Structure model of oxygen nucleus $^{16}_{8}O$

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Abstract. After the helium nucleus $^{4}_{2}H_e$, the oxygen nucleus $^{16}_{8}O$ is the second stable one in Nature and the first upper-order nucleus. Its structure is based on the successive conversions of lithium $^{6}_{3}L_i$, lithium $^{7}_{3}L_i$, beryllium $^{9}_{4}B_e$, boron $^{10}_{5}B$, boron $^{11}_{5}B$, carbon $^{12}_{6}C$ and nitrogen $^{14}_{7}N$ into oxygen nucleus $^{16}_{8}O$. From this first upper-order nucleus the second one is constructed (calcium nucleus $^{40}_{20}C_a$), from the second the third one (tin nucleus $^{120}_{50}S_n$) and from the third the fourth one (orion nucleus $^{307}_{125}O_r$), according to the mirror symmetry. The atomic numbers Z of the above four upper-order nuclei are the so-called four "magic numbers", i.e. $Z_1 = 8$, $Z_2 = 8 \cdot 2,5 = 20$, $Z_3 = 20 \cdot 2,5 = 50$ and $Z_4 = 50 \cdot 2,5 = 125$. It is noted that, this orion nucleus $^{307}_{125}O_r$ with a differential atomic number $Z = 125$ (unified theory of dynamic space) is the corresponding "hypothetical unbihexium Ubh", whose atomic number is $Z = 126$ (Nuclear Physics). However, the number $Z = 125$ looks symmetrical and not magical at all, due to the $2,5$ factor.

Keywords: Upper-order nuclei; magic numbers; mirror symmetry.

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1. Structure model of atomic nuclei

According to the unified theory[1,2] of dynamic space the atomic nuclei[3,4] have been structured through two fundamental phenomena.[5] The inverse electric field[6] of the proton and the electric entity of the macroscopically neutral neutron.[7]

Verification of the experimental spin,[8] the magnetic moment and the mass deficit of the nuclei is the first and necessary condition of their structure. Specifically, the nucleus spin is the sum of its nucleons spin as well as of the magnetic moment and the mass deficit. In addition, it is recalled that at the interaction of proton-neutron the magnetic moment[9] of these nucleons is increased, while at the interaction of same nucleons their magnetic moment is reduced (fluctuation of nucleons magnetic moment[10]). The lower-order nuclei are the deuterium $^{2}_{1}H$, the tritium $^{3}_{1}H$, the helium $^{3}_{2}H_e$ and the helium $^{4}_{2}H_e$. This last nucleus, the helium $^{4}_{2}H_e$,[5] is the most stable in the Nature, with which all the nuclei of the periodic table have been constructed in the core of the stars.

The two protons of the helium nucleus ${}^{4}_{2}H_e$ are very near due to the balance between the two strong forces, i.e. the nuclear force and the antigravity one. They have opposite spins and magnetic moments, causing a strong negative field that would instantly cleave them (beta decay β^+). However, the presence of the two neutrons in the inverse electric field reduces its negativity and avoids this decay, creating the helium nucleus ${}^{4}_{2}H_e$.

