

Jury Member Report - Doctor of Philosophy thesis.

Name of Candidate: Igor Ermakov

PhD Program: Physics

Title of Thesis: Dynamics of exceptional states in many-body systems

Supervisor: Professor Boris Fine

Co-supervisor: Dr. Oleg Lychkovskiy

Name of the Reviewer: Dr. Yevgeny Bar Lev

I confirm the absence of any conflict of interest

(Alternatively, Reviewer can formulate a possible conflict)

Date: 04-10-2022

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

- Brief evaluation of the thesis quality and overall structure of the dissertation.

The thesis is based on three publications of the candidate. In one of the publications the candidate is a second author. The dissertation is overall well written. It has an extensive introduction which also summarizes the results and three chapters listing the results. The writing is of good quality, though it is impossible for me to judge the contribution of the candidate, since the results chapters are almost an exact cut&paste from the published works. I have found the text too verbose in some parts, with things stated before shown or defined. It would ease the reading if things are defined where they first appear. Many parts of the dissertation felt repetitive.

Overall, the dissertation is of reasonable quality. It includes at least one original contribution, which was published in a good journal. I would expect a bit more work to be done by a PhD candidate, however, given the fact that the candidate's PhD adviser moved to a different place in the middle of his PhD, I guess it is understandable.

- The relevance of the topic of dissertation work to its actual content

The topic of the dissertation is relevant to its contents.

- The relevance of the methods used in the dissertation

The methods used in the dissertation are relevant and appropriate.

- The scientific significance of the results obtained and their compliance with the international level and current state of the art

The dissertation provides a fresh look on constructing special initial states, which show almost complete revivals of certain observables, without a corresponding revival in the fidelity. It also provides a connection between a certain periodic trajectory in a classical many-spin system, and its quantum counterpart.

- The relevance of the obtained results to applications (if applicable)

The dissertation proposes how almost complete revival states can be used to benchmark small quantum computers using a classical computer, as also outlines an algorithm for delayed secret disclosure. While it might be hard to actually implement these suggestions, they are plausible.

- The quality of publications

PhysRevA.104.L050202 - Is published as a Letter in PRA. It is of high scientific quality, since includes an original idea/look on the topic of thermalization.

EPL 134 60004 - Is published in a top European journal. It is hard for me to judge the contribution of the candidate to this work, since he is not the leading author, and I was not informed about his contribution. In any case, the work is of reasonable quality.

ArXiv:2205.05584 - The work is pretty recent, so it is not yet published. The candidate is the only author, so it definitely shows independent thinking, it is a relatively straightforward generalization of the PRA, but in my view could be easily

published in PRA.

Overall, the collection of works is acceptable by international standards as a PhD, even if slightly border line.

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