Structure model of calcium nucleus ${}^{40}_{20}C_a$

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Abstract. After the oxygen nucleus ${}^{16}_{8}O$, which is the first upper-order nucleus, the calcium nucleus ${}^{40}_{20}C_a$ is the second upper-order one. Its structure is based on the successive conversions of fluorine ${}^{19}_{9}F$, magnesium ${}^{24}_{12}M_g$ and silicon ${}^{28}_{14}S_i$ into calcium nucleus ${}^{40}_{20}C_a$. From this second upper-order nucleus the third one is constructed (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 125 looks symmetrical and not magical at all, due to the $2,5$ factor (Fig. 5).

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 $^{4}_{2}H_e$.

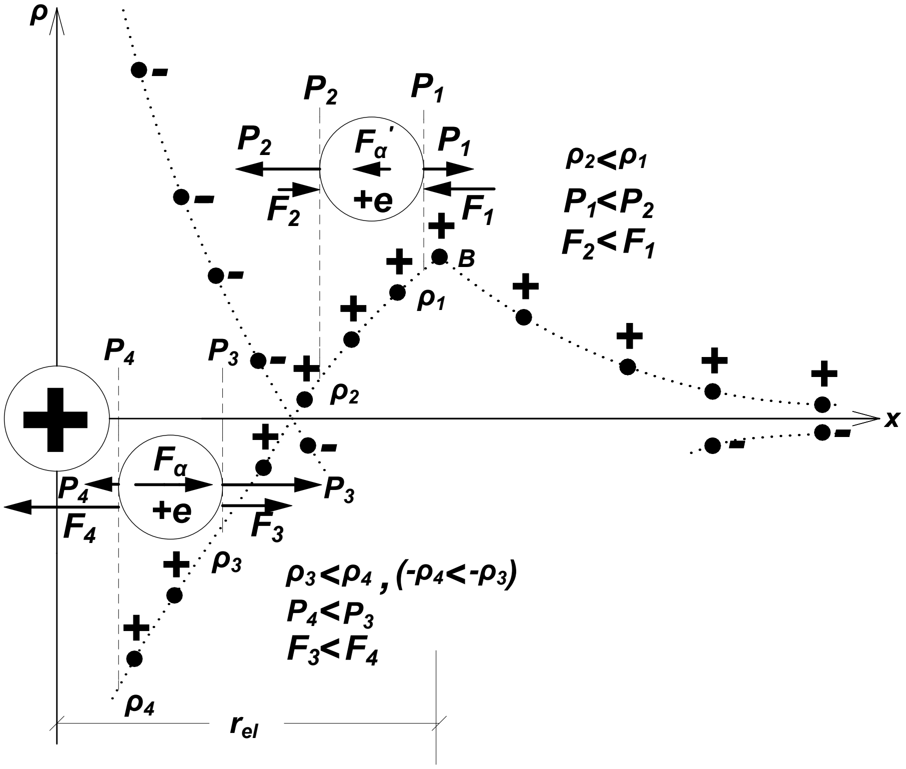

Figure 1. In the upper inverse nuclear field the antigravity force F'_a and the electric resultant[6] $F_1 - F_2$ are attractive, while in the lower field a strong repulsive antigravity force[11] F_a balances the attractive electric resultant[6] $F_4 - F_3$, i.e. the strong nuclear force

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[14] 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[13] 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[15]).

The following is a structure description of calcium nucleus $^{40}_{20}C_a$, that is based on the successive conversions of fluorine nucleus $^{19}_{9}F$, magnesium $^{24}_{12}M_g$ and silicon $^{28}_{14}S_i$ into calcium nucleus $^{40}_{20}C_a$.

