Original Article

Creating Multi-Functional Demonstration Experiment Equipment and Developing Methods of Use of Them in the Lecture

Valijon T. Rakhmanov[1], Khilola Yu. Shoyzakova[2]

[1]PhD Student, Gulistan State University, Gulistan, Uzbekistan.

[2]Lecturer, Gulistan State University, Gulistan, Uzbekistan.

DOI: 10.47750/pnr.2022.13.S08.305

Abstract

This article presents the results of scientific research on teaching students to think logically in the teaching of physics, as well as the solutions of these teaching methods. In the course of the lesson, the presence of experimental constructions of a complex appearance plays a key role in the development of ergonomic skills and creativity in the formation of students' imagination.

Keywords: Ergonomics, Creativity, Knowledge, Ability, Skill, Competence, Experiment, Logic, Imagination, Independent Creativity.

INTRODUCTION

Today, the introduction of many reforms in the education system is working directly to the implementation of the educational process. Uzbekistan has all the necessary conditions for the modern model of innovative development of Uzbekistan.This model is based on the formation of:

- Wide use of scientific and technical potentials;
- Introduction of achievements of fundamental and applied science in practice;
- Introduction of technology that requires deep knowledge;
- Increasing the number of highly qualified scientific personnel.

As we continue to bring reforms in all fields and become upgrading, we must help these reforms to change and increase our spiritual growth and strengthen our national pride and pride depends on the all-round cadres.In the development of the country, in the development of economic, political and spiritual development, the national staff will be one of the main factors. [1] In this regard, the contribution of physics is also significant. The physics is the formation of the product, the product that gives students students, the knowledge of theory in the experiment in the experiment.

THE MAIN RESULTS AND FINDINGS

The concepts and laws of the physics, which is a leader among the nature sciences, lies on the basis of natural science. It is important to constantly improve the teaching methods of natural phenomena to form scientific concepts in the physics. Enrichment of existing theory based on new technical and scientific achievements is important. The protesters from physics occupies an important assistance depending on the logic of the speaker. It is known that the well-placed demonstration expert is not only increasing the curiosity of the audience, but also develops the ability to imagine. Physical thinking requires a lot of hardships and plays an important role in the exercise through an exhibition that provides quality assimilation of the events studying.An important tool in ensuring the founding of the development of physics is the cooperation of the "student and experiment" andergonomics provides the prospects, features and opportunities of science.The field of ergonomics is studied in order to state the student coordinating the performance of experiments.

Ergonomics –(from Greek "Ergos" - work. Nonos - Law) means "work and law".This sector begins a wide range of the twentieth century as a harmonial system of mechanical tasks in human activities, psychology, physiology, hygiene, economy.The international ergonomic union was established in 1969 and held a non-member of more than 30 countries, and Congress was held every 3 years.Their official company published on the publication of "Ergonomics", "Applied Ergonomics"

and "Ergonomics Abstracts" and the universities of several major countries began to teach specialists in the field of ergonomics.Scientific research in the CIS countries was implemented in many organizations. Since 1960, the Information brochure "Technical Aesthetics" is announced monthly and one of the scientific research in various fields is pedagogical ergonomics [36, 86, 87].

The main issue of pedagogical ergonomics is increasing the effectiveness of teacher and student's mental labor. It is known that in physics, the experiment provides students with the rich content and high qualities of science. In addition, it has great importance in psychological. Tasks that unite student and experiment are called Ergotica.

In the training of pedagogical ergonomics, it is focused on pediatric, technical, psychological - physiological, artistic structure and economic requirements. The main indicators that affect the creation of demonstrations of mental labor focus on issues of hygienic, anthropometric, physiological and aesthetic matters.

According to the results of this study, the improvement of "Educational Problems" [141], as well as physics education on experiment demonstration is reflected in this dissertation [67].The task of improving the content of physics and demonstrations of its organization is one of the central issues, waiting for its own solution in the method of teaching physics.Higher education pays great attention to the quality of training specialists. In the preparation of physics teachers with high levels of knowledge and professional skills, the role of physical experiments is very unique.