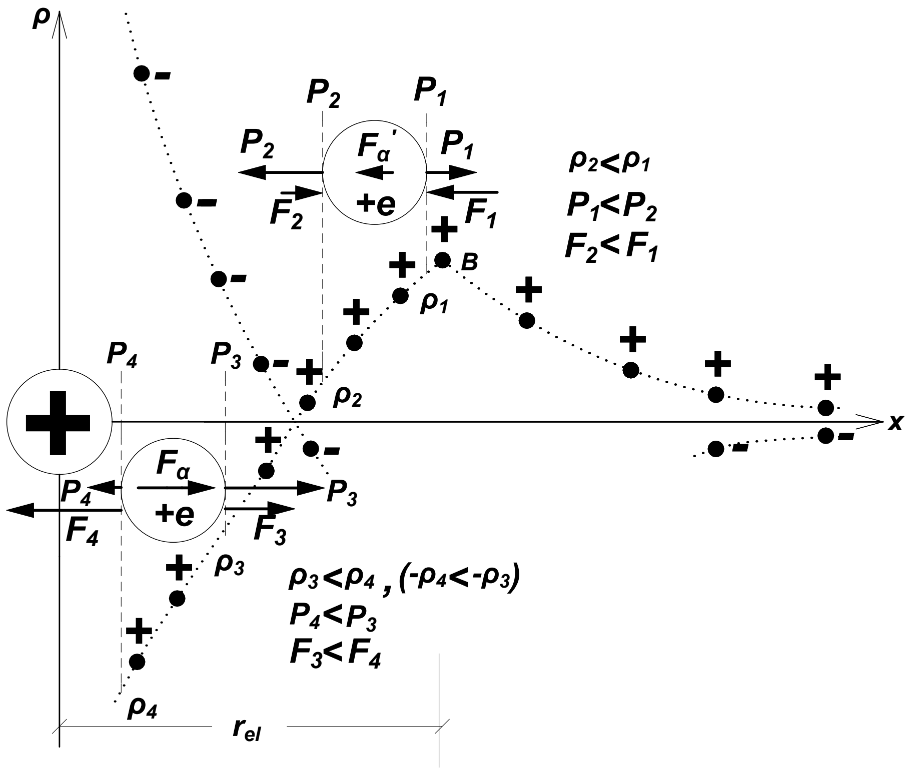

Figure 1. In the upper inverse nuclear field the antigravity force F_a' and the electric resultant[6] $F_1 - F_2$ are attractive, while in the lower field a strong repulsive antigravity force[11] F_a balances the attractive electric resultant[6] $F_4 - F_3$, i.e. the strong nuclear force

Therefore, two protons can not exist in the nucleus without the presence of a neutron, because the increased negativity of field causes a cleaving (beta decay β^+) of one proton. There would be no nuclei without the presence of neutrons that reduce the negativity of the protons field.

As we said, at the nucleus scale the neutron behaves as a positively charged particle[7] and repels the closest proton, which is now moving on a helical orbit emitting gamma radiation and is finally immobilized, due to the balance between the attractive nuclear force and to the strong repulsive antigravity[11] one‡ (Fig. 1 and indicatively see Fig. 2).

‡ In the lower[6] inverse nuclear field, where the relative electric densities are $-\rho_4 < -\rho_3$ (or $\rho_3 < \rho_4$) and for $\rho = \rho_3$, $\rho = \rho_4$ the respective cohesive pressures[13] P_3 and P_4 are $P_3 = P_0(\rho_0 - \rho_3)/\rho_0$, $P_4 = P_0(\rho_0 - \rho_4)/\rho_0$, so $P_4 < P_3$ and $\Delta P = P_3 - P_4$. So, the buoyancy conditions creates a repulsive antigravity force[11] $F_a = V\Delta P/\Delta x$ in the lower inverse nuclear field (Fig. 1), that balances the attractive electric resultant[6] $F_4 - F_3$ (nuclear force).

This radiant energy of the proton transmitted by the neutron is measured as mass deficit[12] Δm and is equal to half of the kinetic energy of the neutron.

It is noted that attraction is exerted by the proton's electric field only, causing the neutron to sink deeper into its lower inverse field. After all, there are nuclei, whose neutrons are rotated around columns of strong electric fields, in addition of those that around the protons are rotated (orbital bonding neutrons, subsection 1.2, Fig. 3).

The following is a structure description of oxygen nucleus ${}^{16}_{8}O$, that is based on the successive conversions of lithium nucleus ${}^{6}_{3}L_i$, lithium ${}^{7}_{3}L_i$, beryllium ${}^{9}_{4}B_e$, boron ${}^{10}_{5}B$, boron ${}^{11}_{5}B$, carbon ${}^{12}_{6}C$ and nitrogen ${}^{14}_{7}N$ into oxygen nucleus ${}^{16}_{8}O$.

1.1. Structure model of lithium nucleus ${}^{6}_{3}L_i$

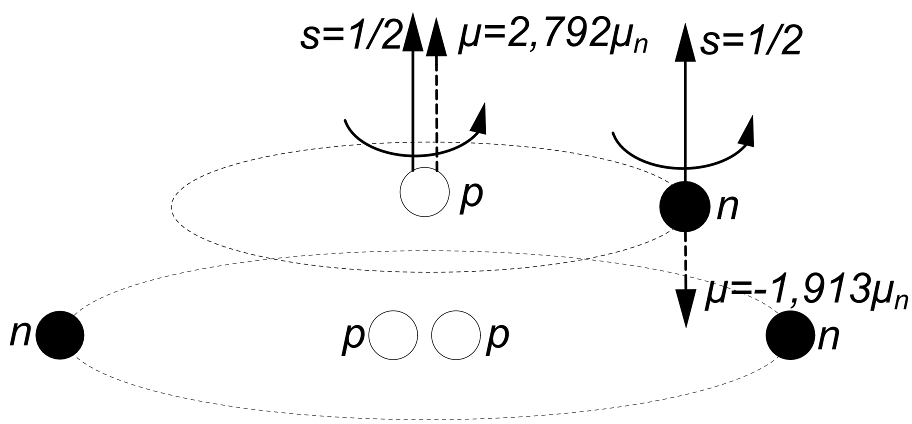

Figure 2. Structure model of lithium nucleus ${}^{6}_{3}L_i = {}^{4}_{2}H_e + {}^{2}_{1}H$, with addition of one deuterium in the helium nucleus ${}^{4}_{2}H_e$

Lithium nucleus ${}^{6}_{3}L_i$ (Fig. 2)

$$ {}^{6}_{3}L_i = {}^{4}_{2}H_e + {}^{2}_{1}H \tag{1} $$

is derived from helium nucleus ${}^{4}_{2}H_e$ by addition of one deuterium ${}^{2}_{1}H$. Their protons are attracted by their common inverse electric field[6] and in a potential column are placed.