1.1. Structure model of fluorine nucleus $^{19}_{9}F$

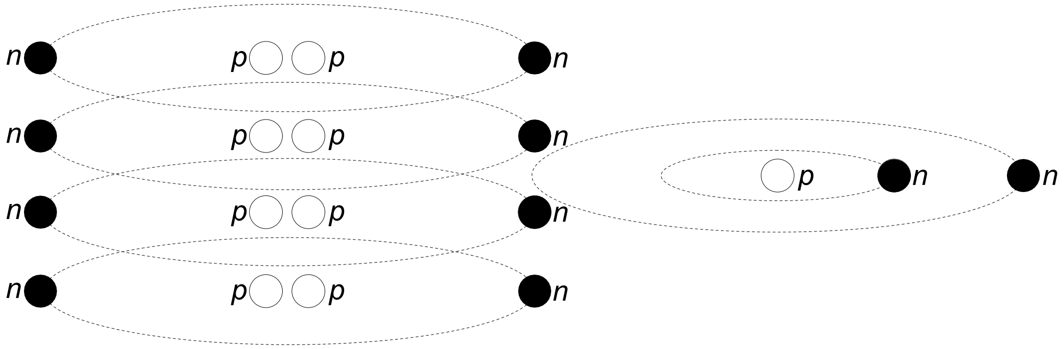

Figure 2. Structure model of fluorine nucleus $^{19}_{9}F =^{16}_{8} O +^{3}_{1} H$, with addition of one tritium $^{3}_{1}H$ adjacent to an oxygen nucleus $^{16}_{8}O$

Fluorine nucleus $^{19}_{9}F$ (Fig. 2)

$$^{19}_{9}F =^{16}_{8} O +^{3}_{1} H \tag{1}$$

is derived by addition of one tritium $^{3}_{1}H$ adjacent to an oxygen nucleus $^{16}_{8}O$.

The experimental spin is

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

and the experimental magnetic dipole moment is

$$\mu = 0 + (2,978 - 0,351)\mu_n = 2,627\mu_n \Rightarrow \mu = 2,627\mu_n, \tag{3}$$

where

$$\mu' = -0,351\mu_n \tag{4}$$

is the reduced magnetic moment of tritium's proton, due to the interaction by the protons of oxygen nucleus (fluctuation of nucleons magnetic moment[10]). It is reminded that the magnetic moment of $^{16}_{8}O$ is[12] $\mu = 0$ and of $^{3}_{1}H$ is[5] $\mu = 2,978\mu_n$.

The experimental mass deficit of fluorine nucleus $^{19}_{9}F$, due to the reduced magnetic moment, is

$$\Delta m = 127,46 + (8,48 + 11,95) = 147,89MeV, \tag{5}$$

where

$$\Delta m' = 11,95MeV \tag{6}$$

is the increased mass deficit of ${}^{3}_{1}H$, due to the electric field of the oxygen's protons. Also, it is reminded that the mass deficit of ${}^{16}_{8}O$ is[12] $\Delta m = 127,46$MeV and of ${}^{3}_{1}H$ is[5] $\Delta m = 8,48$MeV.

