

Titles and Abstracts

Arnaud Beauville (Université Côte d'Azur)

The Ceresa cycle

An algebraic cycle on a smooth projective variety is algebraically trivial if it can be deformed algebraically to zero. This implies that its cohomology class is zero; in 1969 Griffiths showed that the converse is false for many hypersurfaces. A different example is constructed from a curve C embedded in its Jacobian JC : the “Ceresa cycle” $[C] - [(-1)^*C]$ in JC is not algebraically trivial if C is general (Ceresa, 1983), while it is if C is hyperelliptic. In the last three years a number of approaches have been developed to find non-hyperelliptic curves for which the Ceresa cycle is algebraically trivial. In the talk I will survey the history of the problem, then discuss these recent examples of non-hyperelliptic curves, in particular the approach of Laga and Shnidman (2024).

Caucher Birkar (Tsinghua University)

Degenerations of Fano varieties

In this talk we discuss degenerations of Fano varieties which appear naturally in various contexts. We discuss how far these degenerations might be from being rational. This is joint work with Santai Qu.

Michele Bolognesi (Université de Montpellier)

Cubic fourfolds with finite dimensional Chow motive

In this talk I will describe some classes of cubic fourfolds that have a finite dimensional Chow motive, in the sense of Kimura. This will be obtained via some explicit intersection theory on the moduli space of cubic fourfolds, and the well-known relation with K3 surfaces and moduli spaces of sheaves on K3 surfaces. These results come from collaborations with H. Awada-C. Pedrini and R. Laterveer.

Yohan Brunebarbe (Université de Bordeaux)

Constructing holomorphic functions on universal coverings of complex algebraic varieties

What complex analytic spaces can be obtained as the universal covering of a complex algebraic variety? Motivated by this question, Shafarevich asked whether the universal

covering of any smooth projective variety X is necessarily holomorphically convex. In other words, is there a proper holomorphic map from the universal covering of X to a Stein analytic space? Although still open, Shafarevich's question has received partial positive answers, for example when the fundamental group of X admits a faithful complex linear representation (Eyssidieux-Kazhdan-Pantev-Ramachandran). In my talk, I will discuss the generalisation of Shafarevich's question to non-compact algebraic varieties.

This is joint work with Ben Bakker and Jacob Tsimerman.

Jinxing Cai (Peking University)

Automorphisms of regular surfaces of general type acting trivially in cohomology

Let S be a minimal complex nonsingular projective regular surface of general type and $\text{Aut}_0(S) \subset \text{Aut}(S)$ the subgroup of automorphisms of S , inducing trivial actions on $H^*(S, \mathbb{Q})$. It is known that $|\text{Aut}_0(S)| \leq 4$ provided that $\chi(\mathcal{O}_S)$ is sufficiently large. In this talk we show that, if $|\text{Aut}_0(S)| = 4$ and $\chi(\mathcal{O}_S) \geq 36$, then S has a fibration of genus $g = 3$ or 5 ; if we assume in addition that K_S is ample, then $\text{Aut}_0(S) = \mathbb{Z}_2^{\oplus 2}$ and S is isogenous to a product of curves. This is joint work with Wenfei Liu.

Meng Chen (Fudan University)

Several moduli spaces of canonical threefolds with small invariants

We present an application of MMP to determine several moduli spaces of canonical 3-folds with relatively small invariants. As a byproduct, the Noether inequality for 3-folds with $p_g = 5$ is proved. This is a joint work with Yong Hu and Chen Jiang.

Olivier Debarre (Université Paris Cité)

On a conjecture of Kazhdan and Polishchuk

We discuss a conjecture on rank 2 vector bundles on curves that Kazhdan made at his plenary talk at ICM 2022.

Daniel Faenzi (Université de Bourgogne)

Logarithmic derivations along discriminants

Sheaves of logarithmic vector fields, or “derivations”, tangent to a given divisor, are studied in the theory of deformations of singularities. We will discuss some results about stability of these sheaves and a connection with projective duality. Then we will

focus on invariant divisors for the action of a Lie group and concentrate on the study of determinants and discriminants of adjoint groups; if time permits, we will mention ongoing work on discriminants of theta-groups. Joint project with Vladimiro Benedetti, Simone Marchesi, Masahiko Yoshinaga.