The experimental spin is

$$ s = 0 + 1 = 1 \Rightarrow s = 1 \tag{2} $$

and the experimental magnetic dipole moment is

$$ \mu = 0 + (0,857 - 0,036)\mu_n = 0,821\mu_n \Rightarrow \mu = 0,821\mu_n, \tag{3} $$

where

$$ \mu' = -0,036\mu_n \tag{4} $$

is the reduced magnetic moment of deuterium's proton, due to the interaction by the two protons of helium nucleus (fluctuation of nucleons magnetic moment[10]). It is reminded that the magnetic moment of ${}^{4}_{2}H_e$ is[5] $\mu = 0$ and of ${}^{2}_{1}H$ is[5] $\mu = 0,857\mu_n$.

The experimental mass deficit of lithium nucleus ${}^{6}_{3}L_i$ is

$$\Delta m = (28,22 + 1,52 - a) + (2,2 + a) = 31,94 MeV, \quad (5)$$

where

$$\Delta m' = (1,52 - a) MeV \quad (6)$$

and

$$\Delta m'' = a MeV \quad (7)$$

are the increased mass deficit of ${}^{4}_{2}H_e$ and ${}^{2}_{1}H$, due to the strong electric field of their protons. Also, it is reminded that the mass deficit of ${}^{4}_{2}H_e$ is[5] $\Delta m = 28,22$MeV and of ${}^{2}_{1}H$ is[5] $\Delta m = 2,2$MeV.

1.2. Structure model of lithium nucleus ${}^{7}_{3}L_i$

Lithium nucleus ${}^{7}_{3}L_i$ is created from lithium ${}^{6}_{3}L_i$ by the interference of one neutron between helium ${}^{4}_{2}H_e$ and deuterium, due to the attraction of negative potential column of their protons. The so-called orbital bonding neutron reduces the strong negativity of the field and contributes to the stability of the nuclei and especially the heavier ones.

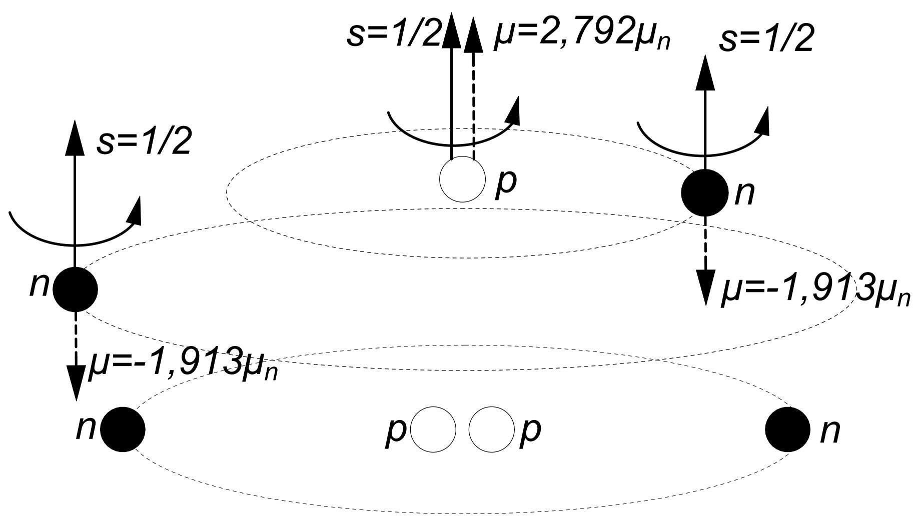

Figure 3. Structure model of lithium nucleus ${}^{7}_{3}L_i ={}^{4}_{2} H_e +{}^{2}_{1} H + n$ or ${}^{7}_{3}L_i ={}^{6}_{3} L_i + n$, i.e. with addition of one bonding neutron in the lithium nucleus ${}^{6}_{3}L_i$

So, the lithium nucleus ${}^{7}_{3}L_i$ (Fig. 3)

$${}^{7}_{3}L_i ={}^{4}_{2} H_e +{}^{2}_{1} H + n \Rightarrow{}^{7}_{3} L_i ={}^{6}_{3} L_i + n \quad (8)$$

has an experimental spin

$$s = 0 + 1 + \frac{1}{2} = \frac{3}{2} \Rightarrow s = \frac{3}{2} \quad (9)$$

and an experimental magnetic dipole moment

$$\mu = 0 + (0,857 + 4,292 + a)\mu_n - (1,913 + a)\mu_n = 3,256\mu_n, \quad (10)$$

where

$$\mu' = (4,292 + a)\mu_n \tag{11}$$

is the increased magnetic moment of deuterium's proton, due to its interaction[10] with the bonding neutron and

$$\mu'' = a\mu_n \tag{12}$$

is the increased magnetic moment of bonding neutron. It is reminded that the magnetic moment of ${}^{4}_{2}H_e$ is[5] $\mu = 0$ and of ${}^{2}_{1}H$ is[5] $\mu = 0,857\mu_n$.

