REVIEW

of the application, submitted for participation in the competition for the academic position of "Associate Professor" in the professional field 4.1. Physical Sciences (Electrical, Magnetic and Optical Properties of the Condensed Matter) for the needs of the University of Sofia “St. Kliment Ohridski” (SU), announced in the State Gazette, issue 87 / 19.10.2021.

The review is prepared by Prof. Valentin Nikolov Popov, D.Sc., Faculty of Physics of SU, in his capacity of a member of the scientific committee according to order RD-38-578/ 09.12.2021 by the Rector of SU.

The only candidate, who has submitted documents for participation in the announced competition, is Chief Assist. Professor Dr. Neno Dimitrov Todorov, Faculty of Physics of SU.

I. General description of the submitted materials

1. Application data

The documents submitted for the competition by the candidate meet the requirements of ЗРАСРБ, ППЗРАСРБ, “Regulations on the terms and conditions for obtaining scientific degrees and holding academic positions at Sofia University "St. Kliment Ohridski”” (ПУРПНСЗАДСУ) и „Additional requirements for candidates for academic positions at the Faculty of Physics of Sofia University“ (ДИКЗАДФФСУ).

For participation in the competition, the candidate Neno Todorov has submitted a list and copies of a total of 18 titles, incl. 12 publications in refereed journals with IF, 3 publications with refereed and indexed conference proceedings and 3 publications in non-refereed and non-indexed publications. Data on the number of independent citations on Web of Science and Scopus, IF, scientific supervision of diploma students and leadership / participation in national / international projects are also presented.

Applied are also a certificate from the employer, a report on classroom employment in the last 5 years, as well as certificates for head of the national physics team at 6 international physics competitions and documents for participation as a member of the national commission for organizing and conducting 6 national Physics Olympiads, 4 spring and 3 autumn national physics competitions. Documents are provided for participation as a member of 2 bilateral research projects funded by the Bulgarian Research Fund and an invitation for postdoctoral studies abroad for 6 months.

2. Candidate data

The candidate was a student of physics at the Faculty of Physics of Sofia University between 2004 and 2010 and was awarded bachelor degree in physics with the defence of a thesis on "Semiconductor photocells and prospects for improving their efficiency" with supervisor Assoc. Prof. M. Baleva, and the degree of Master in Microelectronics and Information Technologies with the defence of a thesis on "Optical phonons of NdBaCo2O5 + x: calculation of the lattice dynamics" with supervisor Prof. M. Abrashev. He was also awarded PhD degree in the professional Field 4.1. Physical Sciences after defending a dissertation titled "Phonons in oxides with complex crystal structure" with double scientific supervision by Prof. M. Abrashev and Dr. E. Folk (Jean Rouxel Institute, Nantes, France). In 2019, for 6 months he was a postdoctoral fellow at the Free University of Berlin, Germany.

The candidate worked as a physicist at the Faculty of Physics of Sofia University between 2008 and 2013, as Assistant between 2013 and 2015 and as Chief Assistant Professor since 2015, leading seminars and practical exercises in General Physics, and participates in the maintenance of the equipment in a laboratory.

3. General characteristics of the scientific works and achievements of the candidate

The candidate's research interests are in the experimental study of Raman spectra mainly of samples of oxides in the form of powders, thin layers and single crystals in order to characterize them, and in the case of single crystal samples he supports the analysis of the results with calculations of the lattice dynamics.

The materials, presented in the competition, cover and in some cases even exceed the minimum requirements of ЗРАСРБ, ППЗРАСРБ, ПУРПНСЗАДСУ and ДИКЗАДФФСУ, as shown in Table 1.

Table 1. Implementation of the minimum requirements of ЗРАСРБ, ППЗРАСРБ, ПУРПНСЗАДСУ and ДИКЗАДФФСУ.

Group of indicators	Indicators	Total point/required minimum total points
А	1. Dissertation for the award of ONS "Doctor"	50 (50)
В	4. Habilitation work - monograph 5. Habilitation work – Scientific publication in editions that are referenced and indexed in world-famous databases of scientific information (Web of Science and Scopus)	0 (0) 25 x 4 publ. in Q1 = 100 (100)
Г	7. Scientific publication in publications that are referenced and indexed in world-famous databases of scientific information (Web of Science и Scopus)	25 x 5 publ. in Q1 20 x 3 publ. in Q2 12 x 2 publ. in Q4 = 219 (200)

