

## Report Short Visit Grant

Title: Affine polynomial Lie Algebra's  
reference nr. 1525  
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Visit of Johan van de Leur to  
Universita degli Studi di Milano-Bicocca  
Date: November 5 - November 11 2006  
Host: Prof. Franco Magri

The purpose of the visit was to start a joint research with Dr. Paolo Casati and Dr. Giovanni Ortenzi of the Universita degli Studi di Milano-Bicocca. The subject of the research was Affine polynomial Lie Algebra's.

During this visit I gave the talk "Geometric Baecklund-Darboux transformations for KP" in the Mathematical Physics Seminar at Universita degli Studi di Milano-Bicocca and I have discussed 3 topics with Dr. Paolo Casati and Dr. Giovanni Ortenzi. The first topic concerns generalizations of the article "New Integrable Hierarchies from Vertex Operator Representations of Polynomial Lie Algebras" by Casati and Ortenzi in Journal of Geometry and Physics 56 (2006). We think that it is possible to generalize this construction in the case of the affine Lie algebra of type  $gl(n)$ , viz., to obtain such a construction for every partition of  $n$ . We will work out this construction in the near future and then write a joint paper.

The second topic was to try to describe the geometric Baecklund-Darboux transformations of the paper

"Geometric Baecklund-Darboux transformations for the KP hierarchy" by Helminck and van de Leur in Publ. Res. Inst. Math. Sci. 37 (2001) in the hamiltonian framework. From our discussions it became clear that this problem is probably very complicated and we decided not to investigate this further.

The last topic is to try to understand if there is a connection between the paper "Sine-Gordon Equation and Representations of Affine Kac-Moody Algebra  $sl(2)$ " by Yuly Billig which appeared in Journal of Functional Analysis 192 (2002) and the so called negative flows of the KdV hierarchy. It turns out that indeed there is a connection. At this moment we are working on the  $sl(n)$ -case (via e-mail). It turns out that there is a close connection to the periodic Toda lattice. We will write a joint paper on this subject.