The experimental mass deficit of lithium nucleus ${}^{7}_{3}L_i$ is calculated

$$\Delta m = (28,22 + c) + (2,2 + b) + (7,75 - c - b) = 38,17MeV. \tag{13}$$

Also, it is reminded that the mass deficit of ${}^{4}_{2}H_e$ is[5] $\Delta m = 28,22$MeV and of ${}^{2}_{1}H$ is[5] $\Delta m = 2,2$MeV.

1.3. Structure model of beryllium nucleus ${}^{8}_{4}B_e$

Beryllium nucleus ${}^{8}_{4}B_e$

$${}^{8}_{4}B_e = {}^{4}_{2}H_e + {}^{4}_{2}H_e \tag{14}$$

is derived from two helium nuclei ${}^{4}_{2}H_e$ and is an unstable nucleus, that breaks down to two ${}^{4}_{2}H_e$ (alpha particles-alpha decay). Here, it is reminded the important role of the orbital bonding neutron, which the above nucleus lacks, in order to reduce the strong negativity of the field and make it a stable nucleus.

1.4. Structure model of beryllium nucleus ${}^{9}_{4}B_e$

Beryllium nucleus ${}^{9}_{4}B_e$ is derived from one helium nucleus ${}^{4}_{2}H_e$, two deuterium nuclei ${}^{2}_{1}H$ and one bonding neutron (Fig. 4)

$${}^{9}_{4}B_e = {}^{4}_{2}H_e + {}^{2}_{1}H + n + {}^{2}_{1}H \tag{15}$$

and has an experimental spin

$$s = 0 + 1 - \frac{1}{2} + 1 = \frac{3}{2} \Rightarrow s = \frac{3}{2} \tag{16}$$

and an experimental magnetic dipole moment

$$\mu = 0 + (0,857 - a)\mu_n - (1,913 + 0,978)\mu_n + (0,857 + a)\mu_n = -1,177\mu_n. \tag{17}$$

The increased mass deficit of beryllium nucleus ${}^{9}_{4}B_e$ is calculated

$$\Delta m = 28,22 + (2,2 + 12) + 13,49 + (2,2 - 0,2) = 60,11MeV \tag{18}$$

It is noted that, the possible fluctuations were considered into the equations of the magnetic moment[10] and mass deficit. Specifically, the lower deuterium, adjacent to the protons of helium ${}^{4}_{2}H_e$ (Fig. 4), has a reduced magnetic moment and an increased mass deficit, while the upper deuterium, adjacent to the neutron, has the opposite fluctuations.

