

Mini-workshop on
Symmetric functions in Combinatorics and Representation Theory with
intensive lecture on Macdonald Polynomials

May 14 - 15, 2013 KIAS (Seminar room 1424)

1 Daily Schedule

Time	May 14 (Tue)	May 15 (Wed)
10:00am - 10:15am	opening	
10:15am - 11:15am	Kwon, Jaehoon	Cho, Soojin
11:15am - 11:30am	Break	
11:30am - 12:30pm	Kim, Myungho	Jonathan Axtell
12:30pm - 2:00pm	Lunch	
2:00pm - 3:00pm	Park, Euiyong	Yoo, Hwanchul
3:00pm - 3:30pm	Tea Break	
3:30pm - 5:00pm	Intensive Lecture: Jim Haglund	

2 Titles and Abstracts

1. Speaker: Kwon, Jaehoon (Sungkyunkwan University)

Title: **Super duality and crystal bases**

Abstract:

We introduce a semisimple tensor category of modules over an quantum orthosymplectic superalgebra. It is a natural counterpart of the category of finitely dominated integrable modules over the quantum classical (super) algebra of type B_{m+n} , C_{m+n} , D_{m+n} or $B(0, m+n)$ from a viewpoint of super duality. We show that a highest weight module in this category has a unique crystal base when it corresponds to a highest weight module of type B_{m+n} , C_{m+n} or $B(0, m+n)$ under super duality. We also give a combinatorial model for these crystals, which can be viewed as a natural super analogue of Kashiwara-Nakashima tableaux of classical type B and C .

2. Speaker: Kim, Myungho (KIAS)

Title: **Symmetric quiver Hecke algebras and R-matrices**

Abstract:

Let $U'_q(g)$ be a quantum affine algebra. For a given family of pairs consisting of simple $U'_q(g)$ -modules and nonzero scalars, we construct a functor from the category of modules over a symmetric quiver Hecke algebras to the category of $U'_q(g)$ -modules. The functor and corresponding symmetric quiver Hecke algebras are determined by the distribution of poles of normalized R-matrices. In this talk, we will review the above construction and provide an application of it.

3. Speaker: Park, Euiyong (University of Seoul)

Title: **Representation type of finite quiver Hecke algebras**

Abstract:

In this talk, we review the categorification for quantum groups using quiver Hecke algebra, and explain my recent work on finquiver Hecke algebras $R_0^\Lambda(\beta)$ with Susumu Ariki at Osaka University. The algebra $R_0^\Lambda(\beta)$ can be understood as an analogue of Iwahori-Hecke algebras associated with the symmetric group. We explain a dimension formula for the algebra $R_0^\Lambda(\beta)$ of type $A_{2\ell}^{(2)}$ using Fock space theory, and give a simple criterion to tell the

representation type. The criterion is a natural generalization of Erdmann and Nakano's for the Iwahori-Hecke algebras. This talk is based on arXiv:1208.0889.

4. Speaker: Cho, Soojin (Ajou University)

Title: **A shifted Littlewood-Richardson rule**

Abstract:

A new description of shifted Littlewood-Richardson rule (Littlewood-Richardson rule for Schur P-functions) is given in terms of plactic monoid elements. We consider the problem to define plactic skew Schur P-functions; we explain the main difficulty on the problem and suggest a model of plactic skew Schur P-functions.

5. Speaker: Jonathan Axtell (Seoul National University)

Title: **Super Schur functors**

Abstract:

We discuss super-analogues of the Schur and co-Schur functors defined by Akin, Buchsbaum and Weyman in their 1982 paper. In particular, we describe a standard basis in terms of (m, n) -hook tableaux and give Cauchy decomposition formulas for super Schur functors.

6. Speaker: Yoo, Hwanchul (KIAS)

Title: **Diagram Specht modules, symmetric functions, and matching ensemble polytopes**

Abstract:

In this talk, the diagram Specht modules and related objects are going to be discussed. In particular we introduce matching ensemble polytope and the conjecture on its volume. We will discuss several evidences to the conjecture, including the toric Specht modules and cylindric Schur functions, and diagrams of permutations and Stanley symmetric functions.

3 Intensive Lecture

Speaker : Jim Haglund (University of Pennsylvania)

- Lecture 1 :

The Combinatorics of Macdonald Polynomials and Related Symmetric Functions

Abstract:

Macdonald polynomials are symmetric functions in a set of variables X which depend on two extra parameters q, t . They satisfy an orthogonality relation and are closely connected to important algebraic and geometric objects such as the Hilbert scheme of points in the plane and Cherednik algebras. Macdonald's original definition was rather indirect, but in this talk we discuss a purely combinatorial formula for Macdonald polynomials due to Haiman, Loehr and the speaker. We then outline several nice applications of this formula to symmetric function theory.

- Lecture 2:

The Combinatorics of the Space of Diagonal Harmonics

Abstract:

Garsia and Haiman pioneered the study of the space of Diagonal Harmonics DH_n and its S_n character. Using properties of the Hilbert scheme, Haiman eventually proved a wonderful formula for this character as a sum of Macdonald polynomials involving rational coefficients in q, t . Various special cases of this formula result in q, t -versions of classical combinatorial objects such as Catalan numbers. In this talk we overview results and conjectures developed over the last ten years, by a variety of researchers, involving combinatorial expressions for q, t -Catalan numbers and other objects connected to DH_n . In particular we discuss recent results expressing these objects in terms of constant-term identities for Laurent series.