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Analysis of the Current State and Problems of Teaching Elementary Particle Physics in Pedagogical Institutions of Higher Education

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Abstract: This article deals with the situation and problems of teaching particle physics in secondary education, professional education and higher education.

Keywords: student, reader, teacher, pedagogy, psychology, psyche, age characteristic, practical training, elementary particle, fundamental interactions, academic lyceum, higher education, problem, analysis, deficiency.

In Uzbekistan, work in the field of nuclear and elementary particle physics is carried out mainly at the Institutes of Nuclear Physics and Physics and Technology of the Academy of Sciences of the Republic of Uzbekistan. Research in this direction began in Uzbekistan in the 1920s. But regular research was conducted at the Institute of Physics and Technology of the Academy of Sciences under the leadership of Academician S.A. Azimov. In 1956, the Institute of Nuclear Physics was established to develop research in this direction. In our republic, many studies were conducted and literature was created on the physics of nuclear and elementary particles.

The problem of matter has been in the center of attention of both philosophers and natural scientists for thousands of years. From the first ideas about elements and elements to modern ideas about quarks, gluons, superstrings, etc., this is the path of human consciousness. Deeper penetration into the structure of the Universe that surrounds us is inextricably linked with the philosophical analysis of the problem of matter.

The qualification and professional training of a student of a higher educational institution of pedagogy, i.e., a future physics teacher, is the connection between his deep mastery of the scientific foundations of the physics course, the presentation and mastery of physics at various stages of teaching. should ensure that they understand the relationship. In particular, the elementary particle physics section of physics is not widely covered in general secondary and secondary special education. This leads to the lack of sufficient basic knowledge and imagination about elementary particles in a student studying in higher education, as a result of which it creates a number of difficulties in mastering this section. On the other hand, this task has not been sufficiently solved in the teaching practice of physics teacher training at the higher educational institution of pedagogy. This, in turn, changes from the concepts of elementary particles, which are rarely explained by students in comparison to other sections of the General Physics course of pedagogical higher education, to the concepts of elementary particles, which are explained in the physics course of general secondary and secondary special education. causing several problems in the teeth. First of all, the teacher has a lack of basic knowledge about elementary particles, the uniqueness of concepts in particle physics, the abundance of conservation laws compared to classical physics, and the conservation or violation of these laws in the process of interaction, that is, the universal and approximate nature of conservation laws

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These problems include the fact that the quantum numbers characterizing the particles have similarities in characterizing the particle itself and the state of the particle.

The topics of the elementary particle physics department, scientific news and historical information in the textbooks and educational literature intended for physics specialists of pedagogical higher education are mainly encyclopedic in nature, and there is a need to present them in a certain sequence. was determined. Especially when we study and analyze the educational literature intended for practical training, first of all, the number of literature is insufficient, at the same time, there are few issues related to the study of elementary particle physics. it was observed that it is not rich in content.

The occurrence of the above-mentioned problems is that the content of elementary particle physics and teaching methods are not provided in general secondary, secondary special vocational education and higher education in elementary particle physics teaching. we think that The issue of finding and solving the problems that arise in such a situation remains the main task of teaching this department today.

Physics in the field of basic preparation in the "Network education standard and in-depth science curricula of academic lyceums in the field of exact sciences" of the Center of Secondary Special and Vocational Education of the Ministry of Higher and Secondary Special Education is considered a science, according to it, from the Department of Elementary Particle Physics, "The Garden of Elementary Particles". The discovery of the positron. Antiparticles. Quantities characterizing elementary particles. Mutual rotations of elementary particles. Division of elementary particles into types. Conservation laws in elementary particle physics. Understanding of the unified theory of types of physical effects in nature. Understanding Cosmic Rays. Their chemical composition. The only physical landscape of the universe." such topics are given.

Physics of elementary particles has its own disadvantages not only from the point of view of learning, but also from the point of view of teaching it, and it requires imagination and wide-ranging thinking from the student.

Unlike other departments of general physics, the department of elementary particle physics has its own characteristics. In particular, as a result of studying it, students will develop a way of thinking specific to the nature of the world of particles, which will help them master the unique features of the microcosm. On the other hand, it has a serious impact on the outlook of future teachers. General physics teaching in the higher education system is based on students' initial knowledge. In addition, elementary particle physics is also taught depending on the knowledge acquired in the physics course of secondary and secondary special vocational education.

