

# **REVIEW**

by Dr. Emilia Mitkova Mihaylova

Scientific specialty: Electrical, magnetic and optical properties of condensed matter

Professor of Physics at the Agricultural University Plovdiv

of the materials submitted for participation in the competition to

occupy the academic position "Associate Professor"

at Paisii Hilendarski University of Plovdiv

in the field of higher education: Natural sciences, Mathematics and Informatics

professional field: Physical Sciences (Physics of wave processes)

Chief Assistant Dr. Aneliya Dakova-Mollova from the "Physics" department at the "Faculty of Physics and Technology" of Plovdiv University "Paisii Hilendarski" is a candidate for the "Associate Professor" position, announced in the State Newspaper, No. 96 of 17.11.2023 and on the website of the University of Plovdiv "Paisii Hilendarski" for the needs of the "Physics" department at the "Faculty of Physics and Technology".

## **1. General presentation of the received materials**

### **Subject:**

By order № ПД-21-386 dated 16.02.2024 of the Rector of Plovdiv University "Paisii Hilendarski" (PU) I have been appointed as a member of the scientific jury of a competition for the academic position of "Associate Professor" in the PU in the field of higher education Natural Sciences, Mathematics and Informatics, professional field Physical Sciences (Physics of wave processes), announced for the needs of the "Physics" department at the "Faculty of Physics and Technology".

For participation in the announced competition, documents were submitted by a single candidate: Chief Assistant Dr. Aneliya Dakova-Mollova from the Department of Physics at the Faculty of Physics and Technology of Paisii Hilendarski University of Plovdiv. The set of paper materials presented by Chief Assistant Dr. Aneliya Dakova-Mollova is in accordance with the Regulations for the Development of the Academic Staff of the PU, and includes the following documents:

1. Application form to the rector for admission to participate in the competition;
2. Resume in European format;
3. Diploma of higher education with acquired educational and qualification degree "master";
4. Diploma for educational and scientific degree "doctor";
5. List of scientific works;
6. Scientific works (copies of publications);
6. List of citations;
7. Certificate of compliance with the minimum national requirements;
8. Annotations of the materials under Art. 65. from PRASPU (in Bulgarian and a foreign language) with extended habilitation certificate;
9. Self-assessment of contributions;
10. Declaration of originality and authenticity of the attached documents;
11. Certificate of work experience;
12. Documents for academic work;
13. Documents for scientific research work;
14. Documents according to the additional requirements of the relevant faculty
15. Other documents.

The candidate Chief Assistant Dr. Aneliya Mincheva Dakova-Mollova has submitted a total of 25 scientific works. The submitted publications for participation in the competition for the academic position of "Assistant Professor" were developed after the acquisition of the degree "Doctor" and after the occupation of the academic position of "Chief Assistant". All publications for the competition are in journals that are referenced and indexed in world-renowned databases of scientific information (Web of Science and/or Scopus).

The candidate Ch. Assistant Aneliya Mincheva Dakova-Mollova, PhD, has participated in 6 research projects, one of which is international, one is national and 4 are university projects. She was the manager of two university projects from the "Partial Funding" competition. Ch. Assistant Dr. Aneliya Mincheva Dakova-Mollova is currently participating in an international consortium.

## **2. Brief biographical data of the applicant:**

- From 2022 to now - Chief Assistant, Institute of Electronics - BAS;
- From 2017 to now - Chief Assistant, Plovdiv University "Paisii Hilendarski";
- From September 2016 to December 2022 - Physicist, Institute of Electronics - BAS;
- From September 2011 to August 2015. – Assistant, Plovdiv University "Paisii Hilendarski";
- October 2010 – May 2011 – Honorary lecturer, Paisii Hilendarski University of Plovdiv;
- February 2010 - June 2010 - Honorary lecturer, Paisii Hilendarski University of Plovdiv.

Ch. Assistant Aneliya Mincheva Dakova-Mollova, PhD, has significant scientific and teaching experience in connection with the announced competition.

