2019 Route 81 Conference
— Schedule —

Saturday, 5 October 2019

Department of Mathematics and Statistics
Queen's University, Kingston, Ontario

08:30 – 09:00	BREAKFAST
09:00 – 09:50	BRENT PYM (McGill) Holonomic Poisson manifolds
09:00 – 10:50	AYAH ALMOUSA (Cornell) Polarizations of powers of the maximal ideal in a polynomial ring
11:00 – 11:30	COFFEE BREAK
11:30 – 12:20	DAOJI HUANG (Cornell) Bruhat atlas on stratified manifolds in coordinates
12:20 – 14:00	LUNCH
14:00 – 14:50	JOHN MYERS (Oswego) Three algebras and three variants of Koszulness
15:00 – 15:50	BEIHUI YUAN (Cornell) A counterexample to the 2r+1 conjecture on algebraic splines
16:00 – 16:30	COFFEE BREAK
16:30 – 17:20	NICHOLAS PACKAUSKAS (Cortland) Quasi-polynomial growth of Betti sequences over a complete intersection

All talks are in 234 Jeffery Hall (it is one floor below ground).
Breakfast and lunch will be in the fifth floor lounge of Jeffery Hall.

Abstracts

Ayah Almousa *Polarizations of powers of the maximal ideal in a polynomial ring*

We study polarizations of powers of the maximal ideal $(x_1, x_2, \ldots, x_n)$ in a polynomial ring of n variables. We give a combinatorial description of all polarizations of the ideal $(x_1, x_2, \ldots, x_n)^d$. We also give a combinatorial description of the Alexander duals of such polarizations in terms of the graph of linear syzygies, and use this description to show that the polarizations define (shellable) simplicial balls in the three variable case; we conjecture this to be true for any n. This is joint work with Gunnar Fløystad.

Daoji Huang *Bruhat atlas on stratified manifolds in coordinates*

A stratified smooth variety admits a Bruhat atlas if it can be covered by open charts isomorphic to opposite Bruhat cells in some Kac-Moody flag manifold via stratified isomorphisms. In this talk, I will present two cases where the Kac-Moody is finite or affine type, which allows explicit computation in coordinates using Bott-Samelson maps and other familiar techniques in studying geometry of flag varieties.

Nicholas Packauskas *Quasi-polynomial growth of Betti sequences over a complete intersection*

It is known that the Betti numbers for any finitely generated module over a local complete intersection ring grow on the order of a polynomial. Further, it can be shown that, for large enough degree, there are two polynomials of interest: one explicitly giving the even Betti numbers and one giving the odd Betti numbers. The aim of this talk is to show a bound on the discrepancy of these two polynomials for every finitely generated module over a complete intersection with respect to an invariant of the ring called its "quadratic codimension". This is joint work with Lucho Avramov and Mark Walker.

Brent Pym *Holonomic Poisson manifolds*

Poisson brackets on algebraic varieties play an important role in many parts of mathematics, from representation theory and noncommutative algebra to gauge theory and mathematical physics, but the moduli space that parametrizes them is not well understood. One reason is that the singularities of Poisson brackets are typically quite complicated, making it difficult to apply deformation-theoretic arguments from classical algebraic geometry. I will describe a new nondegeneracy condition for Poisson brackets, called holonomicity, which tames the deformation problem (via D-module theory), and allows us to identify new explicit irreducible components of the moduli space. This talk is based on joint work with Schedler, and with Matviichuk and Schedler.

Beihui Yuan *A counterexample to the $2r+1$ conjecture on algebraic splines*

An algebraic spline $C^r(\Delta)$ is the set of piecewise polynomial over a simplicial complex with smoothness r. The subset $C^r_d(\Delta)$ consisting of the degree d piecewise polynomials is a finite dimensional vector space. So one question people care about is the Hilbert function of $C^r(\Delta)$, i.e. the dimension of $C^r_d(\Delta)$ for each non-negative degree d. It is known that for large enough d, we may compute it using only local data. In the cases of planar simplicial complexes, it is equivalent to say the degree d component of first homology of the spline complex $H_1(R/J)_d = 0$. Alfeld and Schumaker proved that for $d \geq 3r+1$, $H_1(R/J)_d = 0$. It is conjectured by Schenck and Stiller that all $d \geq 2r+1$ works. We will give an counter-example in which $H_1(R/J)_{2r+1}$ is not 0 and conjecture a new lower bound for d.

John Myers *Three algebras and three variants of Koszulness*

Let R be a standard graded commutative algebra over a field k, let K be the Koszul complex on a minimal set of generators of the irrelevant ideal of R, and let H be the homology of K. We adapt the standard definition of Koszulness in terms of linear free resolutions to apply to K (viewed as a DG algebra) and then to H (viewed as a bigraded algebra); we then describe how these three Koszul properties transfer back and forth between the three algebras R, K, and H.