Combinatorial Aspects of Nilpotent Orbits

Friday, April 20, 2018
Northeastern University
One-day conference preceding the AMS special session with same title,
http://www.ams.org/meetings/sectional/2252_program_ss15.html#title
Organizers: **Leila Khatami, Juianna Tymoczko, Anthony Iarrobino**

All talks will take place in **544 Nightingale Hall**, which is around the corner from 553 Lake Hall

9:30 AM: Gathering: tea, crumpets (553 Lake Hall)
10 - 10:45 AM: Discussion: short intros/problems by participants (544 Nightingale Hall)

11 AM - 12:15 PM: Survey on the questions related to coordinate rings of nilpotent orbit closures
Jerzy Weyman (University of Connecticut)
Abstract: In this talk I will survey the results and open problems on the normality and defining equations of coordinate rings of nilpotent orbit closures. I will also discuss similar questions for Vinberg representations, i.e. a class of representations with finitely many orbits.

12:30 - 1 PM: K-theoretic crystals on Grothendieck polynomials
Oliver Pechenik (University of Michigan)
Abstract: Classically, Schur polynomials simultaneously represent both irreducible representations of GL_n and Schubert classes in the cohomology of Grassmannians. The analogous objects, moving from cohomology to K-theory, are Grothendieck polynomials; however, we don't have a corresponding representation-theoretic interpretation of them. Using the set-valued tableaux of Buch, we build a crystal structure on Grothendieck polynomials, yielding a new combinatorial formula for their Schur expansions. We consider how to extend this crystal by extra "K-theoretic" Kashiwara operators to study the K-theoretic deformations of Demazure characters introduced by Lascoux and Kirillov. (Joint work with Cara Monical and Travis Scrimshaw.)

2:30 - 3:30 PM: Remarks on combinatorial and algebro-geometric properties of orbit closures of Dynkin quivers
Jenna Rajchgot (University of Saskatchewan)
Abstract: A quiver Q is a finite directed graph and a representation of Q is an assignment of vector space to each vertex and linear map to each arrow. Once the vector spaces have been fixed, the space of representations is an affine space. This affine space carries the action of a product of general linear groups. By Gabriel’s Theorem, there are finitely many orbits precisely when the underlying graph of Q is a type A, D, or E Dynkin diagram. This talk will be a survey on combinatorial and algebro-geometric properties of orbit closures (a.k.a. quiver loci) of Dynkin quivers. After providing some background and motivation, I'll discuss a few current research directions, including known results and open questions.

3:45 - 4:45 PM: Spherical nilpotent orbits in symmetric spaces (after Bravi, Chirivì, Gandini and King)

Bart Van Steirteghem (Medgar Evers College, CUNY)
Abstract: Let K be a complex connected reductive group. A homogeneous space K/H is called spherical if a Borel subgroup of K has a dense orbit on it. This talk will be about the spherical nilpotent orbits in the isotropy representation p of K, where K is a symmetric subgroup of a complex simple algebraic group. I will review D. King's classification of, and his work on the Kostant-Sekiguchi correspondence for, these orbits. I will also give an overview of the rich combinatorial theory of spherical varieties and explain how P. Bravi, R. Chirivì and J. Gandini used it to study the closures of spherical nilpotent K-orbits in p.

5:00 - 5:40 PM: Generic Jordan Types of A-module Tensor Products
Chris McDaniel (Endicott College)
Abstract: Let A be a graded Artinian algebra. The Jordan type of a linear form $\ell in A_1$ is the partition P_ℓ whose parts are the block sizes in the Jordan canonical form for its multiplication map m: A to A. The generic Jordan type of A is the largest occurring Jordan type P_ℓ among all $\ell\in A_1$ with respect to the dominance order on partitions, and A has the strong Lefschetz property if its generic Jordan type is as large as possible. Given graded Artinian algebras A, B, C, we say C is an A-module tensor product product if C if free over A and is isomorphic to the tensor product $A\otimes B$ as A modules (but not necessarily as rings). We show that the generic Jordan type of the A-module tensor product C is bounded below by the generic Jordan type of the actual tensor product $A\otimes B$. A corollary is that the strong Lefschetz property for the actual tensor product implies the strong Lefschetz property for the A-module tensor product. We will also give examples from invariant theory showing this implication is strict. (Work joint with S. Chen, A. Iarrobino, P. Marques)