The lecture experiment pays great attention to the use of modern scientific research and technical means. Experients were processed on the basis of pedagogical ergonomis [141]. The book published under the edition of V.P. Zinchenko will be discussed in the entrance to ergonomic [36].The attention is paid to ergonomics and its analysis in the physic encosecedic dictionary. In encyclopedia, ergonomics is widely opened.

The concepts and laws of physics lies on the basis of natural sciences and are a leader to connect it with social sciences.Practical activity in physics will not be free from theoretical thinking and related hypotheses. The theoretical knowledge is of the case in the educational process when the importance is not associated with the experiment.At the initial stage, it is considered to activate the student's cognitive activity and helps him acquire solid knowledge in the future. The psychological state becomes important in the methodical in-depth study of the sources, provides the learner with a high level of knowledge for a long time, and has a positive effect on the speed, volume, and memorization of the learning material.It is known that visual aids and demonstration experiments play an important role in the psychological education of students. As P. L. Kapitsa wrote, "showing physical phenomena without disconnecting them from life allows the student to create an unmistakable connection between theory and practice, and avoids some of the difficulties caused by the description of the phenomenon" [45].

An important aspect of the exhibition for pedagogy is naturalness and quick acceptance of objects by students. At this stage of the teaching process, the exhibition is selected depending on the level of acceptance of the educational material.Physical demonstration experiment in the lecture, selection of the speaker in accordance with the topic is an important factor in each student's deeper learning of science.Demonstration experiments, when well presented, engage students and increase their curiosity. It affects not only the thinking activity, but also the emotional side, imagination.Thus, learning materials related to demonstration experiments are well mastered. Psychological experiments show that the demonstration experiment leaves a deep impression on the student.

It follows that demonstration experiments in lectures for students are an element of their professional training.

In the course of the lecture, if educational goals are formed on the basis of the needs of acquiring knowledge, forming skills and competencies, the goals of cognitive activity become broader and richer in terms of content. Bringing the methods used in the field of science into the educational process, teaching students the methods of mental activity - analysis - synthesis, comparison, abstraction, generalization, inductive and deductive conclusions, forming the skills of independent work on manuals and other educational literature in students, somewhat reduces the differences between them.

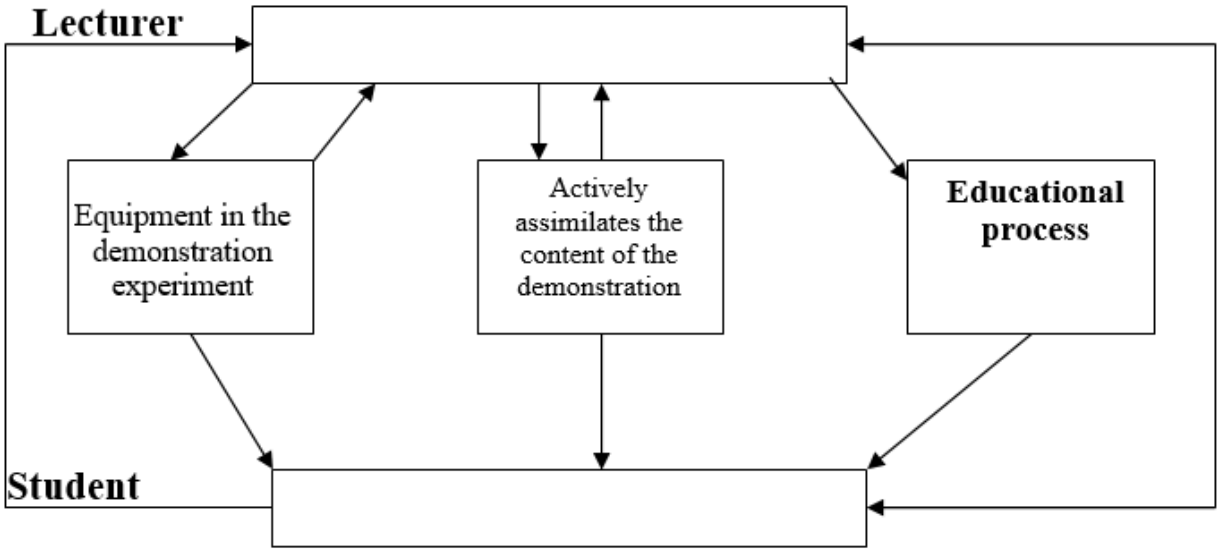
When presenting a lecture, it is necessary to use such a method that the cooperation of theory and practice is on the same level, and it is necessary to convey to students about physical laws, otherwise, with a deep approach to history, students may come to the opinion that "everything happened in the past".Therefore, while mentioning new achievements in physics, it is necessary to talk about their search and development. This is where the lecture experiment comes in handy, that is, a well-chosen experiment that shows how difficult it is to discover certain phenomena. In this case, it is possible to use the technical achievements of science and research development prospects in the course of the lecture. In this regard, there are many methodological centers abroad, where they are taught based on historical approaches.

