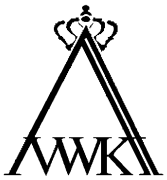

KONINKLIJKE VLAAMSE ACADEMIE VAN BELGIE
VOOR WETENSCHAPPEN EN KUNSTEN

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PREFACE

The congress "Noncommutative structures in Mathematics and Physics" took place in Brussels from July 22 until July 26, 2008, at the same time a contactformum at the Royal Academy, and a satellite meeting of the Fifth European Congress of Mathematics (5ECM, Amsterdam, July 14-18, 2008) organized by the European Mathematical Society. At 5ECM, we organized the minisymposium "Representation Theoretical Methods and Quantization".

Three lines of developments have in recent years emerged in the study of algebraic structures, including in particular structures arising in or motivated by models of theoretical physics:

- a trend towards an algebraization of noncommutative geometry, employing for example the deformation theory of algebras over operads;
- the role of Hopf algebras and related structures, such as weak Hopf algebras and algebroids, as symmetries of low-dimensional quantum systems; for instance, weak Hopf algebras have been established as mathematically natural structures occuring in applications to spin chains and to local conformal field theory;
- the quest for categorification of algebraic structures and of invariants arising from them, of which a well-known instance is the categorification of the Jones polynomial by Khovanov and, more generally, the idea of considering algebraic or physical structures on whole categories so as to achieve universality (in mathematical language) or general covariance (in physics language).

While these lines are closely interwoven, the connections between them have not yet been completely unraveled. This can partly be attributed to the fact that several different communities are involved: algebraists, algebraic geometers, operator algebraists and mathematical physicists. The idea of the conference was to bring together experts from these different areas and reveal connections between various developments. It attracted 117 participants from 39 countries. This volume of the "Proceedings of contactfora" series collects a number of survey papers by participants to the conference, covering the main subjects and reflecting the interdisciplinary philosophy behind the initiative.

The conference was supported by the *Koninklijke Vlaamse Academie van België voor Wetenschappen en Kunsten* (KVAB), the *Académie Royale des Sciences, des Lettres et des Beaux-arts de Belgique*, the *Fonds voor Wetenschappelijk Onderzoek Vlaanderen* (FWO), the Fonds de la Recherche Scientifique (FNRS), the *Brussels Capital Region*, the *Solvay Institutes*, the *Vrije Universiteit Brussel*, the *Université Libre de Bruxelles*, the *Universiteit Antwerpen*, the FWO Research Community *Fundamental Methods and Techniques in Mathematics*, the *Mathematics-Physics Research Platform* MP^2, and the Research project G.0622.06 *Deformation quantization methods for algebras and categories with applications to quantum mechanics* of FWO Vlaanderen.

The meeting took place in a friendly and informal atmosphere, not only due to the scientific program, but also to the cultural side activities, such as the visits to the Town Hall and to Cantillon, Brussels' only surviving tradional gueuze brewery. We thank all the participants, the speakers, the contributors to this volume and the sponsors.

The editors
December 2010

PROGRAM

Tuesday, July 22, 2008

10.00-10.45 Corrado De Concini (Rome)
Quotients of symmetric varieties

11.15-11.45 Tomasz Brzezinski (Swansea)
Torsor bimodules

11.15-12.25 Ulrich Krähmer (Glasgow)
On the Hochschild homology of quantum homogeneous spaces

14.25-15.10 Catharina Stroppel (Bonn)
Constructing highest weight categories using 2-dimensional TQFT

15.20-16.05 Martin Markl (Prague)
Invariant tensors and graphs

Parallel session A

16.30-16.55 Panagiotis Batakidis (Antwerp)
Deformation quantization and Lie theory

17.00-17.25 Francesco D'Andrea (Louvain-la-Neuve)
The noncommutative geometry of the quantum projective plane

17.30-17.55 Claudia Menini (Ferrara)
A functorial approach to pre-torsors

Parallel session B

16.30-16.55 Iana Anguelova (Montréal)
Quantum vertex algebras with Hopf symmetry

17.00-17.25 Jonas Hartwig (Göteborg)
Unitarizable weight modules over generalized Weyl algebras

