

THE 20TH AFFINE ALGEBRAIC GEOMETRY MEETING

ABSTRACTS OF TALKS

★ 2nd March (Wednesday)

■ Masaru Nagaoka (Kyushu University, Fukuoka)

Title: **Pathologies on log del Pezzo surfaces in characteristic five**

Abstract: Log del Pezzo surfaces are 2-dimensional Fano varieties with klt singularities, which form a building block in the minimal model program. Keel-McKernan essentially classified log del Pezzo surfaces over the field of complex numbers around 2000, and Lacini showed that their classification result also holds in characteristic larger than five recently. On the other hand, there are many log del Pezzo surfaces which appear only in low (and positive) characteristics. In this talk, I will explain the classification result on log del Pezzo surfaces which appear only in characteristic five.

■ Masataka Iwai (Tohoku University, Sendai)

Title: **On the structure of projective manifolds whose tangent bundles are positive**

Abstract: In this talk, I will explain the structure of complex projective manifolds or log smooth pairs whose tangent bundles are "positive" (such as ample, nef, big, and pseudo-effective) and summarize recent studies related to our work. A part of this talk is based on a joint work with Genki Hosono and Shin-ichi Matsumura.

■ Akihiro Kanemitsu (Saitama University, Saitama)

Title: **Projective varieties with nef tangent bundle in positive characteristic**

Abstract: Demailly, Peternell and Schneider proved two structure theorems for complex projective manifold with nef tangent bundle:

(A) The variety X decomposes to the product of a Fano manifold and an étale quotient of an abelian variety.

(B) Any extremal contraction of X is smooth.

In this talk, we discuss the positive characteristic version of these theorems. This is a joint work with Kiwamu Watanabe.

■ Enrica Floris (Université de Poitiers, Poitiers)

Title: **Connected algebraic groups acting on Fano fibrations over \mathbb{P}^1**

Abstract: Let G be a connected algebraic group and X a variety endowed with a regular action of G and a Mori fibre space X/\mathbb{P}^1 whose fibre is a Fano variety of Picard rank at least 2. In this talk I will explain why there is a proper horizontal subvariety of X which is invariant under the action of G , alongside with some applications of this result to the classification of connected algebraic subgroups of the Cremona group in dimension 4. This is a joint work with Jérémy Blanc.

★ 3rd March (Thursday)

■ Pedro Montero (Universidad Tecnica Santa Maria, Valparaiso)

Title: **Unipotent group structures on quintic del Pezzo varieties**

Abstract: Del Pezzo varieties arise as a natural higher-dimensional generalization of the classical Del Pezzo surfaces. They were extensively studied by T. Fujita in the 1980s, who classified them according to their degree. In degree 5, it follows from Fujita's classification that all of these manifolds are obtained as linear sections of the 6-dimensional Grassmannian $\text{Gr}(2,5)$ with respect to the Plücker embedding, whose points parametrize 2-dimensional linear subspaces of a vector space of dimension 5. In this talk, we will discuss the existence and uniqueness of \mathbb{G}_a^n -structures on these varieties, i.e., we will determine when and in how many ways one can obtain them as equivariant compactifications of the abelian unipotent group \mathbb{G}_a^n . To do so, we study the Hilbert schemes of certain linear subspaces on such varieties and we analyze some explicit equivariant Sarkisov links. This is a joint work with Adrien Dubouloz and Takashi Kishimoto.

■ Takanori Nagamine (National Institute of Technology, Oyama College, Oyama)

Title: **Some criteria for a ring to be a unique factorization domain**

Abstract: Let A be a unique factorization domain (UFD). We consider ring extensions of the following two types.

- (i) $A[x]$ where $ax = b$ for relatively prime $a, b \in A \setminus \{0\}$ such that ideals (a) and (a, b) are prime.
- (ii) $A[x]$ where A has a \mathbb{Z} -grading, $x^n = F$ for a positive integer n and homogeneous prime $F \in A$ with $\gcd(n, \deg F) = 1$.

In 1964, Samuel studied these ring extensions. In case (i), he showed that, if A is noetherian, then $A[x]$ is a UFD. We show that the noetherian condition can be weakened. In case (ii), Samuel showed that, if A is a polynomial ring over a UFD R , and either $n \equiv 1 \pmod{\deg F}$ or every finitely generated projective R -module is free, then $A[x]$ is a UFD. We show, more generally, that $A[x]$ is a UFD whenever the conditions of (ii) hold. This research is joint work with Daniel Daigle and Gene Freudenburg.

■ Buddhadev Hajra (Indian Institute of Technology, Bombay)

Title: **Zariski's finiteness theorem and properties of some rings of invariants**

Abstract: In this talk I will present a short proof of a special case of O. Zariski's result about finite generation in connection with Hilbert's 14th problem using a new idea. This result is useful for invariant subrings of unipotent or connected semisimple groups. The next result I will talk about is a stronger form of one well-known result by A. Tyc. This result proves that the quotient space under a regular \mathbb{G}_a -action on an affine space over the field of complex numbers has at most rational singularities, under an assumption about the quotient morphism. I will also sketch the main idea of the proof of a result which is an analogue of M. Miyanishi's result for the ring of invariants of a \mathbb{G}_a -action on $R[X, Y, Z]$ for an affine Dedekind domain R . This proof involves some classical topological methods. This is a joint work with R.V. Gurjar and Sudarshan R. Gurjar.

■ Anna Bot (University of Basel, Basel)

Title: A smooth complex rational affine surface with uncountably many nonisomorphic real forms

Abstract: A real form of a complex algebraic variety X is a real algebraic variety whose complexification is isomorphic to X . Many families of complex varieties have a finite number of nonisomorphic real forms, but up until recently no example with infinitely many had been found. In 2018, Lesieutre constructed a projective variety of dimension six with infinitely many nonisomorphic real forms, and last year, Dinh, Oguiso and Yu described projective rational surfaces with infinitely many as well. In this talk, I'll present the first example of a rational affine surface having uncountably many nonisomorphic real forms.