ISSN: 2639-0108

Short Communication

Advances in Theoretical & Computational Physics

Weak Interaction and Radioactivity

Rasim A. Kamliya*

Doctor of Physical and Mathematical Sciences

Associate Professor of the Abkhazian State University Sukhum, Abkhazia

***Corresponding Author**
Rasim A. Kamliya, Doctor of Physical and Mathematical Sciences, Associate Professor of the Abkhazian State University Sukhum, Russia.

Submitted: 2023, July 11; **Accepted:** 2023, July 27; **Published:** 2023, Aug 04

Citation: Kamliya, R. A. (2023). Weak Interaction and Radioactivity. *Adv Theo Comp Phy, 6*(3), 171-173.

The property of radioactivity was discovered in 1896 by the French physicist A. Becquerel. Further research showed that during the radioactive decay of elements, α-, β- and γ-rays are emitted. α-rays are helium nuclei, β-rays are electrons, γ-rays are electromagnetic waves.

The helium nucleus is a collection of two protons and two neutrons.
Helium nuclei are loosely bound to the rest of the nucleus and therefore fall away from the nucleus.

This interaction is called the weak interaction, which generates radioactivity.

It is not known yet:
1. What is the nature of the weak interaction.
2. Why weak interaction is possible only for helium nuclei, and not for any doublets or triplets.
3. Why isomers of radioactive elements have different half-lives.
This work is devoted to clarifying these issues.

Physics considers four fundamental interactions:
1. Electromagnetic
2. Gravity
3. Strong
4. Weak

The nature of the strong interaction was revealed in [1,2]. It is electrical in nature. It is shown that electrically neutral neutrons are strongly attracted at close range.

The interaction force was calculated as a superposition of the forces of interaction between quarks of one nucleon and quarks of another nucleon. Due to the interaction of quark charges, a certain mutual orientation is established. Figure.1 shows two neutrons, Figure.2 shows two protons, and Figure.3 shows a proton with a neutron.

The doublet of a neutron and a proton in Figure.3 differs from the other two doublets in the mutual arrangement of quarks.

