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METHODOLOGY FOR SOLVING PROBLEMS ON FUNDAMENTAL INTERACTIONS BETWEEN PARTICLES IN PRACTICAL LESSONS IN GENERAL PHYSICS

Madaliyev Akmaljon Makhammadjonovich
Kokand SPI
akmalmadaliyev86@gmail.com

ABSTRACT

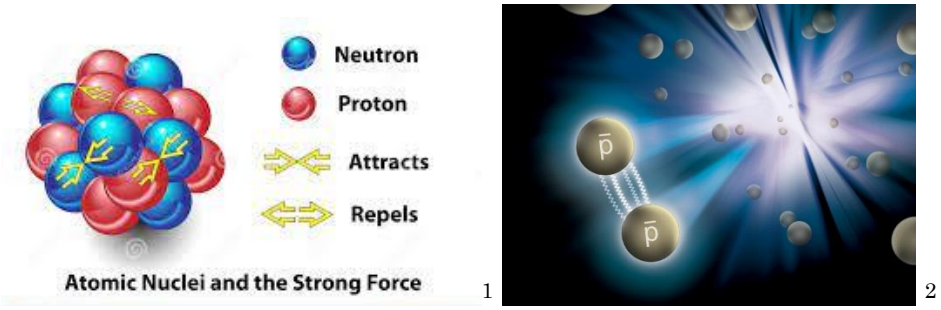
Practical training is considered a type of educational process in higher education institutions and is included in the curriculum of the subject and serves to deepen, strengthen, expand the scope of thinking and apply it in practice. After comparing the practical training with the lecture, it becomes clear that the practical training is a logical continuation of the material learned in the lecture. In Agap, the training of the teacher forms the basis of knowledge in a generalized form, and the practical training consolidates, expands and clarifies this knowledge. Below we will consider the methodology of solving problems related to the fundamental interactions in the world of elementary particles in practical exercises from general physics.

Key words: practical training, methodology, elementary particle, strong interaction, weak interaction, gravitational interaction.

The educational purpose of the lesson: to familiarize students with the participation of particles in fundamental interactions, the nature of fundamental interactions and the processes that occur as a result of them, and to teach them to analyze interaction processes.
The educational purpose of the lesson: to educate students in the spirit of patriotism and awareness of our national heritage by introducing them to the contributions of our ancestors to the field of elementary particle physics.
Developmental purpose of the lesson: To develop the students' ability to solve problems and analyze them from the department of elementary particle physics.
The scientific and practical purpose of the training: to scientifically substantiate the role of fundamental interactions in the world of particles, to expand the scientific worldview of students by explaining their practical importance, to increase their interest in scientific research, and to develop students' professional pedagogical skills and abilities.
Strong interaction. The particles involved in this effect are called hadrons. Rather, particles that participate in all interactions, including the strong interaction, are called hadrons. The strong force holds protons and neutrons in the nucleus, or quarks are bound together by this force to form hadrons. The same effect is responsible for the properties of nuclear and nuclear reactions . We know that the nucleus is made up of protons and neutrons and they interact strongly with each other. Due to the small size of this sphere of influence, each nuclear particle interacts only with neighboring particles. As a result, the density of protons and neutrons is the same for the nuclei of all chemical elements.
The dimensionless constant of the strong interaction in elementary particles is characterized by the pion-nucleon interaction constant "g" as follows:

$$\frac{g^2}{4\pi\hbar c} \approx 15.$$

If it were not for the strong interaction, there would be no πsignificant changes in particles lighter than the meson and the physical phenomena associated with them.



a) b)

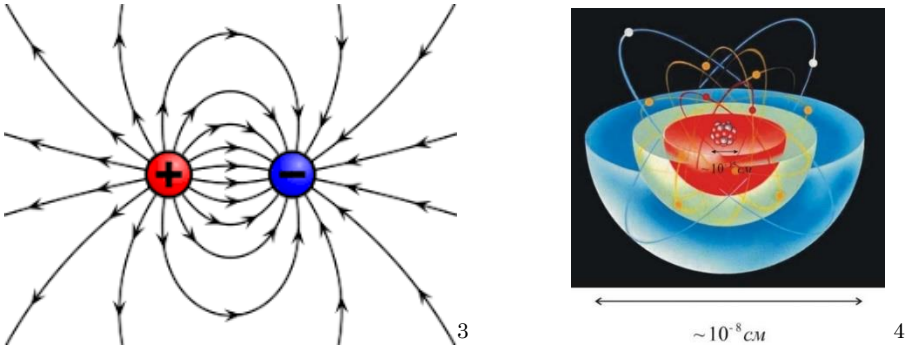
Figure 1. Strong interaction

Electromagnetic interaction. Charged particles are mainly involved in this effect. But neutral particles can also participate in this effect due to their own structure. For example, the neutron participates in the electromagnetic interaction due to its complex structure, i.e. it has a magnetic moment. This effect is currently the best-studied type of effect. An important feature of the electromagnetic effect is the presence of repulsive and attractive forces based on Coulomb's law.