## **3. General characteristics of the applicant's activity**

### **Assessment of the candidate's educational and pedagogical activities:**

As of April 1<sup>st</sup> 2024 Ch. Assistant, Dr. Aneliya Mincheva Dakova-Mollova, has more than 12 years of teaching experience at the University of Plovdiv (PU), of which more than 7 years as a "chief assistant".

**The academic competence of the candidate by professional direction 4.1. Physical Sciences, specialty in Physics is undoubted.**

Chief Assistant Dr. Aneliya Dakova-Mollova:

- **led the following seminar/laboratory exercises:**

1. Exercises in Waveguide and nonlinear optics;
2. Exercises on Femtosecond optics;
3. Exercises on Fiber optics and optical communications/Fiber-optic communication systems;
4. Exercises on Optical communication systems;
5. Exercises on Photonic methods for recording and processing information/Optical methods for processing information;
6. Exercises on Laser Technologies in Medicine;
7. Seminar exercises in Optics;
8. Laboratory exercises in Optics;
9. Seminar exercises on Mathematical methods in physics;
10. Seminar exercises in Theoretical Physics 1 part;
11. Laboratory exercises in Mechanics;
12. Laboratory exercises in Molecular Physics;
13. Laboratory exercises in Physics;
14. Laboratory exercises in Physics 1;
15. Laboratory exercises in Physics 2;
16. Laboratory exercises on Electricity and magnetism.

- **developed curricula and lecture courses for the following academic disciplines at the Plovdiv University:**

1. Bachelor program in Fiber Optics and Optical Communications;
2. Bachelor's program in Optical Communication Systems for the specialty;
3. Bachelor's program in Optical Methods in Medicine for the specialty;
3. Bachelor's program in Optical methods for information processing for the specialty Telematics;
4. Bachelor's program in Photonic methods for recording and processing of information;
5. Master's program in Waveguide and Nonlinear Optics;

6. Master's program in Femtosecond optics;
7. Master's program in Photonic technologies for recording and processing of information.

- **developed 7 electronic courses (one of which is co-authored in English);**
- **supervised 15 graduates who successfully defended the Bachelor's degree;**
- **she supervised 3 graduates who successfully defended the Master's degree.**

### **Evaluation of the candidate's scientific and scientific-applied activity**

#### **Scientific experience:**

As of April 1<sup>st</sup> 2024 ch. Assistant Professor Aneliya Mincheva Dakova-Mollova, PhD, has more than 12 years of scientific experience. During this time, she actively participated in research projects as follows:

- Ch. Assistant Professor Aneliya Mincheva Dakova-Mollova participated in 1 international research project: Chain Reaction: A Sustainable approach to Inquiry Based Science Education, Funding organization: European Commission, Type of competition and year: FP7, 2013, Project number or acronym: No. 321278. Project manager: Prof. Dr. Zhelyazka Raykova. Project duration: 2013-2016. Project status: (completed)
- • Ch. Assistant Professor Aneliya Mincheva Dakova-Mollova participated in 1 national research project on the topic: "Nonlinear interaction and polarization effects of ultra-short laser pulses in dielectric media" with a funding organization: Scientific Research Fund to MES - number DN18/11. Project leader: Prof. Dr. Lyubomir Kovachev. Project duration: 2018-2021 Status: (completed)
- Ch. Assistant Professor Aneliya Mincheva Dakova-Mollova, PhD, participated in 2 university research projects:
  - o Participant in university project MU21-FtF-003 on the topic: Nano- and micro-sized polymer structures as carriers of biologically active substances. Funding organization: Scientific research fund at PU 2 "Paisiy Hilendarski". Type of competition and year: "Young scientists and doctoral students" 2021/2022. Project leader: Assoc. Dr. Maria Marudova-Zhivanovich. Project duration: 2020-2022 Project status: (completed)

o Participant in university project FP-17FF-010 on the topic: Complex approach to the study of physical and engineering aspects of ecologies, Funding organization: Scientific Research Fund at PU "Paisiy Hilendarski", 2017-2018. Project manager: Dr. Dragomir Gospodinov. Project duration: 2017-2018 Project status: (completed)

- Ch. assistant professor, Dr. Aneliya Mincheva Dakova-Mollova, was the manager of two university projects from the "Partial funding" competition for organizing national student scientific conferences in physics and engineering technologies with a deadline of 2018 and 2019, respectively.

