Abstracts
Workshop on Complex Dynamics and Geometry
(28–31 August 2023)

1 Matthieu Astorg

Université d'Orléans, France
Local dynamics of skew-products tangent to identity

Abstract

We study the local dynamics of polynomial skew-products P with a (non-degenerate) fixed point tangent to the identity. We will give an explicit sufficient condition on its coefficients for P to have wandering Fatou components. In particular, we will see that the dynamics of quadratic maps of the form $(z, w) -> (z - z^2, w + w^2 + bz^2)$ is surprisingly rich: under an explicit arithmetic condition on b, these maps have an infinity of grand orbits of wandering Fatou components, all of which admit non-constant limit maps. The main technical result is a parabolic implosion-type theorem, in which the renormalization limits that appear are different from previously known cases.

2 Farhad Babaee

University of Bristol, UK
Complex tropical currents

Abstract

In this talk, I will review several key concepts in Tropical Geometry, highlighting the naturality and numerous applications that arise when integrating the Theory of Positive Closed Currents into this framework. This talk is based on previous works with June Huh, Karim Adiprasito and ongoing joint work with Tien Cuong Dinh.

3 Fabrizio Bianchi

Université de Lille, France
Central limit theorems for complex Hénon maps and automorphisms of compact Kähler manifolds

Abstract

We show that the measure of maximal entropy of every complex Hénon map is exponentially mixing of all orders for Hölder observables. As a consequence, the Central Limit Theorem with respect to this measure holds for all Hölder observables. A similar result also holds for automorphisms of compact Kähler manifolds with simple action on cohomology.
This is a joint work with Tien-Cuong Dinh.

4 Cinzia Bisi

Università degli Studi di Ferrara, Italy
Invariants and automorphisms of slice regular functions

Abstract

Let A be one of the following algebras: $\mathbb{C}, \mathbb{H} = \mathbb{R}_2, \mathbb{R}_3, \mathbb{O}$. For the algebra A, the automorphism group $\mathrm{Aut}(A)$ and its invariants are well known. During the talk, I will describe the invariants of the automorphism group of the algebra of slice regular functions over the quaternions $A = \mathbb{H} = \mathbb{R}_2$ and over $A = \mathbb{R}_3$. Time permitting, the talk will also cover the octonionic case, $A = \mathbb{O}$, which requires the use of Oka Theory. All I will present is a joint project with Joerg Winkelmann.

5 Paolo Cascini

Imperial College London, UK
On the Chern numbers of a smooth threefold

Abstract

We show that the Chern numbers of a smooth complex projective threefold are bounded by a constant which depends only on the topological type of the threefold, provided that the cubic form of the threefold has non-zero discriminant. Joint work with Hsin-Ku Chen.

6 Nguyen-Bac Dang

Université Paris-Saclay, France
Poincare series and dynamics over Berkovich spaces

Abstract

In this talk based on a work in progress with Vlere Mehmeti, we study the continuity of the Hausdorff dimension on the moduli space of Schottky groups of genus g acting over the Berkovich spaces over Z, which were constructed by Poineau Turcheti. Over Non-Archimedean fields, the Hausdorff dimension is equal to the critical exponent of a certain Poincare series. I will show that this Poincare series is a quotient of exponential polynomials, which extends analytically at zero and whose value has a geometric meaning. This is a non-archimedean analog of recent work of Dang-Riviere.

7 Rong Du

East China Normal University, China
Algebraic vector bundles on rational homogeneous spaces

Abstract

I will introduce the background of algebraic vector bundles on rational homogeneous spaces and some open problems related to them in algebraic geometry. In particular, I will focus a type of algebraic vector bundles–uniform bundles on special rational homogeneous spaces. This talk is from a joint work with Xinyi Fang and Yun Gao.

8 Siarhei Finski

École Polytechnique, France
Submultiplicative norms on section rings

Abstract

A graded norm on a section ring of a polarised projective manifold is called submultiplicative if the norm of products of holomorphic sections is no bigger than their products of norms. Such norms arise naturally in complex geometry and functional analysis. In the former context, they appear in the study of holomorphic extension problems, submultiplicative filtrations (related to K-stability and non-Archimedean pluripotential theory) and Narasimhan-Simha pseudonorms. In the latter context, they appear in the study of projective tensor norms on polynomial rings.

