Titles and abstracts :

Noriko Yui (Queen's University)

Title: MODULARITY OF CERTAIN CALABI–YAU THREEFOLDS OF HODGE TYPE (1, 1, 1, 1)

Abstract: This is a progress report on my ongoing research about the modularity of rank 4 and weight 3 Calabi–Yau motives over Q. Our goal is to consider a number of examples of Calabi–Yau threefolds defined over Q having Hodge type (1, 1, 1, 1) (so B3 = 4). A number of string theorists have been considering the modularity question of these Calabi–Yau threefolds at attractor points (a kind of singular points).
We will look into smooth Calabi–Yau threefolds of this Hodge type and purport to establish their modularity. We will focus on examples of Calabi–Yau three-folds which are equipped with real multiplication by some real quadratic fields K = Q(d^1/2) with square-free integers d > 1, and satisfy the Hilbert modularity over K. Starting with the Hilbert modularity over K, we will establish the Siegel modularity over Q of such Calabi–Yau threefolds that their (cohomological) L-functions coincide with the Andrianov L-functions of Siegel modular forms of weight 3, genus 2 on paramodular subgroups of level N of Sp(4,Q).

George Elliott (Toronto Univ.)

Title: On the classification of non-simple C*-algebras, and applications

Abstract: Well-behaved simple C*-algebras have been classified. (The axioms are very simple, the classification functor (the invariant) is very simple, and the description of what can arise---the values of the invariant, and the algebras themselves---is very simple.) Before seriously tackling simple C*-algebras that are not well behaved, one should try harder to classify non-simple well-behaved algebras. Some results are known, for instance for approximately finite-dimensional (AF) C*-algebras. Recently, Yasuhiko Sato and I have classified the algebras that are AF after tensoring with infinitely many matrix algebras, i.e. with a UHF algebra. (We call these rationally AF algebras, or RAF algebras.) The invariant is the same as for AF algebras---the ordered K-group---but the class of algebras, and ordered groups, that arise is considerably larger (already in the simple case). Using the classification of RAF algebras one can construct a wide variety of flows, or time evolutions, on a wide class of C*-algebras. (One can do this to a certain extent with the AF algebra classification and the simple C*-algebra classification, but one can go much farther with the RAF classification.)

Christine Vespa(Aix-Marseille) (I)

Title : On the stable cohomology of the automorphism groups of free groups with coefficients

Abstract: In this talk, I will give an overview of known results on the stable cohomology of the automorphism groups of free groups with twisted coefficients. After explaining the notion of wheeled PROPs, I will describe a wheeled PROP structure on the stable cohomology of automorphism groups of free groups with some particular coefficients. I will explain how cohomology classes, constructed previously by Kawazumi, can be interpreted using this wheeled PROP structure and I will construct a morphism of wheeled PROPs from a PROP given in terms of functor homology and the wheeled PROP evoked previously. This is joint work with Nariya Kawazumi.

Motoko Kato (Ryukyu Univ.)

Title：Acylindrical hyperbolicity of Artin groups associated with graphs that are not joins

Abstract: Artin groups, also called Artin-Tits groups, have been widely studied since their introduction by Tits in 1960s. In particular, Artin groups are important examples in geometric group theory. For various non-positively curved or negatively curved properties on discrete groups, Artin groups are interesting targets. In this talk, we treat acylindrical hyperbolicity of Artin groups. Charney and Morris-Wright showed acylindrical hyperbolicity of Artin groups of infinite type associated with graphs that are not joins, by studying clique-cube complexes and the actions on them. By developing their study and formulating some additional discussion, we demonstrate that acylindrical hyperbolicity holds for more general Artin groups. Indeed, we are able to treat Artin groups of infinite type associated with graphs that are not cones. This talk is based on a joint-work with Shin-ichi Oguni (Ehime University).

Shinichi Tajima (Niigata Univ.)

Title: B-functions, Kashiwara operator and Poincare-Birkoff-Witt algebra

Abstract: attached pdf.

Makiko Mase (Tokyo Metropolitan Univ.)

Title: The Seifert form and Picard lattice associated to simple K3 singularities.

Abstract: We study a relation between the Seifert form of simple K3 singularities, and the Picard lattice of families of K3 surfaces. Let c be the dimension of the eigenspace of eigenvalue 1 of the real Seifert form, and r the Picard number of the family of K3 surfaces corresponding to the singularity. Denote by l the total number of lattice points on all edges of the Newton polytope of the defining polynomial of the general section in the family. We discuss to obtain a numerical relation between c, r, and l. We expect this would help us to give an explicit correspondence between the distinguished basis of the Milnor lattice and generators of the Picard lattice in this case. Although being pointed out by Yonemura, there is no following research done for any relation between these two objects (Seifert form and Picard lattice). In this talk, though only a numerical relation, we can find a clue to investigate geometrical objects concerning K3 surfaces explicitly.

