

**OPINION**  
**of a dissertation**  
**for the acquisition of the educational and scientific degree "PhD"**  
**in a professional direction 1.3. Pedagogy of education in ..., doctoral program**  
**"Methodology of education in physics",**  
**by defense procedure at the Faculty of Physics (FzF)**  
**of Sofia University "St. Kliment Ohridski" (SU)**

The review was prepared by: Associate Professor Iliana Ognyanova Petkova, lecturer at the Faculty of Pedagogy of SU "St. Kliment Ohridski", in my capacity as a member of the scientific jury according to Order No. RD 38 - 617 / 20.11.2023 of Rector of Sofia University.

**Thesis: "COMPARATIVE ANALYSIS OF THE EDUCATIONAL CONTENT IN ATOMIC PHYSICS IN DIFFERENT COUNTRIES"**

**Author of the dissertation: KONSTANTIN PLAMENOV ILCHEV**

**I. General description of the materials gave.**

**1. Particulars of documents submitted.**

The candidate Konstantin Plamenov Ilchev has presented a dissertation and an Autoreferat, as well as the mandatory tables for the Faculty of Physics by the Regulations on the terms and conditions for acquiring scientific degrees and occupying academic positions at Sofia University "St. Kliment Ohridski". There are also 11 other documents in the form of: 1) dissertation, 2) autoreferat in Bulgarian and English, 3) author's contribution reference, 4) declaration of authorship, 5) CV, 6) order for enrollment, 7) order for deduction, 8) application, 9) certificate from the Dean of the Faculty for the past exams from the individual plan, 10) protocol from checking the originality of the dissertation, 11) opinion from an expert on the Report in relation to the procedure for preventing plagiarism in dissertations.

The documents submitted by the applicant comply with the requirements of The Law on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its Implementation and the Regulations on the terms and conditions for acquiring scientific degrees and occupying academic positions at Sofia University "St. Kliment Ohridski".

## **2. Candidate data**

The candidate was born in 1988 in Bulgaria. In the period 2007-2012, he received his Bachelor's degree and Master's degree in Theoretical Physics from the University of Innsbruck, Austria. In the period 2017-2019, he graduated from the Faculty of Physics at Sofia University "St. Kliment Ohridski" in the Master's program "Methodology of Education in Physics and Astronomy", which gives him the necessary competencies to work in the field of education.

## **3. General characteristics of the candidate's scientific achievements**

The presented dissertation is aimed at 3 research fields of pedagogic science - 1. Didactics, 2. Methodology of physics education and 3. Comparative education.

Didactics as a science explores the process of learning and answers such basic questions as: Why? For whom?, What?, How? and What is the result of a carried out training?. The answer to each of them is of utmost importance for the training to be quality and successfully constructed. With the question What? the learning content is linked. The competences we strive to form in students are looked for and set in each subject, for each class. The state educational standards and the planned curricula set the thematic focus and determine the accents to be realized in the teaching of the educational content. On this current and extremely difficult didactic problem the doctoral student has focused his attention by specifying it in the direction of physics education. The PhD student has realized that of particular importance is not only the good knowledge of the educational content, here specifically in atomic physics in the first high school stage, but also the methods by which it's realized. This symbiosis of "learning content-methods" is one of the main problematic fields in didactics. What will be included in physics education as a curriculum is an extremely important and current problem. Any attempt to explore and find a more compelling and age-appropriate representation and content optimization is an achievement.

The dissertation will also enrich comparative studies through the analyses of 1) the results of international research on PISA and TIMSS, 2) TIMSS and TIMSS Advanced and 3) the curricula in atomic and subatomic physics.

The presented scientific publications included in the dissertation meet the minimum national requirements (under Art. 2b, para. 2 and 3 of The Law on the Development of the Academic Staff in the Republic of Bulgaria) and respectively with the added requirements of Sofia University "St. Kliment Ohridski". Kliment Ohridski" for acquiring the educational and scientific degree "PhD" in professional field 1. Pedagogical Sciences.

