Algebraic Geometry and Complex Geometry
23 - 27 juanuary 2017
Afternoon Talks

Rita Pardini (University of Pisa)

Title: The eventual paracanonical map of an irregular variety.

Abstract: I will report on joint work with. M.A. Barja (UPC, Barcelona) and L. Stoppino (Universita' dell'Insubria, Italy)

Given a map $a : X \longrightarrow A$ from a smooth projective variety to an abelian variety and a line bundle L on X, we study the "eventual" behaviour of the linear system $|L|$ under base change with the d-th multiplication map $A \longrightarrow A$. We prove a factorization theorem stating, roughly speaking, that the correponding map stabilizes for d large and divisible enough. When X is of general type, A is the Albanese map and L is the canonical bundle, we obtain the so-called "eventual paracanonical" map, which is a new geometrical object intrinsically attached to X.

REFERENCES: arXiv: 1606.03301, arXiv: 1606.03290

Mohamed Benzerga (Université d'Angers)

Title: Finiteness results for real structures on rational surfaces

Abstract: A real structure on a complex projective variety X is an antiregular (or antiholomorphic) involution. The data of such a structure on X is equivalent to the data of a real variety whose complexification is isomorphic to X (i.e. a real form of X). The aim of this talk is to show how the study of automorphism groups of rational surfaces can be used in order to give a partial answer to the question : does every rational surface have finitely many real forms (up to isomorphism)? On the one hand, we show that every rational surface whose automorphism group does not contain a nonabelian free group has finitely many real forms. On the other hand, we will show that there exist rational surfaces with large automorphism groups which also have finitely many real forms, like unnodal Coble surfaces studied by Cantat and Dolgachev, or KLT Calabi-Yau pairs.

Lionel Darondeau (KU Leuven & Université Aix-Marseille)

Title: Sur l'amplitude du cotangent des intersections complètes

Abstract: C'est un travail commun avec Damian Brotbek. Nous prouvons que toute variété projective lisse M contient des sous-variétés avec cotangent ample en toute dimension $n \leq dim(M)/2$. Nous construisons de telles variétés comme certaines intersections complètes.

Thomas Dedieu (Université Toulouse 3)

Title: Enumeration of curves on K3 surfaces by polyhedral degenerations

Abstract: Let (S, L) be a primitively polarized K3 surface, k an integer. Integral curves of geometric genus g in the linear system $|kL|$ form a family of dimension g (if non-empty). One wants to count the number of such curves passing through g general points fixed on S. Gromov-Witten theory provides a complete answer to this question when $k = 1$, but poses serious problems when$k > 1$. I shall present an approach based upon degenerating the surface S immersed by the system $|kL|$ in a union of planes incarnating a triangulation of the S^2 sphere. This is a joint project with Ciro Ciliberto.

Carlo Gasbarri (Université de Strasbourg)

Title: Liouville's inequality for transcendental points on projective varieties

Abstract: Liouville inequality is a lower bound of the norm of an integral section of a line bundle on an algebraic point of a variety. It is an important tool in may proofs in diophantine geometry and in transcendence. On transcendental points an inequality as good as Liouville inequality cannot hold. We will describe similar inequalities which hold for "many" transcendental points and some applications

Florian Ivorra (Université de Rennes 1)

Title: Perverse motives and mixed Hodge modules

Abstract: Let X be a smooth complex algebraic variety. In this talk, I will explain a way to use perverse homology sheaves of families of algebraic varieties over X to extend Nori's construction of an Abelian category of motives to a relative setting. This approach (which may also be applied to perverse sheaves over finite field) leads to a notion of motivic perverse sheaves and provides a mean to select, among mixed Hodge modules and their extensions, those coming from geometry.

I will also explain how the geometry of these specific perverse sheaves can be used to relate the theory of motives developed by Morel and Voevodsky to the derived category of mixed Hodge modules.

Julien Maubon (Université de Lorraine)

Title: Maximal representations of uniform complex hyperbolic lattices

Abstract: Let Γ be a uniform complex hyperbolic lattice, that is, a discrete subgroup of the group of biholomorphisms $PU(n, 1)$ of the ball B^n acting cocompactly on B^n. If ρ is a representation (a group homomorphism) of Γ in a semisimple Lie group of Hermitian type G, the Toledo invariant of ρ is a measure of the "complex size" of ρ. It is bounded by a quantity depending only on the real rank of G and the volume of the quotient $\Gamma\backslash B^n$. Maximal representations are those for which this bound is attained. We show that if ρ is a maximal representation in a classical Lie group of Hermitian type G and if $n \geq 2$, then necessarily $G = SU(p, q)$ with $p \geq nq$, and there exist a ρ-equivariant holomorphic or antiholomorphic totally geodesic homothetic embedding of the ball B^n to the symmetric space associated to G.

This implies that the representation ρ essentially extends to a homomorphism from the ambient Lie group $PU(n,1)$ to G. The proof mixes the Higgs bundle theory associated to representations of Kähler groups and the dynamics and geometry of the tautological foliation on the projectivized tangent bundle of complex hyperbolic manifolds. This is a joint work with Vincent Koziarz.

Daniel Naie (Université d'Angers)

Title: Twisted Kodaira-Spencer classes and their use in the study of invariants of surfaces in $\mathbb{P}^4$

Abstract: (joint work Igor Reider)

Let X be a projective surface. A twisted Kodaira-Spencer class is an element of the cohomology group $H^1(T_X(-D))$, with D "sufficiently positive". We study the connection between the existence of a non-trivial twisted class and the geometry of X. In particular, we show that, for a minimal general type surface satisfying $c_2/c_1^2 < 5/6$, the non-vanishing of $H^1(T_X(-K_X))$ imposes the existence of configurations of rational curves on the surface.

The techniques used to obtain this result are based on the interpretation of a non-trivial twisted class as an extension —a short exact sequence of locally free sheaves on X—, and on the detailed study of this sequence.

The above point of view and techniques are applied to the study of surfaces in $\mathbb{P}^4$. Indeed, a surface of non-negative Kodaira dimension contained in a hypersurface of degree ≤ 5 displays a natural non-trivial twisted class, allowing us to address the Hartshorne-Lichtenbaum problem for, and to slightly control the irregularity of these surfaces.

Fabio Tanturri (Université Aix-Marseille)

Title: On the unirationality of Hurwitz spaces

Abstract: In this talk I will discuss about the unirationality of the Hurwitz spaces $H_{g,d}$ parametrizing d-sheeted branched simple covers of the projective line by smooth curves of genus g. I will summarize what is already known and formulate some questions and speculations on the general behaviour. I will then present a proof of the unirationality of $H_{12,8}$ and $H_{13,7}$, obtained via liaison and matrix factorizations. This is part of two joint works with Frank-Olaf Schreyer.

References: "Matrix factorizations and curves in $\mathbb{P}^4$" (https://arxiv.org/abs/1611.03669) and "Unirational Hurwitz spaces and liaison" (work in progress).