The 4th Niigata Algebra Symposium

November 24th to November 27th, 2026

Department of Mathematics, Faculty of Science, Niigata University, Niigata, Japan

	9:40–10:40	11:00–12:00	14:00–15:00	15:20–16:20	16:40–17:40
24th	(Free)	(Free)	T. Katsura	K. Ueda	Takuro Abe
25th	S. Ishii	A. Ito	T. Takamatsu	H. Tanaka	M. Saito
26th	T. Yamauchi	K. Ito	T. Yamaguchi	H. Miyazaki	K. Yoshioka
27th	M. Hattori	Takeshi Abe	S. Kawaguchi	S. Matsumura	H. Furusho

Titles and Abstracts

Toshiyuki Katsura (The University of Tokyo)

Mordell–Weil groups of quasi-elliptic surfaces in characteristic 3

In characteristic $p = 3$, we establish a concrete relationship between the torsion rank of the elementary abelian group of global sections of quasi-elliptic surfaces over the projective line $\mathbf{P}^1$ and the p-rank of certain hyperelliptic curves, thereby explaining a mysterious relationship between these two invariants previously observed by I. Dolgachev. As an application, we determine the torsion ranks of the Mordell–Weil groups of a class of quasi-elliptic K3 surfaces.

Kazushi Ueda (The University of Tokyo)

Marked Artin-Schelter surfaces of del Pezzo type

We introduce a class of noncommutative algebraic surfaces, which we call Artin-Schelter surfaces of del Pezzo type, and discuss their classification in terms of an anticanonical divisor on a del Pezzo surface and a line bundle on it. This talk is based on a joint work in progress with Shinnosuke Okawa.

Takuro Abe (Rikkyo University)

Uniform vector bundles and higher order freeness of hyperplane arrangements

We say that a hyperplane arrangement, a finite set of linear hyperplanes in a projective space is free if the polynomial vector field tangent to hyperplanes in the arrangement splits into a direct sum of line bundles. Free arrangements have played a central role in arrangement theory since it connects algebra, topology and combinatorics of arrangements. On the other hand, there is a definition of higher order freeness coming from higher order such vector fields. Higher order objects are now well-studied from the viewpoint of Hessenberg varieties, superspace coinvariants, and rational hit conjecture. Freeness implies higher order freenss, but the converse is not yet known.

In this talk we show that they are equivalent, by using the classification of uniform vector bundles on the projective spaces by Ballico.

Shihoko Ishii (The University of Tokyo)

Sets of values of birational invariants in characteristic zero and positive characteristic

Birational invariants such as minimal log discrepancies (mlds) and log canonical thresholds (lcts) capture important features of singularities. The sets of values taken by these invariants play an important role in birational geometry. For example, ascending chain conditions for these sets are closely related to the termination of flips in the minimal model program. More is known about these sets in characteristic zero, where a wider range of tools is available for studying singularities. This suggests that reducing questions in positive characteristic to characteristic zero may be an effective approach. In this talk, we compare the sets of values of these invariants in characteristic zero and in positive characteristic.

Atsushi Ito (University of Tsukuba)

Seshadri constants and Gromov widths of toric varieties associated with generalized permutohedra

In this talk, we study Seshadri constants and Gromov widths of polarized toric varieties whose moment polytopes are generalized permutohedra. We show that both invariants coincide with the lattice width of the polytope and give an explicit formula in terms of the defining submodular function.

Teppei Takamatsu (Saitama University)

On the F-liftability of singularities

A variety over an algebraically closed field k of positive characteristic is called F-liftable if it admits a flat lifting to $W_2(k)$ together with a lifting of its Frobenius morphism. In this talk, I will discuss classification results for F-liftable singularities and their relationship with F-purity. For normal surface singularities, we show that F-liftability is equivalent to F-purity, apart from the rational double point of type E_8^1 in characteristic five.For normal isolated complete intersection singularities of dimension at least three, the condition is much more restrictive: the only F-liftable cases are regular points and three-dimensional ordinary double points. This talk is based on joint work with Tatsuro Kawakami.