We show that submultiplicative norms on section rings of polarised projective manifolds are asymptotically equivalent to sup-norms associated with metrics on the polarising line bundle. We then derive several applications of this result to the aforementioned problems

9 Yun Gao

Shanghai Jiao Tong University, China
Hyperplane restriction theorem and applications

Abstract

We will introduce a hyerplane restriction theorem for the local holomorphic mappings between projective spaces, which is inspired by the corresponding theorem of Green for homogeneous ideals in polynomial rings. This theorem gives us a formula to estimate the dimension of the linear span of image from the dimension of image of a general linear subspace. In addition, we will introduce a new coordinate-free approach to study the Cauchy-Riemann maps between the real hyperquadrics in the complex projective space. Combining these methods, we can generalize a number of well-known rigidity theorems for the CR mappings between real hyperquadrics with much simpler arguments. And we give the proof for the existence of gaps at all level for the rational proper maps between complex unit balls. This generalizes the GAP Conjecture proposed by Huang-Ji-Yin. It is a joint work with Sui-Chung Ng.

10 Ziyang Gao

Leibniz Universität Hannover, Germany
Sparsity of rational and algebraic points

Abstract

It is a fundamental question in mathematics to find rational solutions to a given system of polynomials, and in modern language this question translates into finding rational points in algebraic varieties. This question is already very deep for algebraic curves defined over Q. An intrinsic natural number associated with the curve, called its genus, plays an important role in studying the rational points on the curve. In 1983, Faltings proved the famous Mordell Conjecture (proposed in 1922), which asserts that any curve of genus at least 2 has only finitely many rational points. Thus the problem for curves of genus at least 2 can be divided into several grades: finiteness, bound, uniform bound, effectiveness. An answer to each grade requires a better understanding of the distribution of the rational points.

In my talk, I will explain the historical and recent developments of this problem according to the different grades. Another important topic on studying points on curves is the torsion packets. This topic goes beyond rational points. I will also discuss briefly about it in my talk.

11 Yong Hu

Shanghai Jiao Tong University, China
Slope inequality for fibered threefolds over curves

Abstract

In this talk, we will introduce the slope inequality for fibered varieties over curves. We will prove that the optimal lower bound of the slope of fibered threefolds over curves is 4/3. If time permits, we will describe the fibered threefolds over curves with slope 4/3. This is a joint work in progress with Tong Zhang.

12 Sichen Li

East China University of Science and Technology, China
Zariski dense orbit conjecture on automorphisms of projective threefolds

Abstract

Let f be a dominant rational self-map of a normal projective variety X. The Zariski dense orbit conjecture predicts that either there is a rational point P of X with a Zariski dense f-orbit, or there is a rational function $h : X ß \mathbb{P}^1$ such that $h \circ f = h$. In this talk, we try to discuss on the conjecture for automorphisms of projective threefolds.

13 Haidong Liu

Sun Yat-Sen University, China
The ampleness conjecture on K-trivial fourfolds

Abstract

K-trivial manifolds are manifolds with linearly trivial canonical divisors and without irregularity. Two typical examples are strict Calabi-Yau manifolds and simple hyperkahler manifolds. The ampleness conjecture predicts that any strictly nef divisors on K-trivial manifolds are ample. In this talk, I will show that this conjecture holds in dimension 4. This is joint work with Shin-ichi Matsumura.

14 Xin Lu

East China Normal University, China
Strict Arakelov inequalities for a semi-stable fibration

Abstract

The classical Arakelov inequality is key to the Shafarevich conjecture. It gives an upper bound for the degree of the Hodge bundle of a semi-stable fibration of curves in terms of the base curve and the discriminant. Later on, such type inequalities are extended to higher dimension and to Higgs bundles. In this talk, I will talk about the development of these Arakelov inequalities and the strictness in certain cases. It is based on joint works with Ke Chen, Sheng-Li Tan, Jin-Bang Yang, and Kang Zuo.

