ARITHMETIC AND GEOMETRY OF ALGEBRAIC VARIETIES
WITH SPECIAL EMPHASIS ON
CALABI–YAU VARIETIES AND MIRROR SYMMETRY
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ABSTRACTS

Norman Do, McGill University

Lattice points in moduli spaces of curves

There appear to be only two essentially distinct ways to understand intersection numbers on moduli spaces of curves. The algebraic geometric techniques of localization and degeneration lead to relations with Hurwitz numbers while the hyerpbolic geometric approach leads to relations with symplectic volumes. In this talk, we'll consider polynomials defined by Norbury which bridge the gap between these two pictures. These polynomials count lattice points in moduli spaces of curves and we'll see that some of their coefficients store interesting information.

Tatyana Foth (University of Western Ontario)

Complex structures and the Teichmueller space

I will talk about the curvature of certain connections on line bundles on the Teichmueller space of compact Riemann surfaces of genus $g > 1$. More generally, I will also discuss the space of complex structures on a compact surface of genus $g > 1$ compatible with a given symplectic form. I will state an open question for a $K3$ surface.

Doug Haessig (University of Rochester)

Variation of zeta functions and Sigma-modules

The deformation of an algebraic variety defined over a finite field creates analytic variations in the associated zeta function. This variation naturally leads to the notion of a σ-module (or F-crystal) and its associated L-function. In this talk, we will discuss this relationship along with various recent results.

Bill Hoffman (Louisiana State University)

Tangents to Chow groups

The Chow groups $\mathrm{CH}^p(X)$ of algebraic cycles of codimension p modulo rational equivalence on a smooth quasiprojective algebraic variety X are among the most basic and, when $p \geq 2$, most mysterious objects in algebraic geometry. This talk is a report on work in progress on the study of the tangent spaces $\mathrm{TCH}^p(X)$ and higher order tangents, the formal completion $\widehat{\mathrm{CH}}^p(X)$. Especially we will discuss extensions of results of Bloch, Stienstra and Green/Griffiths from first order deformations of CH^2 to higher order deformations of CH^n and Bloch's higher Chow groups. This involves ideas from K-theory and cyclic homology. Relations to Hodge-theoretic invariants will also be discussed.

Sheldon Joyner (University of Western Ontario)

An algebraic Knizhnik-Zamolodchikov equation

The Knizhnik-Zamolodchikov equation of conformal field theory arises in the study of the shuffle algebra of polyzeta values since the generating function of multiple polylogarithms gives a fundamental solution of

this equation. By introducing multiple Hurwitz polyzeta functions, and considering an analogous generating series $H(z)$, we develop an algebraic version of the KZ equation, and thereby a difference equation analogue of the notion of connection, for which $H(z)$ is a flat section.

Ken-Ichiro Kimura (University of Tsukuba)

Mixed elliptic motives

The category of mixed motives over a given base field is a conjectural abelian tensor category which should contain Grothendieck's category of pure motives as the full subcategory of semi-simple objects. Bloch and Kriz give a candidate of the category of mixed Tate motives by constructing a Hopf algebra from algebraic cycles. We discuss the construction of a Hopf algebra for the category of mixed motives which is generated by a fixed elliptic curve. This is a joint work with T. Terasoma.

James Lewis (University of Alberta)

The Regulator Map on Voevodsky Motivic Cohomology

This is a report on joint work with Paulo Lima-Filho. The regulator map on Bloch's higher Chow groups into absolute Hodge cohomology has been worked out explicitly by Lewis, Kerr and Mueller-Stach. As Bloch's higher Chow groups can be identified with Voevodsky's motivic cohomology, it is natural to explain the regulator in this context.

Ling Long (Iowa State University)

Some results on supercongruences

Supercongruences satisfied by arithmetic functions are linear congruences that are stronger than what standard methods may predict. For instance, Rodriguez-Villegas conjectured that several values of truncated hypergeometric series arising from periods of special Calabi-Yai manifolds are related to Hecke eigenforms by supercongruences, which are stronger than what can be obtained by Gauss-Manin connection.

In this talk, we will address some current results on supercongruences including a conjecture of van Hamme on Ramanujan-type supercongruence. Our method involves basic p-adic analysis, hypergeometric evaluation identities, and combinatorics. One of the supercongruence from elliptic curve to be mentioned is joint with Heng-Huat Chan and Wadim Zudilin.

Andrey Novoseltsev, University of Alberta

Searching for new Calabi–Yau threefolds

A few years ago Charles Doran and John Morgan have classified integral variations of Hodge structure which can correspond to one-parameter families of Calabi-Yau threefolds. There were two cases for which the existence of a geometric realization was not clear. This talk will report on the recent progress (joint work with Charles Doran) towards constructing these missing examples using singular subfamilies of hypersurfaces and complete intersections in toric varieties.

Abhijnan Rej (The Fields Institute)

Arithmetic geometry of attractor varieties

In this talk, I report on work-in-progress towards understanding Greg Moore's conjectures about attractors in string theory (certain fixed points in flows on the moduli space) as a problem in arithmetic algebraic geometry. In particular I focus on recasting the problems in terms of Deligne cohomology and on the geometry of attractor varieties in terms of Arakelov theory.