17.30-17.55 Sophia Kyritsi (Athens)
Nonsmooth critical point theory on closed convex sets

Parallel session C

16.30-16.55 Rafael Diaz (Caracas)
Invariants from classical field theory

17.00-17.25 Pierre Martinetti (Göttingen)
The standard model from the metric point of view

17.30-17.55 Juri Virkepu (Tallinn)
Operadic harmonic oscillator

Parallel session D

16.30-16.55 Stefan Kolb (Edinburgh)
Schur polynomials and representations of the affine braid group

17.00-17.25 Iulia Pop (Göteborg)
Classification of quasi-trigonometric solutions of CYBE

17.30-17.55 Youichi Shibukawa (Hokkaido)
Bialgebroids related to dynamical Yang-Baxter maps

19.00-21.00 Reception in the wedding room of the town hall

Wednesday, July 23, 2008

10.00-10.45 Christian Kassel (Strasbourg)
Versal quantum principal fiber bundles and polynomial identities

11.15-11.45 Vyacheslav Futorny (Sao Paulo)
Representations of Yangians

11.55-12.25 Alexei Davydov (Sydney)
Commutative algebras in group-theoretic modular categories

14.25-15.10 Gabriella Böhm (Budapest)
A categorical approach to Hopf (co)cyclic (co)homology

15.15-16.05 Vitaly Tarasov (Indianapolis) and Milen Yakimov (Santa Barbara)
Representation theory, Schubert calculus and the Shapiro conjecture

Parallel session A

16.30-16.55 Katrina Barron (Notre Dame)
Uniformization of N=2 super-Riemann surfaces of genus zero and genus one

17.00-17.25 Noriaki Kamiya (Aizu)
On triple systems

17.30-17.55 Satoshi Naito (Tsukuba)
Mirkovic-Vilonen polytopes for Demazure crystals

18.00-18.25 Yinhuo Zhang (Hasselt)
Geometric classification of four dimensional superalgebras

Parallel session B

16.30-16.55 Miodrag Iovanov (Bucharest and Buffalo)
Abstract integrals in algebra and applications:
Compact groups, quantum groups and algebra

17.00-17.25 El Amin Kaidi (Almería)
Centralizer in semiprimitive algebras

17.30-17.55 Vladislav Kharchenko (Mexico City)
Right coideal subalgebras in $U_q^+(\mathbf{so}_{2n+1})$

18.00-18.25 Olga Cerbu (Chisinau)
Some properties of semireflexivity

Parallel session C

16.30-16.55 Cristina Martinez (Aarhus and Bonn)
Applications of Fourier-Mukai transform in Mathematics and Physics

17.00-17.25 Dahmane Hammaoui (Oujda)
Quantum symmetries of higher Coxeter-Dynkin graphs:
A noncommutative case (The D_3-graph of SU(3)-type)

17.30-17.55 Hendryk Pfeiffer (Vancouver)
Tannaka-Krein reconstruction of modular tensor categories

18.00-18.25 Ingo Runkel (London)
From boundary to bulk in conformal field theory

Parallel session D

16.30-16.55 Naruhiko Aizawa (Osaka)
Noncommutative coherent states for quantum groups

17.00-17.25 Gaetano Fiore (Napoli)
On field quantization on NC spaces with twisted symmetries

17.30-17.55 Jerzy Lukierski (Wroclaw)
Noncommutative kappa-deformed quantum fields and kappa-statistics

18.00-18.25 Anilesh Mohari (Kolkati)
Phase transition and split property in quantum spin chain

Thursday, July 24, 2008

09.30-10.15 Yuri Manin (Bonn) and Franz Luef (Vienna)
Quantum Theta functions, moduli over quantum tori,
and Gabor frames for modulation spaces

10.45-11.30 Klaus Fredenhagen (Hamburg)
Quantum field theory and Lorentzian geometry

11.40-12.25 Hans-Jürgen Schneider (Munich)
Quantum groups and the classification of Hopf algebras