ADHERENCE TO ERGONOMIC PRINCIPLES IN THE CREATION OF DEMONSTRATION EXPERIMENTS

We divide the importance of demonstration experiment devices into the "experiment and student" system when demonstrating the importance of demonstration experiment devices through a lecture on physics. The performance quality of this system

depends of the fact that its elements are adapted to each other, and a new scientific independent science - pedagogical ergonomics deals with the problem of active coordination, the characteristics and capabilities of technical tools and the student's body.The object of control that unites technical devices with the student is considered technical devices, and the function of regulatory devices is called ergotic devices. An example of such a system is: the presentation of several demonstration experiments to students from one device, and the object of control in a certain part is the device of physical demonstration experiments used in the lecture.Ergonomics studies the nature of the teacher's main labor activity in order to maximize coordination of the constructed devices and mechanisms with it (Scheme 1).

Scheme 1



It is impossible to create spaceships, high-sounding aircraft, and high-precision equipment without human psychological capabilities, knowledge, and hygiene requirements. Ergonomics also takes into account the artistic construction of devices.

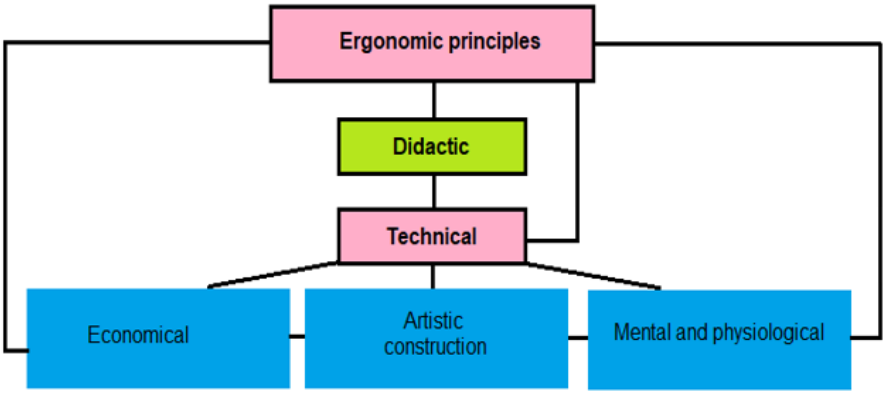
The main issue of ergonomic research is to increase the efficiency of the mental work of the teacher and the student. The main indicators of theoretical work affecting practice include:

- Hygienic (room width, light, color, peace, neatness, etc.);
- Anthropometric (matching the student's body to the object of the experiment and the description of the movement, tension and strength during demonstration experiments);
- Physiological and psychological - physiological (speed of receiving, understanding and processing information);
- Aesthetic (artistic design requirements for experimental devices).

In the system we are looking at, the role of the manager is significant, it is the central control link of the ergotic system, on the other hand, the speaker, who poses certain questions and solves them theoretically together with the students, and finally, justifies the obtained conclusions through a demonstration experiment. Unfortunately, less attention is paid to ergonomic principles in the design of demonstration experiments that are shown during lectures.The effectiveness of many demonstration experiments in physics is low, when the psychophysiological perception of the students is not taken into account.