Zhiyuan Li (Fudan University)

Supersingular Tate conjecture for hyper-Kähler varieties of known types

The Tate conjecture asserts that all Tate classes on a smooth projective variety are algebraic. In this talk, I will talk about so called supersingular Tate conjecture for Hyper-Kähler varieties, which predicts that all cohomology classes of a supersingular Hyper-Kähler variety are algebraic. This is motivated from the work of Artin and Shioda on supersingular K3 surfaces. I will explain how to confirm this conjecture for hyper-Kähler varieties of known types.

This is an ongoing work with Lie Fu and Xuanlin Huang.

Ngaiming Mok (The University of Hong Kong)

Geometric structures and sub-structures arising from varieties of minimal rational tangents and their tangential linear sections

Let X be a uniruled projective manifold and \mathcal{K} be an irreducible component of a moduli space of minimal rational curves on X . Starting in the late 1990s, I have developed with Jun-Muk Hwang the basics of a geometric theory of varieties of minimal rational tangents (VMRTs) $\mathcal{C}_x(X) \subset \mathbf{PT}_x X$ on (X, \mathcal{K}) , captured by the VMRT structure $\pi: \mathcal{C}(X) \rightarrow X$, which generalizes \mathbf{S} -structures on irreducible Hermitian symmetric spaces $\mathbf{S} = G/P$ of rank ≥ 2 . More recently I have been further developing with collaborators a theory of geometric substructures on (X, \mathcal{K}) , called sub-VMRT structures, supported on a complex submanifold $S \subset W$ of an open subset $W \subset X$ in the complex topology and defined by taking intersections of VMRTs with projectivized tangent subspaces on S , given by $\varphi: \mathcal{C}(S) \rightarrow S$, $\mathcal{C}_x(S) := \mathcal{C}_x(X) \cap \mathbf{PT}_x(S)$. Here $\varphi: \mathcal{C}(S) \rightarrow S$ is assumed surjective. One source of the study of geometric substructures on Fano manifolds was the works of Walters (1997), Bryant (2001) and Hong (2007) on Schur rigidity of smooth nonlinear Schubert cycles on irreducible Hermitian symmetric spaces S of rank ≥ 2 settled by a reduction to the study of certain differential systems. The same problem for singular Schubert varieties $Z \subset S$, already taken up by the above authors, was inspired by a problem of Hartshorne's on the smoothability of representatives of certain homology classes. The problem of Schur rigidity on M was settled by Robles-The (2012) by Lie-theoretic cohomological methods.

In this lecture, I will focus on characterization problems involving VMRTs and sub-

VMRTs. This includes the problem of rigidity under projective deformation of rational homogeneous spaces $X = G/P$ of Picard number 1 (Hwang-Mok 2005), the Recognition Problem for the characterization of $X = G/P$ by its VMRT $\mathcal{C}_x(X) \subset \mathbf{P}T_x X$ at a general point (Mok 2008, Hong-Hwang 2008, Hwang-Li 2021), and the problem in algebraic geometry of characterizing certain projective subvarieties of X such as Schubert cycles (Hong-Mok 2013, 2021; Mok-Zhang 2019). In addition, we give applications of our study of sub-VMRT structures to rigidity problems concerning proper holomorphic maps on the interface of several complex variables and Cauchy-Riemann geometry (Kim-Mok-Seo 2023) and to the (yet unpublished) characterization of certain holomorphic isometric embeddings of the complex unit ball in Kähler geometry (Mok-Yang).

