

Alekseev George A.

Position: Leading researcher
Steklov Mathematical Institute
Russian Academy of Sciences
Moscow, Russia

Period covered: 1975 – present time



2010 List of Publications

1. George A. Alekseev, "New soliton generating transformations in the bosonic sector of heterotic string effective theory", *Proceedings of the Twelfth Marcel Grossmann Meeting on General Relativity*, edited by Thibault Damour, Robert T Jantzen and Remo Ruffini, World Scientific, Singapore (2010) (3 pages)

Abstract In the author's paper (Phys.~Rev. {\bf D80}, 041901(R) (2009)), the integrable structure of the symmetry reduced bosonic dynamics in the low energy heterotic string effective theory was presented. In that paper, for a complete system of massless bosonic fields which includes metric, dilaton field, antisymmetric tensor and any number of Abelian vector gauge fields, considered in the space-time of D dimensions with $D-2$ commuting isometries, the spectral problem equivalent to the symmetry reduced dynamical equations was constructed. However, the soliton generating transformations were described in that paper only for the case in which all vector gauge fields vanish. In this paper, we recall the integrability structure of these equations and describe some new type of soliton generating transformations in which the gauge fields can enter the background (seed) solution as well as these can be generated even on vacuum background by an appropriate choice of soliton parameters.

2. George A. Alekseev, "Thirty years of studies of integrable reductions of Einstein's field equations", *Proceedings of the Twelfth Marcel Grossmann Meeting on General Relativity*, edited by Thibault Damour, Robert T Jantzen and Remo Ruffini, World Scientific, Singapore (2010) (22 pages).

Abstract More than thirty years passed since the first discoveries of various aspects of integrability of the symmetry reduced vacuum Einstein equations and electrovacuum Einstein - Maxwell equations were made and gave rise to constructions of powerful solution generating methods for these equations. In the subsequent papers, the inverse scattering approach and soliton generating techniques, Bäcklund and symmetry transformations, formulations of auxiliary Riemann-Hilbert or homogeneous Hilbert problems and various linear integral equation methods have been developed in detail and found different interesting applications. Recently many efforts of different authors were aimed at finding of generalizations of these solution generating methods to various (symmetry reduced) gravity, string gravity and supergravity models in four and higher dimensions. However, in some cases it occurred that even after the integrability of a system was evidenced, some difficulties arise which do not allow the authors to develop some effective methods for constructing of solutions. The present survey includes some remarks concerning the history of discoveries of some of the well known solution generating methods, brief descriptions of various approaches and their scopes as well as some comments concerning the possible difficulties of generalizations of various approaches to more complicate (symmetry reduced) gravity models and possible ways for avoiding these difficulties.

3. G.A. Alekseev, "Reply to F.J.Ernst, V.S.Manko and E.Ruiz "On interrelations between Sibgatullin's and Alekseev's approaches to the construction of exact solutions of the Einstein-Maxwell equations" (2010 J.~Phys.: Conf. Ser. {\bf 229} 012050)", submitted to *J.Phys.A*; Preprint: [arXiv:1008.2787v1 \[gr-qc\]](https://arxiv.org/abs/1008.2787v1) 16 Aug 2010 (16 pages)

Abstract The necessity of this Comment was invoked by numerous mistakes, erroneous discussions and misleading citations curiously collected in the paper of F.J.Ernst, V.S.Manko and E.Ruiz and concerning the interrelations between two integral equation methods developed for solution of Einstein - Maxwell equations more than twenty five years ago. At first, we clarify the origin of the errors in the paper of F.J.Ernst, V.S.Manko and E.Ruiz which gave rise to so curious authors "conclusions" as that the monodromy transform integral equations "...are simple combinations of Sibgatullin's integral equations and normalizing conditions..." or even

that "...in the electrovac case Alekseev's integral equations are erroneous...". In the Comment, the way of correct derivation of Sibgatullin's reduction of the Hauser and Ernst integral equations in the context of the monodromy transform approach is briefly outlined. In response to various speculations and priority claims collected in the section 3 of the F.J.Ernst, V.S.Manko and E.Ruiz paper, the concrete references are given here to the papers which were ignored completely by these authors and which show that the so called "extended electrovacuum N-soliton solutions" considered by E.Ruiz, V.S. Manko and J. Martin in 1995, are not new because all these solutions are the particular cases of a larger class of solutions constructed much earlier in explicit (determinant) form using the monodromy transform equations, and that the real story of construction of the solution for superposition of fields of two Reissner - Nordström sources and of corresponding equilibrium configurations found in our papers with V.Belinski differs crucially from that, which one can read in the paper of F.J.Ernst, V.S.Manko and E.Ruiz.

Visits: 1. Pescara: 22.06.2010-23.06.2010
2. IHES (Paris, France): 20.09.2010 – 30.09.2010

Conferences and seminars:

1. "Nonlinear Physics. Theory and Experiment VI", Gallipoli (Leece, Italy) from June 23 to July 3, 2010.

Talk: G.A.Alekseev, "Einstein-Maxwell solitons and aspects of black hole dynamics in external gravitational and electromagnetic fields" (30 min)

2. IHES, Séminaires sur les aspects théoriques et expérimentaux de la gravitation,

Talk: G.A.Alekseev, "Monodromy transform approach to solution of integrable reductions of Einstein's field equations in General Relativity and String gravity" (1h)