"Quantum Groups, Deformations, and Geometry"
Joseph Donin Memorial Conference
(joint session with Conference in Honor of Prof. Steven Shnider’s Retirement)

15-17 June 2014
Bar-Ilan University, Mathematics Bldg (216) Room 201

This satellite conference is dedicated to the memory of Prof. Joseph Donin, who suddenly passed away in January 2004. One of the fields Joseph Donin was actively working in was deformation of algebraic structures on geometric spaces. He devoted his last 16 years to equivariant quantization of $G$-manifolds. The conference will cover equivariant quantization and related topics of quantum algebra and representation theory. Applications to mathematical physics including integrable systems will also be addressed.
Organizers

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Schedule of talks

Sunday (15 VI ’14)

13:30–14:30 D. Gurevich: Deformation Quantization and Braided Geometry: with Joseph and after

14:30–15:00 J. Bernstein: A remark on quantization of Harish–Chandra modules

Tuesday (17 VI ’14)

14:30–14:45 S. Shnider: The years I spent with Joseph

14:50–15:20 A. Mudrov: On representations of quantum conjugacy classes


16:00–16:30 A. Stolin: On classification of quantum groups

16:35–17:00 Tea, coffee & biscuits

17:00–17:30 I. Loseu: Minimally supported representations of Rational Cherednik algebras and invariants of torus knots

17:35–18:05 A. Appel: Cohomological properties of universal relative twists

19:00 Dinner
Abstracts

Andrea Appel: **Cohomological properties of universal relative twists**

*Abstract*: In 1995, Donin and Shnider provided a new approach to the quantization of a complex semisimple Lie algebra $\mathfrak{g}$, using cohomological methods to directly construct a twist, i.e. an element which reduces the non-trivial associator in the Drinfeld category of $U(\mathfrak{g})$ to the trivial associativity constraint. Their methods were later used by Toledano Laredo to prove existence and properties of relatives twists, which, in the Tannakian formalism, can be thought of as tensor structures on restriction functors.

Motivated by the theory of quasi-Coxeter structures on Kac–Moody algebras, I will discuss the existence and the uniqueness properties of universal relative twists in the framework of PROP categories, generalizing the results of Etingof–Kazhdan and Enriquez for the standard twists. The talk is based on a joint work with V. Toledano Laredo.

Joseph Bernstein: **A remark on quantization of Harish–Chandra modules**

*Abstract*: Let $G$ be a real reductive group, $K$ a maximal compact subgroup of $G$. Important role in representation theory plays the category $\mathcal{M}(\mathfrak{g}, K)$ of Harish–Chandra modules. Consider the quantization $G_q$ of the group $G$. I will discuss how one can approach the problem of quantization of Harish–Chandra modules. The main idea (due to W. Soergel and myself) is to realize the category $\mathcal{M}(\mathfrak{g}, K)$ as a category of sheaves on the symmetric space $X = G/K$. After this we can use the work by J. Donin and S. Shnider who explained how to quantize the symmetric space $X$.

Dmitry Gurevich: **Deformation Quantization and Braded Geometry: with Joseph and after**

*Abstract*: By Braided Geometry I mean a sort of Noncommutative Geometry dealing with braidings, i.e. solutions to Quantum Yang–Baxter Equation. In a sense, it can be treated as a far generalization of super-theory. The main role in this Geometry is played by the so-called Reflection Equation Al-
gebra. This algebra has many remarkable properties which will be discussed in my talk. First, I'll exhibit the Joseph’s contribution to this area. Second, I'll describe the update situation. Also, I plan to demonstrate some possible applications to Physics.

Sergey Khoroshkin: Spin Calogero systems at infinity and representation theory

Abstract: I give a short survey of recent developments in various descriptions of Calogero-Moser systems in a limit of infinite number of particles and of their relations to the representation theory of toroidal Yangians.

Ivan Loseu: Minimally supported representations of Rational Cherednik algebras and invariants of torus knots

Abstract: Rational Cherednik algebras were introduced by Etingof and Ginzburg in the beginning of 2000’s based on an earlier work of Cherednik, Dunkl and others. Surprisingly, these algebras are related to many objects outside Representation theory: Calogero-Moser integrable systems, Hilbert schemes of points on the plane, Macdonald polynomials, the geometry of plane curves, and invariants of torus knots. In my talk I will discuss a connection to the latter. Namely, I will introduce so called minimally supported representations and discuss their properties and their (conjectural) connection to invariants of torus knots – the HOMFLY polynomials and the Khovanov-Rozansky homology. The talk is based on a joint work with Etingof and Gorsky, arXiv:1304.3412.

Andrey Mudrov: On representations of quantum conjugacy classes

Abstract: We discuss quantization of semisimple conjugacy classes of simple complex algebraic groups via quasi/pseudo parabolic Verma modules. Such modules can be associated with points on a fixed maximal torus. When the points lie on the same orbit of the Weyl group, their conjugacy classes coincide. Although the isotropy subgroups are isomorphic in that case, their polarizations, in general, do not perfectly match the polarization of the total group. Namely, their basis of simple roots may not be a part of the total basis.
With respect to this criterion, we classify the stabilizers as of Levi, quasi-Levi (isomorphic to Levi), and pseudo-Levi (essentially non-Levi) types. Accordingly, we consider parabolic, quasi-parabolic, and pseudo-parabolic modules of highest weight and ask if they support quantization of conjugacy classes (exact representation of the quantized coordinate ring). The answer is positive for the special linear group. It seems that there are limitations on the points for other types of quantum groups. This subject is under study.