

V School on Geometry and Physics

4 July – 9 July 2016

1. **Alexey BOLSINOV** – *Loughborough University, UK*

Integrable geodesic flows

2. **Marek BOŻEJKO** – *Uniwersytet Wrocławski, Poland*

Anyonic Fock spaces, q -CCR relations for $|q| = 1$ and relations with Yang–Baxter operators

We will present the following subjects:

- (a) Free and deformed Fock spaces q -Fock spaces for real q (if $q = 1$, we have Bosonic Fock spaces, if $q = -1$, Fermionic Fock spaces).
- (b) Yang–Baxter operators and generalized Fock spaces.
- (c) Anyonic q -Fock spaces and construction of q -Gaussian and q -Poisson processes for $|q| = 1$.
- (d) Applications to new factors of type II and III.

3. **Tomasz BRZEZIŃSKI** – *Uniwersytet w Białymstoku / Swansea University, Poland / UK*

Differential forms on non-commutative algebras

4. **Jerzy KIJOWSKI** – *Centrum Fizyki Teoretycznej, PAN, Poland*

General Relativity Theory and its canonical structure

Symplectic structures arising naturally in the calculus of variations will be thoroughly discussed. Different variational principles for General Relativity will be presented (metric, metric-affine, purely affine) and the relation between them deeply analyzed. Finally, Hamiltonian formulation of the field evolution will be derived.

5. **Bogdan MIELNIK** – *CINVESTAV, Mexico*

Exponential formulae

6. **Emma PREVIATO** – *Boston University, USA*

Complex Algebraic Geometry Applied to Integrable Dynamics: Concrete examples and open problems

Lecture I: Elliptic and Hyperelliptic Theta Functions: Applications to integrable dynamics. The lecture will cover definition and significance of elliptic and hyperelliptic curves, their moduli, and special functions, together with Klein's generalization of the Weierstrass sigma function and its relationship with Sato's tau function. As an application, solutions to examples of integrable hierarchies such as non-linear wave equations and the Toda Lattice will be constructed.

References:

David Mumford, *Tata Lectures on Theta I and II*, Birkhäuser, 1984.

Morikazu Toda, *Theory of Nonlinear Lattices* (2 ed.), Berlin: Springer (1989)

Lecture II: Vector bundles over curves. This lecture will cover definitions of vector bundles over curves and their moduli, together with applications to algebraically completely integrable Hamiltonian systems such as the geodesic and monopole equations.

References:

Robert C. Gunning, *Lectures on Vector Bundles over Riemann Surfaces*. Princeton University Press, 1967.

Nigel Hitchin, On the construction of monopoles. *Communications in Mathematical Physics* 89 (2) (1983) 145-190.

Lecture III: This lecture will bring together integrable fibrations and classical theorems of projective geometry, to conclude with applications to random-matrix theory, ordinary differential equations with no movable singularities (except poles), and open questions.

References:

Olivier Babelon, Denis Bernard and Michel Talon, *Introduction to Classical Integrable Systems*, Cambridge Monographs on Mathematical Physics, 2003.

7. Theodore VORONOV – *University of Manchester, UK*
Volumes of classical supermanifolds

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