:

$$\text{EB} = 13 \text{EB } \alpha + 13 \text{NN} + 13 \text{NP} + 3 \text{NNP} + \text{NN} + 2.5 \text{NN} + 2.5 \text{NP} + \text{NPP} = 517.3220 \text{ MeV}$$

 **$^{60}_{28}\text{Ni}$** 

$^{60}_{28}\text{Ni} = 14 \alpha$  particles and 4 supplementary neutrons

$$\text{EB} = 14 \text{EB } \alpha + 14 \text{NN} + 14 \text{NP} + 4 \text{NN} + 4 \text{NP} = 525.4498 \text{ MeV}$$

Compared to the experimental value (526.8458 MeV) there is an excess of 1.396 MeV or 2.5 lines.

So, the EB is modified in the following way:

$$\text{EB} = 14 \text{EB } \alpha + 14 \text{NN} + 14 \text{NP} + 2.5 \text{NPP} + 1.5 \text{NN} + 1.5 \text{NP} = 526.8421 \text{ MeV}$$

 **$^{63}_{29}\text{Cu}$** 

$^{63}_{29}\text{Cu} = 14 \alpha$  particles, 6 supplementary neutrons and 1 supplementary proton

$$\text{EB} = 14 \text{EB } \alpha + 14 \text{NN} + 14 \text{NP} + 6 \text{NN} + 6 \text{NP} + \text{NPP} = 547.4900 \text{ MeV.}$$

Compared to the experimental value (551.3843 MeV) there is an excess of 3.8943 MeV or 7 lines.

So, the EB is modified in the following way:

$$\text{EB} = 14 \text{EB } \alpha + 13 \text{NN} + 13 \text{NP} + \text{NPP} + 6 \text{NPP} + \text{NPP} = 551.3883 \text{ MeV}$$

## 4.2 Examples for $^{86}_{38}\text{Sr}$ , $^{89}_{39}\text{Y}$ , $^{90}_{40}\text{Zr}$ ( $Z = 38, 39$ and $40$ )

### $^{86}_{38}\text{Sr}$

$^{86}_{38}\text{Sr} = 19 \alpha$  particles and 10 supplementary neutrons.

$$EB = 19 EB \alpha + 19 NN + 19 NP + 10 NN + 10 NP = 745.8469 \text{ MeV.}$$

Compared to the experimental value (748.9272 MeV) there is an excess of 3.0803 MeV or 5.5625 lines. So, the EB is modified in the following way:

$$EB = 19 EB \alpha + 19 NN + 19 NP + 6.5 NN + 6.5 NP + 1.5 NNP + 2 NPP = 748.9418 \text{ MeV.}$$

### $^{89}_{39}\text{Y}$

$^{89}_{39}\text{Y} = 19 \alpha$  particles, 12 supplementary neutrons and 1 supplementary proton

$$EB = 19 EB \alpha + 19 NN + 19 NP + 12 NN + 12 NP + NPP = 767.8371 \text{ MeV.}$$

Compared to the experimental value (775.5440 MeV) there is an excess of 7.7069 MeV or 13.750 lines. So, the EB is modified in the following way:

$$EB = 19 EB \alpha + 19 NN + 19 NP + NN + NP + 2 NNP + 10 NPP = 775.5406 \text{ MeV.}$$

### $^{90}_{40}\text{Zr}$

$^{90}_{40}\text{Zr} = 20 \alpha$  particles and 10 supplementary neutrons.

$$EB = 20 EB \alpha + 20 NN + 20 NP + 10 NN + 10 NP = 781.3330 \text{ MeV}$$

Compared to the experimental value (783.8972 MeV) there is an excess of 2.5642 MeV or 4.625 lines. So, the EB is modified in the following way:

$$EB = 20 EB \alpha + 20 NN + 20 NP + 9 NN + 8 NP + 0.5 NNP + NPP = 783.9062 \text{ MeV.}$$

## 5. Provisional conclusions

Taking into consideration the former examples the net binding energy is proportionate to the number of  $\alpha$  particles and to that one of the supplementary neutrons or protons. The increase of the binding energy is linear, about 7 to 8 MeV each time one nucleon is added to the nucleus. Each time a neutron is added a bond is yield which has either (NN + NP) value or NNP or NPP values.

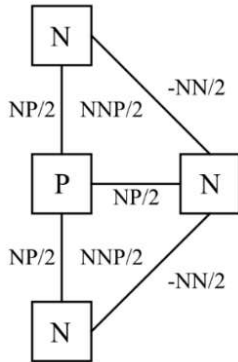
In the following:

- Evidence of He-4 structures (point 6)
- Ni and Cu isotopes (point 7)
- Building some nuclei (point 8)

## 6. Evidence of He-4 structures

In comparing H isotopes and He ones it is to see the huge difference of binding energy values between both. This difference is due to the fact that the He isotopes are containing a He-4 cluster in their nucleus.

Figure 14:  ${}^4_1\text{H}$



$$\begin{array}{r}
 \text{EB} = {}^4_1\text{H} \quad - \text{NN} \quad - 4.9365 \text{ MeV} \\
 1.5 \text{ NP} \quad 3.3369 \\
 \text{NNP} \quad 8.4818 \\
 \hline
 6.8822 \text{ MeV} \\
 / \\
 \text{AME 2016}
 \end{array}$$

$$\text{EB} = - \text{NN} + 1.5 \text{ NP} + \text{NNP}$$

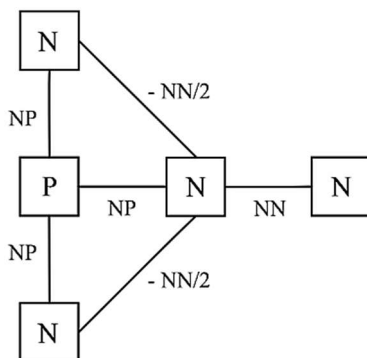
This binding energy is implemented in two alternating phases.

1. 3 NP or Deuterium like bonds link the proton (P) to 3 neutrons (N) (see NP/2).
2. 2 NNP or Tritium like bonds link the structure together (see NNP/2), these bonds are challenged by a NN bond acting negatively, i.e. recreating mass (see -2NN/2)

The mean binding energy can be described as  $1.5 \text{ NP} + \text{NNP} - \text{NN}$ .

**Remark: the four nucleons cannot create an He-4 nucleus, there is only one proton.**

Figure 15:  ${}^5_1\text{H}$

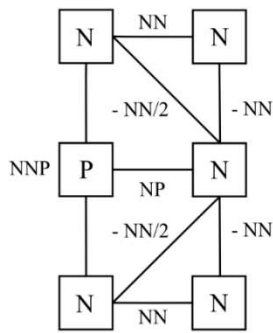


$$\begin{array}{r}
 \text{EB} = {}^5_1\text{H} \quad 3 \text{ NP} \quad 6.6738 \text{ MeV} \\
 \quad \quad \quad - 0.008 \\
 \text{AME 2016}
 \end{array}$$

$$\text{EB} = \text{NN} - \text{NN} + 3 \text{ NP}$$

One neutron (N) is added to the H4 structure to create the H5 structure. The binding energy scheme is similar to that one of H4. 3 NP bonds and one new NN bond link the structure, which is challenged by one negative NN bond located alternatively between 2 neutrons (see the two NN/2 negative bonds recreating mass). The binding energy can be described as 3 NP bonds.

Figure 16:  ${}^6_1\text{H}$



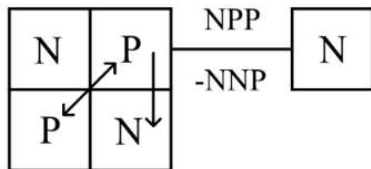
$$\begin{array}{r}
 \text{EB} = {}^6_1\text{H} \quad - \text{NN} \quad - 4.9365 \text{ MeV} \\
 \quad \quad \quad \quad \quad \text{NP} \quad 2.2246 \\
 \quad \quad \quad \quad \quad \text{NNP} \quad 8.4818 \\
 \quad \quad \quad \quad \quad \hline
 \quad \quad \quad \quad \quad 5.7699 \text{ MeV} \\
 \quad \quad \quad \quad \quad / \\
 \quad \quad \quad \quad \quad \text{AME 2016}
 \end{array}$$

$$\text{EB} = - 3 \text{ NN} + 2 \text{ NN} + \text{NP} + \text{NNP}$$

By adding one more neutron (N) the bonds structure for H6 is somewhat modified in comparison to H5. One NNP bond replaces two NP bonds and there is a new NN bond to link the new neutron to the structure. The two NN bonds, the former and the new one, are challenged by two negative NN bonds. The binding energy can be described as NP + NNP - NN. This is similar to H4 structure. The value for H6 is inferior of NP/2, i.e. 1.112 MeV to that one of H4. One notes that the binding energy values are decreasing from H3 to H6 instead of increasing when adding neutrons. This is due to the challenge of some bonds by other negative bonds recreating mass instead of annihilating mass.

