Report on the

XXXI Workshop on Geometric Methods in Physics

Białowieza, Poland

24.06-30.06.2012

The Białowieża meetings have a long tradition going back to 1981. The aim is to bring together mathematicians and physicists working on the interface between Geometry, Mathematical Physics, and Theoretical Physics to foster flow of ideas and informations in both directions. Of course quantization in both its mathematical and physical aspects were always a prominent topic on the conference. It was supplemented by other important directions in the field.

Some specific topics for the XXXI Workshop were

- integrable systems

- field theory and related structures

- quantization methods,

- operator algebras and non-commutative geometry

- infinite-dimensional Lie groups and Lie algebras

A special session was dedicated to the memory of Boris Fedosov who passed away on the 1st of October, 2011.

This is the first time that after the workshop a School (July 2-7, 2012) was organized, addressing in particular younger participants (graduate students, etc.).

Organisation Committee

A. Odzijewicz (Białystok) - chairman, T. Goliński (Białystok) - scientific secretary, S.T. Ali (Montréal, Poland), V. Buchstaber (Moscow), A. Dobrogowska (Białystok), P. Kielanowski (Białystok/Mexico City), M. Schlichenmaier (Luxembourg), A. Sliżewska (Białystok), Th. Voronov (Manchester).

Sponsors of the Workshop:

University of Białystok, European Science Foundation Research Networking Programme *Interaction of Low-Dimensional Topology and Geometry with Mathematical Physics (ITGP)*

List of Plenary Speakers:

1. Iakovos Androulidakis (Athens) – The leafwise Laplacian and its spectrum: the singular case

2. Daniel Beltita (Bucharest) – Symbolic calculus on coadjoint orbits of nilpotent Lie groups

3. Pierre Bieliavsky (Louvain-la-Neuve) – "Oscillating" quantum groups, pentagon equations and multiplicative unitaries

4. Michel Cahen (Brussels) – Symplectic Dirac operators

5. Ludwig Faddeev (St. Petersburg) – Volkov's pentagon relation for the modular quantum dilogarithm

6. Simone Gutt (Brussels) – Mp^c structures and symplectic geometry

7. Kirill Mackenzie (Sheffield) – Duality for multiple vector bundles

8. Motohico Mulase (Davis, USA) – The Laplace Transform, Mirror Symmetry, and the Topological Recursion of Eynard–Orantin

9. Yurii Neretin (Moscow) – Infinite symmetric group, two-dimensional simplicial bordisms, and Feynman diagram

10. Michael Semenov-Tian-Shansky (Dijon) – Poisson structure of difference Lax equations and difference Galois groups

11. Nikita Slavnov (Moscow) – Form factor approach to the correlation functions of integrable models

12. Mikhail Vasiliev (Moscow) – Holography, Unfolding and Higher-Spin Theory

13. Stanisław Lech Woronowicz (Warsaw) – R-matrix in the theory of locally compact quantum group

As it is the tradition in the Białowieża meeting there were quite a number of contributed talks – in total 43 – (see the attached program). Also a poster session was organised, especially inviting younger researchers to present their results.

The complete program of the conference is attached to this report.

webpage of the conference: http://wgmp.uwb.edu.pl/

There also a complete list of abstracts can be found. Furthermore, for a number of talks the slides can be downloaded.

Total number of participants: 84

There will appear a volume in the Birkhäuser "Trends in Mathematics" series on the basis of the 2012 workshop, containing selected contributions.

The topics of the lecture courses of the school were

1. Alexander Belavin – *Alday-Gaiotto-Tachikawa correspondence between Supersymmetic gauge theory in $d = 4$ and Conformal field theory in $d = 2$*

2. Alexey Bolsinov – *Singularities of bi-Hamiltonian systems*

3. Hovhannes Khudaverdian – *Geometry of differential operators*

4. Kirill Mackenzie – *Lie algebroids, Lie groupoids and Poisson geometry*

5. Yuri Neretin – *Virasoro algebra and Riemannian surfaces*

6. Alexander Orlov – *Fermionic language for random matrices and random partitions*

7. Alexander Veselov - *Integrability and Morse Theory*

8. Theodore Voronov - *Q-manifolds and their applications*

Each lecture course consisted of 3 lectures.

Sunday, June 24

09:00–09:15 Opening

09:15–10:10 *Volkov's pentagon relation for the modular quantum dilogarithm.*
Ludwig FADDEEV, St. Petersburg Department of the Steklov Mathematical Institute, Russia

10:15–11:10 *The Laplace Transform, Mirror Symmetry, and the Topological Recursion of Eynard–Orantin.*
Motohico MULASE, University of California, Davis, USA

11:10–11:40 Coffee break

11:40–12:05 *An analogue of the Conjecture of Dixmier is true for the algebra of integro-differential operators.*
Vladimir BAVULA, University of Sheffield, United Kingdom

12:10–12:35 *Heat equation and polynomial dynamical systems.*
Elena BUNKOVA, Steklov Mathematical Institute, Russia