1.2. Structure model of magnesium nucleus ${}^{24}_{12}M_g$

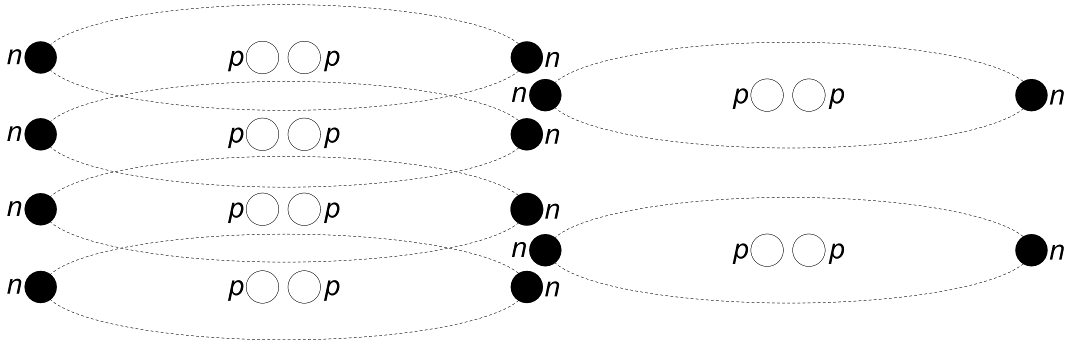

Figure 3. Structure model of magnesium nucleus ${}^{24}_{12}M_g ={}^{16}_{8} O + 2{}^{4}_{2}H_e$, with addition of two helium nuclei ${}^{4}_{2}H_e$ adjacent to an oxygen nucleus ${}^{16}_{8}O$

Magnesium nucleus ${}^{24}_{12}M_g$ (Fig. 3)

$${}^{24}_{12}M_g ={}^{16}_{8} O + 2{}^{4}_{2}H_e \tag{7}$$

is derived by addition of two helium nuclei ${}^{4}_{2}H_e$ adjacent to an oxygen nucleus ${}^{16}_{8}O$.

The experimental spin is

$$s = 0 + 0 = 0 \Rightarrow s = 0 \tag{8}$$

and the experimental magnetic dipole moment is

$$\mu = 0 + 0 = 0 \Rightarrow \mu = 0. \tag{9}$$

The experimental mass deficit of magnesium nucleus ${}^{24}_{12}M_g$, due to the reduced magnetic moment, is

$$\Delta m = 127,46 + (2 \cdot 28,22 + 14,11) = 198,01MeV, \tag{10}$$

where

$$\Delta m' = 14,11MeV \tag{11}$$

is the increased mass deficit of the two ${}^{4}_{2}H_e$, due to the electric field of the oxygen's protons. Also, it is reminded that the mass deficit of ${}^{16}_{8}O$ is[12] $\Delta m = 127,46$MeV and of one ${}^{4}_{2}H_e$ is[5] $\Delta m = 28,22$MeV.

1.3. Structure model of silicon nucleus ${}^{28}_{14}S_i$

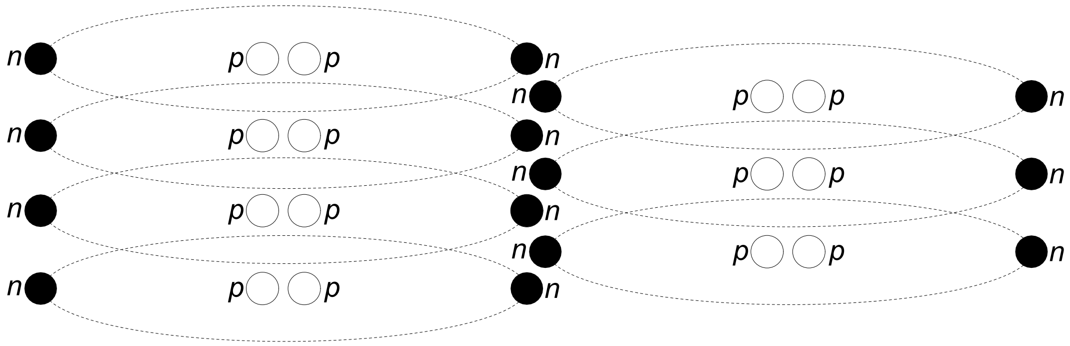

Figure 4. Structure model of silicon nucleus ${}^{28}_{14}S_i ={}^{16}_{8} O + 3{}^{4}_{2}H_e$, with addition of three helium nuclei ${}^{4}_{2}H_e$ adjacent to an oxygen nucleus ${}^{16}_{8}O$

Silicon nucleus ${}^{28}_{14}S_i$ (Fig. 4)

$$ {}^{28}_{14}S_i ={}^{16}_{8} O + 3{}^{4}_{2}H_e \tag{12}$$

is derived by addition of three helium nuclei ${}^{4}_{2}H_e$ adjacent to an oxygen nucleus ${}^{16}_{8}O$.

