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BOOK OF ABSTRACTS

LECTURES

Some families of projective varieties uniformized by the 10-dimensional complex ball

Samuel Boissiere

Université de Poitiers (France)

In a famous paper, Allcock, Carlson and Toledo described the moduli space of cubic threefolds as the arithmetic quotient of the complementary of a hyperplane arrangement in the 10-dimensional complex ball. In this talk, I will give an interpretation of this moduli space as the one parametrizing a family of order three nonsymplectic automorphisms on hyperkhler manifolds deformation equivalent to the Hilbert square of two points on a K3 surface. This is a collaboration with Chiara Camere and Alessandra Sarti.

Generalized Franchetta conjecture for some holomorphic symplectic varieties

Lie Fu

Université de Lyon 1 (France)

The Generalized Franchetta conjecture for K3 surfaces is due to O'Grady, which says that the Chow group of 0-cycles of the generic fiber of the universal K3 surfaces over a moduli space of polarized K3 surfaces is 1-dimensional, generated by the Beauville-Voisin class. We would like to investigate the analogous conjecture for higher dimensional holomorphic symplectic varieties. The main objective of the talk is to provide various evidences which can be obtained using classical projective geometry. More precisely, the following cases will be discussed: Fano variety of lines of cubic fourfolds, n-th Hilbert schemes of K3 surfaces of genus g with n and g in a certain range, Lehn-Lehn-Sorger-van Straten hyper-Kähler eightfolds. This is a joint work with Robert Laterveer and Charles Vial.

Elliptic fibrations on K3 surfaces and linear systems on rational elliptic surfaces

Alice Garbagnati

Università di Milano (Italy)

The rational elliptic surfaces admit a unique relatively minimal elliptic fibration. By a base change of order two on the rational ellliptic fibration R one can obtain a K3 surface X naturally endowed with an elliptic fibration. But the elliptic fibrations on the K3 surfaces are in general more than one. We will discuss what are the linear systems on R which induce elliptic fibrations on X. Moreover, generalizing a method introduced by Prof. Oguiso, we will classify the elliptic fibrations on several K3 surfaces discussing also some tecniques to write their Weierstrass equations and analyzing their specializations. This is joint work with C. Salgado.

Abelian Galois covers of the product of projective lines by K3 surfaces

Tarou Hayashi

Osaka University (Japan)

I give a complete classification of a finite abelian group G which act faithfully on $K3$ surface M with the quotient space M/G is isomorphic to the product of projective lines $\mathbb{P}^1 \times \mathbb{P}^1$.

On Grothendieck ring of varieties and derived equivalence

Atsushi Ito

Nagoya University (Japan)

Two varieties are said to be L-equivalent if their classes coincide in the localization of the Grothendieck ring of varieties by the class of the affine line. I will talk about L-equivalence in connection with derived equivalence. This is a joint work with Makoto Miura, Shinnosuke Okawa, and Kazushi Ueda.

On the Morin problem

Grzegorz Kapustka

Jagiellonian University, Krakov (Poland)

We will study the Morin problem about the classification of finite complete configurations of incident planes in P^5. We show that each such configuration occurs as a subset of the singular locus of a projective model of a moduli space of twisted sheaves on a K3 surface. As a result we show that there is a unique maximal configuration of 20 incident planes in P^5. This is a joint work in progress with A. Verra.

IHS fourfolds - the last involutions

Michal Kapustka

University of Stavanger (Norway)

We present recent progress on the classification of IHS fourfolds of $K3^{[2]}$ type admitting a non-symplectic involution. In particular, we shall discuss maximal dimensional families of IHS fourfolds of $K3^{[2]}$ type with involutions having invariant lattices: $U(2)$ and $U(2) + E_8(-2)$. These are the only possible invariant lattices that are not obtained via previous constructions of Feretti and Mongardi, Wandel. The studied constructions of IHS fourfolds involve degenerations of double EPW quartic sections, introduced in the talk of Ranestad. This is joint work with A. Iliev, G. Kapustka, K. Ranestad, and with C. Camere, G. Kapustka and G. Mongardi.

