

About the Triton Structure

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Abstract: To better understand the structure of matter, it is not enough to study atoms and molecules. For living matter it is necessary to study the cell, including the mitochondrial and for matter in general, it is necessary to determine the elemental elements of the atom and further those of the nucleus, how the nucleons bind to each other, forming virtually new atomic structures if they have electrons, or new ionic structures if they suffer a lack of electrons. The present study aims to explain how the three nucleons bind to a tritium nucleus (nucleus called triton), thus forming the core of the third hydrogen isotope, a positive ion, containing two neutrons and a proton, a single particle positively charged and two neutral charged nuclear particles. For this tritium independent nucleus, called triton, the main dimensions will be determined by calculating its radius R , which is not a constant dimension but a dynamic one, changing its magnitude in function to the velocity of the moving triton particle.

Keywords: Triton, Structure, Dimensions, Nuclear Energy

Introduction

All matter, both vivid (organic) and inorganic, is constituted at the base, from elementary particles called atoms. Atoms are formed around nuclei by capturing electrons that will rotate around nuclei in the form of electron clouds. Generally, a normal atom will contain electrons equal to the number of protons there are within its nucleus. The nucleus of the atom consists of two types of nucleons, protons (charged each with a positive charge) and neutrons (which do not have the load or otherwise have a neutral, zero charge). The nuclei are constructed starting from the minimal nucleus containing a single proton, by addition of nucleons.

If the cores could resist the electromagnetic rejection forces, they could only be made of protons. Because since the first pair of protons put together the mutual rejection forces are large enough to break the link between them, it is already necessary to connect nuclear forces (attraction) so that the core does not break. For this reason, for each added proton in the nucleus, at least one neutron should be added to contribute to the kernel balance (Halliday and Robert, 1966; Petrescu and Calautit, 2016a; 2016b; Petrescu *et al.*, 2017a; 2017b; 2017c; 2017d, 2016a;

2016b; Petrescu, 2018; 2014; 2012a; 2012b; Petrescu and Petrescu, 2014).

For light atoms with mild nuclei (found in the first part of the diagram in Fig. 1), the required number of neutrons in the nucleus is smaller and as we move to the right towards heavier atoms and nuclei, more neutrons will be needed on the nucleus for the link between nuclear nucleons does not break. In other words, as the nucleus is larger (heavier) it will contain a larger number of neutrons within its nucleons (Halliday and Robert, 1966).

On the 45th degree line are the nuclei that have an equal number of protons ($Z = p$) and neutrons ($N = n$) and above it, there are represented the heavier nuclei at which the number of neutrons in the nucleus is higher than that of the protons (Halliday and Robert, 1966). Spontaneous nuclear fission can occur only at heavy and very heavy nuclei located to the right on a larger area of the chart, while nuclear fusion is only possible at the beginning of the diagram on the left for the very first very light nuclei such as the first three isotopes of hydrogen (Kramer, 2011; Moses *et al.*, 2009; Shultis and Faw, 2002; Krane, 1987).

The first circle drawn on the diagram in Fig. 1 corresponds to the light nucleus formed by only one neutron ($Z = \text{zero protons}$) and ($N = 1 \text{ neutron}$).