**Remark:** as there is only one proton in the preceding figures, no He-4 nucleus is created.

Figure 17:  ${}^5_2\text{He}$



$$\text{EB} = - \text{NNP} + \text{NPP} + \text{EB } \alpha$$

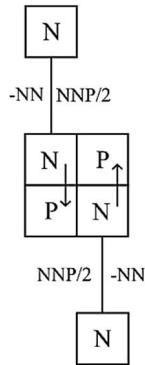
$$\begin{array}{r}
 \text{EB} = {}^5_2\text{He} \quad 1 \text{ EB } \alpha \quad 28.3250 \text{ MeV} \\
 \quad \quad \quad \quad \quad - \text{NNP} \quad - 8.4818 \\
 \quad \quad \quad \quad \quad + \text{NPP} \quad 7.7180 \\
 \quad \quad \quad \quad \quad \hline
 \quad \quad \quad \quad \quad 27.5612 \text{ MeV} \\
 \quad \quad \quad \quad \quad / \\
 \quad \quad \quad \quad \quad \text{AME 2016}
 \end{array}$$

The binding energy of He5 is inferior to that one of  $\alpha$  particle ( $27.561 < 28.325$ ). The nucleus He5, though, cannot be stable. The N(neutron) supplementary to  $\alpha$  particle tends to create a bond with  $\alpha$  particle, i.e. NPP. Nevertheless, this operation results in a dislocation of the nucleus since the bonds among the Ns and the Ps within the  $\alpha$  particle are disturbed. One negative NNP bond which was occurred by the stronger  $\alpha$  bond comes out and is recreating the NNP mass. Actually, in creating the  $\alpha$  particle there are some bonds NP created, then NNP and NPP which are replaced by an  $\alpha$  particle bond (see points 3.3 and 3.4 of chapter 2).

**Remark:** one sees the difference of binding energy value between H-5 and He-5 where an He-4 nucleus is created.

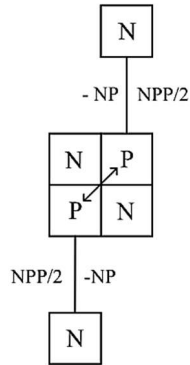
Figure 18:  ${}^6_2\text{He}$

1)



$$E_B = -2 \text{ NN} + \text{NNP} + E_B \alpha$$

2)



$$E_B = -2 \text{ NP} + \text{NPP} + E_B \alpha$$

$$\text{Average : } \frac{-2 \text{ NN} - 2 \text{ NP} + \text{NNP} + \text{NPP} + 2 E_B \alpha}{2}$$

$$E_B = - \text{ NN} - \text{ NP} + 0.5 \text{ NNP} + 0.5 \text{ NPP} + E_B \alpha$$

$E_B = {}^6_2\text{He}$	1 $E_B \alpha$	28.3250 MeV
	- NN	- 4.9365
	- NP	- 2.2246
	0.5 NNP	4.2409
	0.5 NPP	3.8590
		29.2638 MeV
		- 0.007
		AME 2016

The binding energy of He6 is superior to that one of  $\alpha$  particle ( $29.264 > 28.325$ ). The nucleus is therefore not dislocated despite some negative NN and NP bonds which recreate the mass. The two N create some bonds NNP and NPP with  $\alpha$  particle. In order to ensure the equilibrium of the nucleus, one N turns into P by  $\beta^-$  emission (half-life = 0.81 second).

**Conclusion: the huge difference of binding energy value between H and He is due to the presence of a He-4 nucleus in the Helium isotopes.**

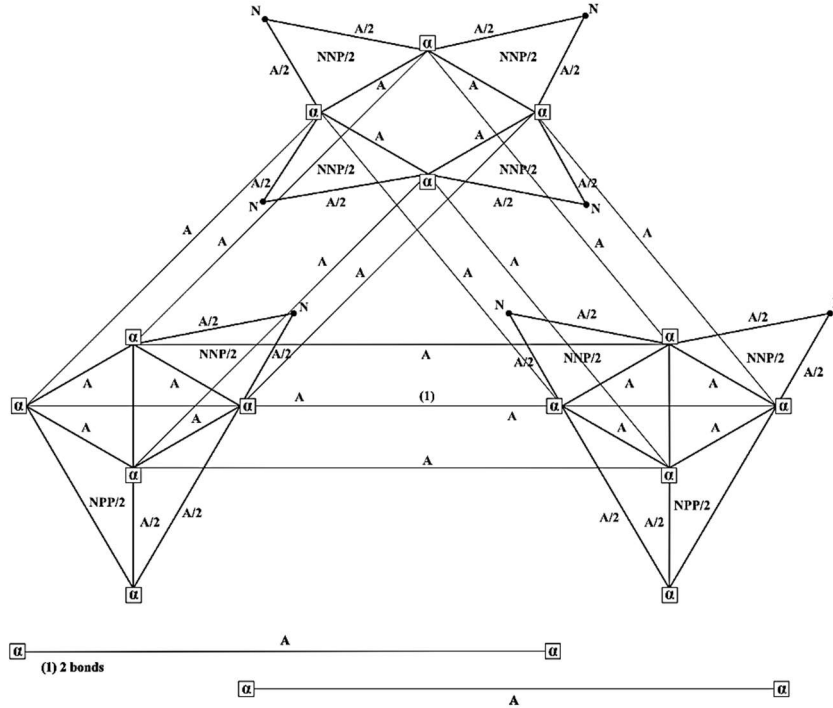
## 7. Ni and Cu isotopes

Figure 19:  $^{63}_{28}\text{Ni}$

Structure: 14  $\alpha$ , 7 N, 0 P

Linear and cross bonds: 26A, 1 NPP

N supplementary bonds: 7A, 3.5 NNP



$^{63}_{28}\text{Ni}$

14 $\alpha$ , 7N, 0P supplementary

EB in MeV = 552.1001

Lifetime: 92 years

Mode of decay:  $\beta^-$

$\left\{ \begin{array}{l} 14 \\ (7+6) \\ (7+6) \\ 0 \\ 1 \\ \left\{ \begin{array}{l} 3.5 \\ 3.5 \\ 3.5 \\ 0 \end{array} \right. \end{array} \right.$	x	28.325	$\left. \begin{array}{r} 396.5500 \\ 64.1745 \\ 28.9198 \\ 0 \\ 7.7180 \\ 17.2778 \\ 7.7861 \\ 29.6863 \\ 0 \\ \hline 552.1125 \\ + 0.012 \end{array} \right\} \text{ MeV}$
	x	4.9365	
	x	2.2246	
	x	8.4818	
	x	7.7180	
	x	4.9365	
	x	2.2246	
	x	8.4818	
	x	7.7180	
	x	7.7180	
	x	7.7180	
	x	7.7180	
	x	7.7180	
	x	7.7180	

Figure 19. Binding energy distribution among  $^{63}_{28}\text{Ni}$ .