Teaching elementary particle physics in a pedagogical higher education institution not only ensures students' deep understanding of modern knowledge, but also ensures the solid and deep mastery of basic physical concepts and laws, and perhaps also the consistency of its teaching at different stages of future education. must provide.

The above-mentioned opinions also confirm the importance of increasing the role of practical training in the teaching of elementary particle physics and training future physics teachers and its content improvement in accordance with the needs of the times.

Below, we will focus on the current state of elementary particle physics education and its content in pedagogical higher education institutions.

Subjects taught in pedagogical higher education (including General Physics) should have a scientific and professional-pedagogical orientation. The role of the higher educational institution of pedagogy in the training of physics teachers is the main one. The elementary particle physics section of the General Physics course, which is presented to the future teachers who are growing up as a specialist in physics, as well as other sections, is the responsibility of the teachers who teach it, such as ensuring its mastery. should be responsible.

In pedagogical higher education, physics of elementary particles is taught as a section of general

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physics (physics of atoms, nuclei and elementary particles). The teaching methodology developed for it is general and mainly intended for teaching atomic and nuclear physics. As a result of our studies, it was found that there are almost no methodological developments and recommendations for teaching elementary particle physics, and the existing ones are designed for conducting lectures. Therefore, dissertations, methodical manuals, scientific articles on the methodology of teaching elementary particle physics in order to study the process of practical training from the general physics course, especially elementary particle physics, and identify shortcomings and eliminate them , textbooks, and educational programs for "Physics and Astronomy" and "Methodology of Teaching Physics and Astronomy" in pedagogical higher educational institutions developed by the Ministry of Higher and Secondary Special Education of the Republic of Uzbekistan syllabi and general physics model science programs were reviewed, studied and analyzed.

Our conclusion from the studies is that there is not enough time allocated for the topics and exercises presented for practical training in the elementary particle physics department in pedagogical higher education. This, in turn, leads to some difficulties in mastering elementary particle physics by future teachers and delivering it to the next generation.

Sufficient time has been allocated for the practical training of the Department of Elementary Particle Physics in the field of physics in higher education institutions of the Commonwealth of Independent States. For example, at Kazan State University (Russian Federation), 6 hours of lectures and 14 hours of practical training are allocated from the Department of Elementary Particle Physics. Lecture sessions reflect the main content of this field and cover the following topics:

Topic: Physics of elementary particles.

Accelerators of charged particles. Classification of accelerators. Collision of bunches of particles in accelerators. Large Hadron Collider. General information about elementary particles. Classification of particles. Leptons and hadrons, resonances, mesons, baryons, isomultiples.

Characteristics of particles: mass, spin, pair, residence time, electric charge, lepton and baryon charge, isospin and its projection, strangeness, charm. Quantum numbers of elementary particles. Laws of conservation. Pair and its conservation law. Non-conservation of pair in weak interaction. A combinatorial pair, its non-conservation in the weak interaction and its time-dependent irreversibility. Quarks and their characteristics. Quark composition of baryons and mesons. Capture of quarks. Quark-lepton symmetry.

Topic: Fundamental interactions.

Exchange mechanism of fundamental interactions. Influencers. Quark-gluon model of strong interaction. The nature of the weak interaction. Intermediate bosons. Unified theory of interactions. Proton instability. A modern view of the structure of the universe. Higgs boson. Standard model.

As can be seen from the above content, this section reflects the latest innovations in this field, theoretical information is sufficiently reinforced in practical training, and as a result, future physics teachers are able to understand the fundamentals of this field and will have the opportunity to fully familiarize themselves with the latest achievements.

Currently, this field, that is, the Department of Elementary Particle Physics, has a strong place in the development of world science and technology. As a clear example of this, it is appropriate to cite the launch of the new generation of accelerators, which are the main devices of particle physics, the Large Hadron Collider, as well as the extensive research and innovations being carried out in it. The largest accelerator in the world is built at CERN (European Center for Nuclear Research), a center for research in the field of elementary particle physics located near Geneva, Switzerland. It is the largest and most powerful particle accelerator in the world (LHC-Large Hadron Collider) is the Large Hadron Collider.

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Based on the results obtained in them, the founders of the universe are becoming clearer, and our imagination about them is expanding.

Changes in the field of elementary particle physics greatly expanded the previously formed concepts in physics and certainly became an area of interest for specialists, especially the younger generation. The achievements in the field of physics, which have been achieved and are being achieved on a global scale, and the research projects planned in the field must always be reflected in our education system.

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