OPINION
on competition for the academic position
"Associate professor"
in the field of higher education 4. Natural sciences, mathematics and informatics,
professional field 4.1. Physical Sciences (Physics of Wave Processes)
for the needs of the Department of Physics at the Faculty of Physics and Technology at the
Plovdiv University "Paisii Hilendarski", announced in the State Gazette no. 96 from 17.11.2023

The opinion was prepared by associate professor Lyuben Mihov Ivanov, Ph.D. - Southwest University "Neofit Rilski" - Blagoevgrad, in his capacity as a member of the scientific jury for the competition according to Order no. РД 21-386 / 16.02.2024 of the Rector of the Plovdiv University "Paisii Hilendarski".

To participate in the announced competition, documents were submitted by a single candidate Chief Assistant Professor Aneliya Mincheva Dakova-Mollova, Ph.D.

1. General description of the presented materials.

Aneliya Mincheva Dakova-Mollova graduated from the Bachelor's degree and then the Master's degree at the Faculty of Physics of "Paisii Hilendarski. PU. She received her doctorate at the Institute of Electronics "Academician Emil Djakov" at the Bulgarian Academy of Sciences, Sofia in 2016. The topic of her dissertation is "Linear and nonlinear optics of femtosecond and attosecond laser pulses". Since 2011, Aneliya Dakova has been appointed to work at PU "Paisii Hilendarski", initially as an assistant, and later as Ch. Assistant Professor. In parallel, she holds the same academic positions at the Institute of Electronics of the BAS.

In order to participate in the competition, the candidate has submitted all the requirements required by the Act for the Development of the Academic Staff in the Republic of Bulgaria and the Regulations for its Application.

25 scientific publications in foreign scientific publications are presented. All correspond to the theme of the contest. Also presented are 15 pcs. other documents (curriculum vitae, official notes, copies of diplomas, declaration-reference regarding the fulfillment of the minimum national requirements, self-evaluation of scientific contributions, annotation of materials, certificates from an employer, etc.)

The documents are properly prepared and presented.

2. Publications before and after obtaining the scientific degree.

From the attached document "List of scientific papers for participation in a competition for an "associate professor" at the Faculty of Physics and Technology of the "Paisiy Hilendarski" PU, the following can be ascertained.

Ten scientific publications were used to acquire the title of "doctor" and to occupy the academic position of "principal assistant" in the Faculty of Physics and Technology of the "Paisiy Hilendarski" PU. All of them were published between 2013-2016.

Another 25 scientific articles were written and published after the defense of the dissertation in the period 2019-2022. With them ch. assistant professor Anelia Dakova, PhD, participated in the competition for the academic position of "associate professor".

1. General characteristics of the candidate's scientific and pedagogical activities.

The scientific work of Chief Assistant Professor Aneliya Dakova, is related to the development of mathematical methods for finding analytical solutions of differential equations describing the propagation of ultrashort optical pulses in different volume and waveguide media. This task is significantly complicated when the pulses are with very short duration (a few femtoseconds) and, accordingly, with a very wide spectrum. In this case, the spectral width of the pulses becomes comparable with their carrier frequency.

This significantly complicates the type of equations studied due to the need to take into account a number of other effects such as higher-order dispersion, energy conversion between interacting waves and different spectral components, etc. In most cases, this type of equations is studied numerically, while the candidate's approach in the competition is to find analytical solutions, which obviously gives more opportunities to analyze the influence of various factors on the dynamics of the studied processes.

The candidate has significant pedagogical activity. According to the Regulations for the Development of the Academic Staff of the "Paisii Hilendarski" PU, a competition for the occupation of the academic position of "associate professor" is opened if the relevant teaching workload can be ensured. The requirement is that no less than 120 hours of lectures are provided, of which no less than 45 hours are on the specifics of the professional direction. According to the report for the current academic year 2023/2024 attached to the competition documents, ch. assistant professor Aneliya Dakova was assigned 142 hours of lectures, of which 105 were in the professional direction. This workload significantly exceeds the intra-university requirements.

Here it is good to point out that Aneliya Dakova was the supervisor of 18 graduates who successfully defended their diplomas.

2. Basic scientific and scientific-applied contributions.

The main scientific direction in which works Ch. Assistant Professor Aneliya Dakova, is related to the propagation of ultra-short optical pulses in various volume and waveguide media. Different regime of propagation in linear media and in media with high nonlinearity and dispersion have been investigated. The formation of light and dark optical solitons in media with different characteristics was studied, the four-photon parametric processes and energy exchange between laser pulses and their components in non-linear dispersive media were considered.

In my opinion the scientific contributions of the candidate, can be grouped in three directions.

The first of them is related to an analytical study of the propagation of spectrally wide light and dark optical solitons in isotropic nonlinear dispersive media [B4-1, B4-2, B4-3, B4-4, Г7-1, Г7-2, Г7 -9, D7-10, D7-11, D7-12, D7-14, D7-16]. The formation of such optical pulses is studied on the base of the nonlinear amplitude equation. New exact analytical solutions of the nonlinear amplitude equation in the form of periodic waves propagating in single-mode optical fibers have been obtained. It is shown that, depending on the degree of ellipticity of the polarization of the light waves, a light or dark soliton is formed, respectively.

The evolution of broad-spectrum laser pulses propagating in single-mode optical fibers with normal dispersion is studied. Taking into account the third order of the dispersion and the dispersion of the nonlinearity, a new analytical solution of the nonlinear amplitude equation in the form of a dark soliton is found. The resulting solution differs significantly from the standard soliton solution of the nonlinear Schrödinger equation.