The demonstration experiment devices showing the main link meet all the requirements, i.e. the ergonomic principles shown in the ergot system, are presented in the scheme 2 below.

Scheme 2



Didactic Principles

This requirement includes the following basic theoretical principles of education:

1. The need for basic and general concepts that are revealed through demonstration experiment devices used to explain the phenomenon.
2. Simple and clear presentation of demonstration experiment drawings revealing the essence of the observed phenomenon. These requirements are inextricably linked to the understanding of the experiment and the high level of observation of the phenomenon. The simpler the experimental device looks during the demonstration, the more convincing it is.
3. Correspondence between the description of the event and the demonstration of the experiment.

Technical Principles

1. The multifunctionality of demonstration experiments, that is, the use of equipment used in one experiment in different experiments. It should be true that the demonstration experiment consists of a large number of parts, as shown in the work, otherwise, such multifunctional sets will not give good results and will cause excessive consumption of lecture time.
2. The structure of the demonstration experiment device allows experiments to be carried out without additions or adjustments, such implementation of the device reduces lecture time.
3. Using the most optimal method in changing the initial state of the experimental device - equipment.
4. Consistency in work.
5. Ease and simplicity of application technique and technology.
6. The ability to easily change the length of the display table support.
7. Safety techniques at work.

Psychological - Physiological Principles

1. It is necessary to make it possible to place the devices of the demonstration experiment in such a way that all the elements of the structure are at the same time let it be seen.
2. Demonstration experiment devices should be placed in a convenient position for use and demonstration.
3. The devices should be placed in such a way that their total length should be about one meter, which makes it possible to withstand anthropometric conditions.
4. Auxiliary device - equipment (power source, generators and
   b.) cannot be in the field of vision of students:
   all controls should be 1m above the ground, should be designed before the show, and should allow for easy demonstration during the lecture.
5. It is necessary to make it possible to quickly collect the device from the field of view of students.

Artistic and Constructive Principles

1. Design of devices.

2. Selection of material.

It should be remembered that the artistic construction structure of demonstration and experiment devices and their compliance with technical and aesthetic principles make the design of the experiment possible in many ways.

Economic Principles

1. Multifunctionality of devices.
2. Economic requirements often conflict with technical requirements and, in our opinion, are not decisive.

Possibilities of Observing Ergonomic Principles in the Use of Demonstration Experiments in the Lecture Process

In the process of teaching physics, effective use of demonstration experiments from the point of view of developing students' thinking ability creates various conditions for creativity. As we know, demonstration experiments take a leading place in practical verification of the correctness of theoretical conclusions. The nature of the demonstration experiments in use is different, and the selection method depends on the teacher's teaching skills, and it is desirable that it incorporates ergonomic aspects.

In this regard, following the principles of pedagogical ergonomics of demonstration experiments, below we look at the examples of multifunctional "Trans-transformer device" and "Ultra-high frequency generator device", "Tesla transformer", "Permanent vibration generator", "Resonator for permanent vibrations", as well as "Optics sections". The point is that with the help of a demonstration experiment device - equipment, multifunctional demonstration experiments are considered by introducing small additions to it.

A Multifunctional Ultra-high Frequency Generator Device

It is known from electrostatics and electromagnetism that an electric field is created in space around a stationary electric charge, and a magnetic field exists only around moving charges. The lines of force of such an electric field consist of open lines of force starting from a positive charge and ending at a negative charge.

The propagation process of magnetic and electric field variables is an electromagnetic wave. When electromagnetic waves propagate, changes in electric and magnetic fields occur periodically at each point in space. When an electric and magnetic field that varies over time is generated, a cumulative magnetic field or a cumulative electric field appears.If an electromagnetic field is created in a finite region of space, this field spreads to the rest of space with a finite speed. This speed is very large and is equal to the speed of light in vacuum ($3 \cdot 10^8$m/sec). In cases where the generated electromagnetic field has a periodic nature, it propagates in the nature of a wave.

