

Summary of works

«Scalar solitons, boson stars and hairy black holes»

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Collection of works includes 40 papers and one monograph published in 2014-2020. Main direction of study of these works is related with construction and study of the structure of classical multisoliton solutions in various non-linear field theories, also in the presence of gravitational interaction. This approach allows to unify the consideration of both topological and non-topological solitons in different dimensions in the flat and in the curved spacetime.

Main results of the study are

- Discovery and investigation of new mechanism of resonance reversible energy transfer between the translational mode of a soliton and collective excitations off the perturbative spectrum;
- Investigation of new mechanism of interactions between the solitons related to the presence of localized collective fermionic states;
- Construction of new stationary solution of the localized solitons of the Fridberg-Lee-Sirlin model and its generalizations;
- Construction of new multisoliton solutions of the Faddeev-Skyrme model and analysis of their structures and dependency on the form of the potential;
- Discovery of new solutions of the extended Skyrme model, which correspond to the crystal structures of dense soliton matter;
- Construction of new soliton solutions of the Gross-Pitaevskii equation, which describe the dynamics of one-component Bose-Einstein condensate in a new, previously unknown, hopfion phase;
- Discovery of a new class of topological planar solitons with two topological invariants in the Skyrme-Maxwell theory;
- Construction of new stationary solutions of the Einstein-Skyrme theory in asymptotically flat space-time with Kerr geometry, and in the space time with AdS geometry;
- Explicit construction of new family of localized regular solutions of the SU(2) Yang-Mills theory coupled to the R² gravity, study of their stability with respect to linearized fluctuations of the metric and the matter fields;
- Proof of existence of new axially-symmetric stationary solutions of the massive Einstein-Klein-Gordon theory with Kerr geometry with angular frequency synchronized with the rotation of the event horizon.
- Discovery of new family of the Einstein theory with fermionic modes localized by gravitational interaction;

- Investigation of thermodynamical properties of hairy black holes with non-Abelian matter fields in the SU(2) Yang-Mills theory in the spacetime with AdS geometry.
- Development of new software package CESDSOL, with computational power significantly exceeds that of previously used for numerical solutions of various systems of non-linear partial differential equations.