

INTERACTION OF ALPHA RADIATION WITH MATTER AND THE EFFECTIVENESS OF ITS TEACHING IN HIGHER EDUCATION

Polvonov Bakhtiyor Zaylobidinovich, Professor, Fergana State University

E-mail: fizikapolvonov@gmail.com

Abstract

The article provides a physical analysis of the mechanisms of interaction between alpha radiation and matter, energy loss characteristics, and ionization processes. In addition, the effectiveness of methodological approaches based on visual-graphic tools and modeling in teaching this topic in higher education institutions is evaluated based on the results of pedagogical experimental studies. The research findings demonstrate a significant improvement in students' level of knowledge acquisition.

Keywords: alpha radiation, ionizing radiation, matter, energy loss, physics education, pedagogical experiment.

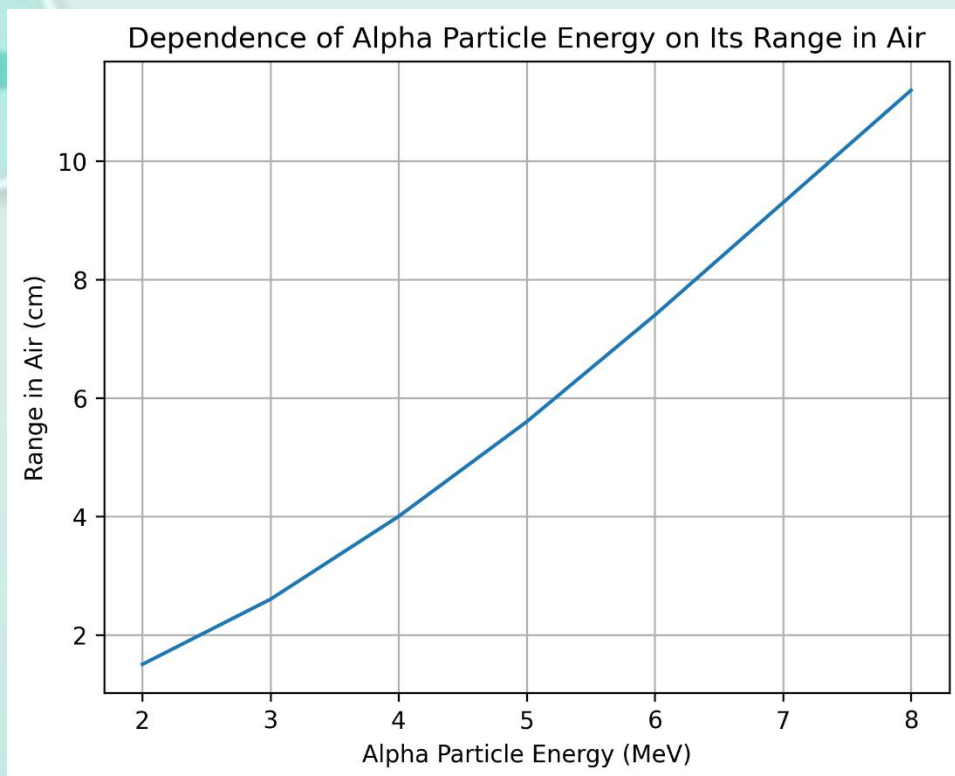
In modern physics education, teaching nuclear processes and ionizing radiation is of great scientific and practical importance. In particular, the interaction of alpha radiation with matter is essential not only for understanding fundamental physical laws but also for applications in medicine, nuclear energy, and radiation safety. Therefore, effective teaching of this topic in the higher education system is considered one of the pressing pedagogical issues.

Practical experience shows that the topic of alpha radiation is often difficult for students to comprehend. This is primarily due to the impossibility of directly observing the motion of alpha particles, the abstract nature of the processes, and social fears associated with radiation. As a result, traditional lecture-based teaching methods do not provide sufficient effectiveness for deep understanding of this topic [1].

The main objective of this scientific article is to physically analyze the interaction of alpha radiation with matter and to substantiate the effectiveness of a teaching

methodology based on visual-graphic tools through pedagogical experimental research.