Propagation of the electromagnetic field in the wave character.

originates from the general theory of electromagnetic phenomena created by Maxwell in 1863, that is, a cumulative electric field is formed in the space around a changing magnetic field. Electromagnetic waves were first studied in 1888 by Hertz in an experiment. Hertz investigated the return, refraction, interference, diffraction and similar phenomena of electromagnetic waves and found that all the laws of optics can be applied to electromagnetic waves.As a result, Maxwell's theory of electromagnetic waves was confirmed, and he laid the foundation for practical generation of electromagnetic waves of different lengths [41, 51, 52].

Based on Hertz's experiments, the following properties of electromagnetic waves were determined:

1. Like light waves, electromagnetic waves are absorbed and scattered by matter.
2. The electromagnetic wave returns at the same angle as it hits the metal surface.
3. When an electromagnetic wave falls on the boundary of two media, it is refracted like a light beam.
4. The electric field strength of the electromagnetic field and the wave of the magnetic field induction vectors Since electromagnetic waves are perpendicular to their propagation, they are transverse waves.
5. Electromagnetic waves are polarized in a high-frequency generator, that is, they are generated in the form of a wave whose vibration amplitudes are located in a certain plane.
6. In electromagnetic waves, like light waves, important phenomena consisting of interference, diffraction and dispersion can be observed.

Modern radio engineering devices allow conducting very clear experiments to observe the properties of electromagnetic waves. In

these experiments, it is optimal to use waves in the centimeter range, which are distributed by special generators of very high frequency (VHF).

Experiment 3. Propagation of Electromagnetic Waves

Electromagnetic waves propagate uniformly in all directions from the source of vibration in a homogeneous medium. But at the boundary of environments with different physical properties, the picture of the propagation of electromagnetic waves changes radically. An electromagnetic wave can partially pass from one medium to another, and partially return from the separation boundary and propagate in the first medium.

A surface oscillating at all points in the same phase is called an electromagnetic wave or an electromagnetic wave front. A line perpendicular to the wave surface is called a beam. Electromagnetic waves propagate in the direction of light. According to Huygens' principle, any point on the surface that is reached by an electromagnetic wave at the same time is a secondary point source of electromagnetic waves. All secondary electromagnetic wave surface is an electromagnetic wave surface at the next instant of time.

When an electromagnetic wave with a flat front falls on a flat surface at the boundary of two media, a returning electromagnetic wave appears. The angle between the vertical line and the beam passing through the separation boundary of the two media is called the angle of incidence of the electromagnetic wave. If the angle of incidence of the electromagnetic wave is different from zero, then the incident electromagnetic wave reaches different points of the separation boundary of the two media.

When students are introduced to the complex, the device shown in Figure 7 is assembled and explained with the main devices of the demonstration.

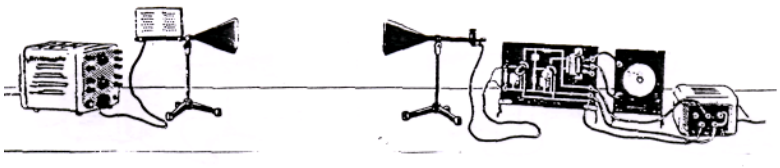


Fig.7

In the assembly process, it is explained that after assembling the device, which consists of a generator in 3 cm electromagnetic waves, a source, a sound frequency generator for changing electromagnetic waves, a receiver, an amplifier and a radio speaker, the amplifier is connected to the circuit, and after 30-40 *seconds*, the generator is connected to the source. After the klystron heats up, the receiver is placed at a distance of 1-2 *m* and the reception of the changed signals is observed.

After moving around the generator with the receiver, the radiation of directional electromagnetic waves is demonstrated. When the generator is turned on, the directivity diagram of the speaker antenna is drawn on the board. After replacing a simple dipole receiver with a loudspeaker antenna, the directional reception of the last electromagnetic wave radiated by the generator is demonstrated.

Experiment 4. Shielded Effect of Conductor

After connecting the generator, reception of electromagnetic waves radiating from it is observed. A metal screen is slowly inserted between the generator and the receiver space, and a gradual change in sound is observed at the receiver. If the screen completely blocks the generator speaker, reception is lost (Figure 8).

