

## JOURNÉES COMPLEXES LORRAINES 2017

### TITLES AND ABSTRACTS

JOSEPH AYOUB

**Title.** Hodge theory for the conservativity conjecture

**Abstract.** The conservativity conjecture predicts that a correspondance between Chow motives is invertible if and only if its class in cohomology is invertible. I will discuss some aspects of a program aiming at proving the conservativity conjecture. More specifically, I'll focus on the part of the program which uses Hodge theory.

DAMIAN BROTBEK

**Title.** On the hyperbolicity of general hypersurfaces

**Abstract.** A smooth projective variety over the complex numbers is said to be (Brody) hyperbolic if it doesn't contain any entire curve. Kobayashi conjectured in the 70's that general hypersurfaces of sufficiently large degree in  $\mathbb{P}^N$  is hyperbolic. This conjecture was only proven recently by Siu.

The purpose of this talk is to present a new proof of this conjecture. The main idea of the proof, based on the theory of jet differential equations, is to establish that a stronger property, open in the Zariski topology, is satisfied for suitable deformations of Fermat type hypersurfaces.

YOHAN BRUNEBARBE

**Title.** On the cotangent bundle of the smooth complex algebraic varieties whose fundamental group is infinite

**Abstract.** I will discuss several positivity properties of the cotangent bundle of the smooth projective complex algebraic varieties whose fundamental group is infinite, as well as their generalizations to quasi-projective varieties.

FRANÇOIS CHARLES

**Title.** Amplitude arithmétique et théorème de Bertini

**Abstract.** Le théorème d'irréductibilité de Bertini affirme que, sur un corps infini, une section hyperplane générale d'une variété projective irréductible de dimension au moins 2 est encore irréductible. Sur un corps fini, cet énoncé devient faux, mais il est possible d'en prouver une version corrigée en remplaçant hyperplans par hypersurfaces de grand degré (travail en commun avec Poonen). Dans cet exposé, nous donnerons une variante du théorème de Bertini pour les fibrés en droites hermitiens sur les variétés arithmétiques. Ce sera l'occasion de décrire quelques aspects de l'amplitude en géométrie arithmétique.

JULIE DÉSERTI

**Title.** Groupe de Cremona et automorphismes de surfaces complexes compactes

**Abstract.** Après avoir introduit le groupe de Cremona j'expliquerai le lien entre les transformations birationnelles du plan projectif complexe et les automorphismes de surfaces complexes compactes d'entropie positive. Je donnerai des constructions explicites de ces derniers et deux critères permettant de dire si une transformation birationnelle du plan projectif complexe est birationnellement conjuguée à un automorphisme.

PASCAL DINGOYAN

**Title.**  $l^2$ -cohomology groups of coverings of some quasi-projective manifolds

**Abstract.** Work in progress with G. Schumacher :

Any quasi-projective manifold  $U = Y \setminus D$  ( $D$  a normal crossing divisor) admits a complete metric of finite volume and asymptotic to a Poincaré metric along its boundary. For some infinite covering  $X \rightarrow U$ , the pullback of this metric is of bounded geometry. One can then apply the theory of Cheeger-Gromov to study the  $l^2$ -cohomology groups of  $X$ . As an early application, one deduces a Galois  $\partial\bar{\partial}$ -lemma and a Atiyah's  $l^2$ -index theorem in this setting.

HENRI GUENANCIA

**Title.** Singular varieties with trivial canonical class

**Abstract.** If  $X$  is a smooth projective variety (or compact Kähler manifold) with trivial first Chern class, then a famous result of Beauville and Bogomolov asserts that up to a finite étale cover,  $X$  is a product of varieties of three possible type : abelian varieties (or tori), Calabi-Yau varieties or Hyperkähler varieties. These last two classes are defined using properties of the algebra of global holomorphic forms.

If  $X$  is singular though (say with torsion canonical bundle and klt singularities) this result is not known and presumably very difficult. I will explain that if in addition  $X$  is assumed to be strongly stable (which is an infinitesimal version of irreducibility) then  $X$  falls into one of the singular analogues of the two categories above (Calabi-Yau and Hyperkähler varieties). If time allows, I will also discuss a decomposition theorem in the case where  $X$  is smoothable.

This is based on two recent collaborations with Stefan Kebekus and Daniel Greb, and with Stéphane Druel.