Group of indicators	Indicators	Total point/required minimum total points
Д	11. Scientific publication in editions that are referenced and indexed in world-famous databases of scientific information (Web of Science and Scopus)	2 x 261 cit. = 522 (50)
Е	14. Participation in a national scientific or educational project	10 x 3 part. =30 = 30 (0)
Additional requirements of the Faculty of Physics of SU	22. Successfully defended doctoral student 23. Number of Group I publications in the recent 3 years 24. Number of publications from group I in groups of indicators B and Г 27. Number of publications in groups of indicators B and Г with a significant contribution by the applicant 28. h-factor 31. Teaching experience (teaching / classroom employment for the last 5 years), hours	2 (1) 5 (1) 9 (7) 5 (4) 7 (5) 2046/1890 (540)

The presented scientific papers do not repeat those of previous procedures for acquiring a scientific title and academic position.

There is no legally proven plagiarism in the submitted scientific papers.

5. Characteristics and evaluation of the teaching activity of the candidate

The candidate reports a classroom activity significantly exceeding the required minimum study load of 540 hours (see Table 1, indicator 31), which is expressed in the conduct of lectures, seminars and practical exercises on a significant number of disciplines, as follows:

- Lectures on discipline (for bachelor's / master's* program): „Fundamentals of Physics I" (КФЕ, ФМ, ФИ, Оптометрия), „General Physics" (АПА* и ФЗАО*), „Optics" (ИФ, АМГ, ЯТЯЕ, МФ, ФЛФ), „Raman Spectroscopy".

- Seminars on discipline (for bachelor / master* program): „Mechanics" (Ф, ККТФ, ИФ, АМГ, ЯТЯЕ, МФ, ФЛФ, КФЕ, ФМ), „Electricity and magnetism" (Ф, ККТФ, ИФ, АМГ, ЯТЯЕ, МФ, ФЛФ), „Optics" (Ф, ККТФ), „Probabilities and Physical Statistics" (Ф, ККТФ, АМГ), „Fundamentals of Physics I" (ФМ, Оптометрия), „General Physics" (АПА* и ФЗАО*).

- Practical exercises: „Mechanics" (Ф, ИФ, ЯТЯЕ, ФМ), „Molecular Physics" (ККТФ, АМГ, ФЯЕЧ, МФ, ФМ), „Physics and Biophysics" (Фармация, ФХФ), „Fundamentals of Physics I" (КФЕ, Оптометрия), „Raman Spectroscopy".

In addition, he is actively involved in extracurricular activities with students and pupils, including preparation of the team of the Faculty of Physics for participation in the Republican Student Olympiad in Physics in 2015, 2017 and 2018, leadership of the national team in Physics to

participate in the International Physics Olympiad (IPhO) in 2017, 2018, 2019 and 2021, the European Physics Olympiad (EuPhO) in 2017, 2018, 2019, 2020 and 2021, and the Romanian Master of Physics (RMPh) in 2016, 2017 and 2010. He is a member of the National Commission for Organizing and Conducting the National Physics Olympiad in 2015, 2016, 2017, 2018, 2020 and 2021, the Spring National Physics Competition in 2018, 2019, 2020 and 2021, and the Autumn National physics competition in 2018, 2019, 2020 and 2021. The experience of preparation and the problems for some of these Olympiads and competitions have been reported in three publications [1-3].

Such activities play a very important role in the professional orientation of future students and researchers in the field of physical sciences.

Publications:

[1] Н. Д. Тодоров, Г. М. Александров и В. Г. Иванов, Европейската олимпиада по физика 2020 г., Физика: методология на обучението 8, 132–145, (2020).
[2] С. И. Иванов, Д. Л. Арнаудов, Н. Д. Тодоров, Д. Й. Мърваков и В. Г. Иванов, Национално пролетно състезание по физика, Стара Загора, 9–11 март 2018 г., Физика: методология на обучението 6, 183–199, (2018).
[3] С. И. Иванов, Д. Л. Арнаудов, Н. Д. Тодоров, Д. Й. Мърваков и В. Г. Иванов, Национално пролетно състезание по физика, Стара Загора, 9–11 март 2018 г. Част 2, Физика: методология на обучението 6, 254–282, (2018).

6. Content analysis of the scientific and scientific-applied achievements of the candidate contained in the materials for participation in the competition

In his research, the candidate uses mainly the experimental method of Raman spectroscopy to characterize various samples, mainly oxides, in the form of powders, thin layers and single crystals. This method is preferred for this purpose because of its non-destructiveness and the possibility it provides for the rapid determination of the composition and structure of samples from the lines in Raman spectra. In the case of samples with a crystal structure, the applicant uses available computer programs to calculate the dynamics of their crystal lattice in order to unambiguously assign the Raman lines to the crystal's vibrational eigenmodes.