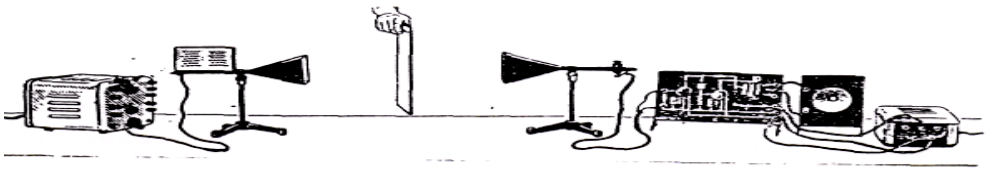


Fig.8

If instead of a metal screen, a screen made of plastic material is inserted, we observe that the electromagnetic waves

are received unchanged.

Experiment 5. Return of Electromagnetic Waves

The purpose of the experiment is to demonstrate the return of electromagnetic waves from the surface of the screen. For this, the device shown in the picture is assembled. After connecting the generator and amplifier, make sure that there is no reception in the receiver. An aluminum plate is included. As shown in the figure, by monitoring the reception, replacing the aluminum plate with steel and then with copper, it is demonstrated that the conductive layer reflects electromagnetic waves well. When the conductive plate is replaced by a dielectric plate, the return is shown to be much worse (Figure 9).

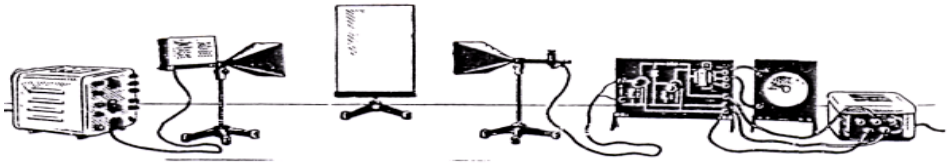


Fig.9

Experiment 6. Law of Return of Electromagnetic Waves

The device depicted in Figure 9 is assembled. The antennas of the generator and the receiver are set at an angle of 30°, lowered to the return plane, and the phenomenon of the return of electromagnetic waves is observed. By changing the angle of the antenna, it is ensured that there is no reception. The experiment is repeated by placing the antennas at an angle of 45° and 60°.Based on the experiment, it is concluded that the angle of return of electromagnetic waves is equal to the angle of incidence. The antenna of the receiver is turned in such a way that the plane of the axis of the wave transmitter, the axis of the wave transmitter of the generator, and the vertically incident beam transmitted from the point of incidence of the wave and the beam recovered from the point of incidence lie in the same plane.

Experiment 7. Collecting Property of Concave Mirror

The centimeter wave receiver without loudspeaker is placed at a distance of 60-80 cm from the generator. After connecting the generator, slow reception of the waves sent by the generator is observed. A Pictet mirror is placed at a distance of 20 cm from the receiver, and the sound of the received signal increases when it is brought closer to the receiver. Maximum sound is achieved when the receiver is placed at the focus of the mirror. Then, when the mirror is brought closer to the receiver, the sound decreases. The experiment confirms that when electromagnetic waves return from the surface of a metal mirror, they are collected at its focus.

Experiment 8. Refraction of electromagnetic waves

The generator and the receiver should be placed at an angle of 30°-40° from different sides of the quadrilateral prism so that the axes of the wave transmitters lie in a straight line. After connecting the generator, it is observed that there is no reception. The receiver is moved parallel to itself and reliable reception of transmitted signals is observed. The structure of electromagnetic waves passing through the prism is drawn on the board. When analyzing the result of the experiment, refraction of electromagnetic waves is observed at the boundary of two dielectrics.

It is felt that the angle of incidence of electromagnetic waves changes. Refraction is not observed in steeply falling waves. When the receiver is placed on the same side as the generator, at the boundary of two dielectrics, it is ensured that not only refraction of electromagnetic waves, but also partial return occurs.

Experiment 9. Lenses for Electromagnetic Waves

A receiver without a speaker and transmitter is installed in front of the generator at a distance of 80 - 120 cm. Turning on the generator, very slow reception of electromagnetic waves radiating from the generator is observed. When moving the receiver on the table, it is ensured that the reception volume does not increase. When re-installing the receiver, a plano-convex lens is inserted into the space between the generator and the receiver, as shown in Figure 10.