14:30–15:10 *Inhomogeneous systems of hydrodynamic type possessing Lax representations.*
Alexandre ODESSKI, Brock University, Canada

15:15–15:40 *Some applications of the reduction method to integrable many-body systems.*
Laszlo FEHER, Wigner RCP, RMKI and University of Szeged, Hungary

15:40–16:10 Coffee break

16:10–16:50 *Cohomology of flag varieties and Bethe algebras.*
Vitaly TARASOV, Indiana University–Purdue University Indianapolis, USA

16:55–17:20 *Proof that Darboux Wronskians give all Darboux transformations of total order two.*
Ekaterina SHEMYAKOVA, Western University, Canada

Monday, June 25

09:00–09:55 *Poisson structure of difference Lax equations and Difference Galois groups.*
Michael SEMENOV-TIAN-SHANSKY, Université de Bourogne, France

10:00–10:55 *Duality for multiple vector bundles.*
Kirill MACKENZIE, University of Sheffield, United Kingdom

10:55–11:25 Coffee break

11:25–12:05 *Berezin transform and a deformation decomposition.*
Vladimir MOLCHANOV, Derzhavin Tambov State University, Russia

12:10–12:50 *An elementary proof of the vanishing of the second Lie algebra cohomology of the Witt and Virasoro algebra with values in the adjoint module.*
Martin SCHLICHENMAIER, Université de Luxembourg, Luxembourg

14:30–15:10 *Poles of Painlevé transcendents and special structures in integrable systems.*
Marco BERTOLA, Concordia University, Canada

15:15–15:40 $\Theta(x,p)-$*deformation quantization of harmonic oscillator on a* $2D-$*phase space.*
Norbert HOUNKONNOU, University of Abomey-Calavi, Republic of Benin

15:40–16:05 Coffee break

16:05–16:30 *A useful parametrization of Siegel-Jacobi manifolds.*
Stefan BERCEANU, "Horia Hulubei" National Institute of Physics and Nuclear Engineering, Romania

16:35–17:00 *Asymptotic behavior of series of multiple integrals.*
Karol KOZŁOWSKI, Institut de Mathématiques de Bourgogne, France

17:05–17:30 *Graded contractions of representations of Lie algebra* $sl(3;C)$.
Petr NOVOTNY, České Vysoké Učení Technické v Praze, Czech Republic

Tuesday, June 26

Special Session in honour of B.V. Fedosov

Chairman: Kirill Mackenzie

09:00–09:05 Opening: *Boris V. Fedosov (1938–2011)*

09:05–10:00 *Holography, Unfolding and Higher-Spin Theory*.
Mikhail VASILIEV, Lebedev Physical Institute, Russia

10:05–11:00 Mp^c *structures and symplectic geometry*.
Simone GUTT, Université Libre de Bruxelles, Belgium

11:00–11:20 Coffee break

11:20–12:15 *Symplectic Dirac operators*.
Michel CAHEN, Université Libre de Bruxelles, Belgium

12:20–13:00 *Star products — formal extension and nonformal extension*.
Akira YOSHIOKA, Tokyo University of Science, Japan

AFTERNOON SESSION 14:25–17:20

Special Session in honour of B.V. Fedosov

Chairman: Yurii Neretin

14:30–15:25 *"Oscillating" quantum groups, pentagon equations and multiplicative unitaries*.
Pierre BIELIAVSKY, Université Catholique de Louvain, Belgium

15:30–15:55 *Noncommutative almost Kaehler–Ricci Solitons and Deformation Quantization*.
Sergiu VACARU, University Alexandru Ioan Cuza, Romania

15:55–16:25 Coffee break

16:25–16:50 *Non-formal star-exponential of Kahlerian Lie groups*.
Axel DE GOURSAC, Université Catholique de Louvain, Belgium

16:55–17:20 *Geometric noncommutative gravity from deformtion quantization of endomorphism bundle*.
Michał DOBRSKI, Politechnika Łódzka, Poland

Wednesday, June 27

09:00–09:55 *Symbolic calculus on coadjoint orbits of nilpotent Lie groups.*
Daniel BELTIȚĂ, Institute of Mathematics "Simion Stoilow" of the Romanian Academy, Romania

10:00–10:55 *Form factor approach to the correlation functions of integrable models.*
Nikita SLAVNOV, Steklov Mathematical Institute, Russia

10:55–11:25 Coffee break

11:25–11:50 *Conformally compactified Minkowski space and nonlinear electrodynamics.*
Gerald GOLDIN, Rutgers University, USA

11:55–12:20 *Fermionic screening currents and chiral de Rham complex on toric manifolds.*
Sergei PARKHOMENKO, L.D. Landau Institute for Theoretical Physics, Russia

12:25–12:50 *Lagrange Anchor and Characteristic Symmetries of Free Massless Fields.*
Dmitry KAPARULIN, Tomsk State University, Russian Federation

