

# Workshop on Algebraic Geometry in Positive Characteristic

May 26–27, 2011 KIAS

## Title and abstract

### Nobuo Hara

Title: F-blowups of normal surface singularities

Abstract.

Yasuda introduced the notion of an F-blowup, which is a canonical birational modification of a variety in characteristic  $p > 0$ . Although some good aspects and pathologies of F-blowups have recently been revealed, their behavior is a mystery yet, even in dimension two. In this talk, I will discuss the behavior of F-blowups of certain normal surface singularities (F-regular, rational and simple elliptic singularities), focusing on the normality, smoothness and stabilization of F-blowup sequences. This is a joint work (working in advance) with T. Sawada and T. Yasuda.

### Hiroyuki Ito

Title: Wildly ramified actions and surfaces of general type arising from Artin-Schreier curves

Abstract.

This is a joint work with Stefan Schroeer. We analyse the diagonal quotient for the self-product of certain Artin-Schreier type curves. The smooth models are surfaces of general type, with Chern slopes tending asymptotically to 1. A close examination of the quotient singularity in characteristic  $p$  arising from the quotient enables to calculate numerical invariants of surfaces. We also give some properties of these surfaces.

## **Toshiyuki Katsura**

Title: Configurations of rational curves on the supersingular K3 surface with Artin invariant 1 in characteristic 3.

Abstract.

Let  $k$  be an algebraically closed field of characteristic  $p > 2$ . Then, the supersingular K3 surface with Artin invariant 1 is unique up to isomorphism and is isomorphic to the Kummer surface which is given by the superspecial abelian surface  $A$ . The Neron-Severi group of the K3 surface is embedded in the even unimodular lattice of rank 26 with signature  $(1, 25)$ . By this embedding the Neron-Severi group is related with the Leech lattice. We have 112 Leech roots which are realized by rational curves on the K3 surface. In this talk we construct 16 curves of genus 4 and 80 elliptic curves on  $A$  such that these 96 curves and 16 exceptional curves give the Leech roots on the K3 surface. We will see these curves give beautiful configurations on the K3 surface.

## **Hiraku Kawanoue**

Title: IFP and R-saturation

Abstract.

After the brief explanation of the ideas of resolution of singularities in characteristic 0, I will introduce IFP (Idealistic Filtration Program), an approach toward the resolution in positive characteristic. I will also discuss the difficulties and possibility of IFP with emphasizing the use of R-saturation (radical saturation).

## **JongHae Keum**

TBA

## **Yongnam Lee**

Title: Simply connected surfaces of general type in positive characteristic via deformation theory

Abstract.

Algebraically simply connected surfaces of general type with  $p_g=q=0$  and  $1 \leq K^2 \leq 4$  in positive characteristic are presented by using a  $\mathbb{Q}$ -Gorenstein smoothing of two-dimensional toric singularities, a generalization of Lee-Park's construction in the field of complex numbers to the positive characteristic case, and Grothendieck's specialization theorem for the fundamental group. It is a jointed work with Noboru Nakayama.

## **Junmyeong Jang**

Title: The ordinarity of an isotrivial elliptic fibration

Abstract.

In this talk, we will see a criterion of the ordinarity for isotrivial elliptic surfaces over a field of positive characteristic in terms of the generic fiber and a suitable covering of the base. Using this, we will prove the ordinary reduction theorem for some isotrivial elliptic surfaces defined over a number field.

## **Noboru Nakayama**

TBA

## **Shunsuke Takagi**

Title: A correspondence of log canonicity and  $F$ -purity

Abstract.

Log canonical singularities form a class of singularities associated to the minimal model program.  $F$ -pure singularities form a class of singularities defined via splitting of Frobenius morphism in positive characteristic. It is conjectured that a  $\mathbb{Q}$ -Gorenstein normal variety is log canonical if and only if its modulo  $p$  reduction is  $F$ -pure for infinitely many primes  $p$ . We discuss a recent development on this conjecture.

**Qihong Xie**

Title: Strongly Lifiable Schemes and the Kawamata–Viehweg Vanishing in Positive Characteristic

Abstract.

A smooth scheme  $X$  over a field  $k$  of positive characteristic is said to be strongly liftable, if  $X$  and all prime divisors on  $X$  can be lifted simultaneously over  $W_2(k)$ . In this paper, first we prove that smooth toric varieties are strongly liftable. As a corollary, we obtain the Kawamata–Viehweg vanishing theorem for smooth projective toric varieties. Second, we prove the Kawamata–Viehweg vanishing theorem for normal projective surfaces which are birational to a strongly liftable smooth projective surface. Finally, we deduce the cyclic cover trick over  $W_2(k)$ , which can be used to construct a large class of liftable smooth projective varieties.