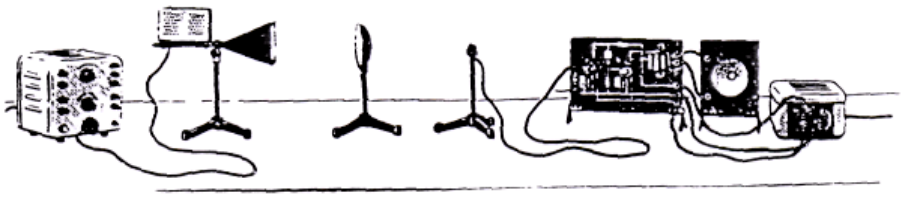


Fig.10

A rapid increase in sound is observed. When moving the lens on the table, it is ensured that there is a position where the sound will be loud. When pushing the receiver, it is observed that the sound is low only in one case. By replacing the convex lens with a concave lens of the same size, a reduction in sound is observed. In the experiment, the property of focusing electromagnetic waves in a convex lens and the property of propagation in a secondary concave lens is demonstrated (Fig. 10).

Experiment 10. Transmission of electromagnetic waves through a triangular prism

Electromagnetic waves radiating from the generator are recorded in a dipole with a receiver. After connecting the generator, the reception of a loud sound is observed. A triangular prism is inserted into the space between the generator and the receiver and the loss of reception is observed. The receiver is lowered to a lower level and the sound is re-received. The experiment confirms the refraction of waves under the influence of a prism. As a result of experiments, the structure of electromagnetic waves passing through the prism is drawn (Fig. 11).

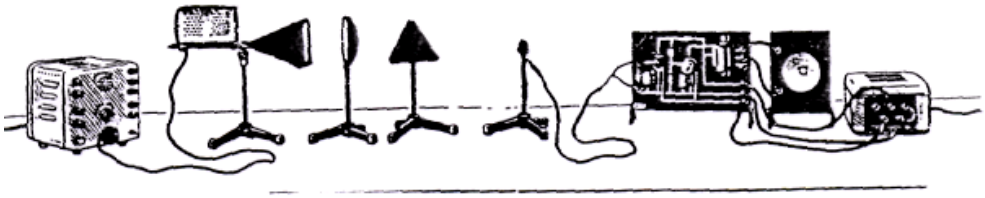


Fig. 11

Experiment 11. Interference of electromagnetic waves (Lloyd structure)

The purpose of the experiment is to show the interference of electromagnetic waves, which is much simpler to understand. For this, a device consisting of a generator and a receiver is assembled, and after assembling them, the reception of sound is observed in the change of signals. As shown in the picture, we put a metal plate on the edge of the table and gradually move it according to the direction of the arrow. In some cases of the plate, the reception is lost.

The loss of reception when the plate is removed shows that it depends on the plate. This experiment is similar to Lloyd's experiment in the optics department of physics.

Experiment 12. Interference of electromagnetic waves (Fresnel structure)

Two flat metal plates are placed on the table in such a way that one of them serves as a continuation of the other. At a distance of 60-70 *cm* from them, the generator is installed so that the axis of its wave transmitter passes through the junction of the plate. Let the angle between the wave plates be 20°-30°. The receiver is installed in the same way. In the experiment, it will be necessary to move the plates of the receiver in a circular arc around the junction point. When the device is dropped, the sound reception of the waves coming from the generator or returning from the plate is observed. The plates are brought together so that they form an angle equal to 180°. In this case, the sound does not change.

CONCLUSION

Thus, with this device, it is possible to demonstrate the return of electromagnetic waves, refraction, interference, diffraction, polarization of electromagnetic waves, as well as two-way communication.

REFERENCES

Курбонов М. Физикадан намойиш экспериментларининг услубий функцияларини кенгайтиришнинг назарий асослари, Монография.– Т.: Фан,

2008. –116 б.

