

# Abstracts

## “Poisson and quantum structures in integrable systems”

### Classical and Quantum Integrability Workshop Series

Leeds, May 19-20, 2023

All talks are held in the MALL (Level 8) at the School of Mathematics.

- **Taras Skrypnyk** (University of Leeds)  
*“Elliptic Gaudin-type models and modified algebraic Bethe ansatz”*  
Abstract: We will consider elliptic Gaudin-type model with and without external magnetic field associated with non-skew-symmetric elliptic r-matrix defined on 4: 1 unramified covering of the Weierstrass cubic. We will develop a modified algebraic Bethe ansatz for the considered elliptic r-matrix and for the algebra generated by the entries of the corresponding Lax operator with the aim of obtaining the spectra of the relevant Gaudin-type Hamiltonians in terms of solutions of modified Bethe equations. The applications of the obtained result to the diagonalization of the anisotropic quantum Euler top, quantum Zhukovsky-Volterra top, quantum Steklov and Rubanovsky tops will be considered.
- **Nicolai Reshetikhin\*** (University of California/Tsinghua University)  
*“Superintegrable systems on moduli spaces of flat connections”*  
Abstract: This talk will start with a short review of the notion of superintegrability in classical Hamiltonian mechanics. Then after a brief review of the Kepler system, one of the natural examples of maximally superintegrable systems, a construction of superintegrable systems on moduli spaces of flat G-connections over surfaces will be given.
- **Jing-Ping Wang** (University of Kent)  
*“Quantisation problems for Integrable Equations”*  
Abstract: In this talk, we’ll discuss a recently emerged approach to the problem of quantisation based on the notion of quantisation ideals. In this approach, we reformulate the problem of quantisation switching the focus from deformations of Poisson manifolds to dynamical systems themselves. We’ll concentrate on quantisation of integrable systems. Namely, we lift a classical integrable system to a system defined on a free associative algebra, preserving integrability. We then explore two-sided ideals (quantisation ideals) in the free algebra, which are invariant with respect to the dynamics and yield Poincaré-Birkhoff-Witt basis in the quotient algebras. We will present our first examples of bi-quantum structures, which reproduce bi-Hamiltonian structures in the classical limits, and first examples of non-deformation quantisations of dynamical systems when the algebra defined by the commutation relations remains noncommutative for any choice of the quantum (Planck-type) constant. This is a joint work with S. Carpentier and A.V. Mikhailov.

- **Alexander Shapiro** (University of Edinburgh)  
*“Gelfand-Tsetlin integrable systems and cluster varieties”*  
 Abstract: I will give a cluster-algebraic description of the Gelfand-Tsetlin subalgebra of a quantum group in type A, and discuss relationships between Gelfand-Tsetlin integrable systems, Coxeter-Toda integrable systems, and Fenchel-Nielsen coordinates in higher Teichmüller theory. This talk will be based on joint works with Gus Schrader.
- **Sylvain Carpentier** (Seoul National University)  
*“Quantization of nonabelian Volterra and nonabelian Toda hierarchies”*  
 Abstract: We discuss in details the problem of quantization for two non-abelian integrable systems, namely the nonabelian Volterra and the non-abelian Toda hierarchies . We retrieved by our method that the nonabelian Volterra equation together with the whole hierarchy of its symmetries admits a deformation quantization. We show that all odd-degree symmetries of the nonabelian Volterra hierarchy admit also a non-deformation quantization, which is a new result. We discuss the problem of finding the Hamiltonians of the quantized systems. For the nonabelian Toda hierarchy we find a biquantization depending on two parameters. Moreover, we exhibit nonlocal conserved quantities which are expected to project for every quantization onto the respective local Hamiltonians. This work is joint with A. Mikhailov and J.P. Wang.
- **Pol Vanhaecke** (University of Poitiers)  
*“Lotka-Volterra systems, Kahan discretisations and Poisson maps”*  
 Abstract: Lotka-Volterra systems are often used as toy models for exploring ideas and conjectures about integrability. This will be illustrated by the example of the integrability of Kahan discretisations, where for Lotka-Volterra systems a very precise answer can be given. In the same spirit, the classification of Lotka-Volterra systems will also be discussed. The talk is based on joint work with C. Evripidou and P. Kassotakis.

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