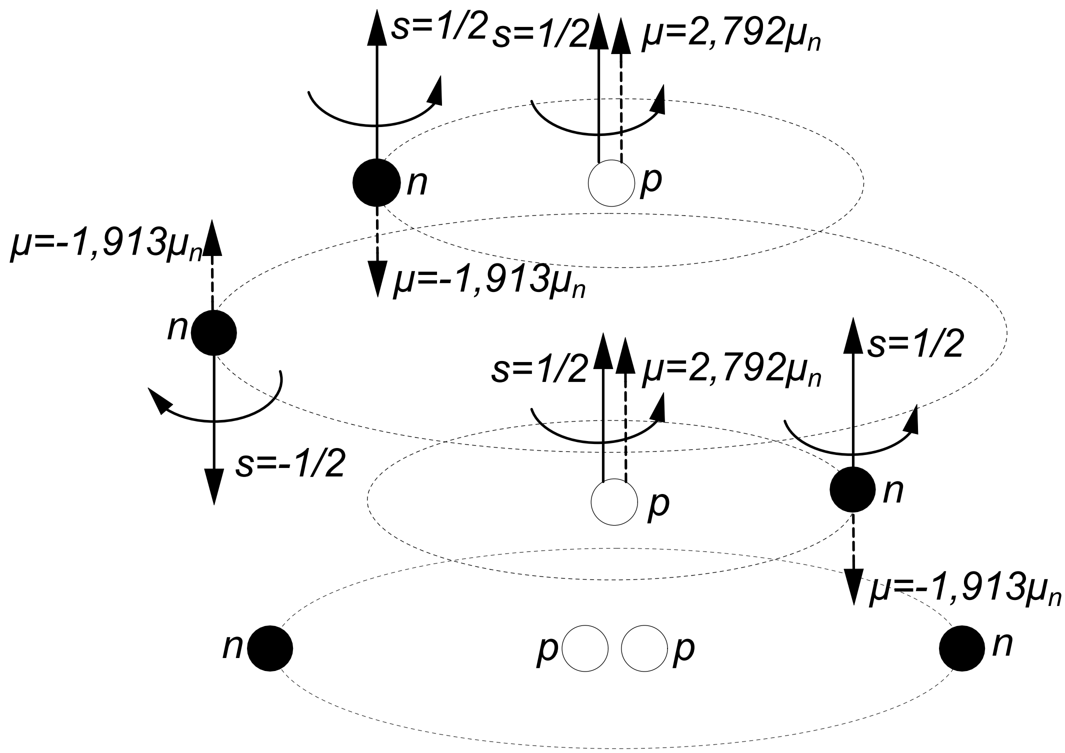

Figure 4. Structure model of beryllium nucleus $^{9}_{4}B_e =^{4}_{2} H_e + 2^{2}_{1}H + n$, with addition of two deuterium nuclei $^{2}_{1}H$ and one bonding neutron in the helium nucleus $^{4}_{2}H_e$

1.5. Structure model of boron nucleus $^{10}_{5}B$

Boron nucleus $^{10}_{5}B$ is derived from one helium $^{4}_{2}H_e$ and three deuterium nuclei $^{2}_{1}H$, whose the sum of their spins gives $s = 3$ and so (Fig. 5)

$$^{10}_{5}B =^{4}_{2} H_e +^{2}_{1} H +^{2}_{1} H +^{2}_{1} H \tag{19}$$

has an experimental spin

$$s = 0 + 1 + 1 + 1 = 3 \Rightarrow s = 3 \tag{20}$$

and an experimental magnetic dipole moment

$$\mu = 0 + 3(0,857 - 0,257)\mu_n = 1,8\mu_n \Rightarrow \mu = 1,8\mu_n, \tag{21}$$

where

$$\mu' = -3 \cdot 0,257\mu_n \tag{22}$$

is the reduced magnetic moment of the three deuterium's protons, due to their interaction.[10]

The mass deficit of the boron nucleus $^{10}_{5}B$ is calculated

$$\Delta m = 28,22 + 3 \cdot 12,14 = 64,65MeV \Rightarrow \Delta m = 64,65MeV, \tag{23}$$

namely it is equal to the mass deficit of helium $^{4}_{2}H_e$ ($\Delta m = 28,22$MeV[5]) and to the increased mass deficit of the three deuterium nuclei ($\Delta m = 3 \cdot 12,14$MeV), whose their orbital neutrons are near to the very strong electric field of the protons.

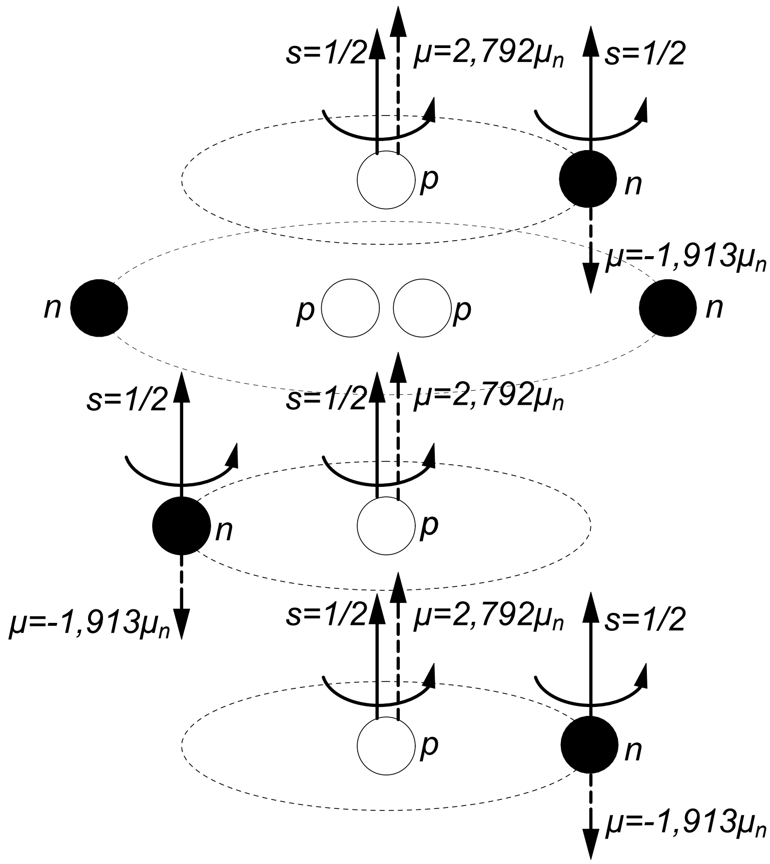

Figure 5. Structure model of boron nucleus ${}^{10}_{5}B =^{4}_{2} H_e + 3^{2}_{1}H$, with addition of three deuterium nuclei ${}^{2}_{1}H$ in the helium nucleus ${}^{4}_{2}H_e$