- Ch. Assistant Professor Aneliya Mincheva Dakova-Mollova is currently participating in an international consortium: Scientific Research Infrastructure "Extreme Light" ELI-ERIC-BG to ELI "Extreme Light Infrastructure", part of the European Road Map (ESFRI). Chairman of the Board of ELI-ERIC-BG: Prof. Dr. Lubomir Kovachev.

**The candidate in the competition has submitted a sufficient number of scientific articles to occupy the academic position of "Associate Professor". The scientific qualification of Assistant Professor Dr. Aneliya Mincheva Dakova-Mollova is undoubted.**

For participation in the competition, 25 scientific articles are presented in publications that are referenced and indexed in world-famous databases with scientific information (Web of Science and Scopus). Of these articles, one is in a journal with Scopus quartile Q1, ten are in journals with quartile Q2, four are in journals with quartile Q3, four are in journals with quartile Q4. Fifteen articles have been published in journals with an SJR indicator. All publications are in English. All posts are co-authored.

### **Contributions (scientific, scientific-applied, applied) and citations**

In the presented by Ch. assistant professor, Dr. Anelia Mincheva Dakova-Mollova works, the main scientific researches with significant personal contributions (the candidate is the first author of 8 scientific publications) are in the field of Physics of wave processes in three directions:

*First direction:* Soliton mode of propagation of optical pulses in non-linear dispersed media. The most significant contributions of the candidate in this direction are:

- The evolution of broad-spectrum laser pulses propagating in single-mode optical fibers with normal dispersion was studied. A new analytical solution of the nonlinear amplitude equation in the form of a dark soliton has been found. The resulting solution differs significantly from the standard soliton solution of the nonlinear Schrödinger equation [G7-14].
- A solution for a single bright highly dispersive optical soliton was obtained by means of the semi-inverse variational principle applied to the perturbed Kudryashov equation [G7-11].
- The formation of highly dispersive dark optical solitons was investigated using the Laplace-Adomian decomposition method [G7-1].
- A solution to the perturbed Fokas–Lenells equation for cubic-noquartic light optical solitons was found [G7-10].
- Cubic-quartz optical solitons were obtained based on the perturbed Fokas–Lenells equation in polarization-preserving and birefringent fibers [G7-12].

*Second direction:* Four-photon parametric processes and energy exchange between laser pulses and their components in nonlinear dispersed media. The most significant contributions of the candidate in this direction are:

- The influence of degenerate four-photon parametric processes on the dynamics of three types of vector solitons - circularly, linearly and elliptically polarized - and the periodic exchange of energy between elliptically polarized waves was studied [B4-7].
- The influence of the degenerate four-photon parametric processes on the energy exchange between the x and y components of the electric field for different polarization states of optical pulses has been analytically studied based on a system of nonlinear differential equations. Taking into account the influence of the effects of phase self-modulation and phase cross-modulation, a new class of analytical solutions was obtained, describing the energy exchange between the components of the electric field [B4-5].

- A specific method is presented for solving a system of two partial nonlinear differential equations of the second order and the third degree, written in dimensionless form, which describe the propagation of light pulses in optical fibers. The resulting solutions determine the periodic exchange of energy between two laser pulses [G7-7].

