Development of the physical world view of students in general system of education of optical engineers

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ABSTRACT

Optimum choosing of the educational conception, variety of the teaching methods, earlier attraction of student's interest to research work, controlling of the level of knowledge allow to form and to develop the physical world view (PWV), that will be depend, expended, concretized in following work.

1. INTRODUCTION

One of the basic problem of the fundamental optical education is training of optical engineers and optical researchers of high qualification for constructing, for usage of high precision, rapidly working, undestructable, automatic devices by studying physical objects on different levels: cosmic, molecular, atomic, electronic, nuclear. Succesful decision of this task is closely connected with organization of material and technical base, with a system of student's training. This problem acquire special actuality in connection with increasing demands to student's education.

2. PHYSICAL WORLD VIEW AND IT'S DEVELOPING

Optical engineers and optical researchers in the conditions of modern optical-mechanical production, construction office, scientific research institution must have fundamental physical education, deep knowledge about abilities of used devices, constructive habits on their improving, and for researchers - to have physical intuition virtuosly of an experimentator. Moreover one must constantly deep and fill up one's knowledge.

The development of the PWV in the total system of optical education has an important part in educational process. PWV means general scientific system of notions about physical objects based on the knowledge abilities of use the main physical ideas and laws, on the deep interest to the studying of modern physical picture of the world, on the wide usage of methods of physical and mathematical modelling, on the development of physical thinking.

The construction of the PWV is a complicated dialectical process It is supposed that one is succession in training of physics courses, consistency introducing and deepening of physical models, determinating of it's applied boundaries, keeping and systematizing of knowledge.

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Our experience of teaching for many years of courses of common physics and physical optics showed, that consistent introduction and usage of molecular-kinetic and electronic notions on the structure of matter allows to explain physical processes in objects without cotradictions in courses of molecular physics, electricity, optics, atomic physics and in special courses on high qualitative and on quantitative levels in many cases. And one can go on to quantum notions more sequently in total.

The Lorents classical electronic theory is the most striking example of usage of electronic notions in optics. It is based on the consideration of interaction of ensemble of electrons and their viscosity motion in the medium. So dielectrics are considered as continum of oscilators, making forced vibrations under the influence of light wave. Complex refractive index will be founded by solving linear differential equation and introducing of notions as vector of polarization and dielectric constant. Real part of the complex refractive index is determined by velocity of lidht wave propagation and imaginary part is determined by absorbing of light. So, the optimum choice of initial educational conseption is to be conditioned by ability of revealing of physical essence of the processes and phenomena.

The structure of educational material can be introduced from basic notions, laws and theory, from experimental data and historical information. There is an essence of this components in the tabl. 1.

Tabl. 1. Analysis of educational material components

Basic notions	Theory - laws	Experiment
1. Phenomenas, objects	1. The definition of physical values	1. Observation of the phenomenas and objects
2. Properties	2. Functional dependence of values	2. Experimental verification, the measure of values
3. Physical values	3. Cause and effect dependence of values	3. Practical applications

It is necessary to reveal prelimanary essence of the basic notions and their correlation for students. Then physical laws, which established functional and causal and effective correlation of basic notions are represented. The rezults and corollary established in the theory must be tested by experiment or by comparision with the earliest data.

One can suggest the breaking up of the material on the next components for deeper teaching of physical theory, tabl. 2.

It is necessary to point up the place of every theory within the fundamental theory bounds. The interact conception must have been initial in this case.

Tabl. 2. The substance and hierarchy of physical theories

Substance	Scale distances, sm	Typical phenomena	Part of physics
1. Facts 2. Hypothesis 3. Models 4. Regularity and laws 5. Cosequences and estimations 6. Experimental verification	1. $10^{23} - 10^{-6}$ 2. $10^{-6} - 10^{-11}$ 3. $10^{-8} - 10^{-13}$ 4. $10^{-11} - 10^{-15}$	1. Moving of planets and bodyes on the Earth 2. Moving of electrons in atom 3. Interaction between electrons and photons 4. Conversions of high-energy particles	1. Classic mechanics 2. Quantum mechanics 3. Quantum electrodynamics 4. The Theory of strong and weak interaction

The quality differences between form of material moving have to be depend on interact and scale of space kinds hierarchy of scale distances is the cause of the hierarchy of forms of material moving, that is direct to hierarchy of fundamental physical theoryes [1].

It is necessary to note, that new theory appears when there are large contradictions between consequences of the theory and experimental datas. Every theory may be estimated at historical, applied, oecological and world view significance.

Impotant components of education of PWV are both substance of education, variety of teaching methods and showing interest of students to knowledge. Traditional methods of teaching such as lectures seminars, laboratory works, test-works must be varied with elements of business games, with tasks on composing physical problems, with computer modelling of physical processes. Quality, graphic and estimating problems must be videly used on the practical lessons and seminars parallely with analytical physical problems. Not only memory, but such habits as thiking, physical thinking are working.

Moreover it helps to learn real structural and time scale of physical values. It is necessary to give problems of different complexity for a good combination of colletive forms of student's education and individual forms of perception.

The earler attracting of students to scientific investigations, to work without assistance, to study the bibliography, to give

students possibilities to master scientific methods of research, discussion of the received rezults.

Participation in seminars and conferences with instructors, the abilities of work on probation and entrance to post-graduate student ship in leading scientific centres maintains an student's interest in optics education, to studying the physical picture of the world.

Existence of scientific school, possibility of attaching student to professors at senior courses allow to deep specialization and individualization of education.

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4. APPENDIXES

There is working program the course of Optics in general physics It consists of lectures (56 hours), seminars and practical lessons (62 hours), laboratory works (32 hours).

T H E M E S	Lectures hours	Seminars hours
1. Introduction. Subject of Optics. Historical review.		
2. The fundamental properties of light (wave and corpuscular properties). Photometry.	6	4
3. Interference of light: notion, methods of observation and conditions of obtaining, applications.	10	10
4. Difraction of light: kind of difractions, principle of Fresnel, zones of Fresnel, difraction grating, difraction of X-ray. Applications.	8	8
5. Geometrical optics: laws of reflection and refraction, Ferma-principle, lenses and mirrors, aberrations, optical phenomenas in the nature, applications.	6	10
6. Polarization of light: notion, wave theory explanation, produce of polarised light, applications.	6	6

T H E M E S (continuation)	Lectures hours	Seminars hours
7. Dispersion, absorbtion, diffusion of light: laws, experimental observation, nature phenomenas, applications.	6	8
8. Theory of relativity; experimental foundation, applications.	4	2
9. Thermal radiation: experimental observation, nature phenomenas, laws, applications.	4	6
10. X-ray radiation:receiving, properties, laws, applications.	2	4

5. REFERENCES

1.V. Multanovskii, " Physical interaction and physical picture of tne world in school course of physics ", Enlightenment, Moscow, 1977.