ARITHMETIC AND GEOMETRY OF HIGHER DIMENSIONAL VARIETIES

WITH SPECIAL EMPHASIS ON

CALABI–YAU VARIETIES AND MIRROR SYMMETRY

MARCH 5–6, 2005

ABSTRACTS

MARCH 5, 2005

10:00am: Victor Batyrev (University of Tübingen/The Fields Institute)

Phases in local mirror symmetry

According to Gelfand-Kapranov-Zelevinski, different (coherent) triangulations of a lattice polytope P are parametrized by vertices of the secondary polytope Sec(P). From physical point of view, different vertices of the secondary polytope Sec(P) represent different "phases" of the corresponding physical theory. The purpose of the talk is to compare A-models and B-models and to formulate local mirror symmetry for an arbitrary phase.

11:15am: Paul Horja (The Fields Institute)

Birational geometry of toric stacks and monodromy

Mirror symmetry provides a well known dictionary between birational geometry and complex geometry on the two sides of mirror symmetry. I will show how toric DM stacks, their orbifold Chow ring and K-theory, are very natural technical tools for probing mirror symmetry. This is joint work with L. Borisov.

2:00pm: Roya Beheshti–Zavareh (Queen's University)

Lines on projective hypersurfaces

In this talk, I will discuss the geometry of the Hilbert scheme of lines on an arbitrary smooth hypersurface of low degree over an algebraically closed field.

3:30pm: Edward Lee (Harvard University)

A Modular Nonrigid Calabi-Yau Threefold Arising from the Horrocks-Mumford Vector Bundle

We construct a determinantal quintic threefold by taking a one-parameter family of abelian surfaces coming from sections of the Horrocks-Mumford vector bundle on $\mathbf{P}^4$. After passing to a big resolution, we show that its middle cohomology breaks up into a 4-dimensional piece arising from a pair of elliptic ruled surfaces and a 2-dimensional piece whose L-function is that of a modular form. An interesting feature is that the elliptic surfaces are a conjugate pair each defined over $\mathbf{Q}(i)$, and that only their union is defined over $\mathbf{Q}$.

4:45pm: Yuri Zarhin (Pennsylvania State University)

Endomorphism algebras of superelliptic Jacobians

We determine a structure of the endomorphism algebra of the jacobian of a curve $y^q = f(x)$ where q is a prime power and $f(x)$ is a "generic" polynomial. Surprisingly, there is a plenty of explicit examples of "generic" polynomials even with rational coefficients.

MARCH 6, 2005

9:30am: Ling Long (Iowa State University)

Picard-Fuchs equations of certain one-parameter families of K3 surfaces

The Picard-Fuchs equation, the differential equations satisfied by the periods of the holomorphic top-forms of a family of Calabi-Yau manifolds, plays an important in determining and describing the Mirror map. In this talk, we will study special families of one-parameter families of K3 surfaces including those whose Picard-Fuchs equation has only two singular points.

10:40am Ruxandra Moraru (The Fields Institute)

Moduli spaces of stable bundles on certain non-Kahler surfaces

In this talk, I will examine the geometry of moduli spaces of stable bundles on Hopf and Kodaira surfaces, which are compact complex surfaces that do not admit Kahler metrics. In particular, I will discuss how these examples are related to mirror symmetry.

11:50am Klaus Hulek (University of Hannover/The Fields Institute)

Modularity of non-rigid Calabi-Yau varieties

In the last few years various authors (Livné and Yui, Hulek and Verill, Schütt et al.) have found series of non-rigid CalabiYau varieties for which modularity can be proved. The aim of this talk is twofold:

(1) We formulate a general criterion which allows to prove modularity for non-rigid Calabi-Yau varieties if the threefold contains sufficiently many elliptic ruled surfaces. This makes use of work of Dieulefait and Manoharmayum who proved a modularity result for rigid Calabi-Yau varities. Our result explains the modularity of most of the examples which were found in the last few years.

(2) Livné and Yui investigated certain Calabi-Yau varieties with a Kummer fibration which are examples of varieties which satisy equality in the Arakelov-Yau inequality. These are semi-stable fibrations whose iterated Kodaira-Spencer map is non-zero and have 6 singular fibres. Their analysis of the modularity of these varieties can be extended to a number of other Kummer fibrations. We shall illustrate this in the example of the Kummer family associated to the group $\Gamma_1(7)$.

This is joint work with H. Verrill.