

REVIEW

by competition for an academic position

"Professor"

**in professional field 4.1 Physical Sciences (General Physics),
for the needs of Sofia University "St. Kliment Ohridski" (SU),
Faculty of Physics, announced in SG no. 24 of 17.03.2023**

The review was prepared by: Prof. Viktor Genchev Ivanov, Faculty of Physics of SU "St. Kliment Ohridski", PN 4.1 Physical Sciences, in his capacity as a member of the scientific jury for the competition according to Order No. RD-38-173 / 20.04.2023 of the Rector of Sofia University.

Only one candidate have submitted documents for participation in the announced competition: Associate Professor, D.Sc. Veselin Todorov Donchev, Faculty of Physics of SU "St. Kliment Ohridski

1. General description of the submitted documents

The documents submitted by the candidate for the competition correspond to the requirements of the ZRASRB, PPZRASRB and the Regulations for the terms and conditions for acquiring scientific degrees and occupying academic positions at SU "St. Kliment Ohridski" (PURPNSZADSU).

To participate in the competition, the candidate submitted a list of a total of 22 titles, including 16 publications in international scientific journals with impact-factor and 6 publications in conference proceedings. In addition to the documents required by the Law, by the regulations of the Sofia University and by the additional requirements of the Faculty of Physics, the candidate has submitted 18 additional documents (Artefacts) that certify his educational experience, scientific tutoring of graduates and doctoral students, his expert work, administrative experience etc.

I believe that the submitted documents are comprehensive enough for the members of the scientific jury to form a reasoned opinion about the candidate's teaching qualities and scientific contributions.

2. Biographic data for the candidate

Veselin Donchev was born in 1959 in the city of Sofia. He completed secondary education at the 9th French Language High School in Sofia in 1979. In 1985, he graduated from the Faculty of Physics of the Sofia University with a major in Physics and a specialization in Solid State Physics.

The average grade from his studies is Excellent 5.97, and from the defense of a diploma thesis - Excellent 6.00. Subsequently, the candidate was enrolled as a doctoral student at the Faculty of Physics of the SU, and in 1991 he obtained a PhD degree in condensed matter physics after defense of a thesis entitled "Investigation of electrical and optical properties of point defects in gallium arsenide". In 2022, after defending a dissertation on "Surface Photovoltaic Spectroscopy" at the Faculty of Physics of the SU, Veselin Donchev was awarded the scientific degree "Doctor of Sciences" in PN 4.1 Physical Sciences (Condensed Matter Physics).

Veselin Donchev's professional career is closely related to the Faculty of Physics of the SU, where he successively held the positions of physicist at the FTTME department (1991-1992), senior assistant (1993-1997) and chief assistant (1997-2004) at the FCM department, and from 2004 – associate professor at the unified department of FCMME. The candidate also has significant administrative experience. In the period 2010-2013, he worked at the EC, Brussels, as an administrator of scientific projects under the 7th FP in the field of nanoelectronics and microsystems. After returning to the Faculty of Physics, he was the head of the FKMME department for two terms.

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

The overall scientific activity of the candidate is thematically related to the optical and photoelectric properties of semiconductors and semiconductor nanostructures. Most of his scientific publications are devoted to the surface photovoltage (SPV) technique, where Veselin Donchev made a number of original contributions, described in detail in his dissertation for obtaining the scientific degree "Doctor of Sciences". In particular, he has developed a theoretical model for the analysis of the SPV phase shift and its relation to the distortion of energy zones near the semiconductor surface, as well as to the kinetics of current carriers. A significant part of his scientific publications, including those submitted for participation in the competition, are experimental studies of various photovoltaic materials using the SPV method, and the data analysis is based on this model.

However, the candidate's scientific research is not limited to SVP, but also uses a wide range of other experimental methods in solid-state physics – photoluminescence, X-ray photoelectron spectroscopy (XPS), Raman and infrared spectroscopy.