1.6. Structure model of boron nucleus ${}^{11}_{5}B$

Boron nucleus ${}^{11}_{5}B$ is derived from one helium ${}^{4}_{2}H_e$, one helium ${}^{3}_{2}H_e$, one tritium ${}^{3}_{1}H$ and one bonding neutron, whose the sum of their spins gives $s = 3/2$ and so (Fig. 6)

$$ {}^{11}_{5}B =^{4}_{2} H_e +^{3}_{2} H_e +^{3}_{1} H + n \tag{24}$$

has an experimental spin

$$ s = 0 + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = \frac{3}{2} \Rightarrow s = \frac{3}{2} \tag{25}$$

and an experimental magnetic dipole moment

$$ \mu = 0+(2,978+1,25)+(-2,127+1,25)+(-1,913+1,25) = 2,688\mu_n \tag{26}$$

The experimental mass deficit of the boron nucleus ${}^{11}_{5}B$ is calculated

$$ \Delta m = 28,22 + (7,69 + 6,7) + (8,48 + 10) + 15 = 76,09MeV. \tag{27}$$

It is noted that, the possible fluctuations were considered into the equations of the magnetic moment[10] and mass deficit.[5]

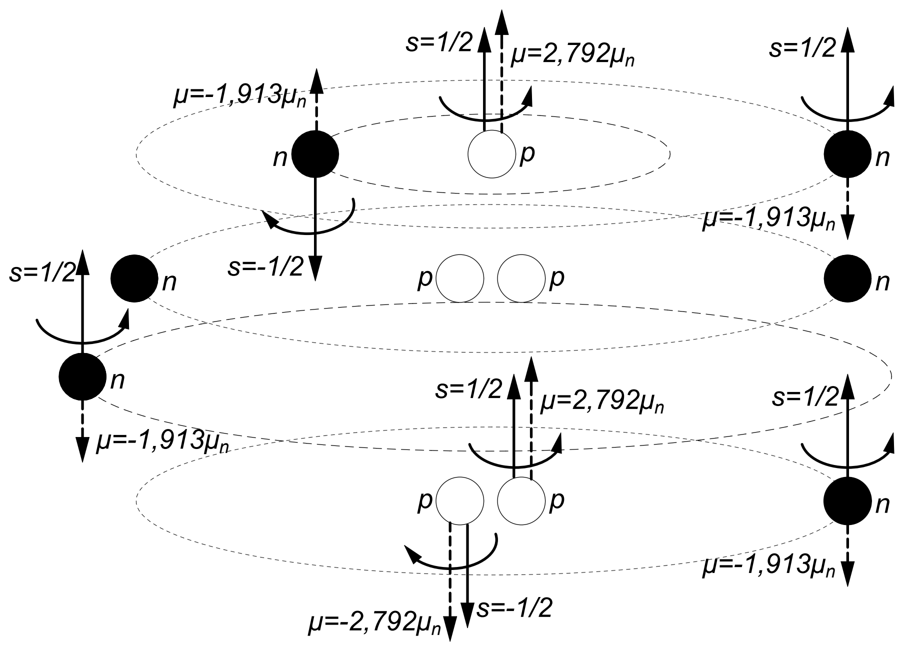

Figure 6. Structure model of boron nucleus ${}^{11}_{5}B ={}^{4}_{2} H_e +{}^{3}_{2} H_e +{}^{3}_{1} H + n$, with addition of one helium ${}^{3}_{2}H_e$, one tritium ${}^{3}_{1}H$ and one bonding neutron in the helium ${}^{4}_{2}H_e$