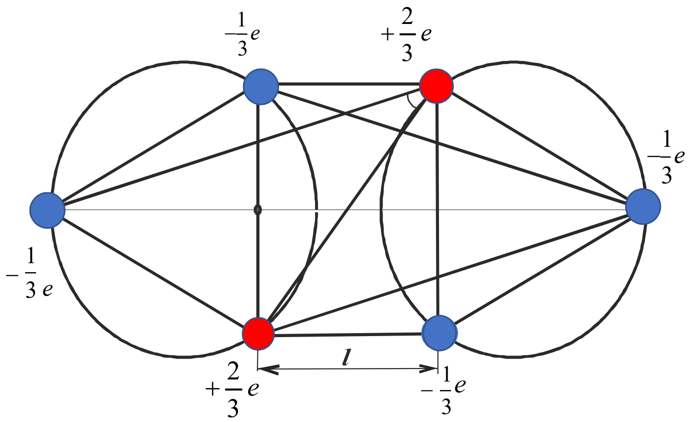

Figure.1

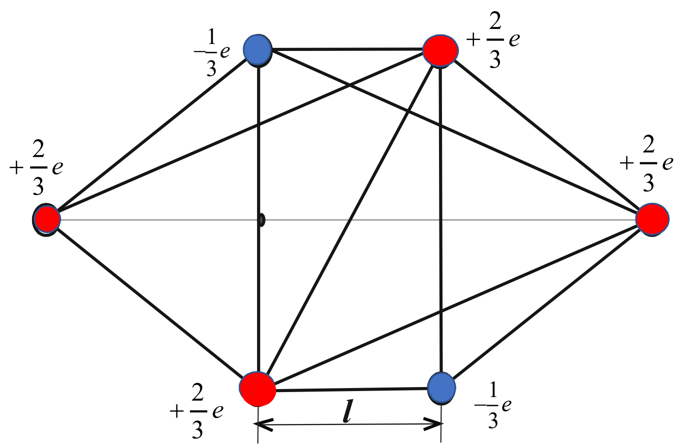

Figure.2

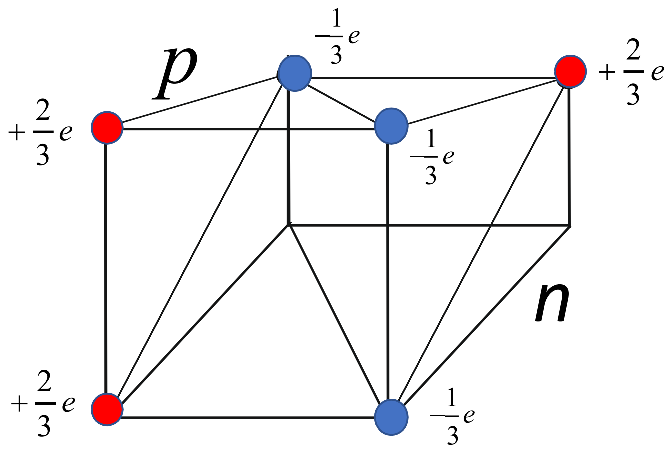

Figure.3

Two protons at a close distance are attracted, showing a strong interaction (Figure.4). The neutron and proton also exhibit strong interaction, but have a different configuration (Figure.3). The strength of the interaction always decreases with increasing distance (Figure.5).

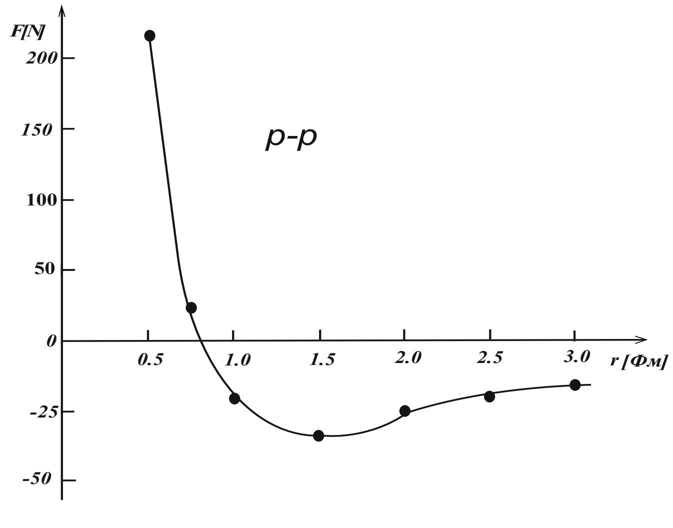

Figure.4

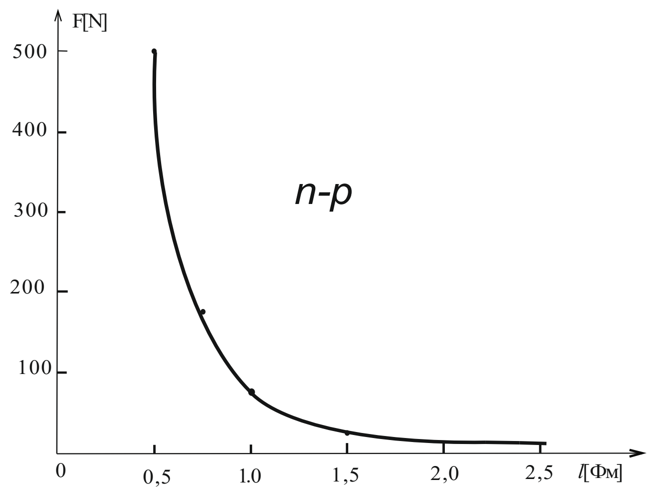

Figure.5

Two deuterons, which have a predominantly positive charge, are attracted at close range due to a certain mutual orientation, which is established under the action of the charges of quarks, forming a helium nucleus. It should be noted that there can be two variants of such structures (Figure.6, Figure.7).

