Group Theory and Its Connections to Representation Theory
Abstracts

Saturday 10:15 – 12:15
Rosa Orellana, Dartmouth
Sarah Witherspoon, Texas A&M
Georgia Benkart, University of Wisconsin-Madison
Lauren Williams, UC Berkeley

Saturday 3:15 – 5:15
Bhama Srinivasan, UIC
Yyjayanthi Chari, UC Riverside
Anne Schilling, University of California, Davis

Saturday 10:15 – 12:15

A geometric approach to the Kronecker coefficients
Rosa Orellana, Dartmouth

We show that the Kronecker coefficients indexed by two two-row shapes are given by quadratic quasipolynomial formulas whose domains are the maximal cells of a fan. Simple calculations provide explicitly the quasipolynomial formulas and a description of the associated fan. As an application, we characterize all the Kronecker coefficients indexed by two two-row shapes that are equal to zero. Joint work with E. Briand and M. Rosas

Generalizations of Drinfeld Hecke Algebras
Sarah Witherspoon, Texas A&M

A crossed product of an algebra with a group of automorphisms encodes the group action in a larger algebra. In case the group acts on a polynomial ring, deformations of the crossed product include the graded Hecke algebras, symplectic reflection algebras, and rational Cherednik algebras that have arisen independently in many different fields. More recently mathematicians have focused on group actions on quantum polynomial rings, and related algebraic structures. In this talk we will introduce these types of actions and algebras as well as some current research.

Planar Diagram Algebras
Georgia Benkart, University of Wisconsin-Madison

This talk will focus on the role of planar diagram algebras in the representation theory of low-rank Lie algebras, Lie superalgebras and quantum groups and on their combinatorial connections with various well-studied sequences of numbers such as the Catalan and Motzkin numbers.

Cluster algebras and combinatorics
Lauren Williams, UC Berkeley

One of the main open problems about cluster algebras is to construct "canonical" vector-space bases of them. In this talk we focus on the cluster algebra attached to a triangulated surface, which is closely related to the decorated Teichmuller space of that surface. In joint work with Musiker and Schiffler, we construct a (vector-space) basis of this algebra and give formulas for each element in the basis, in terms of matchings of bipartite graphs.

Saturday 3:15 – 5:15

Modular Representations: Something old, something new
Bhama Srinivasan, UIC

One of the main problems in the p-modular representation theory of finite groups is to determine the decomposition matrix which relates the complex representations with the p-modular representations of the groups. We will describe how, in the case of groups such as symmetric groups and general linear groups, this problem has been found in recent years to have connections with Lie theory, including quantum groups.

BGG Reciprocity for Current Algebras
Yyjayanthi Chari, UC Riverside

Abstract. We discuss the category $\mathcal{I}_{\mathrm{gr}}$ of graded representations with finite–dimensional graded pieces for the current algebra $\mathfrak{g} \otimes \mathbf{C}[t]$ where $\mathfrak{g}$ is a simple Lie algebra. This category has many similarities with the category $\mathcal{O}$ of modules for $\mathfrak{g}$ and we formulate the analogue of the famous BGG duality. We recall the definition of the projective and simple objects in $\mathcal{I}_{\mathrm{gr}}$ which are indexed by dominant integral weights. The role of the Verma modules is played by a family of modules called the global Weyl modules. We show that in the case when $\mathfrak{g}$ is of type $\mathfrak{sl}_2$, the projective module admits a flag in which the successive quotients are finite direct sums of global Weyl modules. The multiplicity with which a particular Weyl module occurs in the flag is determined by the multiplicity of a Jordan–Holder series for a closely associated family of modules, called the local Weyl modules. We conjecture that the result remains true for arbitrary simple Lie algebras. We also deduce some combinatorial product–sum identities involving Kostka polynomials which arise as a consequence of our theorem. This is based on joint work with Matthew Bennett and Nathan Manning.

The power of symmetric functions in noncommutative variables
Anne Schilling, University of California, Davis

We show in terms of the k-Murnaghan-Nakayama rule and the fusion algebra that it is often preferable to work with symmetric functions in noncommutative variables instead of their commutative counterparts.