FLORIAN IVORRA

**Title.** The Artin part of a motive, weights and motivic nearby sheaves

**Abstract.** The notion of Artin part of a relative motive has been introduced by Ayoub and Zucker in their study of motives associated with compactifications of arithmetic quotients of Hermitian symmetric spaces. They predict the existence of a relation between the Artin part of relative motive and the (conjectural) punctual weight filtration on the heart of the (conjectural) motivic t-structure on the triangulated category of motives.

In this talk, I will present a recent joint work with Julien Sebag in which verify the Hodge theoretic side of Ayoub-Zucker's prediction for smooth cohomological motives (motivic analogue of local systems). I will explain how to compute the Artin part of the motivic nearby sheaf and relate it to the Betti cohomology of Berkovich spaces defined by tubes in non-Archimedean geometry. In the first part of the lecture, I will explain the results about motivic nearby sheaves and their relation with tubes needed and obtained in a previous joint work with Ayoub and Sebag.

CHRISTIAN LEHN

**Title.** A global Torelli theorem for singular holomorphic symplectic varieties

**Abstract.** We study birational contractions of holomorphic symplectic manifolds and their deformations. After developing the local deformation theory, we use ergodic complex structures to replicate for singular symplectic varieties the global moduli theory of irreducible symplectic manifolds. We outline some applications to the birational geometry of  $K3^{[n]}$ -type varieties. This is joint work, partially with Ben Bakker and partially with Gianluca Pacienza.

MANFRED LEHN

**Title.** Symplectic hypersurface singularities

**Abstract.** We know only very few symplectic hypersurface singularities all of which arise as Slodowy slices to nilpotent orbits, and one might speculate if there are any others. I will discuss some of their geometric properties. This is a report on joint work with Y. Namikawa, C. Sorger and D. van Straten.

CHRISTOPHE MOURougANE

**Title.** Asymptotics of  $L^2$  and Quillen metrics in degenerations of Calabi-Yau varieties

**Abstract.** We consider degenerations of complex projective Calabi-Yau varieties and study the singularities of  $L^2$ , Quillen and BCOV metrics on Hodge and determinant bundles. The dominant and subdominant terms in the expansions of the metrics close to non-smooth fibers are shown to be related to well-known topological invariants of singularities, such as limit Hodge structures, vanishing cycles and log-canonical thresholds.

It is a joint work with Dennis Eriksson and Gerard Freixas i Montplet.

DAN POPOVICI

**Title.** Non-Kähler Mirror Symmetry of the Iwasawa Manifold

**Abstract.** This is joint work with Christophe Mourougane. We propose a new approach to the Mirror Symmetry Conjecture in a form suitable to possibly non-Kähler compact complex manifolds whose canonical bundle is trivial. We apply our methods by proving that the Iwasawa manifold  $X$ , a well-known non-Kähler compact complex manifold of dimension 3, is its own mirror dual to the extent that its Gauduchon cone, replacing the classical Kähler cone that is empty in this case, corresponds to what we call the local universal family of essential deformations of  $X$ .

FRÉDÉRIC TOUZET

**Title.** Two dimensional neighborhoods of elliptic curves : formal classification and foliations

**Abstract.** In this talk, I will address the formal classification of two dimensional neighborhoods of an elliptic curve  $C$  with torsion normal bundle. The proof makes use of the existence of a pair (indeed a pencil) of formal foliations having  $C$  as a common leaf, and the fact that neighborhoods are completely determined by the holonomy of such a pair. We will also discuss analytic equivalence and show, for each formal model, that the corresponding moduli space is infinite dimensional.

Joint work with Frank Loray and Olivier Thom.

CHARLES VIAL

**Title.** On the Chow ring of holomorphic symplectic varieties

**Abstract.** Since the seminal work of Beauville and Voisin on the Chow ring of K3 surfaces, it is believed that the Chow ring of smooth projective holomorphic symplectic manifolds should have properties similar to that of the Chow ring of abelian varieties. I will explain which properties are expected, and I will give unconditional results in the case of Hilbert schemes of points on K3 surfaces or abelian surfaces, and in the case of generalised Kummer varieties.

Joint work with Lie Fu and Zhiyu Tian.

JAROSŁAW WIŚNIEWSKI

**Title.** Flag varieties, a geometric characterization and rigidity

**Abstract.** Using reflection groups of the Picard lattice, and (sometime) unique reconstruction of Bott-Samelson varieties, one can characterize total flag varieties of semisimple algebraic groups in terms of their elementary contractions. This implies their rigidity in families of Fano manifolds. The talk is based on a joint projects with Munoz, Occhetta, Sola Conde, Watanabe and Weber.