Skoltech
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Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Aleksey Lunkin

PhD Program: Physics

Title of Thesis: Sachdev-Ye-Kitaev model in the presence of the quadratic perturbation

Supervisor: Assistant Professor Konstantin Tikhonov

Name of the Reviewer:

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	**Date: 20-06-2022**

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 research presented in this thesis is of highest scientific quality. The work is devoted to the study of Sachdev-Ye-Kitaev (SYK) model of interacting fermions in the presence of potential disorder. This research addressed a fundamental problem of understanding the physics of disordered systems of strongly correlated electrons beyond the Fermi-liquid paradigm.

The first part of the thesis contains a brief introduction to the SYK model's physics. This model demonstrates non-fermi liquid behavior. The author shows the importance of the fluctuations in the model. In the second part of the thesis, the stability of this model with respect to quadratic in fermions perturbation is studied. The author shows that strong fluctuations lead to the stability of properties of the SYK model in small parametric area. The third part resulted in a theoretical prediction of a phase transition as a function of potential disorder strength from the non-Fermi-liquid phase of the pure SYK model to the Fermi-liquid phase for strong potential perturbation.

The theoretical methods used to perform this research program are appropriate, and highly sophisticated.

The results of this research were published in Physical Review Letters - a top tier journal. The publications are of highest quality.

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*