

# GÉOMÉTRIE ALGÈBRIQUE

Collège de France

3-4-5 octobre 2016

Lundi 3 octobre	Mardi 4 octobre	Mercredi 5 octobre
10.30-11.30 A. Beauville	10.00-11.00 J.-P. Demailly	10.00-11.00 J. Kollár
	<i>pause café</i> <sup>1</sup>	<i>pause café</i>
11.45-12.45 G. Farkas	11.30-12.30 S. Cantat	11.30-12.30 E. Arbarello
<i>pause déjeuner</i> <sup>2</sup>	<i>pause déjeuner</i>	<i>pause déjeuner</i>
15.00-16.00 K. O'Grady	15.00-16.00 R. Pandharipande	14.00-15.00 O. Debarre
<i>pause café</i>	<i>pause café</i>	
16.30-17.30 D. Huybrechts	16.30-17.30 G. Saccà	15.15-16.15 R. Lazarsfeld
	18.00 Réception <sup>3</sup>	

(1) Le café sera servi pendant les pauses à la cafeteria du Collège de France.

(2) Déjeuners libres à l'extérieur.

(3) La réception aura lieu à la cafeteria du Collège de France.

Programme du congrès

GÉOMÉTRIE ALGÈBRE

Collège de France, 11 Place Marcelin Berthelot - salle 5

3 - 4 - 5 octobre 2016

Lundi 3 octobre 2016

10:30-11:30

**Arnaud BEAUVILLE** (Université de Nice Sophia Antipolis, France)

Titre : AN INTRODUCTION TO ULRICH BUNDLES

Résumé : After explaining what are Ulrich bundles and why they are interesting, I'll focus on the major problem in the subject: the existence of a Ulrich bundle on any projective variety. I'll explain how the standard constructions of rank 2 bundles give a positive answer for some surfaces and threefolds.

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11:45-12:45

**Gavril FARKAS** (Humboldt Universität de Berlin, Allemagne)

Titre : K3 SURFACES OF GENUS 14 VIA CUBIC FOURFOLDS

Résumé : In a celebrated series of papers, Mukai established structure theorems for polarized K3 surfaces of all genera  $g < 21$ , with the exception of the case  $g=14$ . Using Hassett's identification between the moduli space of polarized K3 surfaces of genus 14 and the moduli space of special cubic fourfolds of discriminant 26, we establish the rationality of the universal K3 surface of genus 14. The proof relies on a degenerate version of Mukai's structure theorem for K3 surfaces of genus 8. This is joint work with Verra.

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15:00-16:00

**Kieran O'GRADY** (Université de Rome 1, Italie)

Titre : GIT VERSUS BB COMPACTIFICATION FOR THE MODULI SPACE OF QUARTIC SURFACES

Résumé : This is a report on joint work with Radu Laza. The period map from the GIT moduli space of quartic surfaces to the Baily-Borel compactification of the period space is birational but far from regular. New birational models of locally symmetric varieties of Type IV have been introduced by Looijenga, in order to study similar problems. Looijenga's construction does not succeed in "explaining" the period map for quartic surfaces. We discovered that one can (conjecturally) reconcile Looijenga's philosophy with the phenomenology of quartic surfaces, provided one takes into account suitable Borchers relations between divisor classes on relevant locally symmetric varieties. We work with a tower of locally symmetric varieties, in particular our results should also "explain" the period map for double EPW sextics

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16:30-17:30

**Daniel HUYBRECHTS** (Institut de Mathématiques, Université de Bonn, Allemagne)

Titre : THE GLOBAL TORELLI THEOREM FOR CUBIC FOURFOLDS VIA THE JACOBI RING AND THE DERIVED GLOBAL TORELLI THEOREM FOR K3 SURFACES

Résumé : I will report on an approach to the GT for cubic fourfolds that uses the relation between Kuznetsov's K3 category associated with any cubic fourfold and K3 surfaces.

10:00-11:00

**Jean-Pierre DEMAILLY** (Institut Fourier, Université de Grenoble, France)

**Titre : EXTENSION OF HOLOMORPHIC FUNCTIONS DEFINED ON NON REDUCED ANALYTIC SUBVARIETIES**

*Résumé : The goal of the talk will be to discuss  $L^2$  extension properties of holomorphic sections of vector bundles satisfying weak semi-positivity properties. Using techniques borrowed from recent proofs of the Ohsawa-Takegoshi extension theorem, we obtain several new surjectivity results for the restriction morphism to a non necessarily reduced subvariety, provided the latter is defined as the zero variety of a multiplier ideal sheaf. These extension results are derived from  $L^2$  approximation techniques, and they hold under (probably) optimal curvature conditions.*