On the structure of the effective cone of irreducible symplectic manifolds

Daisuke Matsushita

Hokkaido University (Japan)

For a K3 surface, it is well known that the effective cone is completely determined by (-2)-curves. We will give a higher dimensional analogue of this result. Let X be an irreducible symplectic manifold. Assume that X carries a prime exceptional divisor. The effectivce cone is completely determined by prime exceptional divisors. As an application, we will discuss a subgroup of binational automorphism group of irreducible symplectic manifolds.

Branes and Mirror symmetry on Hyperkähler manifolds

Grégoire Menet

IMECC-UNICAMP, Campinas (Brazil)

A brane is a mathematical object coming from physics, particulary from string theory. In a hyperkẗhler manifold, it is a submanifold which is either complex or Lagrangian with respect to the three ambient complex structures. In this talk, we will discuss how branes, obtained as fixed locus of involutions on hyperkhler manifolds, behave under the Mirror Symmetry transformation.

Towards the classification of symplectic singularities

Yoshinori Namikawa

Kyoto University (Japan)

After introducing the finiteness theorem for symplectic singularities, I will give a characterisation of nilpotent orbit closures of a complex semisimple Lie algebra and their finite coverings.

Tropical geometric compactification of the moduli spaces

Yuji Odaka

Kyoto University (Japan)

Tba.

Primitive automorphisms, dynamical degrees and relative dynamical degerees

Keiji Oguiso

Osaka University (Japan)

The notion of primitive (birational) automorphisms of projective manifolds, which are irreducible automorphisms of manifolds, is introduced by De-Qi Zhang. They are natural objects in birational algebraic geometry. They are also very closely related to complex dynamics of several variables. In fact, the dynamical degrees of birational automorphisms (a kind of refinement of a more classical notion of topological entropy of automorphisms, fitting very well with birational geometry), the relative dynamical degrees (their relative version), introduced by Dinh-Sibony, Dinh-Nyugen-Truong, provide very powerful tools also in studying primitive birational automorphisms of manifolds. See eg. a survey article [*] and references therein about earlier results in this topics.

In this lecture, we first explain basic notions and their basic properties on (relative) dynamical degrees of birational automorphisms based on purely algebro-geometric approach done by Truong [1].

Then, we apply it for projective hyperkähler case, based on a work of Bianco [2].

Finally, we show the existence of abelian varieties, smooth rational manifolds and Calabi-Yau manifolds, with primitive birational automorphisms of first dynamical degree > 1, in any dimension > 1. This part is based on my work [3].

If the time will be allowed, I would like to explain some topological aspects of projective hyperkaeher fourfolds based on my latest joint work with Professor Thomas Peternell [4].

References:

[1] Truong, T.T., (Relative) dynamical degrees of rational maps over an algebraic closed field, arXiv:1501.01523.

[2] Bianco L. F., On the primitivity of birational transformations of irreducible symplectic manifolds, arXiv:1604.05261 (to appear in IMRN).

[3] Oguiso, K., Pisot units, Salem numbers and higher dimensional projective manifolds with primitive automorphisms of positive entropy arXiv:1608.03122 (to appear in IMRN).

[4] Oguiso, K., Peternell, Th., On the homeomophism type of smooth projective fourfolds, arXiv:1707.05657

[*] K. Oguiso, K. Some aspects of explicit birational geometry inspired by complex dynamics", Proceedings of the International Congress of Mathematicians, Seoul 2014 (Invited Lectures) Vol.II (2015) 695–721, ArXiv:1404.2982

On automorphisms of Enriques surfaces and their entropy

Hisanori Ohashi

Tokyo University of Science (Japan)

Entropy measures the "complexity" of a self-map f acting on a topological space X. When X is a compact kaehler manifold, we can compute the entropy via looking at the cohomological action of f by Gromov-Yomdin theorem. For algebraic surfaces, entropies have a close relationship with some sort of special algebraic integers, called Salem numbers. In the talk, I will introduce the distribution problem of entropies on algebraic surfaces, recalling the cases of rational, abelian

and K3 surfaces, and then discuss Enriques surfaces. This is a joint work with Yuya Matsumoto (Nagoya) and Slawomir Rams (Jagiellonian).

