PAFT 2017 – 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: Paolo Aschieri

Monday, April 10

9:30-10:10 **Some applications of the BV-BFV formalism for field theories on manifolds with boundary**

Alberto Cattaneo

Zurich University

In this talk I will introduce the classical and quantum BV-BFV formalism via some simple examples. I will analyze the interplay between the bulk and boundary symmetries and the dependency on background states. Comparison with other quantization method will also be discussed in some instances.

10:15-10:55 **Metrics on state spaces: bipartite systems**

Francesco D'Andrea

University of Naples "Federico II"

Given a noncommutative manifold (a spectral triple), there is a natural construction of a metric on the space of states of the system, generalizing both the geodesic distance of Riemannian geometry and Monge-Kantorovich distance of transport theory. I will discuss the behaviour of such a metric with respect to "Cartesian products" of noncommutative manifolds ("bipartite systems" in the language of quantum physics).

11:00-11:30 **Coffee Break**

11:30-12:10 **Quantum Principal bundles over non affine bases**

Rita Fioresi

Bologna University

The purpose of this talk is to illustrate a theory of quantum principal bundles, over a projective base using sheaf theoretic methods. The key example for such a base is the quotient of a semisimple algebraic group G by a parabolic subgroup P. We interpret the quotient map from G to G/P as a principal bundle map and we proceed to give a quantization, in the sense of quantum groups, that preserves all the natural actions (which become coactions in the language of quantum groups). In the end we examine the case of quantum grassmannian in detail.

12:15 -12:55 **Noncommutative spacetimes**

Koen van den Dungen

Sissa

The framework of noncommutative geometry can be used to describe models of gauge theories. More precisely, one considers almost-commutative manifolds, which are given by the product of a classical manifold (representing spacetime) with a finite noncommutative space (describing the gauge interactions). For a suitable choice of the finite space, the complete Standard Model of elementary particle physics arises.

However, the language of noncommutative geometry is heavily geared towards Riemannian manifolds (i.e., spaces instead of spacetimes). It remains an open question how this framework should be adapted to describe Lorentzian manifolds. In this talk I will describe an explicit construction for a Lorentzian version of noncommutative geometry. We start with the idea that a Lorentzian spacetime can be viewed as a family of spacelike hypersurfaces. Similarly, I will show how we can describe a 'noncommutative spacetime' in terms of a family of 'noncommutative hypersurfaces'.

15:30-16:10 **Lorentz invariant noncommutative gravity and supergravity**

Leonardo Castellani

Eastern Piedmont University

We present a mini-review on Lorentz invariant noncommutative (super)gravity theories in D=3,4,5 dimensions.

16:15-16:55 **Deformed relativistic symmetries: decoherence and dimensional reduction at the Planck scale**

Michele Arzano

University of Rome "La Sapienza"

I will start with a brief introduction to the framework of deformed relativistic symmetries based on Lie-group momentum spaces whose curvature sets a fundamental (Planckian) UV scale at the kinematical level. I will then show how these models can be related to a fundamental decoherence at the Planck scale and how they are relevant for the phenomenon of "dimensional reduction", ubiquitous in a variety of approaches to quantum gravity.

17:00-17:30 **Coffee Break**

17:30-18:10 **Noncommutative field theory and quantum deformations of centrally extended algebras**

Flavio Mercati

University of Rome "La Sapienza"

I will present a recipe for doing field theory on a noncommutative spacetime using the tools of noncommutative differential geometry developed by Woronowicz, Brzezinski, Radko and Vladimirov using the study case of kappa-Poincaré/kappa-Minkowski. Using these tools it is possible to introduce gauge fields and spinors, which are the basic constituents of the Standard Model of particle physics. As it turns out, in kappa-Minkowski there is an incompatibility between the covariant non-cyclic integral and gauge invariance, which suggests that one cannot simply assume that, upon introducing gauge symmetries, the kappa-Poincaré group is simply extended trivially. In fact, in general, the operations of quantum deformation and central extension of a group do not commute. This motivates the study of quantum deformations of central extensions of the Poincaré and (Anti-)de Sitter groups, which I have completed so far only in 1+1 dimensions.