1.7. Structure model of carbon nucleus ${}^{12}_{6}C$

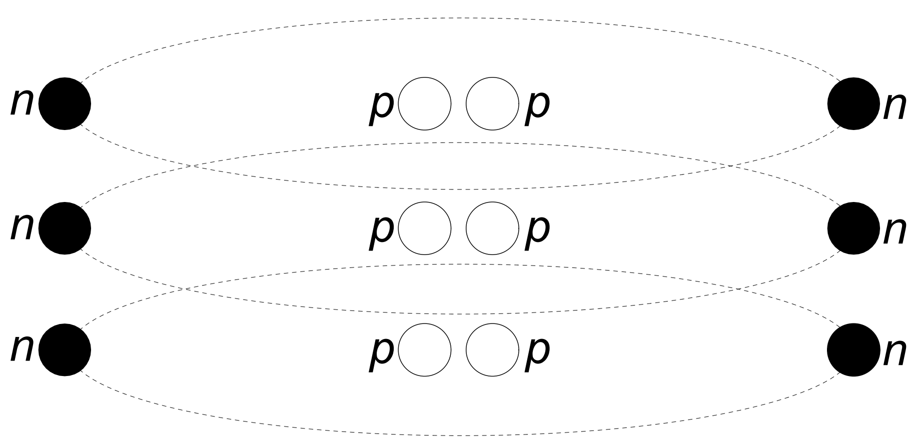

Figure 7. Structure model of carbon nucleus ${}^{12}_{6}C = 3{}^{4}_{2}H_e$, as a column strong electric field of three coaxial helium nuclei ${}^{4}_{2}H_e$

Carbon nucleus ${}^{12}_{6}C$ is derived from three helium nuclei ${}^{4}_{2}H_e$ and is a stable nucleus but not an upper-order one and so its atomic number $Z = 6$ is not a "magic number" either (see subsection 1.9) and so (Fig. 7)

$$ {}^{12}_{6}C ={}^{4}_{2} H_e +{}^{4}_{2} H_e +{}^{4}_{2} H_e. \tag{28} $$

Their protons are attracted by their common inverse electric field[8] and placed in a potential column. So, the experimental spin of the carbon nucleus ${}^{12}_{6}C$ is

$$ s = 0 + 0 + 0 = 0 \Rightarrow s = 0 \tag{29} $$

and its experimental magnetic dipole moment is

$$\mu = 0 + 0 + 0 = 0 \Rightarrow \mu = 0. \tag{30}$$

The experimental mass deficit of the carbon nucleus is calculated

$$\Delta m = 28,22 + 3 \cdot 7,38 = 92,04MeV \Rightarrow \Delta m = 92,04MeV, \tag{31}$$

namely it is equal to the mass deficit of helium $^{4}_{2}H_e$ ($\Delta m = 28,22$MeV[5]) and to the equal increase the mass deficit of the three helium nuclei $^{4}_{2}H_e$ ($\Delta m = 3 \cdot 7,38$MeV).

1.8. Structure model of nitrogen nucleus $^{14}_{7}N$

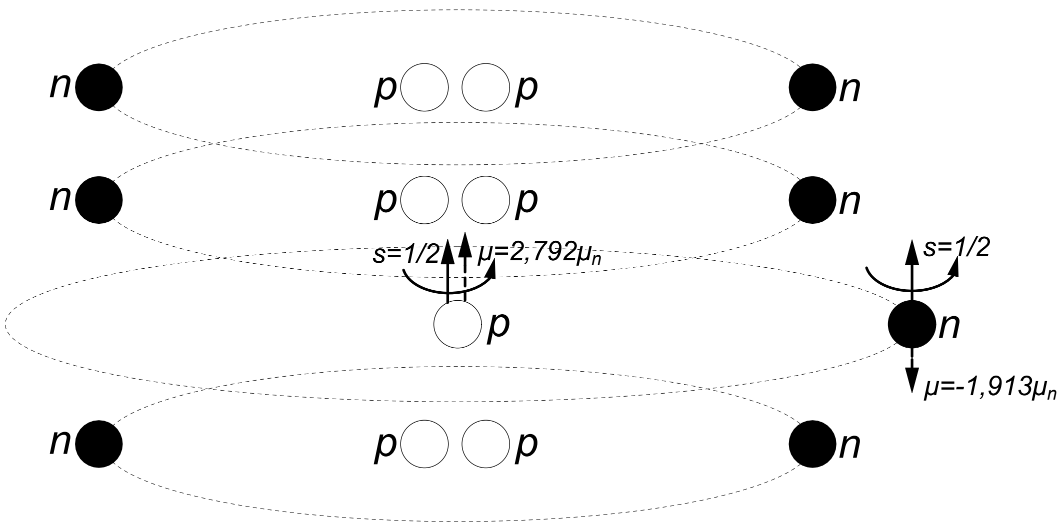

Figure 8. Structure model of nitrogen nucleus $^{14}_{7}N =^{12}_{6} C +^{2}_{1} H$, with addition of one deuterium in the carbon $^{12}_{6}C$