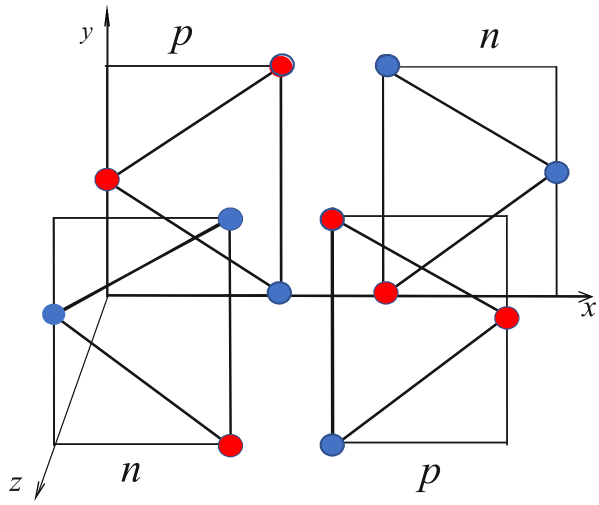

Figure.6

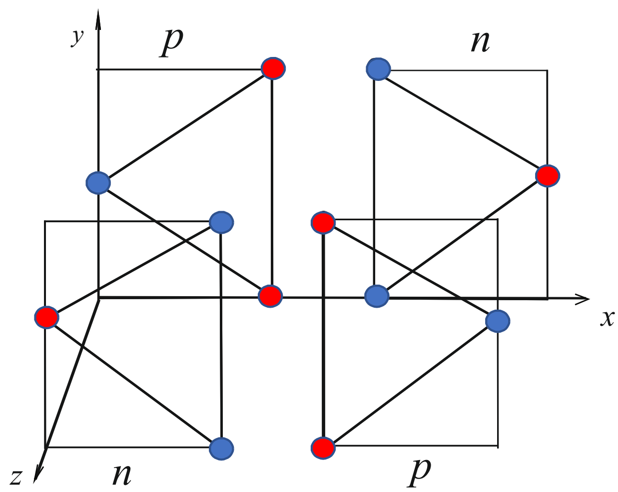

Figure.7

In each of these options, the number of positive quarks is equal to the number of negative quarks and are located at a close distance. Therefore, charge compensation is good. However, the magnitude of the positive charge is +2/3e and is greater than the negative charge of -1/3e. As a result, the total charge of the helium nucleus has a positive value.

At relatively large distances, the helium core is repelled by the rest of the main core.

At a close distance, due to the interaction, the dipoles of the helium nucleus and the dipole of the main nucleus are attracted.

If the helium nucleus is located on the surface of the nucleus with a large mass number, it will be attracted weakly due to the small distance between the positive and negative quarks of the helium nucleus, which contributes to good mutual compensation.

If we take any triplet, then its opposite charges are at a relatively large distance, and it will be attracted to some kind of dipole of a large nucleus. The attraction of the helium nucleus to the large nucleus apparently determines the half-life of a radioactive substance.

The helium nucleus can be attracted to various places in the large core. Since the nucleus does not have spherical symmetry, the force of attraction will be different. This can explain the existence of different half-lives of isomers of radioactive elements.

In general, any substance can contain isomers and therefore the half-life that we can observe is an average value.

In order to determine sufficiently strictly the dependence of the half-life period on the force of interaction of the helium nucleus and the main part of the large nucleus, one should calculate the interaction of quarks of all nucleons of the nucleus. For example, uranium nuclei have 238 nucleons, and the number of quarks will be 238x3=714. Thus, to calculate the force of attraction of the helium nucleus to the main part of the uranium nucleus, one should calculate the interaction of 714 particles, and if the action of the field created by the electron cloud is taken into account, the calculations will be even more complicated. To perform such calculations, it is necessary to create a special program for calculating the interaction of a large number of particles. This is the work of the future.

Conclusions

1. The weak interaction, like the strong one, is electrical in nature.
2. In atoms of elements containing the structure of the helium nucleus, the weak interaction of the helium nucleus with the rest of the nucleus is due to the structure of the helium nucleus, which contains the same number of positive and negative quarks located at a close distance, as a result of which the opposite charges are well compensated.
3. Since the nucleus of any atom does not have spherical symmetry, helium nuclei can be attracted with a different force elsewhere on the surface of the main nucleus, as a result of which the isomers of radioactive elements have different half-lives.

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