

OPINION

on a dissertation

for the acquisition of the educational and scientific degree "doctor"

in professional direction 4.1 Physical Sciences,

under the defense procedure at the Faculty of Physics of the University of St. Kliment Ohridski

The opinion was prepared by: Prof. Asen Pashov, Sofia University St. Kliment Ohridski", Faculty of Physics, in his capacity as a member of the scientific jury according to Order No. RD38-321/06/07/2023 of the Rector of Sofia University.

Dissertation topic: "**Design of Composite Pulse Sequences for Quantum Technologies**"

Author of the dissertation: Hayk L. Gevorgyan

Applicant data

Hayk L. Gevorgyan graduated from Yerevan State University with a bachelor's degree in physics in 2016. From 2016 to 2018, he received two master's degrees: in Theoretical physics at Yerevan State University and in Physics, photonics and nanotechnology at the University of Burgundy, Dijon. In 2018 - 2021, he studied in a doctoral program at the Yerevan Institute of Physics, but this study is still uncompleted. From 2022, he is a doctoral student at the Faculty of Physics of the SU, supervised by Prof. Nikolay Vitanov.

General description of the candidate's scientific achievements

The dissertation is in the field of quantum information technology. New applications of composite pulses are presented, a direction in which the supervisor of the doctoral student, Prof. N. Vitanov, as well as members of his group, work intensively. Numerous articles have been published in the field and quite a few doctoral dissertations have been written. What the PhD student specifically dealt with (according to the titles of chapters 2-7) is:

1. Composite pulses for robust ultrahigh-fidelity rotation gates ,
2. Composite pulses for robust ultrahigh-fidelity phase gates,
3. Narrowband and passband composite pulses: application to quantum sensing,
4. Deterministic generation of arbitrary ultrasmall excitation of quantum systems by composite pulse sequences,
5. Composite pulses for ultra robust or ultrasensitive control,
6. Broadband composite nonreciprocal polarization wave plates and optical isolators.

The original results of the dissertation are formed in 6 articles, of which 3 [1,3,6] are in journals with an impact factor and the doctoral student is the first co-author, and in two of the publications he is the sole

co-author of his supervisor. Two of the articles are ready for submission [2,4]. Article [5] appears as conference proceedings published in full text.

Each chapter presents a completed study. It begins with an introduction, motivation and ends with a conclusion. The review of the literature and the research of previous authors is detailed, with which the PhD student convinces that he knows the current state of the problem well.

Critical notes and recommendations

The introductory part of the dissertation is short. I would have expected a more extensive part where the PhD student introduces the reader to the terminology and formalism of quantum mechanics used. In its form, the dissertation would not serve as introductory reading for future masters and doctoral students.

Conclusion

The work was done at a very good professional level. The language of the dissertation is clear. I have no doubts about the originality of the presented results. The topic is current, as evidenced by numerous publications and participation in conferences. The abstract reflects the content of the dissertation.

Hayk L. Gevorgyan's dissertation, author's abstract and scientific publications meet the minimum scientific requirements of ZRAS, its Regulations and the recommended criteria of the Faculty of Physics. I support the awarding of the educational and scientific degree "Doctor".

20.09.2023

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