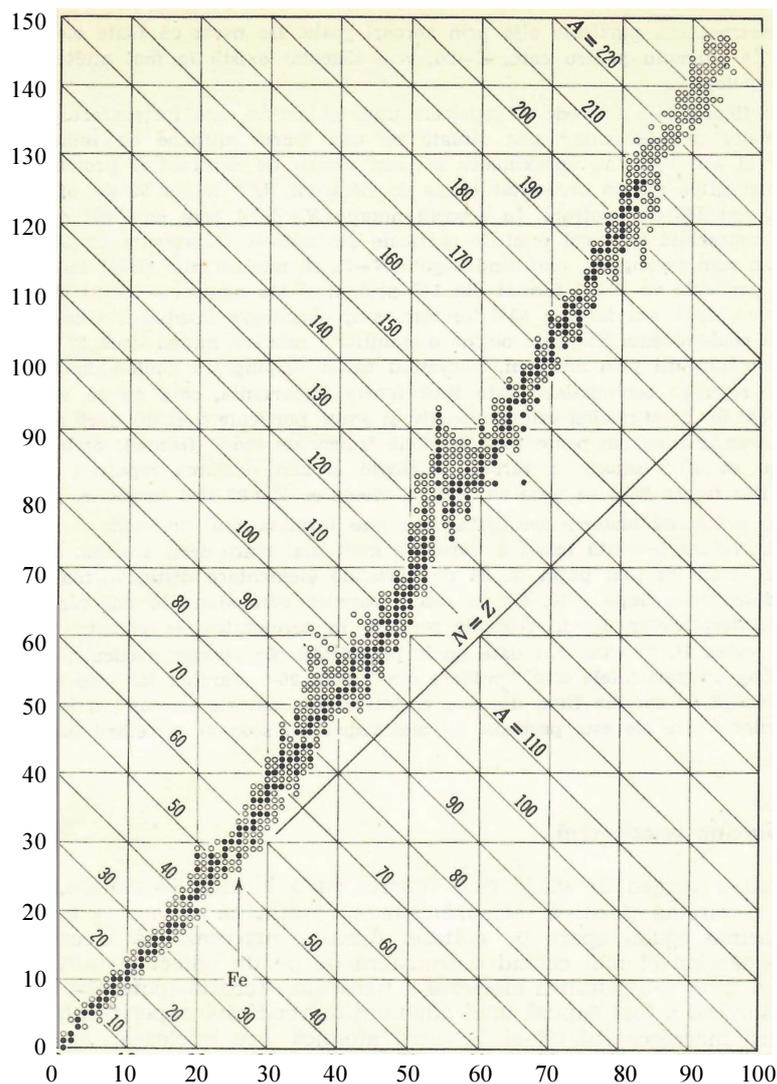


Fig. 1: Diagram of atomic cores (atomic nuclei) (Halliday and Robert, 1966)

For $Z = 1$ (a single proton in the nucleus) there are three drawn variants corresponding to the three hydrogen isotopes). The zero-neutron variant ($N = 0$), where the nucleus contains only one proton and will be called Proton (being the first isotope of hydrogen, which the atom is called protium and the nucleus is called proton). The second variant with a neutron ($N = 1$) in which the nucleus contains a proton and a neutron being the second hydrogen isotope (as a deuterium atom and only as the deuteron nucleus), which is located on the 45-degree line where the nuclei are balanced ($Z = N$). And the third variant at $Z = 1$ is the two neutrons ($N = 2$) representing the third hydrogen isotope (as a tritium atom and as the nucleus called triton), the triton nucleus containing three nucleons, a proton and two neutrons.

In order to better understand the nuclear mechanisms represented in the diagram in Fig. 1, it should be noted that stable nuclei are represented as full circles (black), while unstable nuclei are represented as empty circles (white). So, if the proton is stable, as well as the deuteron, the triton is unstable and even more, even the neutron is now considered unstable and can decay into a proton, an electron and an antineutrino electron. Moving to $Z = 2$ (two protons), we reach the helium with its three isotopes, the first two of which are stable ($N = 1, N = 2$) and the third is unstable ($N = 4$).

Materials and Methods

As we have already shown the third hydrogen isotope, as a nucleus called triton, contains three nucleons, a proton (red) and two neutrons (blue), (Fig. 2).

