

ARITHMETIC AND GEOMETRY OF HIGHER DIMENSIONAL VARIETIES
WITH SPECIAL EMPHASIS ON
CALABI–YAU VARIETIES AND MIRROR SYMMETRY

ABSTRACTS
October 23, 2003

10:00am: James Lewis (University of Alberta)

Real regulators on twisted Milnor complexes

Let X be a projective algebraic manifold, and let $\mathcal{K}_{k,X}^M$ be the k -th Milnor K -theory sheaf on X . In some earlier work by myself and others, a real regulator r from the Zariski cohomology of $\mathcal{K}_{k,X}^M$ (in all degrees) to a certain quotient of real Deligne cohomology was constructed. For certain classes of X , and from the work of others, this real regulator is known to satisfy a Noether-Lefschetz property, viz., r is ‘trivial’. In this talk I discuss twisted variant of Milnor K -theory, and corresponding twisted regulator r_T and arrive at a corresponding complex whose regulator images are nontrivial, even in the cases where r has trivial image.

11:15am: Shabnam Kadir (The Fields Institute)

This talk will concern mirror symmetric pairs of Calabi–Yau manifolds over finite fields. The number of rational points of the manifolds can be written as a function of the “complex structure parameters”. The Weil Conjectures (proved in the 1970s) show that for smooth varieties, these zeta functions take a very interesting form in terms of the Betti numbers of the variety. This has interesting implications for mirror symmetry, as mirror symmetry exchanges the odd and even Betti numbers. I shall discuss the zeta function of a two-parameter family of octics in weighted projective space, $\mathbf{P}_4^{(1,1,2,2,2)}$ [8], are computed. The form of the zeta function at points in the moduli space of complex structures where the manifold is singular (where the Weil conjectures apart from rationality are not applicable), will be discussed. The zeta function appears to be sensitive to monomial and non-monomial deformations of complex structure (or equivalently on the mirror side, toric and non-toric divisors). Various conjectures about the form of the zeta function for mirror symmetric pairs are made in light of the results of this calculation. Connections with L -functions associated to both elliptic and Siegel modular forms will be discussed.

2:00pm: Kenji Ueno (Kyoto University)

On modular functors and conformal field theory

With Jorgen E. Andersen we constructed modular functors from conformal field theory. The construction depends heavily on the classical theory of compact Riemann surfaces. On the other hand from the modular functor we can construct topological quantum field theory (TQFT). We conjecture that our modular functor for $sl(n, \mathbf{C})$ gives the Reshetikhin-Turaev TQFT.

In the present talk I will discuss about this conjecture. Also it is an interesting problem to generalize conformal field theory for algebraic surfaces. I would like to also discuss such possibilities.

3:15pm: Kai Behrend (University of British Columbia/The Fields Institute)

On the cohomology rings of certain stable map spaces

Moduli spaces of stable maps are the spaces one integrates over to construct Gromov-Witten invariants of algebraic varieties. We compute the cohomology ring of the space of stable maps of genus zero and degree three into projective space. We use a vector field on the space of stable maps which is equivariant with respect to a \mathbf{C}^* -action, to reduce the computation to the big Bialynicki-Birula cell, which can be described in terms of spaces of stable curves. We also explain more recent results on Grassmannians.

4:30pm: Andreas Rosenschon (SUNY Buffalo)

On rigidity

Let k be either the real numbers, the complex numbers, or a complete discrete valuation field. We show that torsion and cotorsion of a pseudo-pre theory is invariant under certain field extensions k/k^0 . In particular, this applies to motivic cohomology and algebraic K -theory, generalizing results of Suslin, and Suslin-Voevodsky.

October 24, 2004

9:30pm: Romyar Sharifi (McMaster University)

Class groups through Bernoulli numbers and cup products

We begin with a discussion of the structure of class groups of cyclotomic fields, especially the field of p th roots of unity. We explain the relationship between the structure of these class groups and Bernoulli numbers, which are essentially special values of L-functions. We then consider class groups of larger fields which are Kummer extensions of these cyclotomic fields. We explain how these class groups can be partially described by certain pairings arising from a cup product in Galois cohomology. The values of these pairings are quite mysterious numbers in themselves. We give a conjectural description of some of these values in terms of the L-values of cusp forms satisfying a congruence with Eisenstein series.

10:40am Manfred Herbst (The Fields Institute)

A-infinity algebras in topological open string theory

I discuss consistency conditions which constrain open-closed disk amplitudes of topological strings. They include the A-infinity relations (which generalize associativity of the boundary product of topological field theory), as well as certain homotopy versions of bulk-boundary crossing symmetry and Cardy constraint. I will also discuss relations to string field theory and mirror symmetry.

11:50am Barbara Fantechi (ICTP Trieste/The Fields Institute)

Quantum cohomology for orbifolds

The definition of Gromov Witten invariants has been extended from manifolds to orbifolds by Chen and Ruan, and in the algebraic language to smooth Deligne Mumford stacks by Abramovich, Corti, Graber and Vistoli. This talk will present a reasonably selfcontained overview and some examples.