PAFT 2016 - Problemi Attuali di Fisica Teorica

Current Problems in Theoretical Physics

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Lloyd's Baia Hotel - Vietri sul Mare (Italy)

Noncommutative Geometry

Chairperson: L. Castellani

Sunday, 20th March

15:00

Line bundles over noncommutative spaces

Giovanni LANDI

University of Trieste

We give a `Fock space' construction of principal circle bundles over a noncommutative space, as `direct sums of line bundles'. For each of these one gets an analogue of the classical Gysin sequence which relates K-theory classes of the total space and base space algebras. Implications for T-duality on noncommutative spaces will be drawn out of this construction.

15:45

Non-associative deformations of circle bundles

Francesco D'Andrea

Federico II, Napoli

The first part of the talk will be a tour in non-associative geometry, from almost symplectic structures to the generalized geometries of Hitchin and Gualtieri. I will then recall the notion of cochain quantization, and illustrate its application in the study of circle bundles/line bundles over the noncommutative torus.

16:30 **Coffee break**

17:00

Quantum Homogeneous Spaces and Superspaces

Rita Fioresi

Università di Bologna

We want to give a quantum deformation of the quotient G/P where G is an algebraic reductive group (or supergroup) and P is a parabolic subgroup. We start from the quantum (super)group $O_q(G)$ and our deformation of G/P will be realized as a certain subring of $O_q(G)$. In the end we also discuss the quantization of G/P as P-principal bundle.

17:45

The Geometry of Supermanifolds and Applications

Pietro Antonio Grassi

Università del Piemonte Orientale

Some recent developments in string theory and in supersymmetric theories have prompted a deeper analysis of the geometry of supermanifolds (manifolds with anticommuting coordinates). In the seminar, I will illustrate these new tools: in particular the differential forms and the integration theory on supermanifolds. Several applications of interest for string theory, supergravity and topological quantum field theories will be presented.

Monday, 21st March

9:30

Cartan's structure equations and Levi-Civita connection in Noncommutative Geometry from Drinfeld Twist

Paolo Aschieri

Università del Piemonte Orientale

Deformation quantization of manifolds via Drinfeld twists allows to canonically deform the algebra of functions and the differential geometry. This leads to a general notion of NC connections on bimodules and on products of bimodules (no equivariance condition with respect to the group underlying the twist deformation being required). In particular given a connection on the bimodule of vector fields we canonically obtain a connection on the bimodule of one forms and on their tensor products. On one hand this is used to derive NC Cartan's structure equations that unify different approches to torsion and curvature tensors. On the other hand we show that a metric tensor defines a unique torsion free and metric compatible connection. The construction does not require the choice of a basis of one forms or vector fields, explicit expressions in an arbitrary basis are presented, and generalize to arbitrary twists previous results on abelian twists.

10:15

A sheaf theoretic description of quantum principal bundles

Chiara Pagani

University of Göttingen

In this talk we report on an algebraic approach to the study of quantum principal bundles that is based on sheaf theoretic methods.
A pair $(X,\mathcal{O}_X)$ consisting of a topological space X and a sheaf $\mathcal{O}_X$ of (not necessarily commutative) algebras can be viewed as a quantum (ringed) space.
In this framework, we define a quantum principal bundle to be a sheaf A of algebras over X with $\mathcal{O}_X$ as sub-sheaf of elements (co)invariant with respect to the (co)action of a quantum group of symmetries. More precisely, A is required to be a sheaf of Hopf-Galois algebra extensions. We describe a general theory of deformation of (sheaves of) Hopf-Galois algebra extensions via Drinfeld twists and show how to construct in this way examples of quantum principal bundles as deformations of classical principal bundles.
Based on joint works with L. Cirio and with P. Aschieri, P. Bieliavsky and A. Schenkel.

11:00 **Coffee break**

11:30

Quantum projective spaces from quantization of integrable models

Francesco Bonechi
University of Amsterdam

We discuss an approach to quantum projective spaces based on the quantization of the symplectic groupoid integrating the underlying semiclassical Poisson structure. The main idea is to use the singular real polarization defined by a multiplicative integrable model, that is an integrable model compatible with the groupoid structure. The output of the construction is the groupoid of Bohr-Sommerfeld leaves and its C*-algebra, that we describe explicitly. This construction is based on the bihamiltonian approach to integrable models and can be applied to other examples, like quantum grassmannians.

12:14

Perturbative BV-BFV theories on manifolds with boundary

Alberto Cattaneo
University of Zurich

According to Segal and Atiyah, a quantum field theory on manifolds with boundary should be thought of as, roughly speaking, the assignment of a vector space (space of states) to the boundary and an element thereof (the state or the evolution operator) to the bulk, in a way that is compatible with gluing. In this talk (based on joint work with P. Mnev and N. Reshetikhin) I will describe how this has to be reformulated when working in perturbation theory. In particular, I will discuss the perturbative quantization of gauge theories on manifolds with boundary. It turns out that, under suitable assumptions, the bulk symmetries, treated in the BV formalism, naturally give rise to a cohomological description of the reduced phase space (BFV formalism) in a correlated way that can be quantized. Time permitting, I will present some examples.