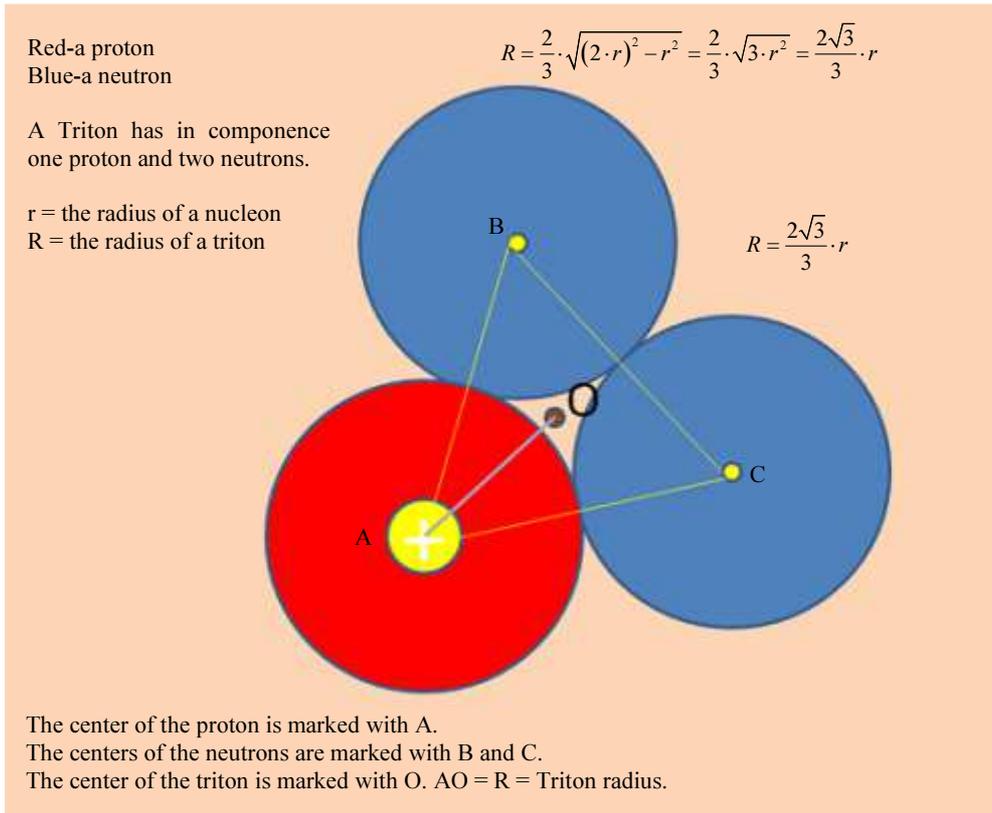


Fig. 2: The third hydrogen isotope, as a nucleus called Triton, contains three nucleons, a proton and two neutrons

The radius of the triton, R , is easily determined with relation 1:

$$R = \frac{2}{3} \cdot \sqrt{(2 \cdot r)^2 - r^2} = \frac{2}{3} \cdot \sqrt{3 \cdot r^2} = \frac{2\sqrt{3}}{3} \cdot r \quad (1)$$

The moment of mechanical inertia relative to an axis passing through the center O of the system is determined by the relationship 2, where M and R are the mass and the radius of triton; m and r are the mass and the radius of one nucleon:

$$\left\{ \begin{aligned} J &= \sum \left(\frac{2}{5} \cdot m \cdot r^2 + m \cdot R^2 \right) = \sum \left(\frac{2}{5} \cdot m \cdot \frac{3}{4} \cdot R^2 + m \cdot R^2 \right) \\ &= \sum \left(\frac{3}{10} \cdot m \cdot R^2 + m \cdot R^2 \right) = \sum \left(\frac{13}{10} \cdot m \cdot R^2 \right) \\ &= \frac{13}{10} \cdot \sum (m) \cdot R^2 = \frac{13}{10} \cdot M \cdot R^2 = \frac{26}{15} \cdot M \cdot r^2 \\ J &= \frac{13}{10} \cdot M \cdot R^2 \end{aligned} \right. \quad (2)$$

Any elementary moving particle possesses the kinetic energy given by the relationship 3 (composed by two components: The kinetic energy of translational motion and rotational kinetic energy of motion), where J is determined with expression (2) and M with relation (4) (Petrescu, 2018):

$$E_c = \frac{1}{2} M \cdot v^2 + \frac{1}{2} J \cdot \omega^2 \quad (3)$$

The mass of particle is determined with the Lorentz relationship 4 (Lorentz):

$$M = \frac{M_0 \cdot c}{\sqrt{c^2 - v^2}} \quad (4)$$

Using (2) and (4) expression (3) takes the form (5):

$$E_c = \frac{1}{2} \frac{M_0 \cdot c \cdot v^2}{\sqrt{c^2 - v^2}} + \frac{1}{2} \cdot \frac{13}{10} \cdot \frac{M_0 \cdot c \cdot R^2}{\sqrt{c^2 - v^2}} \cdot \omega^2 \quad (5)$$

Pulse of the particle is written using the relation 6:

$$p = M \cdot v = \frac{M_0 \cdot c \cdot v}{\sqrt{c^2 - v^2}} \quad (6)$$

The wavelength associated with the particle can be determined with the relationship 7 (according to Louis de Broglie the pulse is conserved), where h is the Planck constant:

$$\lambda = \frac{h}{p} = \frac{h \cdot \sqrt{c^2 - v^2}}{M_0 \cdot c \cdot v} \quad (7)$$

Wave frequency associated with the particle is determining by relationship 8, where c is the light velocity:

$$\gamma = \frac{c}{\lambda} = \frac{c \cdot M_0 \cdot c \cdot v}{h \cdot \sqrt{c^2 - v^2}} = \frac{M_0 \cdot c^2 \cdot v}{h \cdot \sqrt{c^2 - v^2}} \quad (8)$$

The angular velocity of the particle and its square can be calculated with the relationships 9:

$$\begin{cases} \omega = 2\pi\gamma = \frac{2\pi \cdot M_0 \cdot c^2 \cdot v}{h \cdot \sqrt{c^2 - v^2}} \\ \omega^2 = \frac{4\pi^2 \cdot M_0^2 \cdot c^4 \cdot v^2}{h^2 \cdot (c^2 - v^2)} \end{cases} \quad (9)$$

