ABSTRACT

Arkady Berenstein *University of Oregon*

Title Canonical bases for dual groups

Abstract The aim of this mini-course is to introduce and study a certain basis $\mathcal{B}$ for the coordinate algebra $\mathbb{C}[G^*]$ of any complex semisimple or Kac-Moody group G. This basis deserves to be called canonical because it has a number of remarkable properties, such as positivity of structure constants and invariance under the braid group action. Our strategy in the construction of $\mathcal{B}$ and other canonical bases (based on joint work with Jacob Greenstein) is first to quantize the algebra and then use Kazhdan-Lusztig type argument for building canonical bases.

In the first lecture I will overview the theory of (dual) canonical bases on the quantum unipotent groups including quantum Schubert cells for G and their relevance to cluster and Poisson geometry on those groups.

In the second I will introduce a basis $\mathcal{B}'_q$ for the quantum Heisenberg algebra $H_q[G]$, which can be regarded as another quantum deformation of $\mathbb{C}[G^*]$. The classical limit of $\mathcal{B}'_q$ at $q = 1$ gives a "semi-canonical" basis $\mathcal{B}'$ in $\mathbb{C}[G^*]$ which is relevant to a certain cluster structure on $\mathbb{C}[G^*]$.

In the third lecture, using $\mathcal{B}'_q$ as an initial basis in Kazhdan-Lusztig sense, I will construct a basis $\mathcal{B}_q$ in $\mathbb{C}_q[G^*]$ whose classical limit at $q = 1$ is the desired basis $\mathcal{B}$. If time permits, I will discuss its relevance to (generalized) cluster structures on G^*.

Philip Boalch *CNRS, Sorbonne Université - Université de Paris*

Title Introduction to wild character varieties, wild surface groups and global Lie theory

Abstract As is well known the category of tame (or *regular singular*) connections on algebraic vector bundles on a smooth noncompact complex algebraic curve has a purely topological description as the category of local systems of complex vector spaces. Considering suitable moduli spaces one gets a non-compact moduli space with two distinct algebraic structures (that can be viewed as the De Rham and Betti realization of the underlying nonabelian motive). As we vary the curve this change in algebraic structure can be used as a kind of nonlinear Fourier transform to solve nonlinear differential equation (such as Painleve 6). Somewhat less well-known is the natural extension of this story to the other (irregular/wild) connections, and how that solves even more nonlinear differential equations (such as Painleve 1-5). Amusingly the space of deformation parameters can now be much larger than just the moduli of the underlying punctured curve, leading to the notion of *wild Riemann surfaces*. If time permits I'll also discuss steps towards the classification of such nonabelian Hodge moduli spaces (global Lie theory), how a plethora of Nakajima quiver varieties occur as "Lie algebras" of such spaces (the Hiroe-Yamakawa modularity theorem, conjectured by the speaker in 2008), and also the third algebraic structure that such moduli spaces have (as meromorphic Higgs bundles) yielding the link to the algebraic integrable systems

of Hitchin, and Garnier (the classical Gaudin model).

Min Huang *The University of Hong Kong*

Title From acyclic sign-skew-symmetric matrices to acyclic cluster algebras

Abstract In the first part of this talk, we will see that any acyclic sign-skew-symmetric matrix is totally sign-skew-symmetric. Thus we can construct a cluster algebra from an acyclic sign-skew-symmetric matrix. We will discuss some properties of this kind of cluster algebras in the second part.

Yanpeng Li *University of Geneva*

Title New action-angle variables on coadjoint orbits

Abstract The problem of constructing global action-angle variables on coadjoint orbits of compact Lie groups is one of the interesting questions in the theory of integrable systems. A fundamental contribution was made by Guillemin-Sternberg who constructed the Gelfand-Zeitlin integrable systems on coadjoint orbits of the groups SU(n) and SO(n). Recently, toric degeneration techniques allowed for the construction of global action-angle variables on rational coadjoint orbits of compact Lie groups of all types.
In this talk, I will present a new approach which aims at constructing global action-angle coordinates on all regular coadjoint orbits of compact Lie groups and on a large family of related Hamiltonian spaces. It combines the results of Ginzburg-Weinstein on the theory of Poisson-Lie groups and the theory of cluster algebras using the "partial tropicalization" procedure.
The talk is based on joint works with A. Alekseev, A. Berenstein, B. Hoffman, and J. Lane.

Jiang-hua Lu *The University of Hong Kong*

Title Some remarks on friezes of Dynkin type

Abstract We discuss a geometric model for friezes of cluster algebras of finite type.

Xiaomeng Xu *Peking University*

Title Stokes phenomenon in representation theory

Abstract In this talk, we will propose a transcendental construction, via Stokes phenomenon, of the braid group and cactus group actions, originally arising from the theory of quantum groups and crystals.