The PhD student has popularized the results of his dissertation study in 8 publications on the topic as: in 3 of them he is the only author, in 3 - the first co-author, in 1 – second and in 1 – 4th co-author. Four of them are in Bulgarian and 4 in English, 3 are presented at national conferences, 1 at international and 3 are printed in international journals. Konstantin Ilchev has presented a reference

through which he has certified that he has met the additional recommended criteria of the Faculty of Physics by having 2 publications in Group II in editions that are referenced and indexed in world-famous databases of scientific information (Web of Science and Scopus), 2 publications with a significant contribution as one is from Group II. He has participated in 8 scientific forums, in which 4 he has presented a report.

For each of the three similarity coefficients, the plagiarism prevention system reported indicators well below the corresponding %.

#### **4. Characterization and evaluation of the applicant's teaching activities (if required in the PURSU for this)**

There is no attached to the submitted documents a characteristic and assessment of the realized teaching activity of the doctoral student.

#### **5. Meaningful analysis of the scientific and applied achievements of the candidate contained in the materials for participation in the competition.**

In the dissertation presented for analysis one can find innovation in the structuring of the text. Each of the theoretical chapters is constructed in an introduction or motivation to include relevant information; research questions; description of the study and methods; analysis of the results and conclusions made, or trends inferred. This makes the text logically sound and extremely well structured. The results of the analyses are illustrated in figures and diagrams and perfectly structured in tables.

The scientific achievements of the PhD student are in two aspects: theoretical – 1) presentation of the specifics of the educational systems in different countries and derivation of 23 content indicators for comparative analysis of the curricula in atomic and subatomic physics; 2) Bringing out 6 key signs of comparison of the content of publications in the field of training methods; 3) creation of a methodology for quantitative measurement of students' knowledge by seeking the impact of the interactive teaching methods applied by the teacher on the academic issues of atomic and subatomic physics. In practical terms – 1) a comparative analysis of the curricula in atomic and subatomic physics has been carried out according to the specified indicators between Bulgaria, Poland, Slovenia, Lithuania, Estonia, Norway, Canada (province of Alberta), Australia (Queensland), Japan and Singapore; 2) 45 publications in Scopus in the fields of Physics and Astronomy and 69 articles in ERIC in the field of Physics were analyzed according to the 6 criteria and 3) a pedagogical experiment was conducted with 48 students from 4 classes of the 10th grade in a private language school on 4 specific topics of the curriculum in atomic / nuclear physics. The measurement of students' knowledge was conducted through the students' entrance and exit tests and author's tests for intermediate and final assessment were also created. The data are thoroughly analyzed, and the conclusions drawn, and trends formulated, can be the starting point for discussions and future research.

## 6. Critical remarks and recommendations

I recommend that all the methods used in the dissertation be presented in the introduction as well. Currently, this has been done on the individual chapters. The abstract presents fully and accurately the content of the dissertation.

To reformulate the purpose of the study by focusing on optimizing the learning process through better structuring of the learning material and effective training methods.

## 7. Personal impressions of the candidate

I have no personal impressions of the candidate, but through the presented dissertation he demonstrates qualities and skills such as responsibility, organization, thoroughness, critical thinking, creativity, etc.

## 8. Conclusion

After getting acquainted with the presented dissertation, abstract and additional materials, and based on the analysis of their significance and contained in them scientific and applied scientific contributions, **I confirm** that the scientific achievements meet the requirements of the Law and the Rules for its application and the relevant Rules of Sofia University "St. Kliment Ohridski" for **acquiring the educational and scientific degree "PhD"**. In particular, the candidate Konstantin Ilchev meets the minimum national requirements in the professional field and no plagiarism has been established in the dissertation, abstract and scientific papers submitted to the competition.

I give my **positive** assessment of the dissertation.

## II. GENERAL CONCLUSION

Based on the above, **I recommend** the scientific jury to award the **educational and scientific degree "PhD"** in professional field 1.3. Pedagogy of training in ..., doctoral program "Methodology of Physics Education" of Konstantin Plamenov Ilchev.

05.01.2024 г.

Assoc. Prof. Iliana Petkova: .....