



**To the Scientific Jury
of the procedure for Professor of Physics
at the Faculty of Forest Industry,
University of Forestry**

OPINION

by Assoc. Prof. Nikolay Ivanov Minkovski Ph.D.,

University of Forestry, Faculty of Forest Industry, Department of Mathematics, Physics and Informatics

of the materials submitted for participation in the procedure for appointment on the academic position of "professor" in a professional field 4.1. Physical sciences, scientific specialty "Electrical, magnetic and optical properties of condensed matter (multiferroic properties of bulk samples and nanomaterials)", in the discipline "Physics with Biophysics",

The procedure for appointment on the academic position "professor" in Physics is promulgated in the SG, issue 102 / 8.12.2023, procedure code: WWI-P-1123-112 and on the website of University of Forestry for the needs of the Department of Mathematics, Physics and Informatics, as an applicant participates Assoc. Prof. **Iliana Naumova Apostolova** Ph.D. from the same department.

1. Brief biographical data for the applicant

Assoc. Professor Apostolova graduated from the University of St. Kliment Ohridski", Faculty of Physics in 1993 as a Master in Solid State Physics. Then, until the end of 1994, he also graduated as a physics teacher. In the period 2010-2012, she was a doctoral student of independent training at SU "Kliment Ohridski", Faculty of Physics, Department "Physics of Solid State and Microelectronics". In 2012, she successfully defended her dissertation on the topic "Static and dynamic properties of magnetic and multiferroic nanoparticles" and obtained the scientific and educational degree "DOCTOR". For one year she worked as a teacher in 54 Secondary School "ST. Ivan Rilski", and since 1996, after a competition, she has been working at the University of Forestry. She successively held the positions of assistant, senior assistant and chief assistant. In 2015, she won a competition for an "associate professor" at University of Forestry, Faculty of Forest Industry, Department of "Mathematics and Physics" and has been working as such until now.

2. General description of the submitted materials

The applicant Assoc. Prof. Iliana Apostolova participates in the procedure with:

- Teaching aids - 1 piece ("Tests in Physics and Physics with Biophysics for University of Forestry students");

- Textbooks - 2 books; ("Physics with Biophysics", "Physics with Biophysics for Ecologists")
- Books - 0 issues;
- Studies - 0 issues;
- Monographs - 0 issue but participates with 11 publications in journals with Impact factor;
- Publications - 47 issues and all are in international journals with impact factor and Q rank, most publications are in such prestigious journals as Solid State Communications, Physica Status Solidi B, Physics Letters A, Modern Physics Letters B, European Physical Journal B, Physica E, Journal of Magnetism and Magnetic Materials, Journal of Alloys and Compounds, Nanomaterials, Applied Sciences.

Regarding the fulfillment of minimum requirements of the Ministry of Education and Science and University of Forestry for the scientific and teaching activities of the candidates for the academic position "professor" in area 4. Natural sciences, mathematics and informatics and professional direction 4.1. Physical sciences - they are fulfilled by all indicators, the total requirement is 600 points, and Associate Professor Apostolova has presented evidence for 2109 points.

3. Reflection of the candidate's scientific publications in the literature (known citations)

The results of Assoc. Prof. Apostolova's scientific work have been widely cited in scientific periodicals, especially in recent years. The articles that have been submitted for participation in the competition have been cited 414 times so far, and all the citations are in journals with an impact factor and Q rank. Some of the articles are cited multiple times, for example, there are articles cited, 60 times ("Origin of ferromagnetism in transition metal doped BaTiO₃"), 27 times, 24 times. This means that Assoc. Prof. Apostolova is an established scientist in this field and her articles are widely recognized in the international scientific community. As a fact, you confirm my conclusions, it can be pointed out that in Scopus the Hirsch index for Assoc. Prof. Apostolova is 13. This is a very good recognition by the world scientific community for the value of her scientific publications.

4. General characteristics of the applicant's activity

4.1. Educational and teaching activity (work with students and Ph.D. students)

Assoc. Prof. Apostolova is an established teacher of physical and biophysical disciplines taught at University of Forestry. In recent years, she is the author of 2 textbooks and one textbook "Tests in Physics and Physics with Biophysics for the students of University of Forestry ". She prepared a new course for the students of the specialty Ecology and Environmental Protection - Noise and Vibration Protection. She has prepared and gives lectures for more than 10 years in the discipline "Physics with Biophysics" for the students of the specialty "Veterinary Medicine" and the specialty "Ecology and Environmental Protection". She develops a test system for testing. She is the author of several new exercises for the physical practicum. During all the years as a teacher at the University of Forestry, Assoc. Prof. Apostolova always had a full workload of over 360 classroom hours.