Қурбонов М. Физикадан намойиш экспериментларини кўрсатиш жараёнида талабаларнинг ижодий қобилиятларини ривожлантириш. // Халқ таълими.– Т.: 2008. – 2. – Б.82–86.

Мирзахмедов Б.М., Ғофуров Н.Б., Тошмуҳамедов Ф.Ф. Физика ўқитишметодикаси курсидан ўқув эксперименти. –Т.: Ўқитувчи, 1989. – 112 б.

Махмутов М.И. Проблемное обучение. –М.: Педагогика, 1975.–367 с.

Махмутов М.И.Современный урок. –М.: Педагогика, 1985–184 с.

Махмутов М.И. Организация проблемного обучения в школе. –М.: Просвещение, 1977.–240 с.

Махмутов М.И. Теория и практика проблемного обучения.–Казань.: Тат.кн., 1972. –551 с.

Бегматова Д.А. Физика практикуми ишларини миқдорий баҳолашнинг дидактик асослари.: Пед. фан. номзоди дисс. автореф.–Т.: 2004.– 20б.

Бегимқулов У.Ш. Педагогик таълимда замонавий ахборот технологияларини жорий этишининг илмий–назарий асослари. –Т.: Фан, 2007. – 105 б.

Makhmudov Yusup Ganievich, Boymirov Sherzod Tuxtaevich. Types of Positive Communication in the Problematic Teaching of Physics in Secondary Schools // Academicia Globe: Inderscience Research. 2022. - 241-243 p.

Boymirov Sherzod Tuxtaevich, Gayibnazarov Rozimurod Bakhtiyorovich, Axmedova Manzura Gulomjonovna, Berdikulova Shakhsanam Umaralievna, Saparova Gulmira Bakhtiyarovna. Principles of Selection of Materials on the Problem Method of Teaching Physics in Secondary Schools // Texas Journal of Multidisciplinary Studies, 2022. - 283-288 –p.

Makhmudov Yusup Ganievich, Boymirov Sherzod Tuxtaevich. Step-By-Step Processes of Creative Activity of Students in ProblemBased Teaching of the Department of Physics “Electrodynamics” in Secondary Schools // Eurasian Journal of Learning and Academic Teaching, 2022. 132-135 –p.

Boymirov Sherzod Tuxtaevich, Gayibnazarov Rozimurod Bakhtiyorovich, Axmedova Manzura Gulomjonovna, Berdikulova Shakhsanam Umaralievna, Muminjonov Sadiqbek Ikromjonovich. The Role of Problematic Types of Physics Questions in Directing the Reader to Creative Activity // The Peerian Journal, 2022. 54-58 –p.

Ashirov Shamshiddin, Mamatov Abdurayim, Boymirov Sherzod, Sattarkulov Komil, Daminov Rahim. Development of problem technology of teaching in physics // European Journal of Research and Reflection in Educational Sciences. 2019.

Yusuf Makhmudov, Sherzod Boymirov. Educational and creative activity of the student and technology of its management in problem teaching of physics // European Journal of Research and Reflection in Educational Sciences. 2020.

Boymirov Sherzod, Ashirov Shamshiddin. Principles Of Selecting Materials For Problem Based Training In The Section Electrodynamics Physics // Solid State Technology. 2020. 5213-5220 –p.

Sherzod Boymirov, Shamshiddin Ashirov, Alijon Urozbokov, Abduraim Mamatov, Olimjon Xolturayev. Increase the creativity of students by creating problem situations when teaching the physics mechanics section // Asian Journal of Multidimensional Research (AJMR). 2021. 247-253 –p.

Sherzod Boymirov, Shamshiddin Ashirov, Alijon Urozbokov, Abduraim Mamatov, Islom Shermatov. The effect of using interactive methods in teaching physics // ACADEMICIA: An International Multidisciplinary Research Journal. 2021. 962-971 –p.

Sherzod Tuxtayevich Boymirov. PRINCIPLES OF MATERIAL SELECTION IN PROBLEM TEACHING OF ELECTRODYNAMICS // Scientific Bulletin of Namangan State University. 2020. 362-368 –p.