

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Vadim Prokofev

PhD Program: Mathematics and Mechanics

Title of Thesis: Integrable hierarchies of nonlinear differential equations and many-body systems

Supervisor: Professor Anton Zabrodin

Name of the Reviewer: Andrei Zotov

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	Confirm Date: 27-02-2022
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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

This work is devoted to studies of classical integrable systems and their interrelations with integrable hierarchies of soliton equations. The main idea is that a multipole ansatz for solution of soliton equation provides a classical integrable dynamics for the positions of poles. In the end of 70-th using this approach I. Krichever derived the Lax pair with spectral parameter for the elliptic Calogero-Moser model starting from KP equation. This result plays an important role in the theory of integrable systems providing a link to many different applications. Later the approach based on the studies of reductions from hierarchies to classical (and quantum) integrable systems was developed by A. Zabrodin who is an academic supervisor of Vadim.

The results presented in the doctoral thesis are based on five research papers published in the widely-known journals. At the soliton equations side Vadim considered three different hierarchies including KP, 2D Toda lattice and matrix KP. For these hierarchies the most general results were obtained. At the classical many-body systems side the results of the work cover a wide class of models including trigonometric Ruijsenaars–Schneider hierarchy, spin generalization of trigonometric Calogero-Moser hierarchy. Elliptic models of Calogero-Moser and Ruijsenaars–Schneider family were studied as well.

The work consists of four chapters. It is accurately written, contains precise formulations of results and examples. Main statements are proved by explicit calculations. A brief review is also given.

The doctoral thesis by Vadim Prokofev meets high quality standards of research papers in mathematics. The obtained results are important and new. I am sure that Vadim Prokofev deserves obtaining academic degree Doctor of Philosophy in Mathematics.

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

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