Thursday, June 28

Chairman: Ludwig Faddeev

09:00–09:55 *R-matrix in the theory of locally compact quantum groups.*
Stanisław Lech WORONOWICZ, Instytut Matematyki, Uniwersytet w Białymstoku, Poland

10:00–10:55 *The leafwise Laplacian and its spectrum: the singular case.*
Iakovos ANDROULIDAKIS, University of Athens, Greece

10:55–11:25 Coffee break

11:25–11:50 *On mappings with separable dynamics.*
Anatolij ANTONEVICH, Instytut Matematyki, Uniwersytet w Białymstoku, Poland

11:55–12:20 *Quantum Deformations of $D = 4$ SuperPoincaré algebras and their Euclidean counterparts.*
Jerzy LUKIERSKI, Uniwersytet Wrocławski, Poland

12:25–12:50 *How to construct self/anti-self charge conjugate states? Discrete Symmetries, P, C, T and all that.*
Valeriy DVOEGLAZOV, Universidad de Zacatecas, Mexico

AFTERNOON SESSION 14:30–17:20

Chairman: Daniel Beltiţă

14:30–14:55 *Some complex polynomials associated to non-commutative quantum mechanics.*
Syed Twareque ALI, Concordia University, Canada

15:00–15:25 *Dunkl operators as covariant derivatives in a quantum principal bundle.*
Stephen SONTZ, Centro de Investigación en Matemáticas, Mexico

15:25–15:55 Coffee break

15:55–16:20 *Complete Decomposition of Weyl group orbit product of A_2.*
Agnieszka TERESZKIEWICZ, Instytut Matematyki, Uniwersytet w Białymstoku, Poland

16:25–16:50 *Discretization of new Weyl group orbit functions.*
Jiří HRIVNÁK, České Vysoké Učení Technické v Praze, Czech Republic

16:55–17:20 *Vector fields on map spaces and a remark about the AKSZ construction.*
Theodore VORONOV, University of Manchester, United Kingdom

Friday, June 29

14:00–14:25 *On geometry of Carnot–Carathéodory spaces with C^1-smooth vector fields.*
Sergey VODOPYANOV, Sobolev Institute of Mathematics, Russia

14:30–14:55 *Local geometry of Carnot-Caratheodory spaces and its applications in nonlinear control theory.*
Svetlana SELIVANOVA, Sobolev Institute of Mathematics, Russia

15:00–15:25 *Fundamental equations of geodesic and holomorphically projective mappings.*
Josef MIKEŠ, Univerzita Palackého v Olomouci, Czech Republic

15:25–15:55 Coffee break

15:55–16:20 *On holomorphically projective mappings of e-Kahler manifolds.*
Irena HINTERLEITNER, Vysoké učení technické v Brně, Czech Republic

16:25–16:50 *Finsler Ricci flow and Einstein metrics.*
Nasrin SADEGHZADEH, Qom University, Iran

16:55–17:20 *Homotopy classification of superline bundles.*
Saad VARSAIE, Institute for Advanced Studies in Basic Sciences, Iran

POSTER SESSION 15:55–17:20

in the hall

Saturday, June 30

09:00–09:55   *Infinite symmetric group, two-dimensional simplicial bordisms, and Feynman diagrams.*
Yurii NERETIN, Institute for Theoretical and Experimental Physics, Russia

10:00–10:40   *Ginibre and interpolating ensembles as special solutions of integrable hierarchies.*
Alexander ORLOV, Laboratory of Nonlinear Wave Processes, P.P. Shirshov Institute of Oceanology, Russia

10:40–11:10   Coffee break

11:10–11:35   *Unduloid-Like Equilibrium Shapes of Carbon Nanotubes Subjected to Hydrostatic Pressure.*
Ivaïlo MLADENOV, Bulgarian Academy of Sciences, Bulgaria

11:40–12:05   *The Gauge Principle in Two-Dimensional Conformal Field Theory.*
Rafał SUSZEK, Katedra Metod Matematycznych Fizyki, Uniwersytet Warszawski, Poland

12:10–12:35   *Liouville theory, N=2 gauge theories and accessory parameters.*
Marcin PIĄTEK, Uniwersytet Szczeciński, Poland

14:30–14:55   *On Bogomolny decomposition and some solutions of some Skyrme-like models.*
Łukasz STĘPIEŃ, Uniwersytet Pedagogiczny w Krakowie, Poland

15:00–15:25   *Four boson interaction process in quantum optics.*
Jan SMOTLACHA, České Vysoké Učení Technické v Praze, Czech Republic

15:30–15:55   *Lie algebras as symmetry algebras of a system of ODEs.*
Dalibor KARÁSEK, České Vysoké Učení Technické v Praze, Czech Republic

15:55–16:25   Coffee break

16:25–16:50   *Poisson sigma models as constrained Hamiltonian systems.*
Ivo PETR, České Vysoké Učení Technické v Praze, Czech Republic

16:55–17:20   *Some Aspects of Poisson–Lie T-Duality.*
Vojtěch ŠTĚPÁN, České Vysoké Učení Technické v Praze, Czech Republic