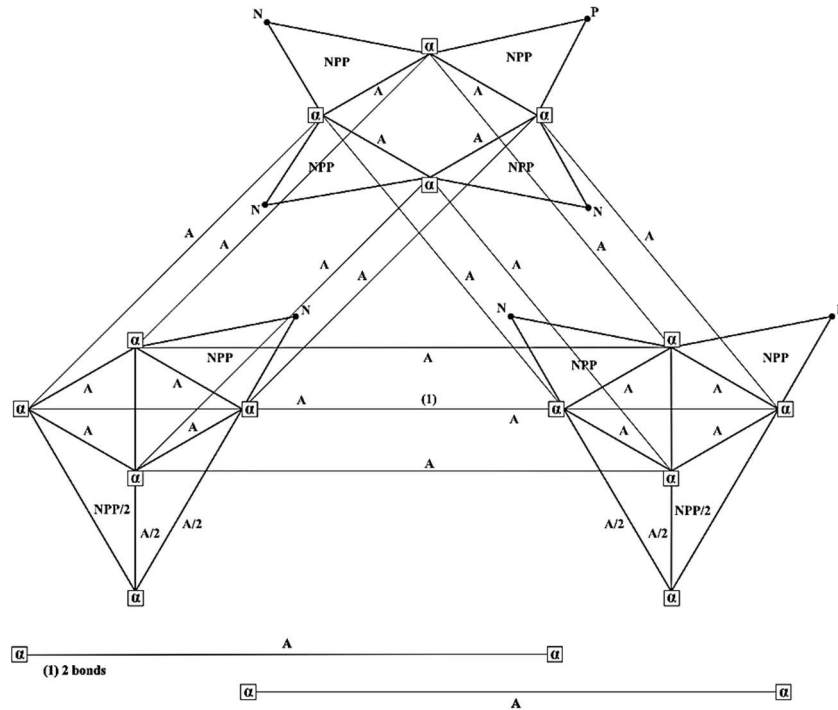
The core is stable. There are 7 N supplementary. This nucleus is submitted to  $\beta^-$  decay which transforms a N into P; in the present case Ni 63 is transmuted into Cu 63. The 7 N supplementary are bound to the  $\alpha$  particles with 7A (3.5 NN + 3.5 NP) + 3.5 NNP bonds.

Figure 20:  $^{63}_{29}\text{Cu}$

Structure: 14  $\alpha$ , 6 N, 1 P

Linear and cross bonds: 26A, 1 NPP

N, P supplementary bonds: 7 NPP



$^{63}_{29}\text{Cu}$

14 $\alpha$ , 6N, 1P supplementary

EB in MeV = 551.3847

Stable	$\left\{ \begin{array}{l} 14 \\ (7+6) \\ (7+6) \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 7 \end{array} \right\} \left\{ \begin{array}{l} x \\ x \\ x \\ x \\ x \\ x \\ x \\ x \\ x \\ x \end{array} \right\} \left\{ \begin{array}{l} 28.325 \\ 4.9365 \\ 2.2246 \\ 8.4818 \\ 7.7180 \\ 4.9365 \\ 2.2246 \\ 8.4818 \\ 7.7180 \end{array} \right\}$	396.5500	MeV	
Nat. abundance: 69.2 %			64.1745	
			28.9198	
			0	
			7.7180	
			0	
			0	
			0	
			54.0260	
			<u>551.3883</u>	MeV
		+ 0.004		

Figure 20. Binding energy distribution among  $^{63}_{29}\text{Cu}$ .

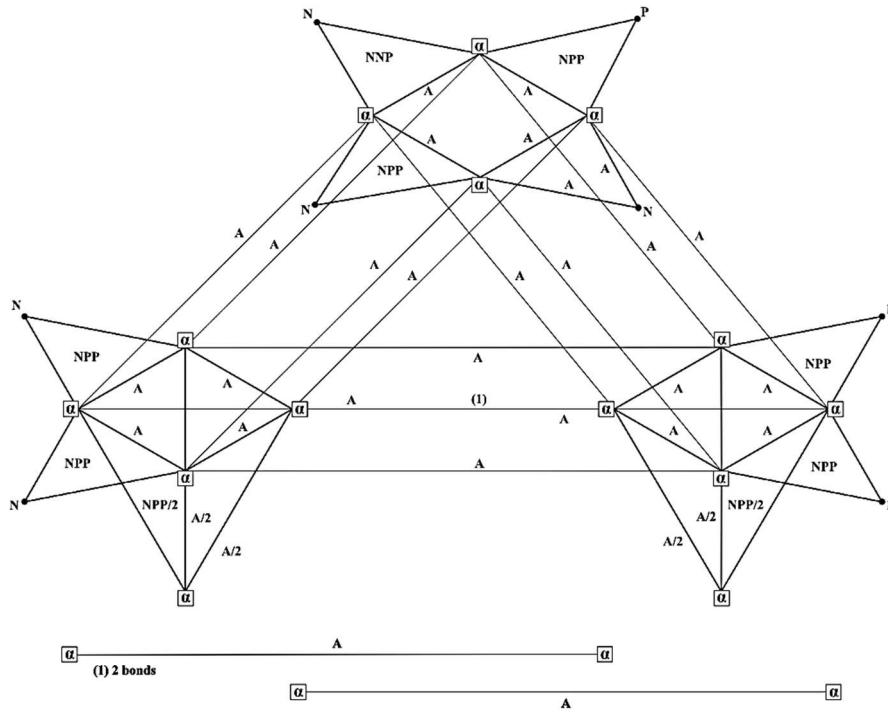
This nucleus is stable. Its structure is comparable to that one of Ni 63 (see former figure 19). Actually, 7A bonds (3.5NN + 3.5NP) + 3.5 NNP bonds are transformed into 7 NPP bonds.

Figure 21:  $^{64}_{29}\text{Cu}$

Structure: 14  $\alpha$ , 7 N, 1 P

Linear and cross bonds: 26A, NPP

N, P supplementary bonds: 2A, 1 NNP, 6 NPP



$^{64}_{29}\text{Cu}$

14 $\alpha$ , 7N, 1P supplementary

EB in MeV = 559.3008

Lifetime: 12.9 hours

Modes of decay:  $\beta^+$ , EC

$\left\{ \begin{array}{l} 14 \\ (7+6) \\ (7+6) \\ 0 \\ 1 \\ 1 \\ 1 \\ 1 \\ 6 \end{array} \right\}$	$\left\{ \begin{array}{l} x \\ x \\ x \\ x \\ x \\ x \\ x \\ x \\ x \end{array} \right\}$	$\left\{ \begin{array}{l} 28.325 \\ 4.9365 \\ 2.2246 \\ 8.4818 \\ 7.7180 \\ 4.9365 \\ 2.2246 \\ 8.4818 \\ 7.7180 \end{array} \right\}$	396.5500 MeV
			64.1745
			28.9198
			0
			7.7180
			4.9365
			2.2246
			8.4818
			46.3080
			559.3132 MeV
+ 0.012			

Figure 21. Binding energy distribution among  $^{64}_{29}\text{Cu}$ .

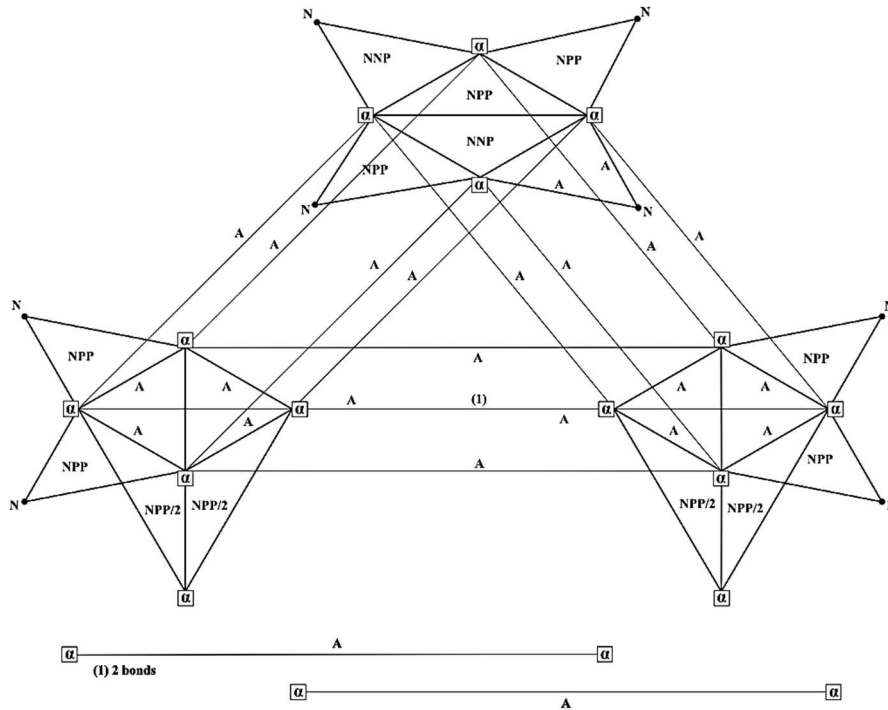
Cu 64 has the same core structure as Cu63 and the same outside core structure as Ni64 (see next figure 22). A  $\beta^+$ , EC decay occurs: the P is modified into N and 6A (3NN + 3NP) are transformed into one NNP and two NPP. Cu64 is transmuted into Ni64.

