Abstracts of the talks presented at the conference

Anton Alekseev
University of Geneva

Deformation quantization of coadjoint orbits

I will explain how Fedosov's quantization applies to coadjoint orbits. In many situations, this method gives rise to explicit formulas for invariant star-products related to dynamical twists and dynamical R-matrices. This talk is based on joint works with A. Lachowska and A. Szenes.

Martin Bordemann
Université de Haute Alsace

(Bi)modules, morphisms and reduction of star-products: the symplectic case, foliations and obstructions

(Bi)modules, morphisms and reduction of star-products are studied in a framework of multidifferential operators along maps: morphisms deform Poisson maps and representations on function spaces deform coisotropic maps. If a star-product is representable on a coisotropic submanifold, it is equivalent to a star-product for which the vanishing ideal is a left ideal. If the reduced phase space exists, a star-product with suitable Deligne class is representable and the reduced algebra is the commutant of this module (hence a bimodule). Obstructions to representability to third order are related to the Atiyah-Molino class of the foliation of the coisotropic submanifold, and the same kind of obstructions occurs for the quantisation of a Poisson map between symplectic manifolds. For vanishing Atiyah-Molino class, the representation and morphism problem is solvable.

Henrique Bursztyn
University of Toronto

Dirac structures, moment maps and quasi-Poisson manifolds

I will describe how the usual notions of hamiltonian action, momentum map and symplectic reduction in Poisson Geometry can be extended to the context of (twisted) Dirac Geometry. I will show how hamiltonian quasi-Poisson manifolds with group-valued moment maps fit into this general framework, and I will point out some nice features of this alternative approach. This is joint work with M. Crainic.

Rui L. Fernandes
Instituto Superior Tecnico of Lisbon

First steps in Poisson topology

In this lecture I will discuss properties of Poisson manifolds, which have a topological flavor, such as rigidity, softness and stability.

Philip Foth
University of Arizona

Toric degenerations of polygon spaces and applications

There are remarkable integrable systems on the moduli spaces of spatial polygons, where the angle variables define the "bending flows". We show that there exist flat degenerations of these spaces to toric varieties where the polytopes are defined by the action variables (diagonals in polygons). We also construct toric degenerations of moduli spaces of stable marked projective lines which also illuminate interesting integrable systems. We generalize this approach to higher dimensions, like Flaschka-Millson integrable systems and Chow quotients of grassmannians by torus action. These constructions can be applied to finding algebraic invariants of these spaces and to representation theory. (Joint work with Yi Hu)

Janusz Grabowski
Polish Academy of Sciences

Frame independent Mechanics: Lie and Poisson brackets on sections of affine bundles

A geometric framework for a frame-independent formulation of different problems in analytical mechanics is developed. In this approach affine bundles replace vector bundles of the standard description. In particular, momenta take affine values and energy functions are replaced by sections of certain affine line bundles called AV-bundles. Categorial constructions for affine bundles and AV-bundles as well as natural analogs of Lie algebroid structures on affine bundles (Lie affgebroids) are presented. Certain Lie algebroids and Lie affgebroids canonically associated with an AV-bundle turn out to be closely related to affine analogs of Poisson and Jacobi brackets. Homology and cohomology of the latter are canonically defined. The developed concepts find an application in solving some problems of frame-independent geometric description of mechanical systems.

Marco Gualtieri
Fields Institute of Montreal

Generalized Geometry

In this talk I will describe generalized complex geometry, which is a way of unifying complex and symplectic geometry using the framework of complex Dirac structures. I will describe the main results in this field, and go on to describe some implications of this unification for mirror symmetry.

Kirill C. H. Mackenzie
University of Sheffield

Duality for double and higher structures

The duality between linear Poisson structures on a vector bundle and Lie algebroid structures on its dual is best expressed in terms of the tangent and cotangent double vector bundles associated to the vector bundle. The duality of double vector bundles is also fundamental to the concept of double Lie algebroid, which includes the cotangent double of a Lie bialgebroid. In this talk we show that the somewhat surprising duality properties of double vector bundles are easily understood in terms of triple vector bundle structures and indicate the general phenomena in the case of higher structures.

Yoshiaki Maeda
Keio University

Complex Maslov blurred bundles

Alan Weinstein constructed Maslov gerbes, which is the complex version of the Maslov bundles. We will give another approach to construct these objects by using the deformation quantization of the quadratic functions in the Weyl algebra.

Philippe Monnier
Instituto Superior Tecnico of Lisbon

Poisson cohomology

We give an explicit computation of the local Poisson cohomology of generic germs at 0 of Poisson structures in dimension 2. While generalizing this computation to higher dimensions, we are led to introduce a new cohomology attached to a function. We then try to give some "basic" properties of this cohomology.

Serge Parmentier
University of Lyon

On dynamical Poisson groupoids

In this talk, I will report on a joint work with L.-C. Li and with R. Pujol. The lecture will survey several properties of Poisson groupoids of Etingof-Varchenko type. In particular, the description of Poisson groupoid duality together with reduced duality diagrams, and the link with Lie quasi-bialgebras will be given. Applications thereof to the description of the moduli space of dynamical r-matrices and double constructions will also be addressed.

Olga Radko
University of California, Los Angeles

The Picard groups and topologically stable Poisson structures

The Picard group of a Poisson manifold P, introduced by Bursztyn and Weinstein, consists of all Morita self-equivalence P-bimodules, with the operation of the relative tensor product. We describe the Picard groups of certain Poisson structures on compact oriented surfaces, and discuss some related results.