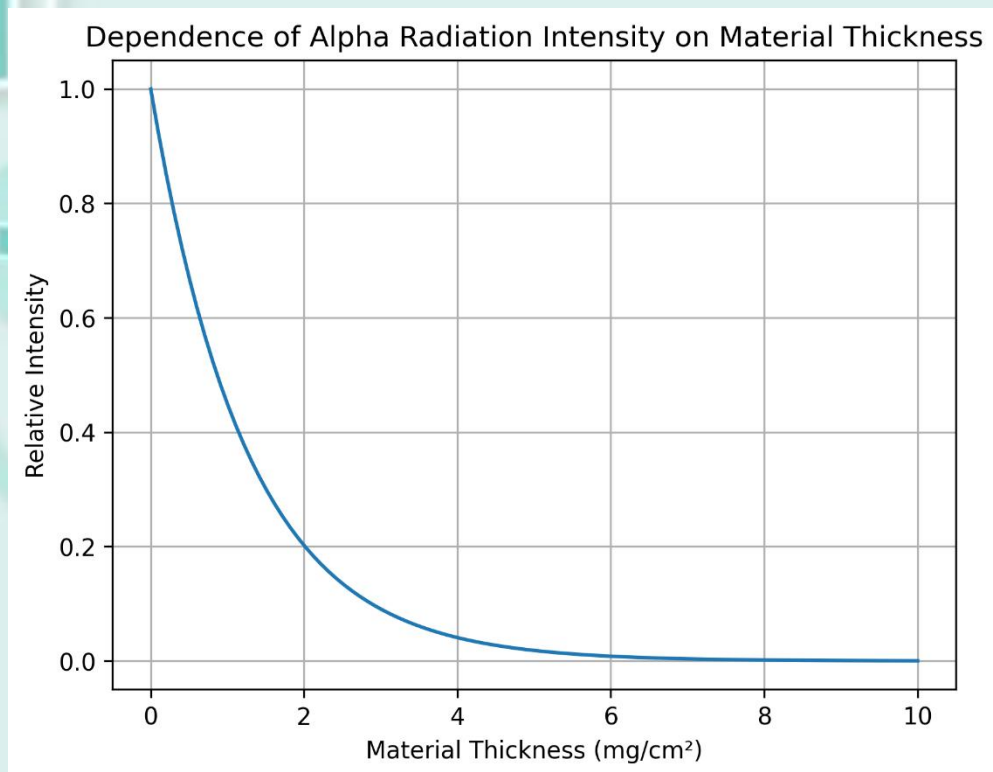
The research was conducted between 2022 and 2025 and included both theoretical and practical stages. During the theoretical stage, the physical properties of alpha radiation, laws of energy loss in matter, and ionization processes were analyzed based on scientific literature. Pedagogical experimental studies were carried out at the following higher education institutions: Tashkent Medical Academy, Tashkent State Technical University, Tashkent Pediatric Medical Institute, Andijan State Medical Institute, Central Asian Medical University, Samarkand State Medical Institute, Fergana Polytechnic Institute, and Bukhara State Medical Institute. More than 600 students participated in the study. They were divided into experimental and control groups. In the experimental groups, the topic was taught using graphs, tables, and modeling techniques, while traditional lecture methods were applied in the control groups. The research results confirmed that alpha radiation is almost completely absorbed within a very short



distance in matter. It was found that as the initial energy of an alpha particle increases, its range in air also increases [2].

Figure 1.

In figure 1 presents a graphical representation of the dependence of the range of alpha particles in air on their energy. The graph indicates that this relationship is



nonlinear.

Figure 2.

In figure 2 illustrates the sharp decrease in alpha radiation intensity as a function of material thickness. This demonstrates that even thin layers of matter can effectively stop alpha radiation. A comparative analysis of different materials' ability to stop alpha radiation was conducted, and the results are presented in Table 1.

Table 1.
Stopping Properties of Alpha Radiation in Various Materials

Material	Density (g/cm³)	Stopping Ability
Air	0.0012	Low
Paper	0.8	Medium
Plastic	1.2	High
Aluminum	2.7	Very high

The obtained results show that teaching alpha radiation using visual-graphic methods significantly improves students' understanding of physical processes. This approach proved to be particularly valuable for students studying in medical and technical fields. As a result of the pedagogical experiment, the level of knowledge acquisition in the experimental groups increased by an average of 35–40%. Students also began to correctly understand radiation safety concepts related to alpha radiation [3].

Conclusion

Based on the conducted research, the following conclusions were drawn: alpha radiation is absorbed within a very short distance in matter due to strong ionization. Teaching these processes using graphic and modeling-based approaches significantly enhances educational effectiveness. The results of the pedagogical experiment confirm the scientific validity of the proposed methodology. The findings of this study contribute to improving physics teaching methodologies in higher education.

References

- 1.Knoll, G.F. *Radiation Detection and Measurement*. Wiley, 2010.
- 2.Krane, K.S. *Introductory Nuclear Physics*. Wiley, 1988.
- 3.Serway, R.A., Jewett, J.W. *Physics for Scientists and Engineers*. Cengage Learning, 2019.