Using 9 the relationship 5 takes the forms 10:

$$\begin{cases} E_c = \frac{1}{2} \frac{M_0 \cdot c \cdot v^2}{\sqrt{c^2 - v^2}} + \frac{1}{2} \cdot \frac{13}{10} \cdot \frac{M_0 \cdot c \cdot R^2}{\sqrt{c^2 - v^2}} \cdot \frac{4\pi^2 \cdot M_0^2 \cdot c^4 \cdot v^2}{h^2 \cdot (c^2 - v^2)} \\ E_c = \frac{1}{2} \frac{M_0 \cdot c \cdot v^2}{\sqrt{c^2 - v^2}} \cdot \left[1 + \frac{26}{5} R^2 \cdot \pi^2 \frac{M_0^2 \cdot c^4}{h^2 \cdot (c^2 - v^2)} \right] \end{cases} \quad (10)$$

The kinetic energy of the moving particle can be determined and by the relationship 11. From the total energy of the particle in movement, subtract the total energy of the particle at rest (potential energy), (Halliday and Robert, 1966; Petrescu and Calautit, 2016a; 2016b; Petrescu, 2018):

$$E_c = E - E_0 = M \cdot c^2 - M_0 \cdot c^2 = M_0 \cdot c^2 \cdot \frac{c - \sqrt{c^2 - v^2}}{\sqrt{c^2 - v^2}} \quad (11)$$

Results and Discussion

Identifying the relationships 10 and 11 are obtained the expressions 12 which can determine the radius of an elementary moving particle with the particularized case when one has as particle the triton:

$$\begin{cases} \frac{1}{2} \frac{M_0 \cdot c \cdot v^2}{\sqrt{c^2 - v^2}} \cdot \left[1 + \frac{26}{5} R^2 \cdot \pi^2 \frac{M_0^2 \cdot c^4}{h^2 \cdot (c^2 - v^2)} \right] \\ = M_0 \cdot c^2 \cdot \frac{c - \sqrt{c^2 - v^2}}{\sqrt{c^2 - v^2}} \\ R = \sqrt{\frac{5}{13}} \cdot \frac{h}{\pi \cdot M_0 \cdot c^2} \cdot \frac{\sqrt{c^2 - v^2} \cdot \sqrt{c^2 - \frac{v^2}{2}} - c \cdot \sqrt{c^2 - v^2}}{v} \\ R = \sqrt{\frac{5}{13}} \cdot \frac{h \sqrt{c^2 - v^2} \cdot \sqrt{c^2 - \frac{v^2}{2}} - c \cdot \sqrt{c^2 - v^2}}{\pi \cdot M_0 \cdot c^2 \cdot v} \end{cases} \quad (12)$$

Conclusion

To better understand the structure of matter, it is not enough to study atoms and molecules. For living matter

it is necessary to study the cell, including the mitochondrial and for matter in general, it is necessary to determine the elemental elements of the atom and further those of the nucleus, how the nucleons bind to each other, forming virtually new atomic structures if they have electrons, or new ionic structures if they suffer a lack of electrons. The present study aims to explain how the three nucleons bind to a tritium nucleus (nucleus called triton), thus forming the core of the third hydrogen isotope, a positive ion containing two neutrons and a proton, a single particle positively charged and two neutral charged nuclear particles. For this tritium independent nucleus, called triton, the main dimensions will be determined by calculating its radius R , which is not a constant dimension but a dynamic one, changing its magnitude in function to the velocity of the moving triton particle.

Using the results of this original study (Equation 12), one can better understand the shape and structural dimensions of elemental particles with immediate applications in which the triton can intervene.

Obviously, the most direct applications will be used to accurately determine the dimensions of the triton depending on its velocity, velocity and kinetic energy to that the triton is accelerated to produce the fusion reaction.

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2. Some Few Specifications About the Doppler Effect to the Electromagnetic Waves: 636 of 28-05-2010 [iEtcaouxxA], physics
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Ethics

This article is original and contains unpublished material. Authors declare that are not ethical issues and no conflict of interest that may arise after the publication of this manuscript.

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Nomenclature

- ϵ_0 \Rightarrow The permissive constant (the permittivity):
 $\epsilon_0 = 8.85418 \text{ E-12 } [C^2/Nm^2]$
- h \Rightarrow The Planck constant: $h = 6.626 \text{ E-34 } [Js]$
- q \Rightarrow Electrical elementary load: $q_e = -1.6021 \text{ E-19 } [C]$ $q_p = +1.6021 \text{ E-19 } [C]$
- c $=$ The light speed in vacuum: $c = 2.997925 \text{ } [m/s]$
- $m_0[kg]$ \Rightarrow The rest mass of one particle
- $m_{0electron}$ $= 9.11 \text{ E-31 } [kg]$
- $m_{0proton}$ $= 1.672621898(21) \text{ E-27 } [kg]$
- $m_{0neutron}$ $= 1.674927471(21) \text{ E-27 } [kg]$
- $m_{0triton}$ $= 5,00554155 \text{ E-27 } [kg]$