15.00-17.00 Visit to Cantillon Brewery

Friday, July 25, 2008

10.00-10.45 Stefan Waldmann (Freiburg)
Covariant strong Morita theory of star product algebras

11.15-11.45 Lars Kadison (Baton Rouge)
Depth Two Hopf subalgebra, Hochschild complex
and noncommutative Galois theory

11.55-12.25 Dimitri Gurevich (Valenciennes)
Maxwell operator on quantum algebras

14.25-15.10 Giovanni Landi (Trieste)
Dirac operators on noncommutative manifolds

15.15-15.45 Olga Bershtein (Kharkov)
On a q-analog of a Sahi result

Parallel session A

16.15-16.40 Sebastian Burciu (Bucharest)
Drinfeld doubles that are ribbon algebras

16.45-17.10 Alexander Chervov (Moscow)
Quantum integrability and the Langlands correspondence

17.15-17.40 Richard Vale (Ithaca)
On the opposite of the category of rings

17.45-18.10 Adam-Christiaan van Roosmalen (Hasselt)
Abelian hereditary categories which are fractionally Calabi-Yau

Parallel session B

16.15-16.40 Victor Abramov and Olga Liivapuu (Tartu)
Graded q-differential algebra approach to q-connection

16.45-17.10 Esengül Saltürk (Istanbul)
A differential calculus on Rh(2|1) super space

17.15-17.40 Eduardo Hoefel (Curitaba)
DG-Lie algebra structure on the deformation complex of Leibniz pairs

17.45-18.10 Shapour Heidarkhani Gorazan (Perpignan)
Existence of three solutions for a Dirichlet boundary value problem

Parallel session C

16.15-16.40 Jawad Abuhlail (Ryad)
Semicorings and semicomodules

16.45-17.10 Laiachi El Kaoutit (Granada)
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17.15-17.40 Alessandro Ardizzoni (Ferrara)
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17.45-18.10 Ramón González Rodríguez (Vigo)
Quasitriangular weak Hopf algebras and weak Yang-Baxter operators

Parallel session D

16.15-16.40 Jaka Cimpric (Ljubljana)
Noncommutative real algebraic geometry

16.45-17.10 Oleksandra Lyapina (Notre Dame)
Lagrangian subalgebras of simple real Lie algebras

17.15-17.40 Georgy Sharygin (Moscow)
Formulas for characteristic classes of principal bundles and twisting cochains

17.45-18.10 Fabio Gavarini (Rome)
Quantization of projective homogeneous spaces and duality principle

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10.00-10.45 Eugene Karolinsky (Notre Dame)
Quantization of Poisson homogeneous spaces, highest weight modules, Kostant's problem

11.15-12.00 Alexander Goncharov (Providence)
The quantum dilogarithm and quantization of cluster varieties

12.10-12.55 Michel Van den Bergh (Hasselt)
From tangent cohomology to Hochschild cohomology via deformation quantization

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De Koninklijke Vlaamse Academie van België voor Wetenschappen en Kunsten coördineert jaarlijks tot 25 wetenschappelijke bijeenkomsten, ook contactfora genoemd, in de domeinen van de natuurwetenschappen (inclusief de biomedische wetenschappen), menswetenschappen en kunsten. De contactfora hebben tot doel Vlaamse wetenschappers of kunstenaars te verenigen rond specifieke thema's.

De handelingen van deze contactfora vormen een aparte publicatiereeks van de Academie.

Contactforum "Noncommutative Structures in Mathematics and Physics" (22-26 juli 2008, S. Caenepeel)

Summary:

Among the recent developments in the study of algebraic structures the following three strongly interrelated trends seem to be outstanding: a quest for a more algebraic version of noncommutative geometry, generalizations of Hopf algebras as symmetry structures and finally, the program of categorification. A powerful complement to the latter is the idea of considering algebraic or physical structures on whole categories rather than on individual mathematical objects.

The conference aimed to relate progress in these directions stemming from work in different subfields of mathematics, including algebra, representation theory, algebraic geometry, operator algebras, and theoretical and mathematical physics.