

Belinski Vladimir

Position: ICRA Net, Faculty Member

Period covered: December 2009-December 2010



I. Scientific Work

Cosmology:

It was finished the first part of the book "Cosmological Singularity" by V.Belinski and T.Damour. The book we are planning to publish with Cambridge University Press. The short and adapted version of this part will appear in AIP Conference Proceedings of XIV Brazilian School of Cosmology and Gravitation (the School was held in Rio de Janeiro in September 2010).

Astrophysics:

We (V.Belinski and G.Alekseev) continued the investigation of exact solutions for the motions of self-gravitating shells which can have some applications to the stellar clusters. The corresponding paper have been published in the Journal of Korean Physical Society in October 2010.

Exact solutions of Einstein and Einstein-Maxwell equations:

1) The new derivation of static equilibrium state for two charged masses in General Relativity was found (V.Belinski and G.Alekseev) in the framework of the Inverse Scattering Method in contradistinction to the previous derivation by the Integral Equation Method. This shows that such solution are of solitonic character and represents the particular case of the most general 12-parametric stationary solitonic solution for two rotating charged objects obtained by Alekseev in 1986. It was shown also that an analytical continuation of this 12-parametric solution in the space of arbitrary parameters is possible which means that applicability of the Inverse Scattering Method in presence of electromagnetic field not restricted only to the naked singularities cases but includes the cases with horizons as well.

2) The stability (with respect to the appearance of rotation) of the true equilibrium static solution recently obtained by Alekseev and Belinski was under investigation. Preliminary results shows that stability exists for small enough rotation but the case of rapid rotation and the structure of the border (in the space of parameters) between stable and unstable solutions remain to be seen. The study is still in progress.

3) It was shown that (unlike to some statements in the literature) the real poles in the dressing matrix of the Alekseev's Inverse Scattering Method for electro-vacuum does not lead to any principal difficulties but the restriction is that real poles correspond to the extreme objects. The formal technique for Inverse Scattering Method for such special case have been constructed. This technique has some new mathematical peculiarities in comparison to the case of complex poles.

4) The work on extension of the of the book "Gravitational Solitons" by V.Belinski and E.Verdaguer have been started (keeping in mind the second edition). The new chapter presenting the Integral Equation Method for construction of solutions of Einstein-Maxwell equations and additional sections demonstrated the new practical applications of the old Inverse Scattering Method have been prepared for inclusion into the second edition.

5) The new derivation for the Kerr solution was found as solitonic perturbation of the Schwarzschild background. The new interpretation for the mass of a Kerr black hole was obtained.

II. Publications

1. G.Alekseev and V.Belinski "On the equilibrium configuration of two Reissner-Nordstrom objects and repulsive gravity", Journ. Korean Phys. Soc., **57**, 571 (2010).
2. V.Belinski "On the Singularity Phenomenon in Cosmology", AIP Conference Proceedings, submitted (2010).

III. Conferences and educational activity

Conferences:

2-nd Galileo-XuGuangqi Meeting, 12-17 July 2010, Ventimiglia (Italy).
The talk: V.Belinski "Stationary Einstein-Maxwell Solitons".

Educational activity:

1) V.Belinski "On the Singularity Phenomenon in Cosmology", the course of 7 lectures at XIV Brazilian School of Cosmology and Gravitation, CBPF and Brazilian ICRANET Department, Rio de Janeiro, 30 August-11 September, 2010.

2) V.Belinski "Cosmological Singularity", the course of 5 lectures for Erasmus Mundus Joint Doctorate Program, Nice University "Sophia Antipolis", Nice (France), 20-25 September, 2010.

III. Work with students:

A.Bravetti (PhD degree under IRAP, in progress)