REVIEW

on the competition for the academic position of "Associate Professor" for the needs of the Central Laboratory of Applied Physics - BAS, in the professional field 4.1. Physical Sciences, specialty "Condensed Matter Physics", announced in the State Gazette No. 55 of July 8, 2025.

Member of the scientific jury: Corr. Member of BAS, prof. Nikolay Nedyalkov, Institute of Electronics “Acad. E. Djakov”, Bulgarian Academy of Sciences

The only candidate in the competition is Dr. Eng.-Physicist Hristo Todorov Kisov, Assistant Professor at the Central Laboratory of Applied Physics (CLAP) in Plovdiv, at the Bulgarian Academy of Sciences. He obtained a Master's degree (Engineer-Physicist) at the "Paisiy Hilehdarski" University, Plovdiv, specialization "Laser Techniques and Technologies" in 1996. He also holds a diploma from the “Panayot Volov” Higher Military School of Artillery and Air Defense. In 2012, he successfully completed his doctoral studies at the Technical University of Sofia, Plovdiv Branch, in the scientific field of Electrical Engineering, Electronics and Automation, with the topic of his dissertation being „Development of solid-state quantum electronic generators based on Neodymium-YAG media with unrivaled simultaneous generation of a pair of lines and frequencies in the range 1 - 1.4μm". He began his scientific career as a part-time assistant at the Agricultural University, Plovdiv in 2012, in 2016 he was a part-time assistant at Plovdiv University, and his main activities are related to giving lectures and exercises. Since 2017 he has been an Assistant professor at the Institute of Optical Materials and Technologies, “Acad. Y. Malinovski”, BAS, Laboratory "Composite and Nanostructured Optical Materials", and since 2021 he has also worked at CLAP, where he has held the position of Assistant professor. The main direction of his scientific activity is related to the development of technologies and devices for applications in sensorics and photonics.

The documents submitted for the competition and their content allow for a clear assessment and analysis of the scientific, applied scientific, organizational and teaching activities of Assistant professor Kisov. In this competition, the candidate participates with 28 publications, of which 15 with an impact factor, 12 with an impact rank, and 1 refereed, from a national journal. More than half of the publications (15) are from the last 5 years, which is a clear indication of active work at this stage of his career. The main publications are well-known in the field of laser applications and sensor development, such as Optics and Laser Technology, Sensors, Applied Optics, which are in

the Q1 or Q2 quartile. This demonstrates that the candidate's work is relevant and the scientific research is at a high international level. The total number of citations of publications with the participation of Senior Assoc. Prof. Kisov is 39. The majority of them are from the last five years, which again demonstrates the relevance of the topics on which he works and recognition by scientists in this field. The candidate has participated in 5 projects under national programs and in one of bilateral international cooperation. The main part of these projects are funded by the Bulgarian Science Fund. The Hirsch index according to SCOPUS is 4. Dr. Kisov has experience in training personnel, which is reflected in the leadership of 9 graduates and one current one from the Technical University - Sofia, Plovdiv Branch and Plovdiv University "Paisiy Hilendarski". In the period 2012-2015 he was a part-time assistant at the Technical University, Sofia - Plovdiv Branch, the Agricultural University, Plovdiv and Plovdiv University "Paisiy Hilendarski", where he gave lectures and exercises in the field of laser technology and optoelectronics. A list of 6 participations in international conferences is presented. Two recognized utility models and one application from the current year are also presented with the documents for participation in the competition, which also demonstrates the candidate's activity in scientific, applied and innovative activities. Dr. Kissov was also an ERASMUS scholarship holder for the academic year 2009-2010 for a period of 3 months at the Technical University in Prague, Czech Republic.

With his scientometric data, Dr. Kisov satisfies the minimum requirements set by the related national regulation, the General Assembly of the Bulgarian Academy of Sciences and the Regulations on the conditions and procedure for acquiring scientific degrees and for occupying academic positions at the Central Laboratory of Applied Physics at the Bulgarian Academy of Sciences. Scientific publications are presented in journals that are referenced and indexed in world-renowned databases of scientific information, which are equivalent to a habilitation thesis (indicator B4). The total number of points for this indicator is 165, with a required score of 100. They are based on 9 publications, 3 from quartile Q1, and two each from quartiles Q2, Q3 and from publications with impact rank. They present main results that have a significant contribution, with Senior Assistant Professor Kisov being the first author in 5 of them. In indicator C (publications outside the habilitation thesis), 19 publications are included, with the corresponding points being 343, with the required 220. In indicator D, related to citations of works in which the candidate is a co-author, the points are 74, exceeding the required 60.

The main scientific activity of Assistant Professor Dr. Hristo Kisov is related to laser techniques and laser technologies for obtaining coatings for sensor applications. These areas include the design, preparation, characterization and experimental confirmation of generation media for the so-called random laser (RL). Solid-state systems composed of organic dyes used in dye lasers (Rhodamine 6G and Rhodamine B) in polymer matrices have been developed. The main characteristics describing in detail such systems as laser media - emission spectra, absorption, generation threshold, as well as the influence of the composition and morphology of the media on these parameters - have been studied. The research was continued in a specific configuration, including a selective resonator, demonstrating the possibility of retuning the wavelength of the emitted radiation in the visible region. A study of the nonlinear properties of such media has also been conducted, demonstrating the realization of a non-degenerate cascade four-wave mixing effect. In another series of works, cases of liquid media containing Rhodamine and Methylene Blue dyes and nanostructures, silver nanowires, as scattering centers are considered. The role of the ratio of dyes and silver nanostructures for the emissive properties is studied. The possibility of tunability by changing the composition has been demonstrated, and the influence of the latter has been found to lead to a reduction in the generation threshold for multiwavelength radiation and an increase in the width of the generated spectral lines. This topic is complemented by the studies of a dye medium (LDS 821) containing gold nanorods as a system for RL generating in the infrared region. An experimental analysis of the role of the size and concentration of gold nanostructures on the emission characteristics was conducted, and an effect on the generation threshold was established.