The 15 publications, submitted for the competition, are divided into groups in Table 1 as follows: in group B are publications [1-4] (all in Q1), and in group Г are publications [5-15] (5 publications are in Q1). The candidate declares a significant contribution to the publications [1,2,5,6,10]. Although the publications have several co-authors, this does not reduce the candidate's contribution, which consists mainly in Raman measurements and computer simulations, as these activities are central for these publications.

Publications with significant contribution of the candidate.

In [1], the candidate measured polarized Raman spectra of Sc2O3 single crystals and performed lattice dynamics and Raman line intensity calculations from first principles in order to support the assignment of the observed Raman lines to concrete phonons. In this way, the lines of all

Raman-active phonons are identified. In [2], these studies were extended to include single crystals R2O3 (R = Sc, Er, Y, Ho, Gd, Eu and Sm) [2], and the assignment of the Raman lines to concrete phonons is supported by calculations of the lattice dynamics within the valence shell model. The observed lines were divided into high-frequency ones with participation of oxygen ions and low-frequency ones with participation of rare-earth ions. The frequency of oxygen lines was found to decrease with increasing lattice parameter, which depends on the radius of the rare earth element, while the frequency of rare earth lines remained almost constant, which was supported by theoretical arguments. It should be noted that in both publications the calculated phonon frequencies are in very good agreement with the frequencies of the respective Raman lines.

Silver nanostructures, deposited on an aluminium substrate, were studied in Raman spectroscopy [5] and it was shown that they can be successfully used to amplify the Raman signal in SERS. In [6], samples of paintings were studied by Raman spectroscopy in order to identify the mineral pigments and other inorganic components of the dyes used, which was of indispensable aid in the restoration of the paintings. In [10], polarized Raman spectra of alpha-FeOOH were measured in the vicinity of the antiferromagnetic-paramagnetic phase transition. The lattice dynamics was calculated within the valence shell model, as well as from first principles, and the results of these calculations were used to assign the observed Raman lines to concrete phonons.

Publications without declared significant contribution.

In [3], the Raman spectra of Sc3CrO6 single crystals at different temperatures and pressures were reported, all 18 Raman-active modes were identified, and for 5 of them a significant decrease in the intensity of Raman lines was observed, which was explained by structural phase transition at about 1100 K. The lattice dynamics was calculated within the valence shell model, as well as the volume expansion coefficient, the compressibility modulus, and the Gruneisen parameter for the observed phonons were derived. Polarized Raman spectra of CuB2O4 single crystals were reported in [4]. The assignment of some Raman lines to concrete phonons was supported by calculations of the lattice dynamics from first principles.

Raman spectra of nanocomposites, obtained by mixing hydrogen-bonded liquid crystals and mesogens (cholesterol benzoate) or non-mesogens (carbon nanotubes, hydrosipyridine, perfluorooctanoic acid), were reported in [7,11,14]. The analysis of the Raman spectra showed the presence of a phase transition between two phases of the liquid crystal - chiral nematic and ferroelectric smectic.

Raman spectra of thin layers of spinel NiCo2O4 were measured in [8]. The spectra of samples, deposited below and above 450 ^{o}C, allowed to confirm the results of other methods for ferromagnetic and non-magnetic phases. In [9], for the reverse spinel LiFe5O8, the lattice dynamics

of the ordered phase was calculated within the valence shell model and its optical properties were modelled to support the analysis of the measured Raman and optical spectra.

In [12], the interpretation of the Raman spectra of a silicon matrix with nanoformations of silicides was performed at a good level with a model of surface phonon-polaritons. Measurements of the Raman spectra of rhodamine-6G and xylene on glass substrates with gold nanoparticles, deposited on them, were reported. It was found that such substrates lead to amplification of the Raman signal up to 10^4 times. In [15], the results of calculations of the NdBaCo2O5+x lattice dynamics within the valence shells model at different oxygen concentrations were reported. The results can be used to interpret the optical spectra of this material.

The presented analysis of the individual publications, attached to the application for the competition, allows me to conclude that the candidate has mastered at a professional level the work with the available equipment for Raman spectroscopy and computer programs for calculating the lattice dynamics. The obtained experimental and theoretical results attract the attention of scientists in the field, which is quantified in a significant number of citations, e.g., [2] - 84 citations, [1] - 21 citations, etc. Publications, not attached for this competition, also have a large number of citations, with the total number of citations of all the candidate's publications exceeding ten times the minimum number required for the competition. The candidate's impact factor is 7, which exceeds the minimum of 5, required for such a competition.