In table D3 of document #12, the candidate presents a list of the publications used at various stages of his academic promotions until now. From these data, it is clear that the scientific papers submitted for participation in the competition do not repeat those previously used for the acquisition of the scientific degrees "Doctor" or "Doctor of Science", as well as for the acquisition of the academic positions "Chief Assistant" and "Doctor" . The data in the same document show that the applicant successfully meets all the quantitative criteria of the RSARB and the regulations to it, and according to some of the criteria - number of publications and citations - significantly exceed the minimum national requirements.

From the summary data in Table I, it is also clear that the candidate fully satisfies the additional requirements of the Faculty of Physics of the SU for occupying the academic position "Professor".

Table I

Additional requirements of the Faculty of Physics	Candidate's indicators
Teaching experience equivalent to 3 years of full auditorium employment according to PUDSU (810 classroom hours)	1816 auditorium hours for the last 5 years
Doctor of Sciences degree	Yes
At least 9 publications in group I, one of which being published in the last 3 years.	45 publications in group I (13 among the presented for the competition), 3 of which in the last three years. Leading or significant contribution in 34 publications (12 among the presented for the competition).
At least one „golden” publication cited more than 20 times.	5 „golden” publications
At least 100 independent citations	Not shown explicitly in document # 12, but according to up-to-date SCOPUS query – 416 independent citations
H-index at least 8	9
Management of an established scientific group or laboratory	Scientific group on “Nanostructures and photovoltaics” at the FKMME department.
Coordination of international and/or national projects or subgroups within international projects	Coordinator of one national project and of the Bulgarian team in two international projects
Plenary or invited talks at international conferences	4
Scientific supervision of graduates and at least one successfully defended doctoral student	Supervision of 6 successfully defended diploma works, and 1 PhD thesis

After having reading of the scientific works submitted for participation in the competition and the reference of the scientific contributions of the candidate, I can confidently state that there is no evidence of plagiarism. The candidate has correctly submitted letters from his co-authors certifying his individual contribution to collective publications.

4. Characteristics and assessment of the candidate's teaching activity

The candidate has thirty years of teaching experience at the Faculty of Physics of the SU. In his capacity as an assistant at the Physics of Condensed Matter department, he led seminars and laboratory exercises on practically all courses taught by the department. After his habilitation, he was the holder of the bachelor's courses in "Mechanics" and "Molecular Physics". In parallel, he reads a number of elective and/or specialized courses related to his scientific work - "Optoelectronic devices", "Nanostructured materials and devices for information technologies" and "Physical foundations of optoelectronics" in the master's program "Microelectronics and information technologies". The candidate is also the head of the teaching laboratory of electricity and magnetism at the FKMME department. I can confidently state that Veselin Donchev is one of the most experienced and qualified professors at the Faculty of Physics of SU.

5. Content analysis of the applicant's scientific and scientific-applied achievements contained in the materials for participation in the competition

A significant part of the publications presented for the competition are developments of the SPV method and its applications for the study of specific semiconductor materials. SPV is not

among the routinely used methods in solid-state physics, which is why there is also a lack of commercially available equipment for this type of research. In this regard, the work F15 is impressive, in which the device of an original experimental set-up for PFN measurements, constructed in the Faculty of Physics under the supervision of Veselin Donchev (corresponding author in the publication) is described. The apparatus allows measurement of surface photovoltage in a metal-insulator-semiconductor (MIS) configuration in the spectral range 700-1800 nm at a constant photon flux. The apparatus was tested on a sample of p-Si covered with a dielectric layer of (Al₂O₃)TiO₂ and the possibility of experimentally determining the diffusion length and recombination time of the carriers was demonstrated.

Research with the described apparatus is the basis of four of the works presented in the competition. In the paper F1, results of SPV investigation of films of perovskite halides grown on a silicon substrate are presented. These are up-to-date materials given their excellent and photovoltaic characteristics. Both the MIS configuration and the Kelvin sample method were used. The optical absorption edge was determined and detailed information was obtained on the distortion of energy zones near the film surface, as well as on the generation and diffusion of current saturates. Thematically and methodologically, the work F2 is close, where, according to the contributions stated by the authors, Vesselin Donchev participated in most stages of the research: making the samples, numerical simulations of the spectra and discussion of the results, as well as the preparation of the graphic material.