Figure 22:  ${}^{64}_{28}\text{Ni}$

Structure: 14  $\alpha$ , 8 N, 0 P

Linear and cross bonds: 20A, 1 NNP, 3 NPP

N supplementary bonds: 2A, 1 NNP, 6 NPP



${}^{64}_{28}\text{Ni}$

14 $\alpha$ , 8N, 0P supplementary

EB in MeV = 561.7575

Stable	$\left\{ \begin{array}{l} 14 \\ (7+3) \\ (7+3) \\ 1 \\ 3 \end{array} \right\}$	x	28.325	$\left. \begin{array}{l} 396.5500 \\ 49.3650 \\ 22.2460 \\ 8.4818 \\ 23.1540 \end{array} \right\}$	MeV	
Nat. abundance: 0.91 %			x			4.9365
			x			2.2246
			x			8.4818
			x			7.7180
	$\left\{ \begin{array}{l} 1 \\ 1 \\ 1 \\ 6 \end{array} \right\}$	x	4.9365	$\left. \begin{array}{l} 4.9365 \\ 2.2246 \\ 8.4818 \\ 46.3080 \end{array} \right\}$		
		x	2.2246			
		x	8.4818			
		x	7.7180			
				561.7477	MeV	
				- 0.010		

Figure 22. Binding energy distribution among  ${}^{64}_{28}\text{Ni}$ .

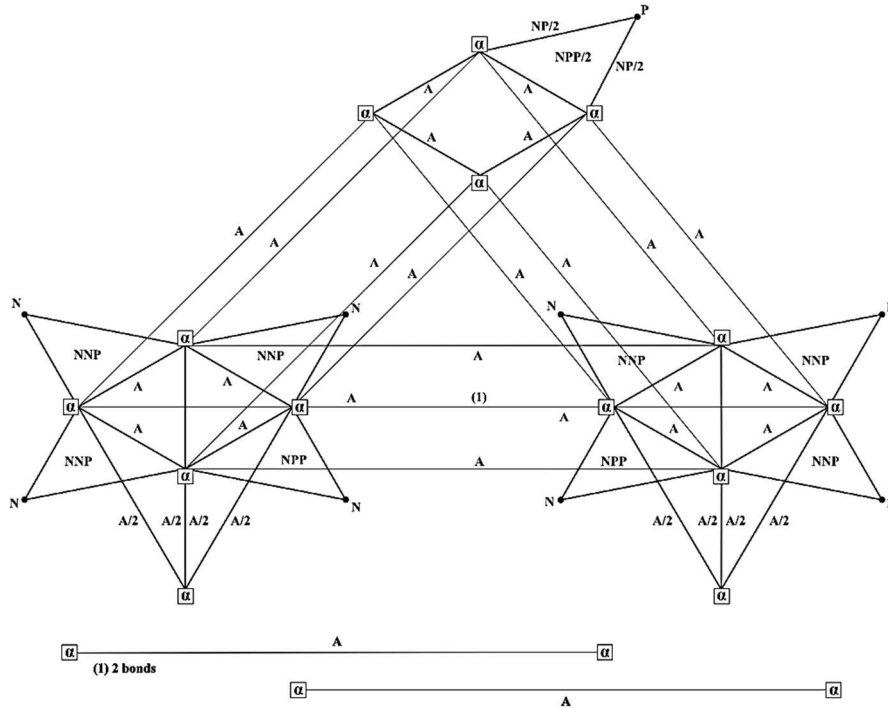
This nucleus is stable.

Figure 23:  $^{65}_{29}\text{Cu}$

Structure: 14  $\alpha$ , 8 N, 1 P

Linear and cross bonds: 28A

N, P supplementary bonds: 1 NP, 6 NNP, 2.5 NPP



$^{65}_{29}\text{Cu}$

14 $\alpha$ , 8N, 1P supplementary

EB in MeV = 569.2112

Stable	$\left\{ \begin{array}{l} 14 \\ (7+7) \\ (7+7) \\ 0 \\ 0 \\ 0 \\ 1 \\ 6 \\ 2.5 \end{array} \right\} \begin{array}{l} x \\ x \\ x \\ x \\ x \\ x \\ x \\ x \\ x \end{array} \left\{ \begin{array}{l} 28.325 \\ 4.9365 \\ 2.2246 \\ 8.4818 \\ 7.7180 \\ 4.9365 \\ 2.2246 \\ 8.4818 \\ 7.7180 \end{array} \right\}$	396.5500	MeV
Nat. abundance: 30.8 %		69.1110	
		31.1444	
		0	
		0	
		0	
		2.2246	
		50.8908	
	19.2950		
	<u>569.2158</u>	MeV	
	+ 0.005		

Figure 23. Binding energy distribution among  $^{65}_{29}\text{Cu}$ .

This nucleus is stable.

This nuclide is the last stable one as far as Nickel and Copper are concerned. Beyond, the nuclides are submitted to  $\beta^-$  decay.

## 8. Building some nuclei

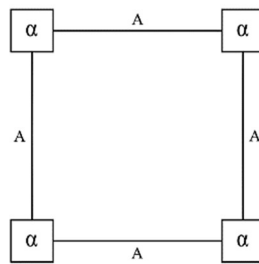
$^{16}_8\text{O}$ ,  $^{20}_{10}\text{Ne}$ ,  $^{36}_{18}\text{Ar}$ , ( $= ^{16}_8\text{O} + ^{20}_{10}\text{Ne}$ ),  $^{38}_{18}\text{Ar}$ ,  $^{40}_{18}\text{Ar}$ ,  $^{78}_{36}\text{Kr}$  ( $= ^{38}_{18}\text{Ar} + ^{40}_{18}\text{Ar}$ ),  $^{80}_{36}\text{Kr}$ ,  
 $^{82}_{36}\text{Kr}$ ,  $^{83}_{36}\text{Kr}$ ,  $^{84}_{36}\text{Kr}$ ,  $^{85}_{37}\text{Rb}$ ,  $^{86}_{36}\text{Kr}$ ,  $^{87}_{37}\text{Rb}$

Figure 24:  $^{16}_8\text{O}$

$4\alpha$

$E_B$  in MeV = 127.6193

$E_B$	4 $\alpha$	113.3000 MeV
	2 NN	9.8730
	2 NP	<u>4.4492</u>
		127.6222 MeV
		+ 0.003



$$E_B = 4 E_B \alpha + 4A = 4 E_B \alpha + 25.75 = 127.6222 \text{ MeV} + 0.003$$

$$A = NN/2 + NP/2 = 6.4375 \quad NN = 8.875 \quad NP = 4$$

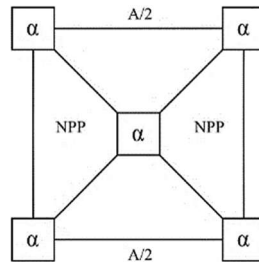
### O16

Four  $\alpha$  particles are linked with four A bonds. An A bond can be described as  $(NN/2 + NP/2)$  bonds. Within an A bond the NN bond and the NP bond are constantly alternating and oscillating. This alternative movement creates the most solid bonds in a nucleus. So, having only A bonds is the most favorable condition for nucleus stability.

