

ARITHMETIC AND GEOMETRY OF ALGEBRAIC VARIETIES
WITH SPECIAL EMPHASIS ON
CALABI–YAU VARIETIES AND MIRROR SYMMETRY
NOVEMBER 15–16, 2014

ABSTRACTS

Chen, Xi (University of Alberta)

Xiao’s Conjecture on Canonically Fibered Surfaces

Abstract: In 1988, Gang Xiao proposed a list of open problems on algebraic surfaces. Many of these remain open to this day. One of the problems concerns the maximal relative genus of a canonically fibered surface. In this talk, I will talk about my proof of this conjecture.

Garcia, Natalia (Queen’s University)

Curves of low genus on surfaces

Abstract: We will discuss a geometric technique to explicitly find curves of genus 0 or 1 on certain general type surfaces. Then we will present some consequences of arithmetic interest under the Bombieri–Lang conjecture.

Goto Yasuhiro (Hokkaido University of Education, Hakodate)

Formal groups attached to Calabi–Yau varieties

Abstract: One can consider one-dimensional formal groups associated with Calabi–Yau varieties. Over a field of positive characteristic, these formal groups are classified by the height. In this talk, we calculate the height of formal groups for various kinds of Calabi–Yau threefolds and K3 surfaces.

Lewis, James (University of Alberta)

The simplicial regulator to Deligne cohomology

Abstract: We provide an explicit description of the Bloch cycle class map to Deligne cohomology, using Bloch’s original simplicial description of his higher Chow groups. This is based on joint work with Matt Kerr.

Molnar, Alex (Queen’s University)

Arithmetic on intermediate Jacobians of rigid Calabi-Yau threefolds

Abstract: Generalizing the Jacobian variety of a curve, one may associate to any higher dimensional complex variety X some (complex) varieties defined in terms of cohomological quotients of X , the intermediate Jacobians. These receive cycle class maps, so there is much interest in being able to define them over number fields in order to study the many open conjectures on cycles and Chow groups of varieties.

We will discuss some examples of rigid Calabi-Yau threefolds where we may compute the intermediate Jacobians as complex tori, and show that a model of the threefolds over the rational numbers leads to a natural rational model of the intermediate Jacobian. This allows us to consider (quadratic) twists of the threefolds, see how this affects the intermediate Jacobian, and compute the L-functions of the twisted threefolds and their respectively twisted intermediate Jacobians, their special values as well as relationships between them.

Perunicic, Andrija (Queen’s University)

Zeta functions of some K3 surface quotients

Abstract: Certain K3 surface quotients appear in a type of mirror symmetry called Berglund-Hübsch duality. We show how to calculate zeta functions of such K3 surfaces defined over finite fields. In certain cases the zeta function can be calculated using Jacobi sums. In other cases we take advantage of the fact that the quotients involved are birational to Fermat surface quotients for which it is easier to work out the zeta function.

Rayan, Steve (University of Toronto)

Hyperpolygons and Hitchin systems

Abstract: Just as the moduli space of semistable n -gons in complex projective space can be realized as the representation space of a certain shape of quiver, their hyperkaehler analogues (moduli spaces of "hyper- n -gons") are quiver varieties for the same quiver, doubled. We study the cohomology of hyperpolygon space, and show that, at least for rank up to and including 3, they carry the structure of complete integrable systems. To accomplish this, we relate hyperpolygon space to singular parabolic Hitchin systems. This is joint work with Jonathan Fisher (arXiv:1410.6467).

Thompson, Alan (University of Waterloo)

Moduli of Calabi-Yau threefolds fibred by lattice polarized K3 surfaces

Abstract: I describe recent progress in joint work with C. Doran, A. Harder and A. Novoseltsev, in which we study the moduli spaces of Calabi-Yau threefolds that admit fibrations by K3 surfaces polarized by certain rank 19 lattices. There are close parallels to be drawn between this theory and the theory of elliptic surfaces: in particular, the coarse moduli spaces of such K3 surfaces are modular curves, and there are analogues of the functional and homological invariants which determine much of the geometry of the Calabi-Yau threefolds fibred by them.

Zhong, Changlong (University of Alberta)

Equivariant oriented cohomology of flag varieties

Abstract: In this talk I will introduce an algebraic and combinatorial construction of the torus equivariant oriented cohomology of flag varieties, generalizing classical results of Demazure and Kostant–Kumar. More precisely, I will introduce the formal affine Demazure algebra constructed based on root systems, whose dual is isomorphic $h_T(G/B)$, where h is an oriented cohomology of algebraic varieties in the sense of Levine and Morel, and G is any split linear algebraic group containing the Borel subgroup B and the torus T . This is joint work with B. Calmes and K. Zainoulline.

Haessig, Doug (University of Rochester)

Zeta functions and L-functions on complements

Abstract We will discuss some recent work on L-functions of exponential sums over finite fields through the optic of arithmetic mirror symmetry.