Another thematic direction represented in the works submitted for participation in the competition F6-F10 is the study of the photoluminescent properties of quantum dots (QDs) InAs/GaAs. The candidate's role in these is in the measurement of the photoluminescence spectra and in the interpretation of the results. The photoluminescence of QDs was investigated under combined irradiation with two laser lines - the main one in the range of energies 1.4-1.5 eV, which excites pairs of electron-hole carriers, and an additional one with energy 1.24 eV. It was found that the additional laser excitation leads to a decrease in the charge of the QDs and at the same time an enhancement of the photoluminescence signal up to 5 times. The effect is most pronounced at low QD concentrations and progressively decreases and disappears at high concentrations. Undoubtedly, these studies are of interest for a number of optoelectronic applications because they demonstrate an effective approach for fine-tuning the charge state and photoluminescence efficiency of QDs.

Vesselin Donchev is the initiator and lead author of the work F11, where a model of the dielectric response of Si-SiO_x nanocomposites was developed using the Brugmann effective medium formalism. Infrared transmission spectra were calculated and compared with experimentally obtained spectra at different filling degrees of the composite. A very good agreement was obtained between the experimental data and the model prediction.

In work F12, an interesting system was investigated - a two-layer microtube obtained by "rolling" a two-layer planar In_{0.215}Ga_{0.785}As/GaAs heterostructure. Raman spectra of the

microtubes were studied in detail and it was found that the main Raman lines are shifted to lower frequencies compared to the same lines in the planar material. This fact is explained by the mechanical stresses in the tube, which allows the authors to obtain the characteristic deformation constant for the Raman-active modes.

Also of interest are works F13 and F14, in which theoretical calculations of the electronic structure in V-shaped quantum threads with fuzzy interfaces are presented. The effects of intra- and inter-diffusion of filament components are discussed. It was found that depending on the "blurring" length L of the interface, the energy spectrum and the electronic wave function undergo significant changes. As L increases, there is an increase in the energies of the localized states and a widening of the energy threshold between the ground state and the first excited state. The wave function undergoes a non-monotonic evolution with increasing L , being initially localized but above a certain critical length delocalized to the interfaces. Although purely theoretical, the research has practical significance in the design of optoelectronic devices based on quantum threads.

In general, I would characterize the contributions of the works submitted for participation in the competition as "enrichment of existing knowledge" and "application of scientific applications in practice."

6. Critical notices and recommendations

I have no fundamental criticisms of the candidate.

7. Personal impressions of the candidate

I have worked with Veselin Donchev at the Faculty of Physics of the SU for more than thirty years and know him as an excellent teacher and active researcher. Apart from the fact that over the years he built one of the most productive scientific laboratories in the Faculty of Physics, the candidate also developed numerous international collaborations, for example with Prof. Balkanski's group in Paris.

Another important quality of the candidate is his excellent organizational and administrative experience, which is evidenced by his position at the European Commission, as well as the two successful terms as head of the largest department in the Faculty of Physics.

8. Conclusion on the application

After having familiarized myself with the materials and scientific works presented by the candidate and based on the analysis of their significance and the scientific contributions contained in them, I confirm that the scientific achievements meet the requirements of ZRASRB, the Regulations for its application, the Regulations of SU "St. . Kliment Ohridski" and the corresponding additional requirements of the Faculty of Physics for occupying the academic position "Professor" in the scientific field and professional direction of the competition.

The candidate has undoubted teaching qualities and is an internationally recognized scientist in a modern scientific and applied direction, who built a scientific group in the Faculty of Physics.

I give my positive assessment of the candidacy and I strongly suggest to the respected Faculty Council of the Faculty of Physics to elect Associate Professor Veselin Donchev to the academic position of "Professor" under PN 4.1 Physical Sciences.

07.07. 2023 г.

Reviewer:

prof. D.Sc. Victor Ivanov