---

$E_B$	$5 \alpha$	141.6250 MeV
	$0.5 \text{ NN}$	2.4683
	$0.5 \text{ NP}$	1.1123
	$2 \text{ NPP}$	<u>15.4360</u>
		160.6416 MeV
		- 0.003

---



$$E_B = 5 E_B \alpha + A + 2 \text{ NPP} = 5 E_B \alpha + 34.1875 = 160.6416 \text{ MeV} - 0.003$$

$$A = \text{NN}/2 + \text{NP}/2 = 6.4375$$

$$\text{NN} = 8.875 \quad \text{NP} = 4$$

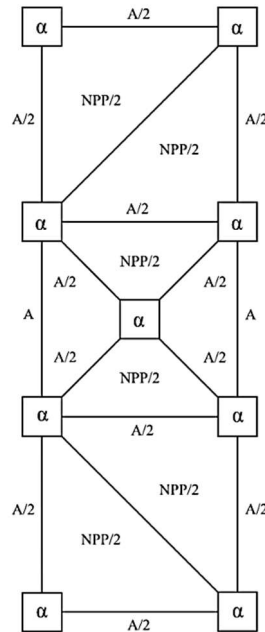
$$\text{NPP} = 13.875 = \text{NN} + 1.25 \text{ NP}$$


---

## Ne20

Five  $\alpha$  particles are linked with two NPP bonds and one A bond. A NPP bond can be described as-(NN +1.25 NP) bonds. So, the four A (NN/2+NP/2) bonds of O16 are replaced by two NPP bonds. A NPP bond links three alpha particles instead of two in the case of NN or NP bonds which are binding respectively two neutrons or one neutron and one proton belonging to two alpha particles.

$E_B$	$9 \alpha$	254.9250 MeV
	4 NN	19.7460
	4 NP	8.8984
	3 NPP	23.1540
		<u>306.7234 MeV</u>
		+ 0.007



$$E_B = 9 E_B \alpha + 8A + 3NPP = 9 E_B \alpha + 93.125 = 306.7234 \text{ MeV} + 0.007$$

$$A = NN/2 + NP/2 = 6.4375$$

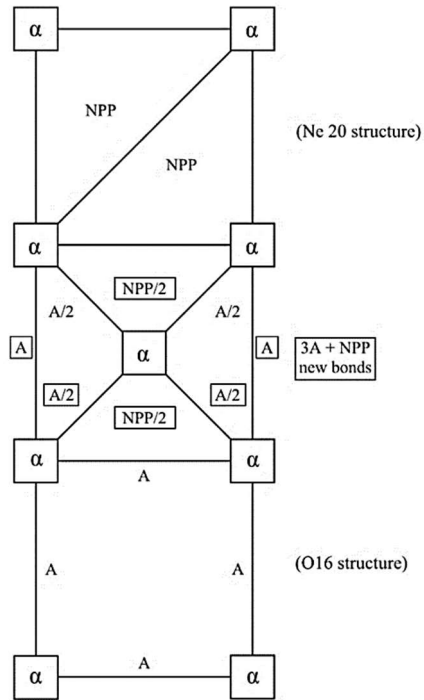
$$NN = 8.875 \quad NP = 4$$

$$NPP = 13.875$$

### Ar36

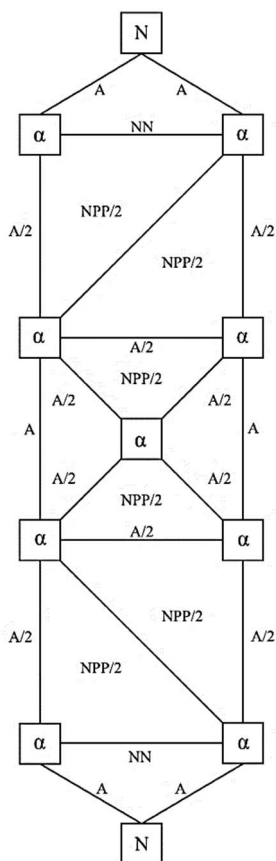
This is a very interesting structure oscillating between 6 NPP and 12A bonds (+ 2A bonds). The range of that oscillation is rather high, hence the difficulty of that nucleus to be settled. Actually, it is the isotope Ar40 which is representing the element Argon. Ar36 involves 9  $\alpha$  particles, that is like O16+Ne20. The total bonds value of Ar36 is 93.125 lines. The total bonds value of O16 and Ne20 is  $(25.75+34.1875) = 59.9375$  lines. The difference between 93.125 and 59.9375 is 33.1875 lines, equivalent to  $3A+NPP$ . A tentative transmutation process between O16 and Ne20 is shown in the next figure 27.

Figure 27: Tentative transmutation process  
 Basis: One O16 structure, one Ne20 structure



Two  $\alpha$  particles of O16 structure interact with one  $\alpha$  particles of Ne20 structure. This creates 2NPP/2 bonds and 2A/2 bonds. Two A bonds are closing the new structure. In total 3A and 1NPP bonds are created. The 2NPP bonds of Ne20 structure and the 4A bonds of O16 structure mix in order to create symmetry. The result is shown in the preceding figure 26 concerning Ar36.

$E_B$	9 $\alpha$	254.9250	MeV
	7.5 NN	37.0238	
	5.5 NP	12.2353	
	3 NPP	<u>23.1540</u>	
		327.3381	MeV
		- 0.005	



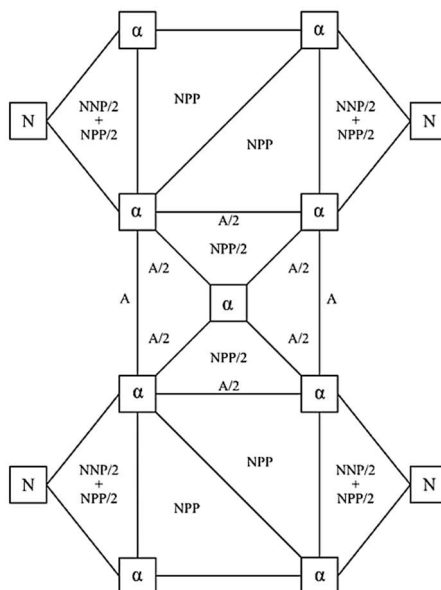
$$E_B = 9 E_B \alpha + 11A + 2NN + 3NPP = 9 E_B \alpha + 130.1875 = 327.3381 \text{ MeV} - 0.005$$

$$A = NN/2 + NP/2 = 6.4375 \quad NN=8.875 \quad NP=4 \quad NPP = 13.875$$

**Ar38**

Compared with Ar36 (figure 26) 4A bonds are created to link each N to two  $\alpha$  particles. Also, 2NN bonds replace the 2 A/2 bonds at top and bottom of the structure.

$E_B$	$9 \alpha$	254.9250 MeV
	$2.5 \text{ NN}$	12.3413
	$2.5 \text{ NP}$	5.5615
	$2 \text{ NNP}$	16.9636
	$7 \text{ NPP}$	<u>54.0260</u>
		343.8174 MeV
		+ 0.007



$$E_B = 9 E_B \alpha + 5A + 2\text{NNP} + 7\text{NPP} = 9 E_B \alpha + 159.8125 = 343.8174 \text{ MeV} + 0.007$$

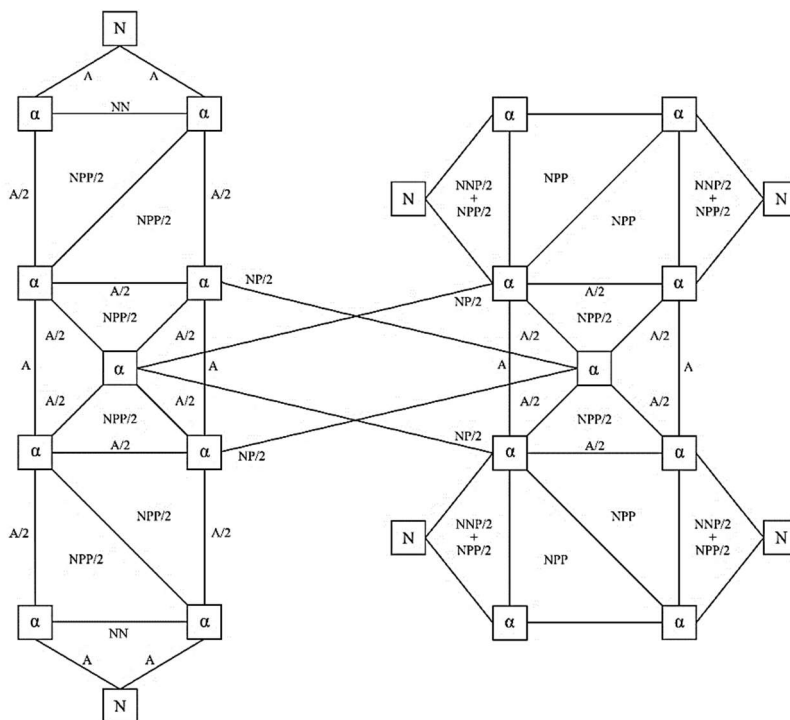
$$A = \text{NN}/2 + \text{NP}/2 = 6.4375 \quad \text{NN}=8.875 \quad \text{NP}=4$$

$$\text{NNP} = 15.25 \quad \text{NPP} = 13.875$$

### Ar40

Compared with Ar36 (figure 26), the core of the structure is similar, the two peripheric parts being modified due to the introduction of 4 neutrons.

