

## **Alekseev George A.**



Position: Leading researcher, Steklov Mathematical Institute

of the Russian Academy of Sciences Moscow, Russia

Period covered: 1975 – present time

### **I Scientific Work**

Development of the theory of integrable reductions of Einstein's field equations and its applications in General Relativity and other gravity, string gravity and supergravity models in four and higher dimensions. Construction of physically interesting solutions for stationary axisymmetric fields, interacting gravitational and electromagnetic waves or cosmological models and studies of their physical and geometrical properties.

### **II Conferences and educational activities**

*II a Conferences and Other External Scientific Work*

*II b Work With Students*

*II c Diploma thesis supervision*

*II d Other Teaching Duties*

*II e. Work With Postdocs*

### **III. Service activities**

*III a. Within ICRANet*

*III b. Outside ICRANet*

### **IV. Other**

## **2016 List of Publication**

"Collision of strong gravitational and electromagnetic waves in the expanding universe"

G. A. Alekseev

Phys. Rev. D 93, 061501(R) (2016) – Published 3 March 2016

### **Abstract**

An exact analytical model of the process of collision and nonlinear interaction of gravitational and/or electromagnetic soliton waves and strong nonsoliton electromagnetic traveling waves of arbitrary profile propagating in the expanding universe (the symmetric Kasner spacetime) is presented. In contrast to intuitive expectations that rather strong traveling waves can destroy the soliton, it occurs that the soliton survives during its interaction with electromagnetic waves of arbitrary amplitude and profile, but its parameters begin to evolve under the influence of this interaction. If a traveling electromagnetic wave possesses a finite duration, the soliton parameters after interaction take constant values again, but these values in general are different from those before the interaction. Based on exact solutions of the Einstein-Maxwell equations, our model demonstrates a series of nonlinear phenomena, such as (a) creation of gravitational waves in the collision of two electromagnetic waves, (b) creation of electromagnetic soliton waves in the collision of a gravitational soliton with traveling electromagnetic waves, (c) scattering of a part of a soliton wave in the direction of propagation of a traveling electromagnetic wave, and (d) quasiperiodic oscillating character of fields in the wave interaction region and multiple mutual transformations of gravitational and electromagnetic waves in this region. The figures illustrate these features of nonlinear wave interactions in general relativity.