4.2. Scientific and scientifically applied activity

The scientific activity of Assoc. Prof. Iliana Apostolova is concentrated in the theoretical study of magnetoelectric interactions to explain the properties of multiferroic nanomaterials. These materials promise great application, and therefore the scientific results are relevant and important. The causes of spin-induced polarization of multiferroics have been theoretically investigated. The influence of doping multiferroics as nanoparticles was investigated. For example, BaTiO₃ with Fe, YCrO₃ with Mn or Gd, LuFeO₃ and LaFeO₃ doped with Sm, YFeO₃ with Sc, BiFeO₃ with Tb and others. In the scientific articles of Assoc. Prof. Apostolova, important results were obtained for "Room-Temperature Magnetism" and "Room-Temperature Multiferroism" in doped magnetic and multiferroic nanoparticles, such as SnO₂, In₂O₃, CuAlO₂, FeS₂, Bi₂Fe₄O₉, Fe₃O₄. Research in the field of self-controlled magnetic hyperthermia is a good basis for application in modern medicine. Thus, experimenters can successfully select suitable magnetic nanomaterials. Theoretically, important data were obtained for determining *SAR* (specific absorption rate) - a basic parameter for successful medical applications. Some of the scientific articles are devoted to the phonon spectra of multiferroics and magnetic nanomaterials, with particular attention paid to the influence of doping.

The general impression is that Assoc. Prof. Apostolova is conducting a multifaceted theoretical study of nanoscale multiferroics, which will be essential for their future application.

Iliana Apostolova also participates in several scientific and scientific-applied projects, where she uses her experience as a theoretical physicist.

4.3. Implementation activity

I have no information of innovative activities such as patents, new products or brands. I assume that the scientific projects in which Assoc. Prof. Apostolova is a participant can lead to results of certain practical interest and the possibility of registration as a patent or utility model, for example the project "Explanation and development of the new effects discovered by us in nanoscale ordered organic films for development of nanocomposite chemical sensors for rapid, real-time, field-based gas measurements and monitoring of emerging organic contaminants in drinking water".

4.4. Contributions (scientific, scientific and applied, applied)

In the scientific articles with which Assoc. Prof. Apostolova participates, the main scientific contribution is the creation of theoretical models that explain the appearance of multiferroism in nanoscale structures. On their basis, the processes in multiferroics at the microscopic level are qualitatively explained. This enables volume and surface effects to be successfully analyzed. Theoretical models have been applied to explain the properties of doped multiferroics with various impurities. A significant contribution is the theoretical study of a large number of compounds with a view to their future application in medicine for local tissue heating based on the use of magnetic nanoparticles. With an alternating magnetic field, they induce self-consistent magnetic hyperthermia. All theoretical models and their results are supported by appropriate

experimental results proving their credibility. These models further enrich our knowledge and approaches in the study of electrical, magnetic and optical properties of condensed matter.

5. Assessment of the personal contribution of the applicant

Assoc. Prof. Apostolova is a very active member of a scientific group under the leadership of Prof. Wesselinowa. In the last 15 years, this group has established itself as the main theoretical generator of many new scientific ideas in the field of multiferroics and nanomaterials. As a member of this group, Assoc. Prof. Apostolova made an indisputable contribution. She is a very good specialist in numerical modeling of processes and effects in nanoscale structures, and without her active participation this scientific group would hardly have been such a significant factor in the theory of condensed matter, i.e. here we can talk about creating a scientific school.

6. Critical notes - I have no critical remarks.

7. Personal impressions

I have known Associate Professor Iliana Naumova Apostolova for almost 30 years. My impressions of her work as a teacher and as a scientist are very good. I have watched her grow from assistant to associate professor. I have excellent impressions of her work with students. As a scientist, she has seen great growth in the last ten years. It can now be confidently asserted that she is a very good theoretical physicist in the field of condensed matter and in particular multiferroics, nanomaterials, thin layers, graphene-like structures. Her doctoral dissertation is on a similar topic, i.e. there is consistency and continuity of its scientific development.

8. Conclusion:

Bearing in mind the above, I propose that Assoc. Prof. Dr. Iliana Naumova Apostolova be elected as a "professor" in the field of higher education 4. Natural sciences, mathematics and informatics by professional direction 4.1. Physical sciences, scientific specialty "Electrical, magnetic and optical properties of condensed matter (multiferroic properties of bulk samples and nanomaterials) for the needs of the University of Forestry.

8.04.2024

Assoc. Prof. Nikolay Minkovski Ph.D.