$E_B$	18 $\alpha$	509.8500 MeV
	10 NN	49.3650
	10 NP	22.2460
	2 NNP	16.9636
	10 NPP	<u>77.1800</u>
		675.6046 MeV
		+ 0.028



$$E_B = 18 E_B \alpha + 10 NN + 10 NP + 2 NNP + 10 NPP = E_B {}^{38}_{18}\text{Ar} + E_B {}^{40}_{18}\text{Ar} + 2 NP = 675.6046 \text{ MeV}$$

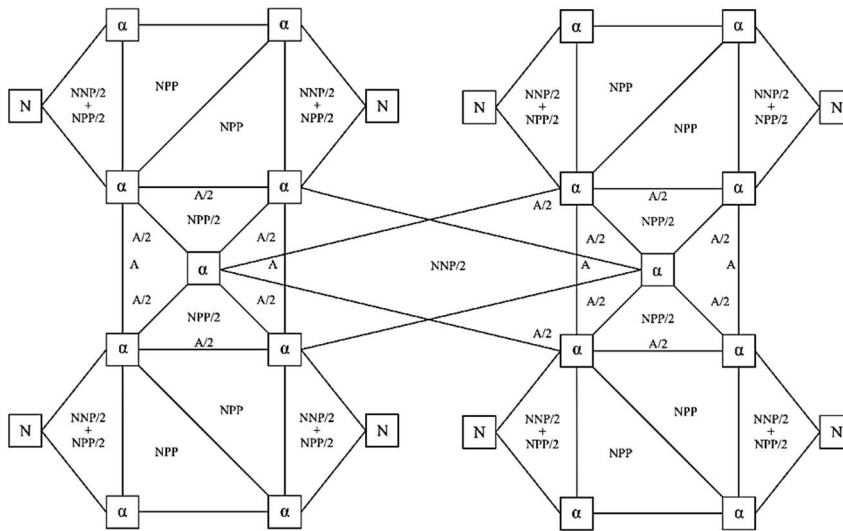
$$A = NN/2 + NP/2 = 6.4375 \quad NN=8.875 \quad NP=4$$

$$NNP = 15.25 \quad NPP = 13.875$$

### Kr78

Compared with Ar38 (figure 28) and Ar40 (figure 29), the structure is unchanged. To link the structures two NP bonds are introduced which are alternating.

$E_B$	18 $\alpha$	509.8500 MeV
	5.5 NN	27.1508
	5.5 NP	12.2353
	0.5 NNP	4.2409
	10 NPP	77.1800
	4 NNP	33.9272
	4 NPP	<u>30.8720</u>
		695.4562 MeV
		+ 0.022



$$E_B = 18 E_B \alpha + 11A + 0.5 NNP + 10 NPP + 4 NNP + 4 NPP =$$

$$2 E_B \text{ } ^{40}_{18}\text{Ar} + A + NNP/2 = 695.4562 \text{ MeV}$$

$$+ 0.022$$

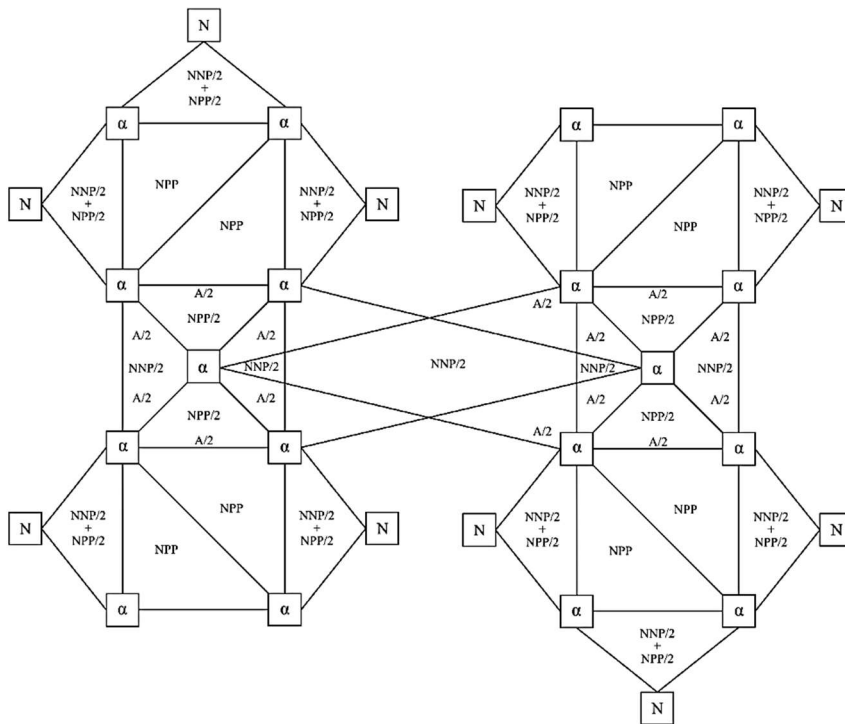
$$A = NN/2 + NP/2 = 6.4375 \quad NN=8.875 \quad NP=4$$

$$NNP = 15.25 \quad NPP = 13.875$$

**Kr80**

Compared with Ar40 (figure 29), the structure is unchanged but doubled. To link the two Ar40 structures a NNP bond and 2A bonds are introduced. They are alternating (=  $NNP/2 + 2A/2$ ). Each of the eight N supplementary is linked to the core with  $(NNP/2 + NPP/2)$  bonds.

$E_B$	$18 \alpha$	509.8500 MeV
	$3.5 NN$	17.2778
	$3.5 NP$	7.7861
	$2.5 NNP$	21.2045
	$10 NPP$	77.1800
	$5 NNP$	42.4090
	$5 NPP$	<u>38.5900</u>
		714.2974 MeV
		+ 0.022



$$E_B = 18 E_B \alpha + 7A + 2.5 NNP + 10 NPP + 5 NNP + 5 NPP =$$

$$E_B \text{ } ^{80}_{36}\text{Kr} + 2 NNP - 4A + NNP + NPP$$

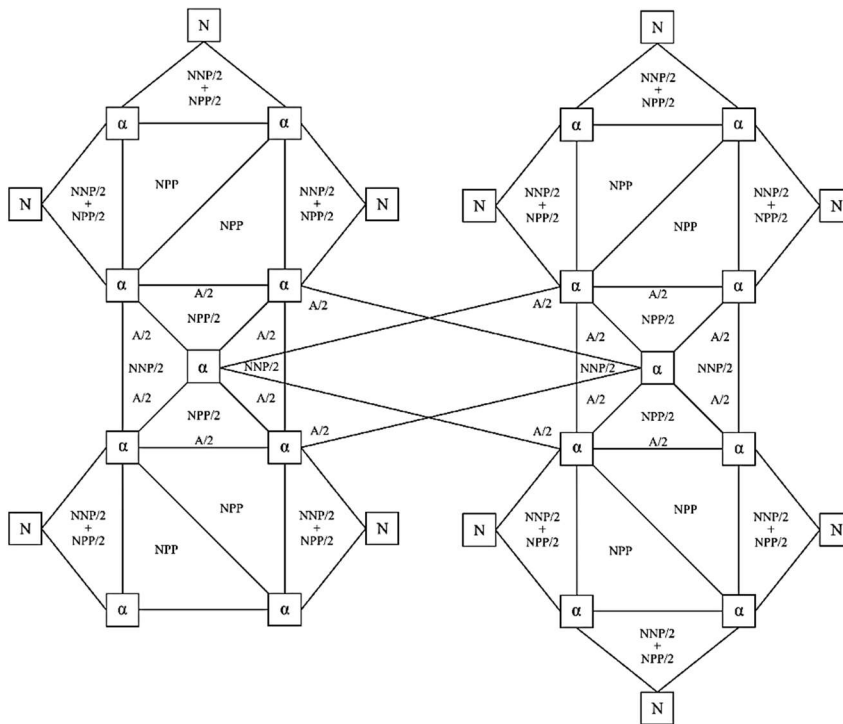
$$A = NN/2 + NP/2 = 6.4375 \quad NN=8.875 \quad NP=4$$

$$NNP = 15.25 \quad NPP = 13.875$$

**Kr82**

Compared with Kr80 (figure 31), 4A of the core of the structure are exchanged with 2 NNP. Each of the ten N supplementary is linked to the core with (NNP/2 + NPP/2) bonds.