Hiromu Tanaka (Kyoto University)

Frobenius splitting for smooth Fano threefolds

A smooth Fano threefold of characteristic $p > 11$ is F-split. In this talk, we overview some ideas of the proof.

Masa-Hiko Saito (Kobe Gakuin University/Kobe University)

Canonical coordinates of Moduli spaces of parabolic connections and parabolic Higgs bundles

The moduli spaces of stable parabolic connections on algebraic curves with regular or irregular singularities have been constructed as smooth quasi-projective varieties, and through an analysis of the Riemann-Hilbert correspondence, the geometric Painlevé property of the isomonodromic deformation equations has been established. Since the phase space of Painlevé-type equations is now understood globally as a moduli space of stable parabolic connections, a detailed study of the phase space becomes possible through moduli theory, opening the way to an algebro-geometric study of integrable systems.
In this talk, we focus on the symplectic structure of moduli spaces of connections and Higgs bundles, and explain a method for constructing Darboux coordinates for this symplectic structure. We present recent results of Loray, Komyo, Szabó and Saito in the rank 2 case, and discuss their extension to higher rank.

Takuya Yamauchi (Tohoku University)

The residual monodromy for the Dwork family in even characteristic and its applications to Galois representations

In this talk, I will explain the classification of the residual monodromy representations associated with the Dwork family in characteristic two. I will also discuss various applications to the mod 2 images of Galois representations arising from the Dwork family, including an application concerning the 28-bitangents of a certain plane quartic curve with S_8-symmetry.

Kazuhiro Ito (Tohoku University)

Close local fields, affine Springer fibers and fundamental lemmas

The theory of close local fields, developed by Kazhdan and Deligne, allows us to approximate equal-characteristic local fields by highly ramified local fields of characteristic zero. In this talk, I will explain a geometric local constancy result for affine Grassmannians and affine Springer fibers in families of close local fields. As an application, I will show that (regular semisimple) orbital integrals are locally constant in these families. This allows us, for example, to transfer the standard endoscopic fundamental lemma from characteristic zero to local fields of arbitrary positive characteristic. This is joint work with Sebastian Bartling.

Tatsuki Yamaguchi (Institute of Science Tokyo)

Plus-pure thresholds of hypersurfaces in mixed characteristic

Recent advances in perfectoid theory have led to the development of mixed-characteristic analogues of F-singularities in positive characteristic. These singularities are closely related to singularities in the minimal model program. The plus-pure threshold, a mixed-characteristic analogue of the log canonical threshold and the F-pure threshold, is an invariant that measures perfectoid purity, a mixed-characteristic analogue of F-purity. In this talk, we will explain an algorithm for estimating plus-pure thresholds and discuss some applications involving Yoshikawa's splitting-order sequences, a generalization of the quasi-F-split height.

Hiroyasu Miyazaki (NTT Institute for Fundamental Mathematics)

Motives, divisors, and ramification filtrations

One of the fundamental features of Morel-Voevodsky's motivic homotopy theory is $\mathbb{A}^1$-homotopy invariance. While this property plays a central role in the theory, it also prevents us from detecting certain phenomena in algebraic geometry, particularly those involving wild ramification and irregular singularities.

In joint work with Junnosuke Koizumi and Shuji Saito, we have developed a motivic framework that incorporates ramification data without imposing $\mathbb{A}^1$-homotopy invariance. The key idea is to replace schemes with pairs consisting of a scheme and a divisor, leading to a theory in which ramification filtrations can be treated as part of the motivic structure itself. The construction parallels that of the theory of motives with modulus to some extent, but it also introduces new ideas and techniques.

We will outline the construction of this framework and discuss its relationship with classical invariants. In particular, we will explain how classical filtrations from ramification theory and the theory of irregular connections can be recovered through a uniform construction.