The experimental spin is

$$ s = 0 + 0 = 0 \Rightarrow s = 0 \tag{13}$$

and the experimental magnetic dipole moment is

$$ \mu = 0 + 0 = 0 \Rightarrow \mu = 0. \tag{14}$$

The experimental mass deficit of silicon nucleus ${}^{28}_{14}S_i$ is

$$ \Delta m = 127,46 + (2 \cdot 28,22 + 14,11) = 198,01 MeV, \tag{15}$$

where

$$ \Delta m' = 14,11 MeV \tag{16}$$

is the increased mass deficit. Also, it is reminded that the mass deficit of ${}^{16}_{8}O$ is[12] $\Delta m = 127,46$MeV and of one ${}^{4}_{2}H_e$ is[5] $\Delta m = 28,22$MeV.

1.4. Structure model of calcium nucleus ${}^{40}_{20}C_a$

Calcium nucleus ${}^{40}_{20}C_a$ (Fig. 5)

$$ {}^{40}_{20}C_a ={}^{16}_{8} O + 2{}^{4}_{2}H_e +{}^{16}_{8} O \tag{17}$$

is derived of two oxygen nuclei ${}^{16}_{8}O$ by bonding adjacent of two helium nuclei ${}^{4}_{2}H_e$ (a half oxygen), according to the mirror symmetry $(2,5$ factor).

The experimental spin is

$$ s = 0 + 0 = 0 \Rightarrow s = 0 \tag{18}$$

and the experimental magnetic dipole moment is

$$ \mu = 0 + 0 = 0 \Rightarrow \mu = 0. \tag{19}$$

The experimental mass deficit of calcium nucleus $^{40}_{20}C_a$ is

$$\Delta m = 127,46 + (2 \cdot 28,22 + 30) + 127,46 = 341,35 MeV, \tag{20}$$

where

$$\Delta m' = 30 MeV \tag{21}$$

is the increased mass deficit of the two $^4_2H_e$, due to the electric field of the oxygen's protons. Also, it is reminded that the mass deficit of $^{16}_8O$ is[12] $\Delta m = 127,46$MeV and of one $^4_2H_e$ is[5] $\Delta m = 28,22$MeV.

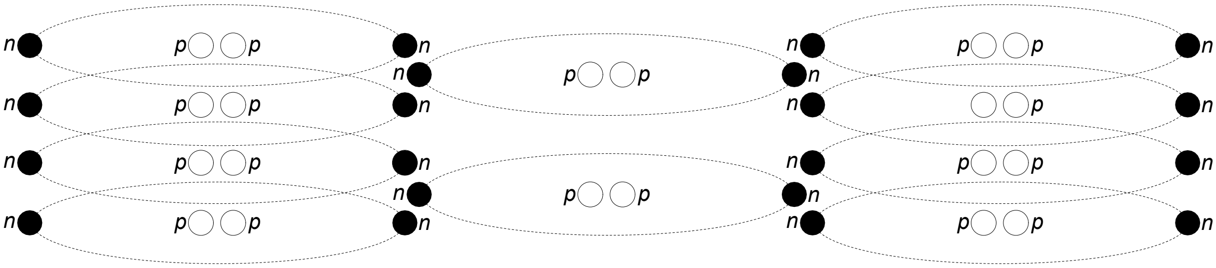

Figure 5. Structure model of calcium nucleus $^{40}_{20}C_a = ^{16}_8 O + 2^4_2H_e + ^{16}_8 O$, as a mirror symmetry of two oxygen nuclei $^{16}_8O$ and two helium nuclei $^4_2H_e$ (a half oxygen), according to the 2, 5 factor

After the oxygen nucleus $^{16}_8O$, which is the first upper-order nucleus, the calcium nucleus $^{40}_{20}C_a$ is the second upper-order one. From this second upper-order nucleus the third one is constructed (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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