Another main direction of Dr. Kissov's research activity is the development of sensor elements based on surface plasmon resonance, and for selectivity, a method for applying layers of different proteins based on the MAPLE technique has been developed. Effective deposition of hemoglobin layers on the main structure has been demonstrated, which is an original development of the team, and with the help of the obtained elements, glucose levels below 0.1 mmol/L, various gases, and viral proteins have been detected. Functionalized sensor elements based on surface plasmon resonance have been developed, tested and tested for the detection of Helicobacter pylori in saliva. The research conducted is complex, including theoretical developments, optimization of experimental conditions for obtaining and analysis of the influence of layer parameters on the efficiency of the sensor elements.

Another group of studies, in which Senior Assistant Professor Kisov participates, are related to theoretical and experimental analyses of the propagation of laser radiation in turbid tissues, study of the disperse composition of model emulsions containing biopolymer and experimental results for magnetic field detection based on the method of channeled polarimetry.

The research conducted by Assistant Professor Kissov is directly related to the development of light sources, with their specificities, such as RL. They have potential for application in information recording, sensors, and bioapplications. This is a topic that is still being developed, including from a fundamental physics perspective. The group in which the candidate works is a pioneer in this field on a national scale.

The second main topic in the candidate's work is related to the efficient, "non-invasive" transfer of complex biological materials and applications in sensor development. The demonstrated detections of materials with high social significance undoubtedly define them as particularly relevant and of interest from an applied point of view.

In essence, the main scientific and scientific-applied contributions of the presented works can be attributed to obtaining new knowledge and enriching existing ones in the field of laser technology and the application of laser methods in the development of systems with sensor applications. The most significant, directly related to the candidate's contribution, can be listed as:

- Design, development and characterization of solid and liquid media for the so-called "random laser". New results have been demonstrated for media enabling tunable radiation in the visible spectral region. New systems have been developed, containing no additional scattering components and combining two different dyes as active media. Based on the created materials, nonlinear effects, specifically non-degenerate cascade four-wave mixing, have been demonstrated. This is a new and significant result that significantly enriches the knowledge of how such systems work and defines new aspects of potential applications. In this direction, significant results have been obtained on the characteristics and capabilities of laser generation media with additionally introduced scattering components - gold and silver nanostructures.

- Effective application of an existing technology, so-called MAPLE, for the deposition of biocoatings. Original results were obtained for the deposition of hemoglobin, a case not presented by other authors. The layers are combined with systems operating as sensors based on the mechanism of spectral position sensitivity of surface plasmon resonance. In this way, a

functionalization was obtained that enables selective detection of components with high social significance. Such results have been demonstrated experimentally.

The results obtained are a solid theoretical and experimental basis for the development of RL-type laser systems and effective deposition of biological materials, which makes them an important part of the future development of laser equipment and the application of laser technologies in modern and new directions.

The results of the research conducted have been published in reputable publications, recognizable in the field of research related to laser technologies and the development of sensor elements. The candidate's main contributions are presented in publications in journals such as Optics and Laser Technology, Plasmonics, Applied Optics, Sensors which are in the Q1 or Q2 quartile, and/or have a high impact factor (e.g. for Plasmonics it is 4.3). This proves their high quality, relevance and originality. The citations of publications in which Dr. Kissov is a co-author indicate their results, which appear in the main areas of contribution, and in some publications (e.g. Sensors and Actuators Reports, 3, 2021, 100040), they are discussed in more detail. This demonstrates a high objective assessment of the contributions of the work by scientists working in these fields.

Dr. Kisov is the first author in 5 of the publications from indicator B (out of 9 in total), which is evidence of a leading role in the research conducted. For other publications in which the candidate's main contributions are presented, opinions from the leading authors are attached, also expressing Dr. Kisov's significant contribution to the development of experimental systems and methods, the organization and conduct of experiments, and the analysis of results.

I have no significant critical remarks on the substance or technical presentation of the documents. It would be more convenient to present the data in the relevant Tables, where they would indicate, for example, the points that carry the relevant quotes. It is also appropriate to list the titles of conference presentations.

Conclusion:

My acquaintance with the results of the scientific research, applied and pedagogical activities of Senior Assistant Professor Dr. Hristo Todorov Kisov gives me reason to believe that he is an accomplished scientist with a significant contribution to the field of development and application of laser technologies and laser systems., with the skills and ability to define and lead

high-level scientific research. The quantitative indicators of his scientific activity correspond to the criteria set by the national law, the General Assembly of the Bulgarian Academy of Sciences and the Regulations on the conditions and procedure for acquiring scientific degrees and for occupying academic positions in the Central Laboratory of Applied Physics at the Bulgarian Academy of Sciences, necessary for occupying the academic position of "associate professor".

Based on the above, I express a positive assessment and support for his candidacy and recommend that the Scientific Jury support and propose to the SC of the Institute of Electronics, Senior Assistant Professor Dr. Hristo Todorov Kisov to be elected to the academic position of "Associate Professor" in the field 4.1. Physical Sciences, specialty "Condensed Matter Physics".

20.10.2025 г.

Prof. N. Nedyalkov