Electromagnetic interaction is weaker than strong interaction and stronger than other forces. The sphere of influence of electromagnetic forces extends from 10 to ^{14} cosmic distances. The dimensionless quantity driving the electromagnetic interaction, calculated from the central constant of elementary particle physics, is entered as follows:

$$\alpha^2 = \frac{e^2}{4\pi\hbar c} = \frac{1}{137}.$$

If there was no electromagnetic interaction, only particles heavier than p-mesons would remain in nature. Particles with almost the same mass but different charges could not be separated from each other.



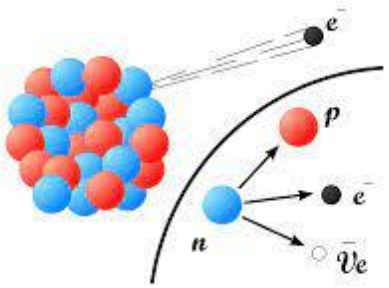
a) b)

Figure 2. Electromagnetic interaction

Weak interaction. Weak interaction. This effect is common to almost all particles. The processes that take place under this influence are quite slow. The decay of atomic nuclei $\beta-$is an example

[1] dreamstime.com
[2] zen.yandex.ru
[3] https://www.google.com/url
[4] https://www.google.com/url

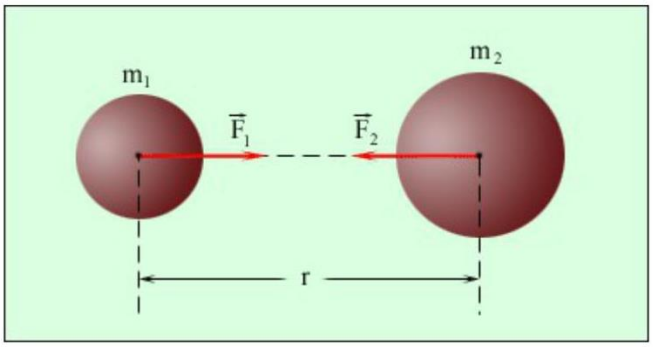
of the weak interaction. The weak interaction is 10 ^{14} times weaker than the strong interaction. However, this effect has its place in the world of elementary particles . Weak interaction processes are very diverse. However, their effect constant $\left(\frac{G}{\hbar c}\right)^2 \left(\frac{\hbar}{mc}\right)^{-4} \approx 5 \cdot 10^{-14}$ will be the same. The weak interaction has less symmetry than the strong interaction. If the weak interaction did not exist , only neutrinos would exist.



[5]

Fig. 3. Weak interaction

Gravitational interaction. Gravitational interaction . It is a universal effect . All particles participate in this effect. Gravitational interaction is the weakest of the above effects . Since its action time is 10 ^{17} s and the impact force is 10 $^{-40}$, it is ignored in the theory of elementary particles. Gravitational effect only for bodies larger than the Planck mass, i.e. $m_{Pl} = 10^{19}$GeV will be noticeable.



[6]

Fig. 4. Gravitational interaction

process a + b → c + d + f + ⋯of strong interaction if it is realized in the form of a process. We can cite the following as an example of this process. If we consider the formation of meson during the interaction, we can see the birth of neutral meson in the collision of two π^0 –protons π^0 –. The reaction of this process is as follows p + p → p + p + π^0. The decomposition process a → b + c + ⋯takes place visually. This process is weak interaction. Since leptons are mainly involved in the weak interaction, it is $\tau^- \to \bar{e} + \bar{\nu}_e + \nu_\tau$divided into a pure lepton process and a half or impure lepton process depending on the products. $\tau^- \to \pi^- + \nu_\tau$ ra As an example of these, we can cite the following.

Applying the "Charhpalak" method to solving issues related to fundamental interactions. The table is filled in by putting "+" in the required cell according to Charkhpalak technology

[5] https://publi.cz/books/270/08.html
[6] https://studfile.net/preview/1358199/page:4/

Influence types / Each other effects characteristics	Strong interaction	Electromagnetic interaction	Weak interaction	Gravitational interaction
Due to this interaction, quarks combine to form hadrons, nucleons combine to form atomic nuclei, and nuclei form α- decay occurs.				
This interaction unites the nucleus and electron into atoms, and atoms into molecules, and under its influence γ- decay of nuclei occurs.				
Almost all particles disintegrate under the weak interaction and nuclear βdecay occurs.				
In the world of elementary particles, it can be ignored due to its extreme weakness.				
The carrier of the effect is a photon				
The carrier of influence is gluons				
The carrier of influence is bosons				
The impact carrier is the graviton				

Tasks to complete during training.

Issue 1. Explain whether the following processes occur as a result of the strong interaction or not.

1. $\pi^- + p \to K^+ + \Sigma^-$, 2. $\pi^- + p \to K^0 + \Lambda^0$,

3. $\pi^- + p \to K^- + K^+ + n$, 4.$\pi^- + p \to \Omega^- + K^+ + K^0 + K^0$

Issue 2. Which of the following processes can occur as a result of the weak interaction?