The evolution of ultra-short broadband laser pulses within the framework of the non-paraxial nonlinear amplitude equation in nonlinear fibers with normal dispersion is analyzed. A

solution to this equation has been found in the form of a dark soliton propagating in isotropic single-mode optical fibers. Its stability is due to the balance between the normal dispersion and the nonlinearity of the medium.

The second direction is related to the analytical study of the process of four-photon parametric mixing and energy exchange between broad-spectrum laser pulses and their components in nonlinear dispersed media [B4-5, B4-6, B4-7, D7-4, D7-7]. The process of four-photon mixing between a pumping, signal and idler wave at different (circular, linear and elliptical) polarization of the interacting waves at a distance of the order of several coherence lengths has been studied. Exact analytical solutions are found that describe the periodic energy exchange between the three waves under the influence of phase self-modulation and phase cross-modulation. It is shown that the energy exchange period strongly depends on the initial phase difference between the components. This phenomenon leads to periodicity in the rotation of the polarization ellipse.

The process of energy exchange between the two polarization components of an optical pulse with elliptical polarization has been studied on the basis of a generalized system of nonlinear amplitude equations. An exact analytical solution of this system is obtained, which describes the energy exchange between the polarization components of the optical pulse. This is shown to result in a rotation of the plane of polarization.

A third direction presented in the works [D7-3, D7-5, D7-6, D7-8, D7-13, D7-15, D7-17, D7-18] is related to the analytical study of the conditions for generation and propagation of optical vortex structures in isotropic nonlinear dispersive media. 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 has been found in the form of optical vortices. They are of the amplitude type and are characterized by ring-shaped structures in the intensity field of the x and y components of the laser pulse. The nonlinear dispersion relations resulting from the obtained vortex solutions show that the stability of the vortex structures results from the balance between diffraction and nonlinearity, as well as nonlinearity and angular distribution of the field.

3. Publication activity and citations (according to the candidate data):

Ch. Assistant Professor Aneliya Dakova participated in the competition with 25 scientific works, all of which are in journals with an impact factor or impact rank. Sixteen of these works have been published in highly reputable journals: in the first quartile Q1 - 1 article, in the second quartile Q2 - 10 articles, in the third quartile Q3 - 4 articles and in the fourth quartile quartile Q4 - 1 article. The remaining publications, 9 in number, are mainly presented as materials from conferences.

In the Author's reference for scientific contributions ch. assistant professor Aneliya Dakova, states that the number of citations without self-citations is 80, and the h-index is 8. All citations are in authoritative journals.

4. Publication activity and citations (according to his data):

Ch. Assistant Professor Aneliya Dakova participated in the competition with 25 scientific works, all of which are in journals with an impact factor or impact rank. Seven t of these works have been published in highly reputable journals: in the first quartile Q1 - 1 article, in the second quartile Q2 - 10 articles, in the third quartile Q3 - 4 articles and in the fourth quartile quartile Q4 - 1 article. The remaining publications, 9 in number, are mainly presented as materials from conferences.

In the Author's reference for scientific contributions ch. Aneliya Dakova, assistant professor, states that the number of citations without self-citations is 80, and the h-index is 8. All citations are in authoritative journals.

6. Contribution of the candidate to the collective publications.

In all scientific articles submitted for participation in the competition, the candidate participates in co-authorship with other scientists. It is noteworthy, however, that in 7 of the works ch. Assistant Professor Anelia Dakova, participated as the first author. From the conversations held with some of the co-authors, I got the impression that the contribution of the participant in the competition in all publications is beyond doubt.

7. Critical notes and recommendations.

I have no critical remarks and recommendations to the candidate in relation to his scientific activity and layout of the presented materials.

8. Personal impressions of the candidate.

I have known Aneliya Dakova for about 10 years in her capacity as a doctoral student at the Institute of Electronics of the Bulgarian Academy of Sciences. I haven't worked on scientific tasks with her, so I don't have systematic and in-depth observations, but from the conversations I have had very good impressions of her basic knowledge of physics and the high level of mathematical training.

9. Conclusion

According to the submitted documents, the only candidate in the competition, Chief Assistant Professor Aneliya Mincheva Dakova-Mollova fulfils all the requirements of Act for the Development of the Academic Staff in the Republic of Bulgaria and the Regulations for its Application.

The candidate in the competition has submitted a sufficient number of scientific papers and fully satisfies the Minimum National Requirements. After getting acquainted with the presented articles and reports published as materials at various conferences and based on the analysis of their significance, I am convinced that the scientific and scientific-applied contributions contained in most of them are sufficiently significant and are related to the topic of the current competition "Physics of Wave Processes".

Based on this, I consider that Ch. Assistant Professor Aneliya Mincheva Dakova-Mollova, PhD, is a highly qualified and erudite scientist capable of conducting independent scientific research as well as leading a scientific team.

I give a very positive assessment of the candidate's application in the current competition and I recommend with full conviction to the respected members of the jury to propose to the Faculty Council of the Faculty of Physics and Technology of Plovdiv University "Paisii Hilendarski" to choose ch. assistant professor, Dr. Aneliya Mincheva Dakova-Mollova, for the academic position "associate professor" in professional direction 4.1 "Physical sciences", specific specialty "Physics of wave processes".

April 3, 2024   Prepared the opinion:

associate professor PhD Lyuben Mihov