- **F. Petit**, *Quantization of spectral curves and DQ-modules*

  In this talk, I will explain how the quantization of spectral curves associated to Higgs bundles can be studied from the standpoint of DQ-modules. In particular, I will prove that given an holomorphic Higgs bundle on a compact Riemann surface of genus greater than one, there exists an holonomic DQ-module supported by the spectral curve associated to this bundle.

- **M. Schlichenmaier**, *N-point Virasoro algebras considered as Krichever–Novikov type algebras*

  We explain how the recently again discussed $N$-point Witt, Virasoro, and affine Lie algebras are genus zero examples of the multi-point versions of Krichever–Novikov type algebras as introduced and studied earlier by me. Using this more general point of view, useful structural insights and an easier access to calculations can be obtained.

- **M. Stienon**, *Kontsevich–Duflo theorem for Lie pairs*

  The Kontsevich–Duflo theorem asserts that, for any complex manifold $X$, the Hochschild–Kostant–Rosenberg map twisted by the square root of the Todd class of the tangent bundle of $X$ is an isomorphism of associative algebras form the sheaf cohomology group $H^\bullet(X, \wedge T_X)$ to the Hochschild cohomology group $HH^\bullet(X)$. We will show that, beyond the sole complex manifolds, the Kontsevich–Duflo theorem extends to a very wide range of geometric situations describable in terms of Lie algebroids and including foliations and actions of Lie groups on smooth manifolds. A Lie pair $(L, A)$ consists of a Lie algebroid $L$ together with a Lie subalgebroid $A$. To each Lie pair are associated two Gerstenhaber algebras, which play roles similar to the spaces of polyvector fields and polydifferential operators. The Hochschild–Kostant–Rosenberg map twisted by the square root of the Todd class of the Lie pair yields an isomorphism between these two Gerstenhaber algebras.

- **A. Tortorella**, *Homotopy versions of Jacobi bundles*

  In this talk, based on joint work with Andrew J. Bruce, we present the notion of *higher Kirillov brackets* on the sections of an even line bundle over a supermanifold. When the line bundle is trivial we shall speak of *higher Jacobi brackets*. These brackets are understood furnishing the module of sections with an $L_\infty$-algebra, which we refer to as a *homotopy Kirillov algebra*. We are then led to *higher Kirillov algebroids* as higher generalisations of Jacobi algebroids. Furthermore, we show how to associate a higher Kirillov algebroid and a homotopy BV-algebra with every higher Kirillov manifold. In short, we construct homotopy versions of some of the well-known theorems related to Kirillov's local Lie algebras.

- **P. Xu**, *Fedosov dg manifolds and Gerstenhaber algebras associated with Lie pairs*

  We study two cohomology groups, which serve as replacements for the spaces of "polyvector fields" and "polydifferential operators" on a pair $(L, A)$ of Lie algebras (or more generally, Lie algeboids). In particular, we prove that both cohomology groups admit Gerstenhaber algebra structures. Our approach is based on the construction of a homological vector field $Q$ on the graded manifold $L[1] + L/A$ and of a dg foliation (which we call Fedosov dg Lie algebroid) on the resulting dg manifold $(L[1] + L/A, Q)$.

Joint Meetings on

# Noncommutative Geometry and Higher Structures

Università degli Studi di Perugia

25 – 29 July 2016

The conference will take place in the Math. Department of the University of Perugia. The scientific activities start at 2:30 PM on Monday 25 July and finish at 12:30 AM on Friday 29 July.

For informations, please consult the website:

`http://www.dmi.unipg.it/ncg2016/`

## Abstracts

- **I. Androulidakis**, *Almost regular Poisson manifolds*

  We introduce a big class of Poisson manifolds, the "almost regular" ones. Roughly, they are the Poisson manifolds whose symplectic foliation is regular in a dense open subset. All regular Poisson manifolds are included in this class, as well as all the log-symplectic manifolds and certain Heisenberg-Poisson manifolds. We are looking for desingularizations of such structures, which means a Poisson groupoid which defines the symplectic foliation and whose Poisson structure is regular. A natural candidate is the associated holonomy groupoid, which is smooth in this category. We show that, moreover, this groupoid satisfies all our other requirements. In the case of log-symplectic manifolds, a simple minimality argument shows that it coincides with the symplectic groupoid constructed by Gualtieri and Li. And for the Heisenberg-Poisson manifolds under consideration, it is exactly Connes' tangent groupoid. This hints that various blow-up constructions in Poisson geoemtry can be replaced by the systematic construction of the holonomy groupoid of a singular foliation.