Mutsuo Oka (Tokyo Science Univ.)

Title: μ-Zariski pair of links

Abstract: attached pdf file

Shihoko Ishii (The Univ. of Tokyo)

Title: Log discrepancies of fractional ideals on a smooth varieties.

Abstract: We study a fractional ideal with a real exponent on a smooth variety. It is known that the set of log discrepancies of log canonical ``ideals” with real exponents is discrete by Kawakita’s theorem. We try to generalize this into ``essential fractional ideals”. The result I will show in the talk is a ``conditional answer” to the generalization problem. In the talk, I will also explain why we need to study a fractional ideal.

Takahiro Saito (RIMS, Kyoto Univ.)

Title: A description of monodromic mixed Hodge modules

Abstract: The irregular Hodge filtration is expected to be a ``Hodge filtration'' of a twisted de Rham cohomology of a holomorphic function that appears as a mirror of a Fano manifold. In general, the irregular Hodge filtrations are complicated and it is difficult to deal with them. Note that the twisted de Rham cohomology can be expressed in terms of the Fourier-Laplace transform of a certain regular D-module. One reason that makes the irregular Hodge filtration difficult is that the Fourier-Laplace transform is irregular in general. I try to make everything clear in the simple case: ``monodromic".

For a complex manifold X, regular monodromic D-modules on X¥times C have the important property that ``their Fourier-Laplace transforms are regular again". For a mixed Hodge module whose underlying D-module is monodromic (which is called a monodromic mixed Hodge module), it is natural to expect that its Hodge filtration and the irregular Hodge filtration of its Fourier-Laplace transform are ``easy". In fact, in my papers: [1] and [2], I clarified the structure of the Hodge filtrations of monodromic mixed Hodge modules, described the irregular Hodge filtrations of the Fourier-Laplace transforms concretely, and proved that they have

good properties. I think my result is a good step toward understanding general (irregular) Hodge filtrations.

In this talk, in the first half, I will introduce the theory of mixed Hodge modules and the way from classical Hodge theory to it. In the second half, I will explain my results on the description of monodromic mixed Hodge modules.

[1] Takahiro Saito, A description of monodromic mixed Hodge modules, J. Reine Angew. Math. 786 (2022), 107–153. MR4434749
[2] Takahiro Saito, The Hodge filtrations of monodromic mixed Hodge modules and the irregular Hodge filtrations, 2022. arXiv:2204.13381.

Todor Milanov (IPMU, The Univ. of Tokyo)

Title: The higher residue pairing

Abstract: The higher residue pairing of K. Saito is a fundamental object in singularity theory with very important applications to mirror symmetry. The original definition uses the Cech cohomology approach, while more recently, Li--Li--Saito were able to find a construction based on compactly supported forms. My talk will consist of two parts. First, I would like to explain a new construction of the higher residue pairing based on Dolbeault cohomology. Then I would like to explain an interesting application. Namely, the new formula allows us to give an elementary proof of a result due to Hertling, that is, the higher residue pairing is a polarizing form for the Hodge structure on the vanishing cohomology of a weighted-homogeneous singularity.

Christine Vespa(Aix-Marseille) (II)

Title : Eilenberg Mac Lane polynomial functors and their applications

Abstract: In mathematical analysis, polynomial functions play a crucial rôle due, in particular, to Taylor’s theorems. In the 1940s the concepts of categories and functors emerged in algebraic topology. Functors play for categories an analogous

rôle that functions in analysis. They are now central tools in algebraic topology and algebraic geometry.
In 1954, Eilenberg and Mac Lane introduced the notion of a polynomial functor as a generalization of additive functors. In the analogy between functions and functors, polynomial functors play the same role as polynomial functions. Fundamental results in representation theory and algebraic topology have been obtained using the polynomial functors.
In this talk, I will develop the previous analogy, give results on polynomial functors on finitely generated free groups and present some recent applications.

Yoshihisa Saito (Rikkyo Univ.)

