Skoltech
Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Anton Putintsev

PhD Program: Physics

Title of Thesis: Ambient Polaritonics

Supervisor: Professor Pavlos Lagoudakis
Co-supervisor: Dr. Denis Sannikov

Name of the Reviewer:

I confirm the absence of any conflict of interest	**Date: 27-09-2022**

The purpose of this report is to obtain an independent review from the members of PhD defense Jury before the thesis defense. The members of PhD defense Jury are asked to submit signed copy of the report at least 30 days prior the thesis defense. The Reviewers are asked to bring a copy of the completed report to the thesis defense and to discuss the contents of each report with each other before the thesis defense.

If the reviewers have any queries about the thesis which they wish to raise in advance, please contact the Chair of the Jury.

Reviewer's Report

Reviewers report should contain the following items:

- Brief evaluation of the thesis quality and overall structure of the dissertation.
- The relevance of the topic of dissertation work to its actual content
- The relevance of the methods used in the dissertation
- The scientific significance of the results obtained and their compliance with the international level and current state of the art
- The relevance of the obtained results to applications (if applicable)
- The quality of publications

The summary of issues to be addressed before/during the thesis defense

The PhD thesis contains 6 Chapters. The Chapter 1 is an introduction. It describes research gaps, obtained results as well as structure of PhD thesis. Chapter 2 presents a difference between excitons in inorganic and organic materials, strong light-matter coupling, organic polariton platforms. The last one can be considered as research objects. Chapter 3 describes a qusi-steady regime. Chapter 4 devoted to hybrid organic microcavities. This type of microcavities gives an opportunity to realize a room temperature condensation. Chapter 5 is related to a photon statistics of organic polariton condensates. Chapter 6 contains the conclusions as well as the author's vision of future research. The bibliography list consists of 135 references. The quality of writing and print design is very high. The author uses the LATEX for thesis processing. Obtained results can take into account during an elaboration of polariton coherent sources, amplifiers, switchers, and logic gates.

The main part results of PhD thesis have been already published in the international journals with a high impact factor (IF) named Applied Physics Letters (IF= 3.816) and Scientific Reports (IF=4.996). Also, one of the manuscripts in under revision now. It has been submitted to Physical Review X (IF= 14.417). The quality of the publications is very high and has been confirmed by IF of the journals. The affiliations of the co-authors, as well as the level of the journals and references, show the international level of the PhD thesis results.

The text of PhD thesis is solid and is presented in a cohesive way. However, I have few technical comments and questions to be addressed to the author for improve the quality of this PhD thesis:

1) Main object of research was BODIPY-Br dye molecules. There are many others variants for example J-aggregates of ICG. I did not find enough explanation about this chose in thesis;
2) The author wrote: we restrict the range of pump influences to avoid any possible degradation of the structure. Would be useful to consider a possible photodegradation of BODIPY molecules during irradiation using pulse laser;
3) I did not find any explanation about the thickness of silver coating. It was equal to 200 nm.
4) Page 38, Figure 4-4, Why is the experimental quality factor higher compared to the model quality factor after 3 pairs of hybrid mirrors?
5) A summary after every chapter including the review chapter would be very useful.

Provisional Recommendation

☒ *I recommend that the candidate should defend the thesis by means of a formal thesis defense*

☐ *I recommend that the candidate should defend the thesis by means of a formal thesis defense only after appropriate changes would be introduced in candidate's thesis according to the recommendations of the present report*

☐ *The thesis is not acceptable and I recommend that the candidate be exempt from the formal thesis defense*