FIELDS

SUMMER SCHOOL ABSTRACTS 1.2

JASON BANDLOW AND NICOLAS THIÉRY
University of Pennsylvania and Universite Paris Sud 11

Computer exploration of affine Schubert calculus using Sage

Computer exploration plays an essential role in research on affine Schubert calculus. Because of this, several members of the FRG on Affine Schubert Calculus got strongly involved in the development of algebraic combinatorics features in Sage, a general purpose open source mathematical software. In this series of four lectures, we will give a general introduction to Sage, and then focus on the features relevant to the topics of the summer school: partitions, cores, tableaux, root systems, symmetric functions, k-Schur functions, affine Stanley symmetric functions, nil-Hecke algebras, ...

The lectures will be followed by hands-on tutorials. Interested participants are strongly encouraged to bring their own laptop. No software other than a web-browser is necessary.

THOMAS LAM
University of Michigan

Affine Stanley symmetric functions

This will be a series of introductory talks concerning Stanley symmetric functions and affine Stanley symmetric functions, focusing on the algebraic and combinatorial aspects. The first lecture will discuss reduced words in the symmetric group, the original definition of Stanley symmetric functions, and the Edelman-Greene correspondence. The second and third lectures will discuss an algebraic approach to (affine) Stanley symmetric functions based upon the (affine) nilCoxeter and nilHecke algebras, together with the Fomin-Stanley and Peterson subalgebras.

LUC LAPOINTE
Universidad de Talca

k-Schur functions: definitions, atomic properties and k-poset

First lecture: Definitions We will present the various conjecturally equivalent characterizations of k-Schur functions $s_\lambda[X;t]$: the tableau atom definition, the algebraic definition using Jings operators and the definition as sums over strong tableaux with spin. We will give an overview of the properties of k-Schur functions and specify whether they are known to hold in each characterization.

Second lecture: Atomic properties We will focus on the tableau definition of k-Schur functions. We will discuss the notions of katabolism, cyclage, Lascoux-Schutzenberger action of the symmetric group on words, etc. We will introduce the concept of copies of atoms and explain the meaning of the Pieri rule and branching coefficients (decomposition of k-Schurs into k+1-Schurs) in this context.

Third lecture: k-poset We will introduce a poset (the k-poset) on a certain type of partitions called k-shapes that allows to give an explicit expression for the branching coefficients. We will explain how the k-poset is compatible with the concept of charge and with the Lascoux-Schtzenberger action of the symmetric group on words. Finally, we will present a conjecture that relates the k-poset and tableau atoms, and give some open problems that arise from the k-poset.

JENNIFER MORSE
Drexel University

Affine combinatorial refinement of Schur functions

Starting from scratch, these lectures will introduce k-Schur functions and show examples of their properties in the ungraded case that refine fundamental aspects of Schur functions.

The first lecture will introduce Schur functions s_λ , which play a fundamental role in various fields such as the representation theory of the symmetric group, the geometry of Grassmannians and quantum many-body physics. We will discuss aspects making the Schur functions a fundamental combinatorial basis for the symmetric function space: tableaux, Pieri rules, and Littlewood-Richardson rules. We will also discuss the role of Schur functions in the theory of Macdonald polynomials.

The second and third lectures will reveal the origin of k-Schur functions and dual k-Schur functions. We will discuss specific properties of these functions refining those of Schur functions that were discussed in the first lecture. In particular, analogs tied to the type A-affine Weyl group for classical ideas such as Pieri rules and tableaux.

MARK SHIMOZONO
Virginia Tech

k-Schur functions extended to other types

LENNY TEVLIN
New York University

An Introduction to Quasi-symmetric and Noncommutative Symmetric Functions

I will introduce some natural bases of algebras of quasi-symmetric and noncommutative symmetric functions and should how Hopf duality between these algebras can be used to obtain the rest.