Tudor Ratiu
École Polytechnique Fédérale de Lausanne

Orbits in Banach Lie-Poisson spaces

The notion of Banach Lie-Poisson space will be briefly presented and the main properties of these spaces will be discussed. Special emphasis will be given to the problem of extensions. Then various orbits in specific Banach Lie-Poisson spaces associated to W*-algebras and operator ideals will be analyzed. Examples of embedded orbits will be given and also those that carry a Kähler structure.

Pavol Ševera
Comenius University of Bratislava

Non-commutative differential forms and quantization of the odd symplectic category

There is a simple and natural quantization of differential forms on odd Poisson supermanifolds, given by the relation $[f, dg] = \{f, g\}$ for any two functions f and g. We notice that this non-commutative differential algebra has a geometrical realization as a convolution algebra of the symplectic groupoid integrating the Poisson manifold. This quantization is just a part of a quantization of the odd symplectic category (where objects are odd symplectic supermanifolds and morphisms are Lagrangian relation) in terms of Z_2-graded chain complexes. It is a straightforward consequence of the theory of BV operators acting on semi-densities, due to H. Khudaverdian.

Izu Vaisman
University of Haifa

Poisson structures on foliated manifolds

I present a survey of results on relationships between a Poisson structure P and a foliation F on a differentiable manifold M. First, I will discuss transversally-Poisson structures of F. These are bivector fields P that define a Poisson algebra structure on the subalgebra of F-leaf-wise constant smooth functions of M. Such structures are relevant for physical systems with gauge parameters. P is equivalent with a foliation of M by pre-symplectic leaves, which contains F as a sub-foliation. Then, we will discuss leaf-wise Poisson structures, i.e., Poisson bivector fields P of M such that the symplectic leaves of P are submanifolds of the leaves of F. Here, the main result is a spectral sequence for the Poisson cohomology of P. Finally, we will present the coupling Poisson structures of Vorobjev. They extend Sternberg's symplectic form, which describes the coupling between a particle and a field. We will present the characterization of an F-coupling Poisson bivector field P via a normal bundle of F, and give a simpler construction of Vorobjev's structure on the dual bundle of the kernel of a transitive Lie algebroid over a symplectic manifold.

Theodore Voronov
University of Manchester

Higher derived brackets

Various brackets in algebra and geometry, such as the Lie bracket in an arbitrary Lie algebra or superalgebra, the Poisson bracket on a Poisson manifold, etc., are examples of the so called "derived brackets" having as their source a canonical bracket (such as the commutator of vector fields or the canonical Poisson bracket on the cotangent bundle) and a "deriving element". In all these cases, the deriving element is in a certain sense "quadratic" and the resulting bracket satisfies the Jacobi identity. "Higher derived brackets" is a generalization of derived brackets, a construction of an infinite sequence of operations from simple data on a Lie superalgebra, giving strongly homotopy Lie algebras and algebras related to them. It should be looked at as a proper framework for "non-quadratic" deriving elements. On one hand the main statement is purely algebraic, on the other hand the construction is motivated by various examples from geometry and mathematical physics. It contains, in particular, the standard description of arbitrary SH Lie algebras via homological vector fields and the example of brackets generated by a differential operator (such as the Batalin–Vilkovisky type operators).

Aissa Wade
Penn State University

On the local structure of Dirac manifolds

We give a local normal form for Dirac structures. As a consequence, we show that the dimensions of the pre-symplectic leaves of a Dirac manifold have the same parity. We also show that, given a point m of a Dirac manifold M, there is a well-defined transverse Poisson structure to the pre-symplectic leaf through m. Finally, we describe the neighborhood of a pre-symplectic leaf in terms of geometric data. This description agrees with that given by Vorobjev for the Poisson case.

Alan Weinstein
University of California, Berkeley

Prequantization of Poisson manifolds associated with contact manifolds

Given a manifold C with a cooriented contact structure, a construction of LeBrun (1991) produces a Poisson manifold P with boundary. The interior of P is the symplectization of C, while the boundary of P is a copy of C with the zero Poisson structure (nevertheless, Poisson automorphisms of P preserve the contact structure on the boundary). In this talk, we will propose that an appropriate prequantization of P is given by a Jacobi manifold Q and a Jacobi map $p : Q \to P$. The fibres of p are, as usual, the orbits of a circle action, but the circle action is not free on the part of Q lying above C. The proposal is based on considerations coming from Berezin-Toeplitz quantization of bounded domains like the unit ball in complex n-space.

Ping Xu
Penn State University

On the universal lifting theorem

Give a Lie groupoid G, the space of multiplicative multivector fields on G is naturally a graded Lie algebra. For a Lie algebroid A, we introduce the notion of the so called "multi-differentials", which is also a graded Lie algebra. We prove that for an s-connected and s-simply-connected Lie groupoid, these two graded Lie algebras are isomorphic. As an application, we prove the integration theorem of quasi-Lie bialgebroids. Application to quasi-Poisson manifolds is discussed. This is a joint work with David Iglesias and Camille Laurent.

Nguyen Tien Zung
University of Toulouse

Linearization of Lie groupoids and symplectic groupoids

I will talk about some recent results concerning the linearization of Lie groupoids and symplectic groupoids, and some applications.