SE Lie Theory Workshop 2021: Invited Talks

Speaker: Iana Anguelova
Affiliation: College of Charleston

Title: *Multilocality and chiral algebras*

Abstract: In one of my last conversations with Ben Cox, we discussed our mutual desire to work together on the axiomatic approach to multilocal and quantum chiral algebras. We both had worked already on issues related to multilocality– situations where the fields/vertex operators in question have Operator Product Expansions (OPEs) with more than the one singularity at "z=w". In particular, we worked together on the theory of N-point local chiral algebras, i.e., algebras that are "complete" with respect to OPEs, and have singularities at roots of unity. But we were planning to work on the outstanding case where the OPEs have singularities at infinite multiplicative lattices. Such is the example of the Frenkel-Jing quantum vertex operators. In this talk I will discuss some problems arising in the axiomatic approach to multilocal chiral algebras, both N-point local, and quantum.

Speaker: Bojko Bakalov
Affiliation: North Carolina St. University

Title: *On the cohomology of vertex algebras and Poisson vertex algebras*

Abstract: Following Beilinson and Drinfeld, we describe vertex algebras as Lie algebras for a certain operad of n-ary chiral operations. This allows us to introduce the cohomology of a vertex algebra V as a Lie algebra cohomology. When V is equipped with a good filtration, its associated graded is a Poisson vertex algebra. We relate the cohomology of V to the variational Poisson cohomology studied previously by De Sole and Kac. This talk is based on joint work with Alberto De Sole, Reimundo Heluani, Victor Kac, and Veronica Vignoli.

2

Speaker: Lisa Carbone
Affiliation: Rutgers University and Institute for Advanced Study, School of Natural Sciences

Title: *A Lie group analog for the monster Lie algebra*

Abstract: The Monster Lie algebra m is an infinite dimensional Lie algebra constructed by Borcherds as part of his program to solve the Conway-Norton Monstrous Moonshine Conjecture. We describe how one may approach the problem of associating a Lie group analog for m and we outline some constructions. This is joint work with Abid Ali, Elizabeth Jurisich and Scott H. Murray.

Speaker: Vyacheslav Futorny
Affiliation: University of Sao Paulo

Title: *Free field constructions for affine Kac-Moody algebras*

Abstract: Classical free field realizations of affine Kac-Moody algebras (introduced by M.Wakimoto, B.Feigin and E.Frenkel) play an important role in quantum field theory. B.Cox initiated the study of free field realizations for the non-standard Borel subalgebras which led to an important class of intermediate (or parabolic) Wakimoto modules. A uniform construction of such realizations will be discussed based on a joint work with L.Krizka and P.Somberg.

Speaker: Jiuzu Hong
Affiliation: University of North Carolina, Chapel Hill

Title: *Smooth locus of twisted affine Schubert varieties and twisted affine Demazure modules*

Abstract: Let G be a special parahoric group scheme of twisted type, excluding the absolutely special case for twisted A_2n. Using the methods and results of Zhu, we prove a duality theorem for general G: there is a duality between the level one twisted affine Demazure modules and function rings of certain torus fixed point subschemes in twisted affine Schubert varieties for G. Along the way, we also establish the duality theorem for untwisted E_6. As a consequence, we determine the smooth locus of any affine Schubert variety in affine Grassmannian of G, which confirms a conjecture of Haines and Richarz. This is a joint work with Marc Besson.

Speaker: Dijana Jakelic
Affiliation: University of North Carolina, Wilmington

Title: *On Deodhar's Localization Functor*

Abstract: This talk will present several remarks on connections among Enright's completion, Deodhar's localization functor, Ben Cox's early work on generalization of Deodhar's results, and related topics.

Speaker: Daniel Orr
Affiliation: Virginia Tech

Title: *Difference operators for wreath Macdonald polynomials*

Abstract: The subject of Macdonald theory began with the Macdonald polynomials themselves, and with very concrete auxiliary algebraic structures that were constructed in order to define them. Later, when Haiman's proof of the Macdonald positivity conjecture revolutionized the subject, the scope of Macdonald theory widened to include the geometry of Hilbert schemes of points in the plane. (For this reason, one should associate ordinary Macdonald polynomials with the Jordan quiver.)

A cyclic quiver generalization of Macdonald polynomials was born in reverse, starting with a geometric conjecture which was made by Haiman and later proved by Bezrukavnikov and Finkelberg. Thus the resulting polynomials, which are known as wreath Macdonald polynomials, arise from the geometry of cyclic quiver Nakajima varieties. Their existence relies on an elusive object known as the Procesi bundle, which is available only by deep and indirect means.

Only recently has direct understanding of wreath Macdonald polynomials begun to emerge, through methods based on the quantum toroidal algebra. In this talk, I will review the origins of (wreath) Macdonald theory and discuss new explicit results on wreath Macdonald polynomials, and anticipated applications, from joint work in progress with Mark Shimozono and Joshua Wen.

4

Speaker: Weiqiang Wang
Affiliation: University of Virginia

Title: *From quantum groups to i-quantum groups*

Abstract: Drinfeld-Jimbo quantum groups have made major impacts on representation theory and other areas. i-Quantum groups arise from quantum symmetric pairs. We shall explain why it is natural to view i-quantum groups as a generalization of quantum groups, and then discuss some of the many new developments and applications of i-quantum groups as initiated in Huanchen Bao's UVA dissertation. (Some related topics of i-quantum groups will be presented in a short talk during this workshop given by a UVA student.)

Speaker: Milen Yakimov
Affiliation: Northeastern University

Title: *Noncommutative tensor triangular geometry and support varieties for Hopf algebras*

Abstract: We will describe a theory of noncommutative tensor triangular geometry for monoidal triangulated categories. It is aimed at investigating support varieties for finite dimensional Hopf algebras via noncommutative Balmer spectra. We will state effective reconstruction theorems for these spectra and an intrinsic characterization of those categories whose support variety maps satisfy the tensor product property. As an application, we obtain a treatment of the Benson-Witherspoon Hopf algebras, which previously eluded approaches of this kind, and a proof of a recent conjecture of Negron and Pevtsova that the cohomological support maps of the Borel subalgebras of all Lusztig small quantum groups possess the tensor product property. This is joint work with Daniel Nakano (University of Georgia) and Kent Vashaw (MIT).

Speaker: Kaiming Zhao
Affiliation: Wilfrid Laurier University

Title: *Simple restricted modules over the mirror Heisenberg-Virasoro algebra*

Abstract: All simple weak twisted modules over the Heisenberg-Virasoro vertex operator algebras, and all simple restricted modules over the mirror Heisenberg-Virasoro algebra will be given in this talk.