**Annotation information**

on the results of the topic 01-3-1116-2014/2018

**"**Modern mathematical physics:

strings and gravity, supersymmetry and integrability**"**

The studies were conducted in the following areas: superstrings; developing of new mathematical methods for adequate description of  variety of integrable modelsр and their exact classical and quantum solutions; analysis of a wide range of tasks in superstrings and superbranes theory including the study of non-pertubative regimes of supersymmetric gauge theories; development of cosmological models of the early Universe, primordial gravitational waves and construction of the microscopic description of black.

The general dynamical equations describing homogeneous isotropic cosmologies coupled to a scalaron ψ have been obtained. Global issues in minimal supergravity models where a single field inflaton potential emerges were considered. New models of compact stars with different equations of states in the model of minimal dilaton gravity were developed. For a 5d supergravity model we constructed black brane and Vaidya anisotropic backgrounds with Lifshitz-like boundaries.

In symplectic geometry a new notion of special Bohr - Sommerfeld lagrangian submanifolds has been introduced. A generalization of the notion of toric structure on a compact symplectic manifold, which is called pseudotoric structure, has been proposed. Integrable open (spin) chain models of gl(n|m)- and osp(n|m)-type were formulated and investigated (in the algebraic terms of the algebra of the permutation group, Brauer algebra and their quantum deformations). The determinant representations for the correlation functions in such models have been constructed.

There was continued the study of the quantum-mechanical systems of particles with extended worldline supersymmetry. New one-dimensional systems with extended and deformed N=4 supersymmetry were constructed in superfield approach for the different cosets of the supergroups SU(2|1) and SU(2|2). Structure of superfield counterterms of the D=6, N=(1,1) supersymmetric Yang-Mills theory was studied. Explicit calculations in harmonic superspace show the one-loop finiteness of this theory.

New multisoliton solutions of the Faddeev-Skyrme model and self-dual extension of the Skyrme model are constructed. New models of massive particles of fixed spin and higher spin particles are constructed in the twistor formulation.There are investigated N=4 supersymmetric quantum mechanical sigma models for study of diverse geometries. In the study of N=4 supersymmetric mechanics, there is the qeneralization of the Witten–Dijkgraaf–Verlinde–Verlinde (WDVV) equation from Rn to an arbitrary Riemannian manifold. The supersymmetric extensions of the Calogero model with arbitrary number of supersymmetries has been constructed.

A new method to investigate stability of higher order gravity theories was proposed. The correction to the Casimir force is calculated due to the relative motion of the boundaries. Within the Dirac model for the electronic excitations of graphene the full polarization tensor with finite mass and chemical potential were calculated. A harmonized inflation scenario is proposed, in which only the Standard Model fields are present: robust inflation on the Planck scale, caused by the Yang-Mills field coupled to gravity, naturally prepares the required initial conditions for inflation on the scale of the Great Unification caused by the Higgs field. We have refuted the old hypothesis that black holes with electric, magnetic, and dilaton charges are not singular only at quantized values of the dilaton coupling constant. We have shown that this condition is satisfied only in the linear approximation, and in general case the regularity condition leads to the quantization of the dilaton charge.

The results were published in leading scientific journals (more than 180 papers) and have been presented at the representative Russian and international conferences (more than 40 talks). The planned work was fully completed. In the process of work the fixed assets and intellectual property, issued by patents, was not created.

Topic leaders A.P.Isaev

 S.O.Krivonos

 A.S.Sorin

Scientific leader of the topic A.T.Filippov