Kota Yoshioka (Kobe University)

Birational automorphim groups of a generalized Kummer manifold for an abelian surface with Picard number 1

For an abelian surface of Picard number 1, I would like to explain my result on the birational automorphims of a generalized Kummer manifold which was obtained a few years ago.

Masafumi Hattori (Kyoto University)

K-moduli wall crossing for quasimaps and automorphic forms for moduli of rational elliptic surfaces

The moduli space of rational elliptic surfaces has two natural compactifications arising from very different constructions. One is described by the GIT Moduli of rational elliptic surfaces, while the other comes from the Baily-Borel compactification of an eight-dimensional ball quotient. The relation between these two compactifications has been studied from several different viewpoints, including stable maps, KSBA moduli, and automorphic forms. In this talk, I will explain how to interpolate them by a family of moduli spaces. We develop a theory of K-moduli wall crossing for quasimaps to construct them. Furthermore, we identify the resulting models on the ball quotient side using automorphic forms.This is a joint work with Yota Maeda.

Takeshi Abe (Doshisha University)

Lang-Vojta Conjecture over Function Fields for Very General Log Projective Spaces

The Lang-Vojta conjecture predicts that integral points on varieties of log general type are not Zariski dense. Over function fields, an analogous problem asks whether sections satisfying a prescribed integrality condition form a bounded family outside a proper exceptional set. In this talk, we consider pairs

$(\mathbb{P}^n \times C, D)$, where C is a smooth complex projective curve and D is a very general divisor in a globally generated linear system of relative degree d. By taking the generic fiber of the projection $\mathbb{P}^n \times C \to C$, we can regard the pair $(\mathbb{P}^n \times C, D)$ as a log projective spaces over the function field of C. For $d > (3n+3)/2$, we obtain an inequality bounding the normalized degree of a nonvertical curve in $\mathbb{P}^n \times C$, not lying in the exceptional set, in terms of its geometric genus and the number of distinct intersections with D. As a consequence, we obtain the boundedness of integral sections outside this locus.

Shu Kawaguchi (Kyoto University)

Tropicalization of Weierstrass points

The tropicalization of Weierstrass points of line bundles on algebraic curves is related to the degeneration of Weierstrass points in families of curves. In this talk, I would like to first review previous work on the tropicalization of Weierstrass points. Then, I would like to discuss the Weierstrass gap sequences of points on tropical curves, exploring their structural properties and their relationship to the tropicalization of Weierstrass gap sequences of line bundles on algebraic curves. This is based on joint work with Omid Amini (arXiv:2603.19393).

Shin-ichi Matsumura (Tohoku University)

Beauville-Bogomolov-Yau decomposition for Kahler generalized pairs

The classical Beauville-Bogomolov-Yau decomposition theorem states that, after passing to a finite etale cover, a compact Kahler manifold with trivial first Chern class decomposes into a product of a complex torus, strict Calabi–Yau manifolds, and holomorphic symplectic manifolds. In this talk, I will explain a Beauville-Bogomolov-Yau type decomposition theorem for generalized pairs in the Kahler setting. The main result describes the structure of Kahler generalized pairs of Calabi-Yau type in terms of rationally connected fibers and a base with trivial canonical class. I will also discuss some recent developments in the generalized minimal model program that play an essential role in the proof. This is joint work with Juanyong Wang, Xiaojun Wu, and Qimin Zhang.

Hidekazu Furusho (Nagoya University)

Constructing multiple zeta values over totally real cyclotomic fields

We construct 'multiple zeta values over totally real cyclotomic fields' from iterated integrals of differences of cotangent forms. These integrals can be expressed explicitly in terms of cyclotomic multiple zeta values, while their geometry reveals a mixed Tate structure over the totally real field. I will explain this construction and its compatibility with Goncharov's coproduct. This is joint work with Jin Cao.

Organizers: Akinari Hoshi, Hideo Kojima, Takuzo Okada, Kazuhiko Yamaki.