Shigeru Mukai (Kyoto University & MCM, CAS)

Holomorphic symplectic 6-folds associated with Kummer quartics

The orthogonal group of the lattice $II_{1,17}(2^{+6})$ has a fundamental domain with $896+64$ facets by Borcherds (2000). This is the Picard lattice (w.r.t. Beauville form) of the holomorphic symplectic 6-fold $\text{Jac}(|h|)$ of a very general Kummer quartic surface (S, h) . I will explain the following Theorem: The birational automorphism group $\text{Bir}(\text{Jac}(|h|))$ is generated by 864 reflections among the 896 above and a 2-group whose center is Rapagnetta (2007)'s involution.

Nicolas Perrin (École Polytechnique)

Rigidity of equivariant Schubert classes

(j.w. A. Buch and P.-E. Chaput) The cohomology class of a subvariety Y in X is called rigid if Y is the unique subvariety representing $[Y]$. Rigidity of Schubert classes in homogeneous spaces is a classical problem. I will explain a variant of this problem in equivariant cohomology and prove the equivariant rigidity of any Schubert class. I will then explain how to use this to lift the Seidel representation in quantum K-theory to a geometric statement.

Xavier Roulleau (Université d'Angers)

On the pluri-cotangent maps of surfaces of general type

Let X be a smooth compact, complex surface of general type whose cotangent bundle Ω_X is strongly semi-ample i.e. such that a symmetric power $S^n \Omega_X$ is generated by its space of global sections $H^0(X, S^n \Omega_X)$. We study the finiteness of the pluri-cotangent maps of X , namely the morphisms $\mathbf{P}(\Omega_X) \rightarrow \mathbf{P}(H^0(X, S^n \Omega_X))$. It will be illustrated by various examples. This is a joint work with Francesco Polizzi (Naples).

Erwan Rousseau (Université de Bretagne Occidentale)

A generalization of the Bloch-Ochiai theorem

The classical Bloch-Ochiai theorem states that a complex projective manifold with irregularity larger than its dimension has no Zariski dense entire curve. I will present a generalization of this theorem in the setting of pairs. (Joint work with S. Kebekus).

Xiaotao Sun (Tianjin University)

Xiao's slope inequality in positive characteristic and applications

We will discuss generalizations of Xiao's slope inequality in positive characteristic and its applications. This is a joint work with Gu Yi and Zhou Mingshuo.

Sheng-Li Tan (East China Normal University)

Xiao's slope inequality and Poincare problem for a foliated algebraic surface

Let \mathcal{F} be a foliation on a smooth projective surface S over the complex number \mathbb{C} . We introduce three birational non-negative invariants $c_1^2(\mathcal{F})$, $c_2(\mathcal{F})$ and $\chi(\mathcal{F})$, called the Chern numbers. If the foliation \mathcal{F} is not of general type, the first Chern number $c_1^2(\mathcal{F}) = 0$, and $c_2(\mathcal{F}) = \chi(\mathcal{F}) = 0$ except when \mathcal{F} is induced by a non-isotrivial fibration of genus $g = 1$. If \mathcal{F} is of general type, we have Xiao's slope inequality when \mathcal{F} is algebraically integral. As a corollary, \mathcal{F} is always transcendental if the slope is less than 2. On the other hand, we also prove three sharp Noether type inequalities if \mathcal{F} is of general type. As applications, we obtain a criterion for foliations to be transcendental using Noether type inequalities, and we also give a partial positive answer to the question on the lower bound on the volume of a foliation of general type. This is a joint work with Xin LU.

Qizheng Yin (Peking University)

D-equivalence conjecture for $K3^{[n]}$

I will explain how to use Markman's hyperholomorphic bundles to show that birational hyper-Kähler varieties of $K3^{[n]}$ type are derived equivalent. This is joint work with Davesh Maulik, Junliang Shen, and Ruxuan Zhang.

Kang Zuo (Wuhan University)

Coleman-Oort conjecture for Shimura curves of Mumford type

I shall report on the recent progress of the finiteness and the non-existence problems of Shimura curves of Mumford types contained in the closure of the Torelli locus of smooth projective curves of genus $g > 3$ in the moduli space of principal polarized g -dim abelian varieties generically. This is based on joint works and projects with K. Chen, X. Lu and SL. Tan.