- **P. Antonini**, *Towards $K$-theory for non-integrable transitive Lie algebroids*
  In this talk I'll report on work in progress with I. Androulidakis concerning the noncommutative geometry of Lie Algebroids. The guideline of the project is the problem of "doing index theory" when one starts with a geometric structure described by a non integrable algebroid. An important instance are Poisson manifolds. The first step in this direction is the case of transitive Lie algebroids (non-integrable). We will present a procedure to construct an integrable lift for any Lie algebroid as such, provided the second homotopy group of its base manifold is finitely generated. This method, inspired by the examination of the Molino-Almeida examples, produces a unique Morita class of integrable Lie algebroids lifting the original (non-integrable) one. The construction is specified explicitly by $\pi_2$ of the base manifold and leads to our proposal for the definition of a $K$-theory group with good properties for such algebroids.
- **S. Barannikov**,
  bla bla bla
- **D. Broka**, *Symplectic realizations of holomorphic Poisson manifolds*
  We present our construction of an holomorphic symplectic realization for an arbitrary holomorphic Poisson manifold $X$. More precisely, we construct a new holomorphic symplectic structure on a neighborhood $Y$ of the zero section of the cotangent bundle $T^*X$ such that the projection map is a holomorphic symplectic realization. By using Poisson sigma models, deceptively simple formulas can then also be obtained for the symplectic form. This is a joint work with Ping Xu.
- **O. Iena**, *On 1-dimensional planar sheaves: modifying Simpson moduli spaces by vector bundles*
  Fix a linear polynomial $P(m) = dm + c$ with integer coefficients and consider the Simpson moduli space M of semistable sheaves with this Hilbert polynomial on the projective plane. A generic sheaf in $M$ is a line bundle on its Fitting support, which is a planar projective curve of degree d. The closed subvariety M' of sheaves that are not vector bundles on their support is in general non-empty and not a divisor. We are interested in understanding $M'$ and replacing it by a divisor that consists of vector bundles (on curves). In the talk we will discuss the geometry of $M'$ for Hilbert polynomials $dm - 1$. (An open dense subset of) the exceptional divisor of the blow-up of $M$ along $M'$ can be naturally seen as a space of vector bundles on curves.
- **N. de Kleijn**, *An equivariant algebraic index theorem*
  Since the discovery of the Atiyah-Singer index theorem there has been a steady program of generalizations and adaptations of the theorem. In 1995 Tsygan-Nest proved an algebraic version of the index theorem which holds for any deformation quantization of a symplectic manifold. They showed later that it is possible to derive the Atiyah-Singer index theorem from the algebraic one. Since then there have also been generalizations of the algebraic index theorem. One of these is to find an "equivariant" version when the deformation quantization is equipped with a group action by algebra automorphisms. In this talk I explain how one interprets the index theorem as an equality in cyclic periodic cohomology and subsequently show how one can use this and the framework of Gelfands formal geometry to derive an equivariant version of the algebraic index theorem in the case of discrete groups acting on a symplectic deformation quantization. The talk is based on work joint with Alexander Gorokhovsky and Ryszard Nest.
- **N. Kowalzig**, *When Ext is a Batalin-Vilkovisky algebra*
  We show under what conditions the complex computing general Ext-groups carries the structure of a cyclic operad, which, when descending to cohomology, implies that Ext defines a Batalin-Vilkovisky algebra. This is essentially achieved by dualising the formerly obtained corresponding result that produced the structure of a cyclic operad on the complex computing the CoTor-groups over the dual of a (left) Hopf algebroid, asking for the notion of so-called contramodules, which were introduced along with comodules by Eilenberg-Moore half a century ago, but later somehow forgotten. In particular, we give an explicit formula for the inverse of the Hopf-Galois map on the dual, illustrating recent categorical results and answering a long-standing open question. As an application, we prove that the Hochschild cohomology of an associative algebra $A$ is Batalin-Vilkovisky if $A$ itself is a contramodule over its enveloping algebra $A \otimes A^o p$, which includes the well-known statements for symmetric algebras, and possibly also the respective results for Frobenius algebras as well as Calabi-Yau algebras (due to Tradler, Menichi, Lambre, Zhou, Zimmermann, Ginzburg, and others).
- **G. Landi**, *Line bundles over noncommutative spaces*
  We give a Pimsner algebra construction of noncommutative lens spaces as 'direct sums of line bundles' and exhibit them as 'total spaces' of certain principal bundles over noncommutative weighted projective spaces. For each quantum lens space one gets an analogue of the classical Gysin sequence relating the KK theory of the total space algebra to that of the base space one. This can be used to give explicit geometric representatives of the K-theory classes of the lens spaces.
- **C. Laurent-Gengoux**,
  bla bla bla
- **L. Lunardon**,
  bla bla bla
- **M. Manetti**,
  bla bla bla
- **F. Meazzini**,
  bla bla bla
- **V. Melani**, *Poisson and coisotropic structures in derived algebraic geometry*
  The purpose of this talk is to give an overview of derived Poisson geometry. We start by some quick reminders on derived algebraic geometry, and we explain how to interpret the classical definitions of Poisson and coisotropic structures in this context. We present some recent existence results for these structures, as well as applications to deformation quantization of moduli spaces. In the last part of the talk, we mention some of the perspectives of the theory of derived coisotropic structures.
- **C. Pagani**, *Noncommutative spherical manifolds and their symmetries*
  A noncommutative spherical manifold (of odd dimension) is the $*$-algebra generated by a unitary solution to certain equations in cyclic homology. Solutions in dimension $n = 3$ have been studied by Connes and Dubois-Violette in 2002, resulting in a 3-parameter family of quantum spheres. Symmetries of these spheres, for generic values of the parameters, are still unknown. In this talk, after a review of the general theory of spherical manifolds, I will discuss an attempt of constructing quantum groups of symmetries for quantum 3-spheres and for their corresponding 4-planes. Based on a joint work in progress with G. Landi.