$E_B$	18 $\alpha$	509.8500 MeV
	4 NN	19.7460
	4 NP	8.8984
	2 NNP	16.9636
	10 NPP	77.1800
	5.5 NNP	46.6499
	5.5 NPP	<u>42.4490</u>
		721.7369 MeV
		- 0.008



$$E_B = 18 E_B \alpha + 8A + 2 \text{NNP} + 10 \text{NPP} + 5.5 \text{NNP} + 5.5 \text{NPP} = E_B \text{ } ^{82}_{36}\text{Kr} - \text{NNP}/2 + A + \text{NNP}/2 + \text{NPP}/2$$

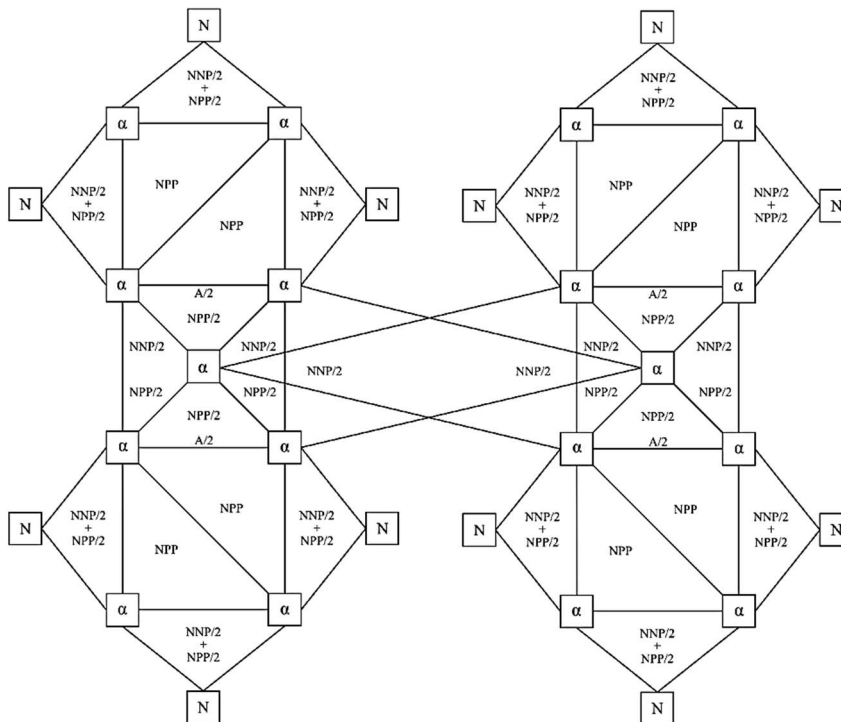
$$A = \text{NN}/2 + \text{NP}/2 = 6.4375 \quad \text{NN}=8.875 \quad \text{NP}=4$$

$$\text{NNP} = 15.25 \quad \text{NPP} = 13.875$$

### Kr83

Compared with Kr82 (figure 32), 1A has replaced 1 NNP/2 in the core of the structure. Each of the eleven N supplementary is linked to the core with (NNP/2 + NPP/2) bonds.

$E_B$	18 $\alpha$	509.8500 MeV
	1 NN	4.9365
	1 NP	2.2246
	3 NNP	25.4454
	12 NPP	92.6160
	6 NNP	50.8908
	6 NPP	46.3080
		<u>732.2713 MeV</u>
		+ 0.006



$$E_B = 18 E_B \alpha + 2A + 3 \text{ NNP} + 12 \text{ NPP} + 6 \text{ NNP} + 6 \text{ NPP} = E_B^{83}_{36} \text{Kr} - 6A + \text{NNP} + 2 \text{ NPP} + (\text{NNP}/2 + \text{NPP}/2)$$

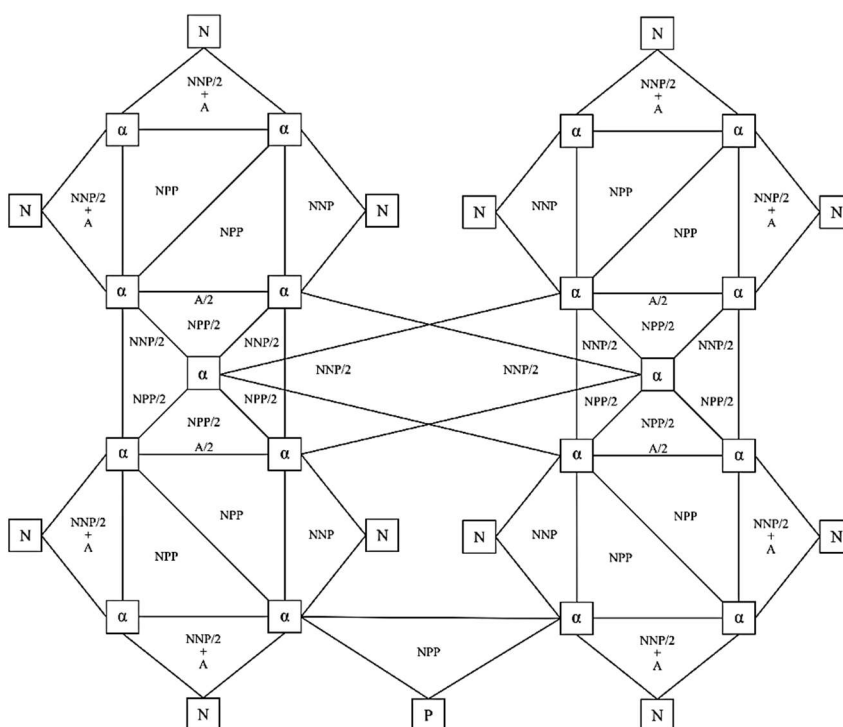
$$A = \text{NN}/2 + \text{NP}/2 = 6.4375 \quad \text{NN}=8.875 \quad \text{NP}=4$$

$$\text{NNP} = 15.25 \quad \text{NPP} = 13.875$$

### Kr84

Compared with Kr83 (figure 33), 6A are replaced with NNP + 2 NPP in the core of the structure. Each of the twelve N supplementary is linked to the core with (NNP/2 + NPP/2) bonds.

$E_B$	18 $\alpha$	509.8500 MeV	
	1 NN	4.9365	
	1 NP	2.2246	
	3 NNP	25.4454	
	12 NPP	92.6160	
12 N supplementary	}	4 NN	19.7460
		4 NP	8.8984
		8 NNP	67.8544
1 P supplementary		1 NPP	7.7180
		<u>739.2893 MeV</u>	
		+ 0.007	

