Journées de Physique Mathématique
Lyon, du 12 au 14 Septembre 2012
AdS/CFT, Supersymmetry, and Integrability

Programme

Volker SCHOMERUS (DESY, Hamburg), *Strings in AdS Spacetimes*
Vera SERGANOVA (UC Berkeley), *Supersymmetry and Super-Lie Algebras*
Konstantin ZAREMBO (NORDITA, Stockholm), *Quantum Super-Yang-Mills theories and Integrability*

Mercredi 12 Septembre 2011
salle Fokko du Cloux

09:30 10:30	Volker Schomerus	Strings in AdS I
11:00 12:00	Vera Serganova	SuSy and SuLie I
14 :00 15 :00	Kenji Iohara	Extension SuLie
15:30 16:30	Konstantin Zarembo	QSuYM & Integrability I
17:00 18:00	Volker Schomerus	Strings in AdS II

Jeudi 13 Septembre 2011
salle Fokko du Cloux

09:30 10 :30	Vera Serganova	SuSy and SuLie II
11:00 12:00	Konstantin Zarembo	QSuYM & Integrability II
14:00 15:00	Jérôme Germoni	``Walking wild''
15:30 16:30	Volker Schomerus	Strings in AdS III
17:00 18:00	Vera Serganova	SuSy and SuLie III

Vendredi 14 Septembre 2011, salle Fokko du Cloux

09:30 – 10:30	Konstantin Zarembo	QSuYM & Integrability III
11:00 – 12:00	Volker Schomerus	Strings in AdS IV
14 :00 – 15:00	Jean-Michel Maillet	``Integrability'' TBA
15:30 – 16:30	Vera Serganova	SuSy snd SuLie IV
17:00 – 18:00	Konstantin Zarembo	QSuYM & Integrability IV

Un dîner sera organisé jeudi 13 Septembre à 20H, au restaurant La Brunoise (4, rue Alexandre Boutin, Villeurbanne).

Résumés/Abstracts:

Minicourses :

Volker Schomerus: *"Strings in Anti-de Sitter Backgrounds"*

Gauge/String dualities provide a new (super-)geometric perspective on quantum gauge theories that comes with novel computational tools. In these lectures I will review some of the basic concepts and results along with a few challenges for future research.

 (1) Introduction to Gauge/String Duality
 (2) Supercoset Sigma Models
 (3) Sigma Models and Strings in AdS
 (4) Spectroscopy for Superspheres

Vera Serganova: *"Supersymmetry and Lie superalgebras"*

The goal of these lectures is to give an introduction to Lie superalgebras and their representation theory.

The first lecture starts with definitions of a Lie superalgebra and a Lie supergroup and discussion of connection between these two notions. I will give several examples of Lie supergroups and, in particular, define Berezinian and odd determinant. Then I plan to review the classification of simple Lie superalgebras over complex numbers and basic structure theory.

The second lecture deals with elementary representation theory of classical supergroups, for instance, super-analogue of Peter-Weyl theorem. We classify finite-dimensional irreducible representations of classical Lie superalgebras (su(m,n), osp(m,2n)) and define degree of atypicality. We discuss polynomial representation of su(m,n) (super Schur-Weyl duality) and Q(n) (Sergeev duality). Finally, I will describe the center of the universal enveloping algebra (Casimir elements).

The third lecture is on supergeometry methods in representation theory. We start with constructing homogeneous supermanifolds. My main examples are grassmanianns and flag supermanifolds. We shall see that the Borel-Weil-Bott theorem does not hold in the supercase. I will formulate a weaker version of it with application to representations. If times permits, I will also review the notion of associated variety with application to Kac-Wakimoto conjecture about superdimension.

In the last lecture I plan to comment on recent results about categorification of gl(infinity) by Brundan and Stroppel. I am going to explain the combinatorics of weight diagrams with application to general character formulas for classical Lie superalgebras.

Konstantin Zarembo: *"Quantum Super-Yang-Mills theories and Integrability"*

1. Super-Yang-Mills theory and its symmetries
2. Spin chains and Bethe ansatz
3. Classical Bethe equations, finite-gap integration, and classical strings in AdS(5)xS(5)
4. Thermodynamic Bethe ansatz and the Y-system
5. (Time permitting) Algebraic Bethe ansatz

Orateurs locaux :

Jerome Germoni (ICJ) :   *"From irreducible to indecomposable: a walk on the wild side"*

It is known that most simple Lie superalgebras have finite-dimensional representations that are not isomorphic to the direct sum of their irreducible constituents. Similarly, highest weight modules and modules in the intermediate series of the Virasoro algebra admit non-split extensions, which are used e.g. in logarithmic conformal field theory. This raises the problem to classify these representations.

It turns out that most of these categories of representations have ``wild representation type''. In the talk, we will explain what this means and why it makes it hopeless, in practice, to obtain a classification of all representations.

Kenji Iohara (ICJ) :   *"Central extension of Lie superalgebras"*

After recalling some basic facts about central extensions of Lie (super)algebras, I will present some known results for Lie (super)algebras related to simple finite Lie (super)algebras.

Jean-Michel Maillet (ENS) :   *"Form factor approach to the asymptotic behavior of correlation functions in critical models"*

I will describe the form factor approach to the correlation functions of critical models in the example of the XXZ Heisenberg chain in the thermodynamic limit (the limit of infinite size chain). The methods amounts to first compute the matrix elements of the local operators in the eigenstates basis (form factors) and their behavior in the thermodynamic limit. The leading asymptotic behavior of the correlation functions, written as sums over form factors, can then be computed using a purely combinatorial summation formula that first appeared in the theory of z-measures over partitions. As a result, we derive from first principles the conformal behavior of critical lattice models in the thermodynamic limit.

Organisateurs : Johannes Kellendonk (ICJ), Henning Samtleben (ENS), Thomas Strobl (ICJ)