Title: Orthogonal polynomials and Hecke algebras associated with elliptic root systems

Abstract： In this talk, we explain the relationship between the theory of multi-variable orthogonal polynomials and the Hecke algebras associated with elliptic root systems. In the first half, we give a survey on the theory of orthogonal polynomials in one variable. Under the certain reasonable condition (so-call the ``duality constraint''), there exist the master family called the Askey-Wilson polynomials. Analyzing an algebraic structure behind these polynomials, we reach the Hecke algebra associated with the marked elliptic root system (m.e.r.s. for short) of type $A_1^{(1,1)}$. Conversely, starting from a certain natural representation (the polynomial representation) of that Hecke algebra, one can recover the theory of the Askey-Wilson polynomials in an algebraic way. In the second half, we generalize the story above to the multi-variable cases by using the Hecke algebras associated with m.e.r.s.. Roughly speaking, our Hecke algebras are known as the double affine Hecke algebras (DAHA). However, our advantage is the existence of the behind root system (m.e.r.s.). Indeed, symmetries of m.e.r.s. can be lifted to algebra automorphisms of our Hecke algebra. By using these automorphisms, certain terminologies in this area can be understood in uniform way. If time permits, we discuss on some applications of these automorphism to the theory of orthogonal polynomials.

Kyoji Saito (TSVP-OIST, RIMS) (I) (II)

Title: Elliptic root systems, elliptic Artin groups and elliptic Artin Monoid,
joint work with Yoshihisa Saito

Abstract: We give an elementary introduction to elliptic root systems and elliptic Artin groups, and discuss some new aspects of them.

Part I: Starting with an axiomatic introduction of generalized root systems and elliptic root systems, we describe
i) Classification of elliptic root systems in terms of elliptic diagrams,
ii) Presentations of elliptic Weyl groups and elliptic Artin groups, in terms of elliptic Coxeter relations and elliptic Artin braid relations.
The present Part I gives a preparation to the talks given by Yoshihisa Saito and to the Part II of myself.

Part II: We discuss whether the classical result by P. Deligne:

The regular orbit space for a finite reflection group is an Eilenberg-Maclane space. That is, it is a $K(¥pi,1)$ space for the Artin group. can be generalized to the elliptic Artin groups. Actually, we show that elliptic Artin monoids are no-longer lattice. Then, using this fact, we construct second homotopy classes in the elliptic regular orbit space and conjecture that they don't vanish. This gives a counter example to a long conjecture whether discriminant complements are $K(¥pi,1)$ spaces.

Xiaobing Sheng (Univ. of Tokyo)

Title: Jones' construction on knots and links from elements of Thompson's groups-some experimental results

Abstract: Vaughan Jones, in his late years, motivated by an attempt to develop new conformal feld theory, obtained a sequence of results related to Thompson's groups F: (resp. T) One of the results among these is a rather concrete way of constructing knots and links from Thompson's group F as an analogue of the results on braid groups. Aiello and Baader extended these results to the positive oriented Thompson's group F which is isomorphic to Higman (Brown-) Thompson group F3: Here we present a sequence of computational results on certain sequences of knots and links from certain sequences of words and we also provide a way of estimating the number of crossings from the group theoretic property.

Andreani Petrou (OIST)

Title: Towards knot matrix models for twisted hyperbolic knots

Abstract: Torus knot matrix models are defined by the superintegrability condition that the averages of characters are equal to the HOMFLY polynomial of torus knots. An alternative manifestation of superintegrability is the complete factorizability of the Harier-Zagier transform -a sort of a Laplace transform- of the polynomial invariants. I shall explain how skein theory can be used to calculate the relevant knot polynomials, via recursive formulas. With this approach, we investigate knot matrix models beyond torus knots, by computing explicit Harer-Zagier formulas for some infinite families of twisted hyperbolic knots. The resulting expressions turn out to be almost factorized rational functions with an intriguing zero locus structure that has traits reminiscent of ADE singularity theory. This talk is based on a short term project supervised by Prof. Shinobu Hikami.

Shinobu Hikami (OIST)

Title: Towards knot theory from random matrices

Abstract: Knots are described by strings of one stroke trajectory. We consider the replica N->0 limit in Gaussian means of NxN Hermitian matrices, which implies one stroke graphs. It includes knots and unknotted circles. The formula of a generating function for Seifert graphs of knots and circles is derived. The knot polynomials are discussed in the relation to one point function of a matrix model, which was considered for the intersection numbers of the moduli space of Riemann surface.

Martin Forsberg Conde(OIST)

Title: The representation theory of of type A Iwahori–Hecke algebras I

Abstract: We will give a gentle introduction to the type A Hecke algebras and their representation theory, aiming to give an overview of important results, and emphasize combinatorial aspects.

Liron Speyer (OIST)

Title: The representation theory of of type A Iwahori–Hecke algebras II

Abstract: Building on Martín's talk, we will introduce the cyclotomic Hecke algebras and cyclotomic KLR algebras, explain their connection, and talk about some recent results in the representation theory of Hecke algebras.