ARITHMETIC AND GEOMETRY OF ALGEBRAIC VARIETIES
WITH SPECIAL EMPHASIS ON
CALABI–YAU VARIETIES AND MIRROR SYMMETRY
NOVEMBER 5–6, 2005

ABSTRACTS

NOVEMBER 5, 2005

9:30am: Roy Joshua (Ohio State University)

Kunneth and motivic decomposition for quotient varieties

In this talk we discuss Kunneth decomposition in the sense of Murre for quotients of Abelian varieties by finite groups. This applies in particular to symmetric products of Abelian varieties and also to certain smooth quotients in positive characteristics which are known to be not Abelian varities, examples of which were considered by Enriques, Igusa and Beauville.

10:30am: Ronald van Luijk (CRM Montreal and MSRI Berkeley)

Quartic K3 surfaces with trivial automorphism group

In 2004, Bjorn Poonen proved that for every field k and every integers $n \geq 1, d \geq 3$ with (n, d) not equal to $(1, 3)$ and $(2, 4)$, there exists a smooth hypersurface $X \subset \mathbf{P}^{n+1}$ over k of degree d such that the automorphism group of X over the algebraic closure of k is trivial. For $(n, d) = (1, 3)$ such hypersurfaces do not exist. In this case X would be a plane cubic curve and by choosing a flex as the origin, such an X obtains the structure of an elliptic curve on which multiplication by -1 is a nontrivial automorphism. We will deal with the case $(n, d) = (2, 4)$ and show that smooth quartic surfaces in $\mathbf{P}^3$ with trivial automorphism group do exist if the characteristic of k is at most 5.

11:30am: Matt Papanikolas (Texas A& M University)

Hypergeometric functions over finite fields and counting points on varieties

First studied by Greene and Stanton in the 1980's, finite field hypergeometric functions are constructed as certain sums of products of Jacobi sums. Work of Ahlgren, Koike, Ono, and others have shown in certain examples that values of these hypergeometric functions are closely related to counting points on some Calabi-Yau manifolds over finite fields as well as to Fourier coefficients of modular forms. Our overall goal is to explain these phenomena, and we consider additional examples of values of 4F3-hypergeometric functions and investigate how they count points on families of varieties whose Picard-Fuchs equations are essentially hypergeometric. Joint work with Frechette.

2:30pm: Helena Verrill (Louisiana State University)

Toric modular Calabi–Yau threefolds

I will discuss possible methods of locating modular Calabi-Yau threefolds in toric families of Calabi-Yau threefolds.

3:30pm: Nam-Hoon Lee Lee (University of Michigan)

New examples of Calabi-Yau threefolds with Picard number one

Very often, a Calabi-Yau has a degeneration to a normal crossing of two quasi-Fano varieties. We will show how to calculate the Picard group, the Hodge numbers and the Chern class of the original Calabi-Yau from those of the quasi-Fano varieties and give some examples. We found that the **Q**-Fanos, which H. Takagi constructed a few yeas ago, admit smooth double coverings. By applying the above method, we can show that they are Calabi-Yaus with Picard number one, for which only about 30 examples were known before. It turns out that at least 14 of them are new and seven of those new ones have the invariants which were predicted by C. Sevenheck and D. van Straten. We will also discuss other issues, related with semistable degeneration of Calabi-Yaus.

4:30pm: John Scherk (University of Toronto)

Borel–Serre compactifications of classifying spaces of Hodge structures

The moduli spaces for polarized abelian varieties and for polarized K3 surfaces are locally hermitian symmetric spaces. Compactifications of these provide information about degenerations of these types of varieties. Classifying spaces of Hodge structures were introduced in part to generalize such moduli spaces. So it is natural to study their compactifications. The reductive Borel-Serre compactification seems particularly well-suited.

NOVEMBER 6, 2005

9:30am: Andreas Rosenschon (State University of New York at Buffalo)

A Lefschetz $(1,1)$-theorem for proper seminormal complex varieties

For a proper smooth complex variety, the Lefschetz (1,1)-theorem describes the image of the cycle map that assigns to a line bundle its integral cohomology class. The obvious analogue of this theorem for singular varieties is false. We state and prove a 'revised' Lefschetz $(1,1)$-theorem for proper seminormal varieties. This is joint work with L. Barbieri-Viale and V. Srinivas.

10:30am: Michela Artebani (University of Milano and Queen's University)

A moduli space of genus three curves and K3 surfaces

S. Kondo has defined a birational period map from the moduli space of genus three curves to an arithmetic quotient of the complex 6-ball parametrizing certain polarized K3 surfaces. We show that this period map can be extended to a surjective morphism on a suitable compactification of the moduli space of genus three curves. Moreover, we study Heegner divisors in the ball quotient and give an interpretation in terms of genus three curves.

11:30am: Noriko Yui (Queen's University)

Motives and mirror symmetry

This is a joint work in progress with my former postdoc, Shabnam Kadir. In this talk, I will try to explain mirror symmetry phenomena for certain classes mirror pairs of Calabi–Yau threefolds in terms of motives. Also modularity questions for these Calabi–Yau threefolds will be discussed.