Evaluation report

of dissertation

for obtaining the scientific degree "Doctor of Physical Sciences" in professional field 4.1 Physical sciences (Physics of atoms and molecules), on defence procedure at the Faculty of Physics of Sofia University "St. Kliment Ohridski ”

The opinion was prepared by Prof. Stoyan Christov Russev, DsC, Sofia University “St. Kliment Ohridski”, Faculty of Physics, in his capacity as a member of the scientific jury according to Order № RD 20-127 / 22.01.2021 of the Rector of Sofia University.

Dissertation topic: " Quantum Optical Analogues"

Author of the dissertation: Assoc. Prof. Dr. Andon Angelov Rangelov

I. General description of the submitted materials

1. Submitted documents

The candidate Assoc. Prof. Dr. Andon Angelov Rangelov presented the following documents: 1. Dissertation work (in English); 2. Author's abstract of the dissertation; 3. Information on compliance with the minimum national requirements and the minimum requirements of the Faculty of Physics, including the mandatory tables for Faculty of Physics of the Regulations on the terms and conditions for acquiring scientific degrees and holding academic positions at Sofia University "St. Kliment Ohridski ”; 4. Copy of the diploma for the educational and scientific degree "PhD"; 5. Diploma for higher education of the educational-qualification degree "bachelor" in the specialty "physics"; 6. Declaration of authorship; 7. Autobiography; 8. List of citations; 9. The full text of 32 publications included in the dissertation.

All documents necessary for the defence are presented and they comply with the requirements of the state laws and the Regulations on the terms and conditions for acquiring scientific degrees and holding academic positions at Sofia University "St..Kliment Ohridski ”.

2. Professional and biographical data about the candidate

Andon Rangelov is a graduate of the Faculty of Physics, Sofia University "St. Clement of Ohrid. During the period 1998-2002 he was a bachelor's student in physics, graduating with

honors. From 2004 to 2008 he was a full-time doctoral student and in 2008 he defended a dissertation in the scientific specialty "Theoretical and Mathematical Physics" on "Coherent control of quantum systems with pulsed fields". Since 2009 he has been working in the Department of Theoretical Physics at the Faculty of Physics - until 2012 he was an assistant, from 2012 to 2015 - chief assistant and since 2015 - associate professor at the Faculty of Physics of Sofia University "St. Kliment Ohridski".

The teaching activity of Assoc. Prof. A. Rangelov includes lectures and exercises in Electrodynamics (bachelors), Quantum Mechanics (bachelors) and Quantum transitions (masters). He has been the supervisor of three bachelor theses in physics, co-supervisor of one successful PhD student and is currently co-supervisor of one PhD student.

3. General characteristics of the candidate's scientific achievements

The dissertation presented by Assoc. Prof. Dr. Andon Angelov Rangelov has a volume of 149 pages and contains 6 chapters. The first two chapters are devoted to several variants of composite polarizing optical elements with a wide spectral range - wave plates and a polarizing rotator. The mutual angular positions of the composite phase-delay plates are theoretically optimized, providing the widest possible spectral range of operation of the proposed composite elements. These optical components have been experimentally demonstrated and the results show a very good agreement with the theory. Chapter three is devoted to the adiabatic transformation of polarization, using for theoretical consideration the analogy of the spatial evolution of polarization in uniaxial crystalline media with the temporal evolution of appropriate quantum systems. Chapter 4 discusses frequency conversion in a wide frequency range by using composite nonlinear crystals, and chapter 5 - optimized for a wide spectral range optical insulators based on the non-reciprocity of the Faraday effect or mixing of three waves in a nonlinear medium. The last chapter is related to waveguide optics and discusses schemes for achromatic waveguide separators.

Most of the proposed schemes and theoretical results have been verified and supported by experimental data. According to the author himself, in theoretical research he has a leading contribution, and in experiments the author has developed the theoretical part. The leading ideological role of the theoretical results of the dissertation in the experiments presented in it is obvious to me. This combination of theoretical and experimental research is rare and is a great merit of the dissertation.

The candidate's dissertation includes 32 of his publications - 30 of them are in group I (24 from Q1 and 6 - from Q2) and 2 - in group III. In 17 of the publications from group I included in the dissertation the candidate has a significant contribution (according to the criteria in the Additional requirements to the candidates for obtaining scientific degrees of Faculty of physics), as in 8 of them he is the first author (in 2 - the only author). The candidate's works have been cited (without auto-citations) 575 times (634 according to the latest reference in Scopus). Its Hirsch index is 12.

These scientometric data far exceed both the minimum national requirements (under Art. 2b, para. 2 and 3 of ZRASRB) and the additional requirements of the Faculty of Physics of Sofia University "St. Kliment Ohridski" for obtaining the scientific degree "Doctor of Physical Sciences" in the professional field 4.1 Physical Sciences.

The abstract correctly reflects the main accents in the dissertation and its contributions. There is no legally proven plagiarism in the submitted articles, dissertation and abstract. The scientific publications included in the dissertation do not repeat those from previous procedures for acquiring a scientific degree.

4. Scientific and scientific-applied achievements

The research presented in the dissertation of the candidate Andon Rangelov is united by the general idea of using analogies in the mathematical description of various phenomena and systems in wave optics and quantum mechanics. As shown in the dissertation, the results from one area (CM in the dissertation) inspire new ideas and approaches in the other. The nature of the scientific and scientific-applied contributions of the candidate is the enrichment of existing knowledge and the application of these scientific achievements in practice. I fully accept the scientific contributions formulated by the candidate at the end of the Abstract.

5. Critical remarks and recommendations

I have no critical remarks.

6. Conclusion

After getting acquainted with the presented dissertation, abstract and other materials, and based on the analysis of their significance and contained in them scientific and scientific-applied contributions, I confirm that the scientific achievements meet the requirements of

ZRASRB and the Regulations for its application and the relevant Regulations of Sofia University "St. Kliment Ohridski" for obtaining the scientific degree "Doctor of Physical Sciences". The candidate satisfies the minimum national requirements in the professional field and no plagiarism has been established in the dissertation, abstract and scientific papers submitted at the competition.

I give my positive assessment of the dissertation.

II. OVERALL CONCLUSION

Based on the above, I recommend the scientific jury to award the degree of "Doctor of Physical Sciences" in the professional field 4.1 Physical Sciences (Physics of Atoms and Molecules) to Andon Angelov Rangelov.

9.04.2021 г.

Reviewer:

Stoyan Rusev
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Date: 2021.04.11 15:18:53 +03'00'

(prof. Stoyan Russev)