*Third direction:* Propagation of optical vortex structures in isotropic non-linear dispersed media. The most significant contributions of the candidate in this direction are:

- An approach for finding solutions to the system of nonlinear amplitude equations characterizing the dynamics of the components of 3D laser pulses in isotropic nonlinear dispersed materials is presented. A new class of exact analytical solutions was found in the form of optical vortices [G7-3].
- A mathematical method for solving vector nonlinear differential equations with application in waveguide optics is presented. A new class of analytical solutions describing the generation of laser vortices in gradient optical fibers has been found [G7-6].
- New classes of analytical solutions have been found characterizing the generation and evolution of laser ring structures in optical waveguides with a step profile of the refractive index and anomalous dispersion [G7-8].
- The vector nonlinear amplitude equation describing the propagation of laser pulses in gradient fibers with a concave refractive index profile is solved analytically. New classes of amplitude vortex solutions with spiral structures in the electric field components were found [G7-13].
- A new class of exact analytical solutions of the system of nonlinear space-time amplitude equations describing the propagation of laser pulse components in gradient fibers with a concave profile of the refractive index was found [G7-18].
- The vector nonlinear amplitude equation describing the propagation of laser pulses in gradient fibers with a concave refractive index profile is solved analytically. New classes of amplitude vortex solutions with spiral structures in the electric field components were found [G7-13].
- A new class of exact analytical solutions of the system of nonlinear space-time amplitude equations describing the propagation of laser pulse components in gradient fibers with a concave profile of the refractive index was found [G7-18].



The scientific and scientific-applied contributions listed above have received international recognition of importance, which is evident from the number of citations in the renowned referencing database Scopus – more than 300 citations for the last 5 years (without self-citations). Candidate has an h-index of 9 (by Scopus).

In the Citation List, the candidate has described 80 citations, all of which are in international journals. The quantitative indicators of the criteria for occupying the academic position "Associate Professor" have been met.

#### **4. Assessment of the candidate's personal contribution**

The personal contribution of the candidate is undoubted and most significant in the scientific publications of which he is the first author (B4-1, B4-2, B4-3, B4-5, B4-6, B4-7, G7-7 and G7-18). Of these publications, 6 are with Scopus quartile Q2, one is with quartile Q3 and one is with SJR indicator.

#### **5. Critical remarks and recommendations**

My recommendation to Ch. assistant professor Dr. Aneliya Mincheva Dakova-Mollova is to continue her research work in the field of Physics of wave processes, making efforts to independently publish some important scientific and/or scientific-applied results.

### **CONCLUSION**

The documents and materials presented by Ch. Assistant Professor, Dr. Aneliya Mincheva Dakova-Mollova, meets all the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB), the Regulations for the Implementation of ZRASRB and the relevant Regulations of PU "Paisii Hilendarski".

The candidate Ch. Assistant Professor Aneliya Mincheva Dakova-Mollova fulfills all the minimum national requirements for the scientific and teaching activity of the candidates for obtaining a scientific degree and for holding the academic position of "Associate Professor" in scientific field 4. Natural sciences, mathematics and informatics from The regulations for the implementation of the law on the development of the academic staff in the Republic of Bulgaria, as follows:

According to group of indicators "A" - 50 items.

According to group of indicators "B" - 130 items.

According to group of indicators "G" - 257 items.

According to group of indicators "D" - 160 items.

After getting acquainted with the materials and scientific works presented in the competition, analyzing their significance and the scientific, scientific-applied and applied contributions contained in them, I find it reasonable to give my positive assessment and recommend the Scientific Jury to prepare a report-proposal to the Faculty Council of the "Faculty of Physics and Technology" at the PU for the election of the Chief assistant professor, Dr. Aneliya Mincheva Dakova-Mollova, in the academic position of "associate professor" at Plovdiv University "Paisii Hylandarski" in the field of higher education "Natural Sciences, Mathematics and Informatics", professional direction 4.1. Physical sciences (Physics of wave processes).

2<sup>nd</sup> of April 2024

Plovdiv

The review prepared by: .....

(Prof. Dr. Emilia Mitkova Mihaylova)