Categorical dynamics on K3 surfaces

Genki Ouchi

University of Tokyo (Japan)

In this talk, I would like to talk about relations between autoequivalences of derived categories of K3 surfaces and automorphisms of moduli spaces of stable objects on them from point of view of dynamical invariants called categorical/topological entropy.

Kählerness of moduli spaces of sheaves over nonprojective K3 surfaces

Arvid Perego

Université de Lorraine, Nancy (France)

All known examples of irreducible hyperkahler manifolds can be obtained, up to deformation, from moduli spaces of sheaves over projective K3 surfaces or abelian surfaces: this is one of the main reasons these moduli spaces have long been studied. The case of moduli spaces of sheaves over nonprojective K3 surfaces presents several open problems, and in a recent paper in collaboration with M. Toma we showed that many results available for moduli spaces of sheaves over projective K3 surfaces still hold in the nonprojective case. One of the most important properties which is still open is the kahlerness: are these moduli spaces Kahler manifolds? In this talk i will explain a result recently obtained : the moduli spaces of sheaves over K3 surfaces are Kahler if and only if their second Betti number is the sum of the corresponding Hodge numbers.

Symmetric and skew symmetric degeneracy loci and constructions of hyperkähler manifolds

Kristian Ranestad

University of Oslo (Norway)

Minors of matrices are defining equations for many classical varieties, which are therefore called degeneracy loci. Starting with Kummer surfaces, I shall explain a relation between symmetric and skew symmetric degeneracy loci. I shall go on to show how hyperkhler manifolds can be constructed from such degeneracy loci, in reporting on work with A. Iliev, G. Kapustka and M. Kapustka.

Apolarity, powersum varieties and divisors in the moduli space of cubic fourfolds

Kristian Ranestad

University of Oslo (Norway)

Apolarity is a classical aspect of Macaulays inverse systems that is used in the study of powersum varieties, the varieties of ways of presenting a symmetric form as a sum of powers of linear forms. Applied to general cubic forms defining fourfolds, one may define powersum varieties that are hyperkhler manifolds. In the talk I shall, starting with simpler examples, explain this application of apolarity, and then go on to discuss divisors in the moduli of cubic fourfolds and the corresponding families of polarized hyperkhler manifolds. This talk based on joint work with A. Iliev and with C. Voisin.

Degenerations of hyperkhler manifolds

Giulia Saccà

Stony Brook University (USA)

The problem of understanding semistable degenerations of K3 surfaces has been greatly studied and is completely understood (Kulikov-Pinkham-Persson). The aim of this talk is to present joint work with J. Kollár, R. Laza, and C. Voisin generalizing some of these results to higher dimensional hyperkhler (HK) manifolds. I will also present some applications, including a generalization of theorem of Huybrechts to possibly singular symplectic varieties and shortcuts to showing that certain HK manifolds are of a given deformation type.

Involutions of special irreducible holomorphic symplectic fourfolds

Alessandra Sarti

Université de Poitiers (France)

I will report on recent results on involutions on the Hilbert scheme of two points on a generic K3 surface of any polarisation. In this case the Picard number of the Hilbert scheme is two, which is the minimum possible. For some special values of the polarisation, that are solutions of some Pell's equations, the automorphisms group is non trivial and it is generated by a non-symplectic involution. After presenting general results on non-symplectic involutions, I will describe geometric realisations of them.

Spherical sheaves on ADE singularities

Hokuto Uehara

Tokyo Metropolitan University (Japan)

Spherical objects in the derived category of coherent sheaves induce autoequivalences, so called twist functors. We often need knowledge of spherical objects to study the autoequivalence groups. In my talk, I report my research on spherical sheaves on the minimal resolutions of ADE singularities on surfaces.

Moduli of stable sheaves on Enriques surfaces

Kota Yoshioka

Kobe University (Japan)

We study the birational equivalence of moduli spaces of stable sheaves on Enriques surfaces. In particular, we show that if the dimension is odd, then the moduli spaces are birationally equivalent to the Hilbert scheme of points. This is a joint work with Howard Nuer.

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