1. $\Lambda^0 \to p + \pi^-$, 2. $\Lambda^0 \to n + \pi^0$, 3. $\Sigma^+ \to p + \pi^0$, 4.$\Sigma^+ \to n + \pi^+$

Issue 3. Name the structures that exist in nature due to the electromagnetic interaction and explain them.

4 . The following decompositions occur according to which interaction ?

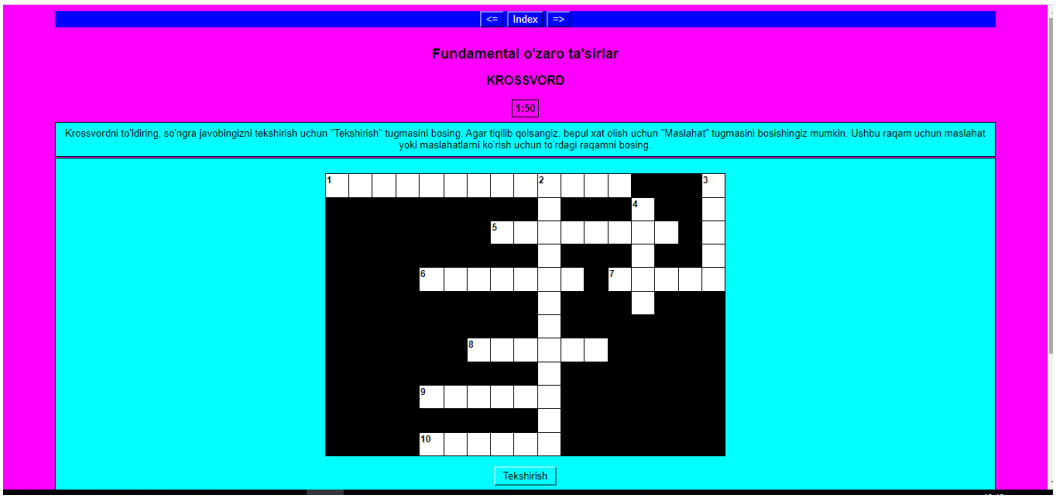
1. $\Sigma^+ \to \pi^+ + n$, 2. $\Sigma^0 \to \Lambda + \gamma$, 3.$\Sigma^0 \to \Lambda + e^- + \bar{\nu}_e$

Issue 5. Look at the processes shown below and identify the type of interaction

1. $K^- + p \to \Lambda + \pi^0$, 2. $\pi^+ + p \to \Sigma^+ + K^+$, 3. $\Sigma^0 \to \Lambda + \gamma$,

4. $\Xi^0 \to \Lambda + \pi^0$, 5. $\pi^0 \to \gamma + \gamma$, 6.$\Omega^- \to \Xi^- + \pi^0$

Crossword " and non-standard tasks to check their knowledge of fundamental interactions.



1 . Write the corresponding numbers on the right side of the table according to the interaction of the processes listed below.

1. $K^- + p \to \Lambda + \pi^0$ 2. $\pi^+ + p \to \Sigma^+ + K^+$ 3.$\Sigma^0 \to \Lambda + \gamma$

4. $\Xi^0 \to \Lambda + \pi^0$ 5. $\pi^0 \to \gamma + \gamma$ 6.$\Omega^- \to \Xi^- + \pi^0$

Mutually effects	Answer numbers
Strong	
Weak	
E electromagnet	

2. Which of the following statements are correct?

A. $K^- + p \to \Lambda + \pi^0$ the process takes place under strong mutual influence

B.$\pi^+ + p \to \Sigma^+ + K^+$ the process occurs under weak interaction

C.$\Sigma^0 \to \Lambda + \gamma$ the process occurs under the influence of electromagnetic interaction

D. $\Xi^0 \to \Lambda + \pi^0$ the process occurs under weak interaction

E. $\pi^0 \to \gamma + \gamma$ the process takes place under strong mutual influence

F. $\Omega^- \to \Xi^- + \pi^0$ the process occurs under the influence of electromagnetic interaction

Answer :

A	B	C	D	E	F

REFERENCES

1. Madaliyev Akmaljon Makhammadjonovich. Scientific-Methodical Approach To Processes Involving "Fundamental", "Strange" And "Charming" Particles During Practical Training , Galaxy International Interdisciplinary Research Journal: Vol. 10 No. 11. 2022. 1 – 7 p.
2. Nasriddinov KR, Madaliyev AM Amali in training particles physics department appropriation efficiency increase ways _ Academic research in educational sciences. 2021. Vol. 2, Issue 3. 42-46 p.
3. Nasriddinov KR, Madaliyev AM Modern of research features , development directions and outlook in formation instead of Mejdunarodnoi nauchnoy conference " Tendentsii development physical condensed sred ". - Fergana , 2021. 500-504 p.