Publications:

[1] N. D. Todorov, M. V. Abrashev, V. Marinova, M. Kadiyski, L. Dimowa и E. Faulques, Physical Review B 87, 104301, (2013), Q1.
[2] M. V. Abrashev, N. D. Todorov и J. Geshev, Journal of Applied Physics 116, 103508, (2014), Q1.
[3] S. Kesari, N. D. Todorov, V. Marinova и R. Rao, Journal of Raman Spectroscopy 51, 1362–1371, (2020), Q1.
[4] V. G. Ivanov, M. V. Abrashev, N. D. Todorov, V. Tomov, R. P. Nikolova, A. P. Litvinchuk и M. N. Iliev, Physical Review B 88, 094301, (2013), Q1.
[5] G. G. Tsutsumanova, N. D. Todorov, S. C. Russev, M. V. Abrashev, V. G. Ivanov и A. V. Lukoyanov, Nanomaterials 11, 3184, (2021), Q1.
[6] Y. Tavitian, D. Y. Yancheva и N. D. Todorov, The European Physical Journal Plus 136, 733, (2021), Q1.
[7] M. Petrov, P. M. Rafailov, H. Naradikian, B. Katranchev и N. D. Todorov, Journal of Molecular Liquids 272, 97–105, (2018), Q1.
[8] M. N. Iliev, P. Silwal, B. Loukya, R. Datta, D. H. Kim, N. D. Todorov, N. Pachauri и A. Gupta, Journal of Applied Physics 114, 033514, (2013), Q1.
[9] V. G. Ivanov, A. P. Litvinchuk, N. D. Todorov, M. V. Abrashev и V. Marinova, Physical Review B 84, 094111, (2011), Q1.
[10] M. V. Abrashev, V. G. Ivanov, B. S. Stefanov, N. D. Todorov, J. Rosell и V. Skumryev, Journal of Applied Physics 127, 205108, (2020), Q2.
[11] B. Katranchev, M. Petrov, P. Rafailov, N. D. Todorov, E. Keskinova, H. Naradikian и T. Spassov, Molecular Crystals and Liquid Crystals 632, 21–28, (2016), Q2.
[12] M. Baleva, A. Atanassov, M. Marinova, G. Zlateva и N. D. Todorov, Journal of Nanoscience and Nanotechnology 8, 768–774, (2008), Q2.
[13] V. G. Ivanov, N. D. Todorov, L. S. Petrov, T. Ritacco, M. Giocondo и E. S. Vlakhov, Journal of Physics: Conference Series 682, 012023, (2016), Q4.

[14] B. Katranchev, M. Petrov, P. M. Rafailov и N. D. Todorov, Journal of Physics: Conference Series 682, 012001, (2016), Q4.
[15] N. D. Todorov, M. V. Abrashev, V. G. Ivanov и E. Vlakhov, AIP Conference Proceedings CP1203, 1003, (2009).

7. Critical remarks and recommendations

My main remark to the candidate is the lack of oral and poster reports at national and international scientific events in the field of his research.

8. Personal impressions of the candidate

None.

9. Conclusion on the application

After getting acquainted with the materials and scientific papers presented in the competition and based on the analysis of their importance and the scientific and applied scientific contributions contained in them, I confirm that the scientific achievements of the candidate meet the requirements of ЗРАСРБ, ППЗРАСРБ, ПУРПНСЗАДСУ and ДИКЗАДФФСУ for the candidate to hold the academic position of "Associate Professor" in the scientific field and professional field of the competition. In particular, the candidate satisfies the minimum national requirements in the professional field and no plagiarism has been established in the scientific papers submitted at the competition.

I give my positive assessment of the application.

II. OVERALL CONCLUSION

Based on the above, I recommend to the scientific committee to propose to the competent body for the selection of the Faculty of Physics of Sofia University "St. Kliment Ohridski" to elect Chief Assistant Professor Dr. Neno Dimitrov Todorov to the academic position of "Associate Professor" in the professional field 4.1. Physical sciences (Electrical, Magnetic and Optical Properties of the Condensed Matter).

Valentin Popov
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10/02/2022 Reviewer: .....

Sofia (Prof. Valentin Nikolov Popov, D.Sc.)