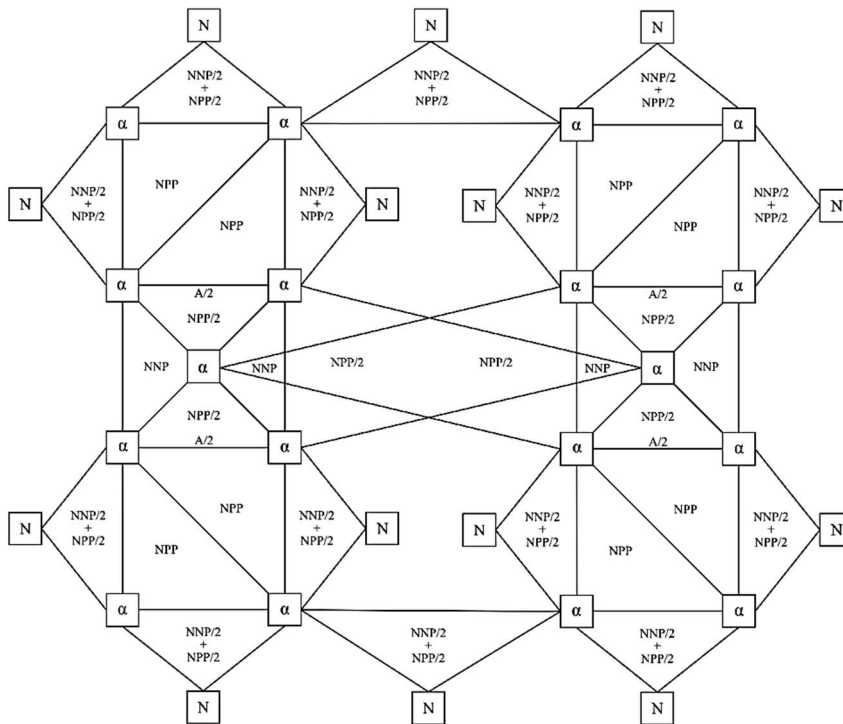


$$E_B = 18 E_B \alpha + 2A + 3 NNP + 12 NPP + 8A + 8 NNP + 1 NPP$$

### Rb85

Compared with  $^{84}_{36}\text{Kr}$  (figure 34), 6 NPP are modified into 8A (4 NN + 4 NP) + 2 NNP. One NPP is added to link the proton.

$E_B$	18 $\alpha$	509.8500 MeV
	1 NN	4.9365
	1 NP	2.2246
	4 NNP	33.9272
	11 NPP	84.8980
	7 NNP	59.3726
	7 NPP	<u>54.0260</u>
		749.2349 MeV
		/



$$E_B = 18 E_B \alpha + 2A + 4 \text{NNP} + 11 \text{NPP} + 7 \text{NNP} + 7 \text{NPP} = E_B {}^{84}_{36}\text{Kr} + \text{NNP} - \text{NPP} + \text{NNP} + \text{NPP}$$

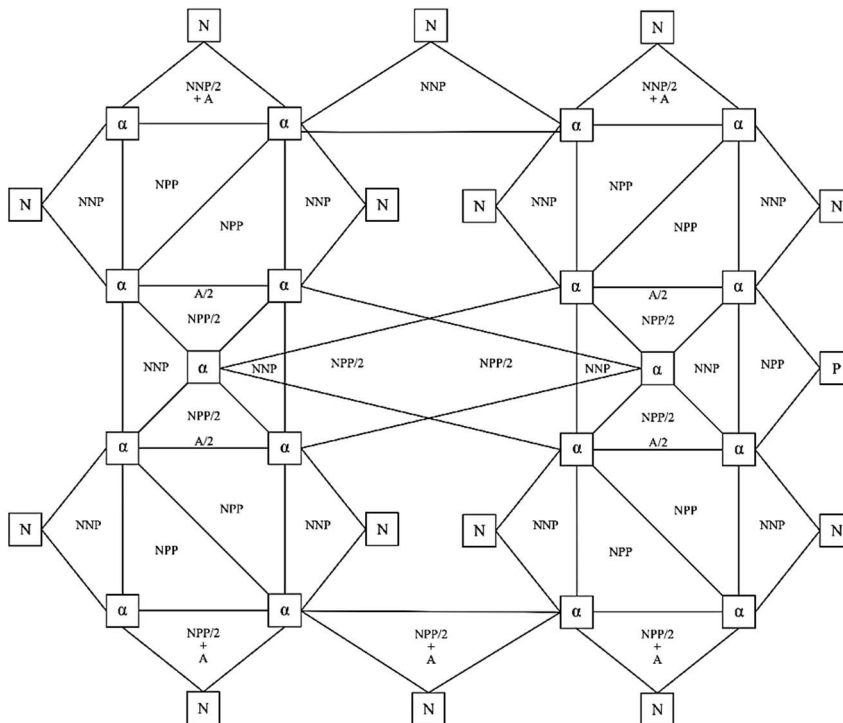
$$A = \text{NN}/2 + \text{NP}/2 = 6.4375 \quad \text{NN}=8.875 \quad \text{NP}=4$$

$$\text{NNP} = 15.25 \quad \text{NPP} = 13.875$$

### Kr86

Compared with Kr84 (figure 34), 1 NNP replaced 1 NPP in the core of the structure. Each of the fourteen N supplementary is linked to the core with (NNP/2 + NPP/2) bonds.

$E_B$	18 $\alpha$	509.8500 MeV	
	1 NN	4.9365	
	1 NP	2.2246	
	4 NNP	33.9272	
	11 NPP	84.8980	
14 N supplementary	}	2.5 NN	12.3413
		2.5 NP	5.5615
		10 NNP	84.8180
1 P supplementary	}	2.5 NPP	19.2950
			<u>757.8521 MeV</u>
		- 0.003	



$$E_B = 18 E_B \alpha + 2A + 4 \text{ NNP} + 11 \text{ NPP} + 5A + 10 \text{ NNP} + 2.5 \text{ NPP}$$

**Rb87**

Compared with  $^{86}_{36}\text{Kr}$  (figure 36), 5.5 NPP are modified into 5A and 3 NNP. One NPP is added to link the proton.

**SUMMARY OF BINDING ENERGY BREAK DOWN**  
(figures 30 to 37)

	$^{78}_{36}\text{Kr}$	$^{80}_{36}\text{Kr}$	$^{82}_{36}\text{Kr}$	$^{83}_{36}\text{Kr}$
Core	18 $\alpha$ 8 NN 6 NP / 8 NPP	18 $\alpha$ 5 NN 5 NP / 10 NPP	18 $\alpha$ 3 NN 3 NP 2 NNP 10 NPP	18 $\alpha$ 3 NN 3 NP 2 NNP 10 NPP
Link	2 NP	(A + NNP/2)	(A + NNP/2)	2A
N suppl	6 $\left\{ \begin{array}{l} 2 \text{ NN} \\ 2 \text{ NP} \\ 2 \text{ NNP} \\ 2 \text{ NPP} \end{array} \right.$	8 $\left\{ \begin{array}{l} 4 \text{ NNP} \\ 4 \text{ NPP} \end{array} \right.$	10 $\left\{ \begin{array}{l} 5 \text{ NNP} \\ 5 \text{ NPP} \end{array} \right.$	11 $\left\{ \begin{array}{l} 5.5 \text{ NNP} \\ 5.5 \text{ NPP} \end{array} \right.$
P suppl				

	$^{84}_{36}\text{Kr}$	$^{85}_{37}\text{Rb}$	$^{86}_{36}\text{Kr}$	$^{87}_{37}\text{Rb}$
Core	18 $\alpha$ 1 NN 1 NP 2 NNP 12 NPP	18 $\alpha$ 1 NN 1 NP 2 NNP 12 NPP	18 $\alpha$ 1 NN 1 NP 4 NNP 10 NPP	18 $\alpha$ 1 NN 1 NP 4 NNP 10 NPP
Link	NNP	NNP	NPP	NPP
N suppl	12 $\left\{ \begin{array}{l} 6 \text{ NNP} \\ 6 \text{ NPP} \end{array} \right.$	12 $\left\{ \begin{array}{l} 4 \text{ NN} \\ 4 \text{ NP} \\ 8 \text{ NNP} \end{array} \right.$	14 $\left\{ \begin{array}{l} 7 \text{ NNP} \\ 7 \text{ NPP} \end{array} \right.$	14 $\left\{ \begin{array}{l} 2.5 \text{ NN} \\ 2.5 \text{ NP} \\ 10 \text{ NNP} \\ 1.5 \text{ NPP} \end{array} \right.$
P suppl		1 NPP		1 NPP

## 9. Conclusions

Unlikely the classical fusion process the nucleosynthesis presented above has other properties. The classical fusion process occurs once the two nuclides have a mass and a charge, hence the difficulty to fuse both. The nucleosynthesis based on the Higgs boson occurs before the mass has a charge. Moreover, alpha clustering has two features:

- the dipolar magnetic moment within the alpha particles can be described as zero:
- two poles of two protons are annihilated and the two other poles of the two protons are implemented in a way to be complementary, having each another quantum number value so as not to interfere in the expelling process of the two electrons (see chapter 1 point 7.3.3 and point 3.5 of present chapter)

This enables the alpha particle to be stable.

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