Working Workshop on
Calabi-Yau Varieties and Related Topics

Aug.9 (Thu.),10 (Fri.), 2018

Rm.301, South Build. #1, Gakushuin University

Aug.9 (Thu.)

14:30–15:30 Kenji Hashimoto (Univ. of Tokyo)

Mirror symmetry for complete intersection K3 surfaces in weighted projective spaces

15:50–16:50 Atsushi Kanazawa (Kyoto Univ.)

Tyurin degenerations and Lagrangian fibrations of Calabi-Yau manifolds

17:10 – 18:10 Hisanori Ohashi (Tokyo Univ. of Sci.)

Topological classification of automorphisms on Enriques surfaces of order 4

18:30 – Dinner (discussion)

Aug.10 (Fri.)

9:30–10:30 Shigeyuki Kondo (Nagoya Univ.)

Borcherds products and K3 surfaces

11:00 – 12:00 Kenichiro Kimura (Tsukuba Univ.)

The Abel-Jacobi map for higher Chow cycles

13:30 – 14:30 Ichiro Shimada (Hiroshima Univ.)

The elliptic modular surface of level 4 and its reduction modulo 3

15:00 – 16:00 Tomohide Terasoma (Univ. of Tokyo)

Comodules over Bloch Hopf algebra associated to Aomoto polylogarithms

16:30 – 17:30 Noriko Yui (Queen's Univ.)

Four-dimensional Galois representations of certain Calabi-Yau threefolds over Q

Orgainzers: Y. Goto (Hokkaido Edu.), S. Hosono (Gakushuin), N. Yui (Queen's Univ.)

Title and Abstracts

Aug.9

Kenji Hashimoto (Univ. of Tokyo)

Title: Mirror symmetry for complete intersection K3 surfaces in weighted projective spaces

Abstract: We discuss mirror symmetry for some special complete intersection K3 surfaces in four dimensional weighted projective spaces. In particular, we are interested in Dolgachev mirror symmetry.

Atsushi Kanazawa (Kyoto Univ.)

Title: Tyurin degenerations and Lagrangian fibrations of Calabi-Yau manifolds

Abstract: A Tyurin degeneration is a degeneration of a Calabi-Yau manifold to a union of two quasi-Fano manifolds intersecting along a common smooth anti canonical divisor. This is known to be an analogue of a Heegaard decomposition of a compact oriented 3-manifold into two handlebodies. I will discuss some interplay between Tyurin degenerations and Lagrangian fibrations, with particular emphasis on SYZ and DHT conjectures.

Hisanori Ohashi (Tokyo Univ. of Sci.)

Title: Topological classification of automorphisms on Enriques surfaces of order 4

Abstract: In a joint work with H. Ito, we classified involutions on Enriques surfaces some years ago. Based on this, we extend the result to order 4 including both semi-symplectic and non-semi-symplectic cases. This is a joint work with H. Ito (Nagoya).

Aug.10

Shigeyuki Kondo (Nagoya Univ.)

Title: Borcherds products and K3 surfaces

Abstract: I will give a survey on an application of the theory of automorphic forms on bounded symmetric domains of type IV due to Borcherds to moduli spaces of lattice polarized K3 surfaces. I will discuss, for example, moduli of marked cubic surfaces, plane quartics, Enriques surfaces, ordered 6 points and 8 points on the projective line. All results in this talk are not new.

Kenichiro Kimura (Tsukuba Univ.)

Title: The Abel-Jacobi map for higher Chow cycles

Abstract: The Abel-Jacobi map Φ is a morphism from the group of homologically trivial algebraic cycles to a complex torus called the intermideate Jacobian. This

map was defined by Griffiths, and its image is described as certain currents. Later Bloch generalized the map Φ to higher chow cycles. His definition was given in terms of Deligne-Beilinson cohomology, and currents are implicitly used. We will explain how to describe the image of Φ for higher Chow cycles as currents. The main ingredient is admissible semi-algebraic chains constructed together with Terasoma and Hanamura. As an application, we show that the Hodge realization of the polylog cycles can be identified with $\Phi(\rho)$ for a certain relative higher Chow cycle ρ.

Ichiro Shimada (Hiroshima Univ.)

Titile: The elliptic modular surface of level 4 and its reduction modulo 3

Abstract: The elliptic modular surface of level 4 is a complex K3 surface with Picard number 20. This surface has a model over a number field such that its reduction modulo 3 yields a surface isomorphic to the Fermat quartic surface in characteristic 3, which is supersingular. The specialization induces an embedding of the Néron-Severi lattices. Using this embedding, we determine the automorphism group of this K3 surface over a discrete valuation ring of mixed characteristic whose residue field is of characteristic 3. The elliptic modular surface of level 4 has a fixed-point free involution that gives rise to the Enriques surface of type IV in Nikulin-Kondo-Martin's classification of Enriques surfaces with finite automorphism group. We investigate the specialization of this involution to characteristic 3.

Tomohide Terasoma (Univ. of Tokyo)

Title: Comodules over Bloch Hopf algebra associated to Aomoto polylogarithms

Abstract: In the paper by Beilinson-Goncharov-Schechtman-Varchenko, they consider a motives associated to Aomoto polylogarithms associated to hyperplane arrangement in affine spaces. In this talk, we construct a comodule over the Hopf algebra defined by Bloch using his cycle complexes in normal corssing case. In this talk, we use higher homotopy construction.

Noriko Yui (Queen's Univ.)

Title: Four-dimensional Galois representations of certain Calabi-Yau threefolds over $\mathbb{Q}$

Abstract: I will consider the four-dimensional Galois representations arising from Calabi–Yau threefolds over $\mathbb{Q}$ with all the Hodge numbers of the third cohomology groups equal to one. There are many examples of (families) of such Calabi–Yau threefolds. The modularity/automorphy of such Calabi-Yau threefolds will be the main topic of this talk. Conjecturally, such Galois representations should be associated to Siegel modular forms of weight 3 and genus 2 on some subgroups of $\mathrm{Sp}_4(\mathbb{Z})$. This is a preliminary report on this project.