Report on the project "Mathematical models of statistical physics of complex systems"

The project "Mathematical models of statistical physics of complex systems" is devoted to non-perturbative studies of complex systems including the systems of equilibrium and non-equilibrium statistical physics, quantum mechanics and quantum field theory using methods of the theory of integrable systems, as well as to development of appropriate mathematical techniques. The main attention is paid to studies of exactly solvable (integrable) models. Though the set of integrable models is an exceptional subset in the world of models of theoretical physics, the results obtained from their exact solutions can be extended far beyond the range of integrability using the universality concept. This is why the subject of the project is of high importance for those fields of statistical and mathematical physics, where the traditional perturbative methods of theoretical physics fail. Among these fields the members of the team plan to study non-equilibrium low-dimensional stochastic systems such as reaction-diffusion and driven-diffusive particle systems, equilibrium statistical mechanics of lattice models like dimers polymers, percolation and quantum mechanics of spin chains etc. Another part of the project is devoted to the development of mathematical tools of the theory of integrable models like the theory of special functions, representation theory etc.

The project is expected to exploit the power of the theory of integrable systems to bring an important contribution to several fields of statistical and mathematical physics and to make an impact on the theory itself. The methods and approaches are adequate to the aims of the project. I would like to point out the interdisciplinarity of the project and the presence of both applied and fundamental directions of planned investigations. This is definitely the very strong side of the project. The team of the project possesses the background necessary for the project realization. The members of the group are the authors of pioneering results in the fields the project deals with. The solid list of international cooperations reflects the serious internationally recognized level of the planned research.

To conclude, I have no doubt that the aims of the project will be achieved and important results will be obtained in course of its realization. I highly support opening the new project "Mathematical models of statistical physics of complex systems" within the Topical Plan for JINR Research and International Cooperation.

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