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11:30-12:30

**Serge CANTAT** (Université de Rennes, France)

**Titre : FROM BIRATIONAL TRANSFORMATIONS TO REGULAR AUTOMORPHISMS**

*Résumé : Birational transformations may contract hypersurfaces, may have Indeterminacy points, ... I shall describe an argument which, starting with such a group of birational transformations, provides a way to conjugate this group to a group of (pseudo)-automorphisms. This argument applies to a class of groups which appears in the study of cubical complexes. (this talk is based on a joint work with Yves de Cornulier)*

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15:00-16:00

**Rahul PANDHARIPANDE** (ETH Zürich, Suisse)

**Titre : TAUTOLOGICAL CLASSES ON THE MODULI SPACE OF K3 SURFACES**

*Résumé : I will discuss kappa classes on the moduli space of quasi-polarized K3 surfaces and relations obtained from the moduli spaces of stable maps to the universal family. I will explain the proof of the generation of the tautological ring by Noether-Lefschetz Loci. There are a number of open questions. Joint work with Qizheng Yin.*

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16:30-17:30

**Giulia SACCÀ** (Université de Stony Brook, USA)

**Titre : INTERMEDIATE JACOBIANS AND HYPERKAHLER MANIFOLDS**

*Résumé : In recent years, there have been an increasing number of connections between cubic 4folds and hyperkahler manifolds. The first instance of this was noticed by Beauville-Donagi, who showed that the Fano varieties of lines on a cubic 4folds  $X$  is holomorphic symplectic. The aim of the talk is to describe another instance of this phenomenon, which is carried out in joint work with R. Laza and C. Voisin.*

*Given a general cubic 4fold  $X$ , we can consider the universal family  $Y_U \rightarrow U$  of smooth hyperplanes sections of  $X$  and the relative*

*Intermediate Jacobian fibration  $f: J_U \rightarrow U$ . In 1995 Donagi and Markman constructed a holomorphic symplectic form on  $J_U$ , with respect to which the fibration  $f$  is Lagrangian. Since then, there have been many attempts to find a smooth hyperkahler compactification of  $J_U$ . This was conjectured to exist and to be deformation equivalent to O'Grady's 10-dimensional exceptional example. With Radu Laza and Claire Voisin, we solve this conjecture by using relative compactified Prym varieties.*

10:00-11:00

**János KOLLÁR** (Université de Princeton, USA)

**Titre : MODULI OF STABLE VARIETIES**

*Résumé : I will discuss recent results on the moduli problem of stable varieties, primarily focusing on its local aspects*

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11:30-12:30

**Enrico ARBARELLO** (Université la Sapienza, Rome, Italie)

**Titre : POLARIZED HALPHEN SURFACES AND DU VAL CURVES**

*Résumé : A genus- $g$  du Val curve is a degree- $3g$  plane curve having 8 points of multiplicity  $g$ , one point of multiplicity  $g-1$ , and no other singularity. In a joint work with A. Bruno, G. Farkas and G. Saccà, we prove that a general du Val curve is Brill-Noether-Petri curve. This also gives examples of BNP curves defined over  $\mathbb{Q}$ . In a joint work with A. Bruno, we prove that the corank of the Gauss-Wahl map of a general du Val curve of odd genus is equal to one. The two results together show that the characterization of BNP curves with non-surjective Gauss-Wahl map as hyperplane section of K3 surfaces and limits thereof (obtained jointly with A. Bruno and E. Sernesi) is optimal. This is done via the study of polarized Halphen surfaces.*

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14:00-15:00

**Olivier DEBARRE** (Ecole Normale Supérieure, France)

**Titre : UNEXPECTED ISOMORPHISMS BETWEEN HYPERKÄHLER FOURFOLDS**

*Résumé : Using Verbitsky's Torelli theorem, we show the existence of various isomorphisms between certain hyperkähler fourfolds.*

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15:15-16:15

**Robert LAZARFELD** (Université de Stony Brook, USA)

**Titre : MEASURES OF IRRATIONALITY FOR HYPERSURFACES OF LARGE DEGREE**

*Résumé : Given an  $n$ -dimensional smooth hypersurface  $X$  of degree  $d$  in projective space, it is elementary that  $X$  is irrational when  $d > n+1$ , but it is interesting to ask "how irrational" such a hypersurface can be. We discuss various measures of irrationality, and show that they are governed by birational positivity properties of the canonical bundle. Among other things, we prove a conjecture of Bastianelli, Cortina and De Poi concerning the least degree with which  $X$  can be expressed as a rational covering of projective space. Time permitting, I will also discuss some open problems, and some further results of Bastianelli, Ciliberto, Flamini et al computing related invariants for hypersurfaces. This is joint work with Bastianelli, De Poi, Ein and Ullery.*