15 Yusuke Nakamura

The University of Tokyo, Japan
Minimal log discrepancies of quotient singularities

Abstract

The minimal log discrepancy (MLD) is an invariant of singularity defined in the context of the minimal model program. In this talk, we will discuss the minimal log discrepancies of quotient singularities. I will explain that the PIA (precise inversion of adjunction) conjecture and Shokurov's index conjecture hold for quotient singularities. For the PIA conjecture, the theory of the arc space of a quotient singularity established by Denef and Loeser is an essential tool. For the index conjecture, Jordan's theorem on finite linear groups is essentially used. This is joint work with Kohsuke Shibata.

16 Johan Taflin

Université de Bourgogne, France
Blenders and the sparsity of postcritically finite endomorphisms

Abstract

Postcritically finite rational maps are of particular importance in one-variable complex dynamics. They are related to strong bifurcations phenomena and they form a Zariski dense set in the moduli space of degree d rational maps. In higher dimensions, we prove with Thomas Gauthier and Gabriel Vigny that postcritically finite maps are not Zariski dense in the moduli space of degree d endomorphisms of the projective space P^k as soon as d and k are larger or equal to 2. The proof is a combination of arguments coming from complex analysis, arithmetic geometry and smooth dynamics. An important step is to obtain an open set of maximal bifurcations using special hyperbolic sets called blenders.

17 Long Wang

Fudan University, China
Arithmetic degrees of dominant rational self-maps

Abstract

We discuss a conjecture of Kawaguchi and Silverman about arithmetic degrees of dominant rational self-maps defined over number fields. Some new results and an application to the existence of Zariski dense orbits will be given. This is based on joint work with Yohsuke Matsuzawa.

18 Shou Yoshikawa

Tokyo Institute of Technology, Japan
Polarized endomorphism and Frobenius liftability

Abstract

Polarized endomorphisms are endomorphisms preserving some polarization of projective varieties. It is known that admitting a polarized endomorphism imposes strong conditions for structure of varieties. For example, rational surfaces admitting polarized endomorphisms are toric and Fano threefolds with Picard rank one admitting polarized endomorphisms are projective spaces. Furthermore, similar results are known even in positive characteristic. Frobenius liftable varieties are varieties which lift

to characteristic p^2 with Frobenius morphism. Frobenius liftability also imposes strong condition for structure of varieties. In this talk, I will introduce relationship between structure of varieties admitting polarized endomorphisms and structure of Frobenius liftable varieties.

19 Tong Zhang

East China Normal University, China
Noether inequality for complex irregular threefolds of general type

Abstract

The classical Noether inequality asserts that $\mathrm{Vol}(S) \geq 2p_g(S) - 4$ for a complex smooth projective surface S of general type. If S is irregular, O. Debarre proved that S satisfies a stronger Noether inequality that $\mathrm{Vol}(S) \geq 2p_g(S)$. Recently, J. Chen, M. Chen and C. Jiang proved the optimal Noether inequality that $\mathrm{Vol}(X) \geq 4/3p_g(X) - 10/3$ for a complex smooth projective threefold X of general type with $p_g(X) \geq 11$ or $p_g(X) \leq 4$. In this talk, I will introduce an optimal Noether inequality for almost all complex irregular threefolds of general type. This is a joint work in progress with Y. Hu.

20 Guolei Zhong

Institute for Basic Science, Korea
Structure of projective varieties with certain positive tangent sheaves

Abstract

Positivities of tangent sheaves are expected to impose rather restrictive geometry on the underlying space. In this talk, we consider a projective klt variety X with an almost nef tangent sheaf T_X, i.e., $T_X|_C$ is nef for any curve $C \subseteq X$ not lying in a given countable union of proper closed subvarieties. We establish a structure theorem towards the fundamental building blocks of such varieties. Then we apply this structure to the classification of surfaces and threefolds with certain positive tangent sheaves. Furthermore, we will discuss a few questions on the equivariant minimal model program with respect to certain positive tangent sheaves. This is based on my joint work with Masataka Iwai and Shin-ichi Matsumura.