Nitrogen nucleus $^{14}_{7}N$ is derived from one carbon $^{12}_{6}C$ with addition of one deuterium $^{2}_{1}H$, whose the spin is $s = 1$ and so (Fig. 8)

$$^{14}_{7}N =^{12}_{6} C +^{2}_{1} H \tag{32}$$

has an experimental spin

$$s = 0 + 1 = 1 \Rightarrow s = 1 \tag{33}$$

and an experimental magnetic dipole moment

$$\mu = 0 + (0,857 - 0,454)\mu_n = 0,403\mu_n \Rightarrow \mu = 0,403\mu_n, \tag{34}$$

where

$$\mu' = -0,454\mu_n \tag{35}$$

is the reduced magnetic moment of the deuterium's proton.[10]

The increased mass deficit is due to the reduced magnetic moment. So, the mass deficit of the nitrogen nucleus $^{14}_{7}N$ is calculated

$$\Delta m = 92,04 + (2,2 + 10,2) = 104,5MeV \Rightarrow \Delta m = 104,5MeV. \tag{36}$$

1.9. Structure model of oxygen nucleus $^{16}_{8}O$

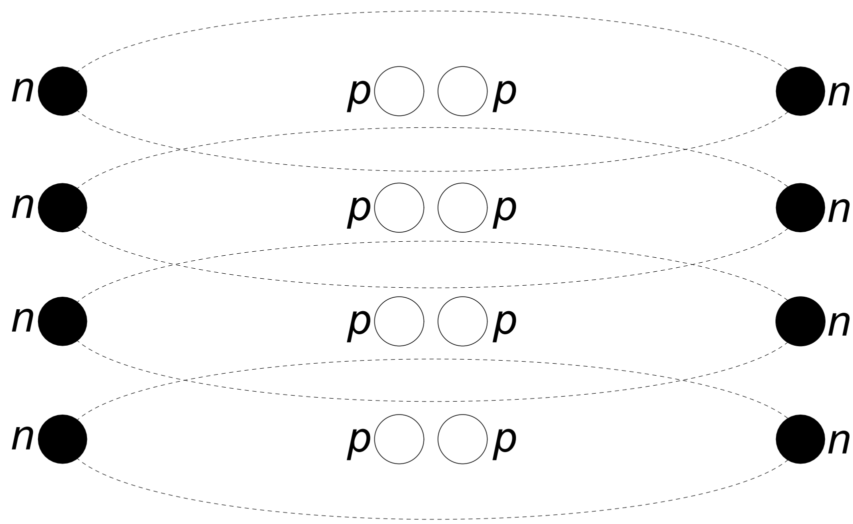

Figure 9. Structure model of oxygen $^{16}_{8}O = 4^{4}_{2}H_e$, as a column strong electric field of four coaxial helium nuclei $^{4}_{2}H_e$

Oxygen nucleus $^{16}_{8}O$ is derived from the nitrogen nucleus $^{14}_{7}N$ (Eq. 32) by completing of the deuterium $^{2}_{1}H$ as a helium $^{4}_{2}H_e$ and so (Fig. 9)

$$^{16}_{8}O =^{12}_{6} C +^{4}_{2} H_e \tag{37}$$

has an experimental spin

$$s = 0 + 0 = 0 \Rightarrow s = 0 \tag{38}$$

and an experimental magnetic dipole moment

$$\mu = 0 + 0 = 0 \Rightarrow \mu = 0. \tag{39}$$

The experimental mass deficit of the oxygen nucleus is calculated

$$\Delta m = 92,04 + (28,22 + 7,2) = 127,46MeV \Rightarrow \Delta m = 127,46MeV, \tag{40}$$

where

$$\Delta m' = 7,2MeV \tag{41}$$

is a small increase of the magnetic moment, due to the increased negativity of the field. It is noted that, $\Delta m = 92,04$MeV (Eq. 31) and $\Delta m = 28,22$MeV[5] are the respective mass deficits of carbon $^{12}_{6}C$ and helium $^{4}_{2}H_e$.

After the helium nucleus $^{4}_{2}H_e$, the oxygen nucleus $^{16}_{8}O$ is the second stable one in Nature and the first upper-order nucleus.[14] From this first upper-order nucleus the second one is constructed (calcium nucleus $^{40}_{20}C_a$), from the second the third one (tin nucleus $^{120}_{50}S_n$) and from the third the fourth one (orion nucleus $^{307}_{125}O_r$), according to the mirror symmetry.

The atomic numbers Z of the above four upper-order nuclei are the so-called four "magic numbers", i.e. $Z_1 = 8$, $Z_2 = 8 \cdot 2,5 = 20$, $Z_3 = 20 \cdot 2,5 = 50$ and

$Z_4 = 50 \cdot 2,5 = 125$. It is noted that, this orion nucleus ${}^{307}_{125}O_r$ with a differential atomic number $Z = 125$ (unified theory of dynamic space[1,2]) is the corresponding "hypothetical unbihexium Ubh", whose atomic number is $Z = 126$ (Nuclear Physics). However, the number $Z = 125$ looks symmetrical and not magical at all, due to the $2,5$ factor.

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