Titles and Abstracts

(1) **Marco Andreatta**: Effective Adjunction Theory

Abstract: Let X be a projective variety and H a Cartier divisor on X. The effectivity, or non effectivity, of some adjoint divisors $aK_X + bH$, for suitable a, b, determines the geometry of X.

I will first give a proof of the following version of the *Termination of Adjunction*: X with at most canonical singularities is uniruled if and only if for each very ample Cartier divisor H on X we have $H^0(X, m_0K_X + H) = 0$ for some $m_0 = m_0(H) > 0$.

Then I will discuss the following *Conjecture*: Assume that X has terminal singularities, H is nef and big and $s > 0$. $H^0(X, K_X + tH) = 0$ for every integer t with $1 \leq t \leq s$ if and only if $K_X + sH$ is not pseudo-effective; this is true if and only if the pair (X, L) is birational to a precise list of (uniruled) models.

The Conjecture is true for $s \geq (\dim X - 1)$; this can be proved via the *Theory of the Reductions*, started by Fujita and Sommese, which nowadays can be interpreted as a *Minimal Model Program with Scaling*.

(2) **Miguel A. Barja**: Recent developments on linear systems on maximal Albanese dimension varieties

Abstract: I will survey several techniques, results and open problems, regarding linear systems on varieties of maximal Albanese dimension such that eventual maps, continuous rank functions, Clifford-Severi inequalities and eventual paracanonical maps. These include several results by Pardini, Stoppino and myself and some further work by Jiang and Pareschi.

(3) **Caucher Birkar**: Geometry of Fano fibrations.

Abstract: Fano fibrations are roughly morphisms of varieties whose general fibres are Fano varieties. Such fibrations appear naturally in the context of birational geometry and moduli theory. In this talk we explore some of the geometric properties of such fibrations.

(4) **Arnaud Beauville**: An ampleness criterion for rank 2 vector bundles on surfaces

Abstract: We give an ampleness criterion for globally generated rank 2 vector bundles on certain surfaces. This applies to the Lazarsfeld-Mukai bundles, to congruences of lines in $\mathbb{P}^3$, and possibly to the construction of surfaces with ample cotangent bundle.

(5) **Ugo Bruzzo**: The Noether-Lefschetz problem and the Hodge conjecture

Abstract: I will review some recent results about the Noether-Lefschetz problem for surfaces in normal 3-folds, in particular, about the density of the components of maximal codimension of the Noether-Lefschetz locus. Moreover, I will describe an application of some results about the Noether-Lefschetz problem to the Hodge conjecture for hypersurfaces in toric varieties. (Joint work with A. Grassi and partly with A. F. Lopez).

(6) **Sebastian Casalaina-Martin**: Distinguished models of intermediate Jacobians

Abstract: In this talk I will discuss joint work with J. Achter and C. Vial showing that the image of the Abel–Jacobi map on algebraically trivial cycles descends to the field of definition for smooth projective varieties defined over subfields of the complex numbers. The main focus will be on applications to topics such as: descending cohomology geometrically, a conjecture of Orlov regarding the derived category and Hodge theory, and motivated admissible normal functions.

(7) **Paolo Cascini**: Minimal Model Program for foliations.

Abstract: I will survey some recent results on the study of the birational geometry of co-rank one foliations over complex projective threefolds. Joint work with C. Spicer.

(8) **Ivan Cheltsov**: On a question of Charlie Stibitz and Ziquan Zhuang Abstract: Recently, Charlie Stibitz and Ziquan Zhuang posed a question: is it true that alpha-invariants of birationally superrigid Fano varieties are greater than 1/2? We will show that the answer to this question is probably No by answering negatively its equivariant version. This is a joint work with Ziquan Zhuang.

(9) **Meng Chen**: The Noether Inequality for Algebraic Threefolds (with an appendix by János Kollár)

Abstract: We establish the Noether inequality for projective 3-folds. More precisely, we prove that the inequality $\mathrm{vol}(X) \geq \frac{4}{3}p_g(X) - \frac{10}{3}$ holds for all projective 3-folds X of general type with either $p_g(X) \leq 4$ or $p_g(X) \geq 21$, where $p_g(X)$ is the geometric genus and $\mathrm{vol}(X)$ is the canonical volume. This inequality is optimal due to known examples found by M. Kobayashi in 1992. This is a joint work with Jungkai A. Chen and Chen Jiang.

(10) **Ciro Ciliberto**: Contractible curves on a rational surface

Abstract: Let (S, D) be a pair with S a smooth, irreducible, projective, surface and D an effective, reduced divisor on S. The pair (S, D) is said to be *contractible* if there is a birational map $\phi : S \dashrightarrow S'$ with S' smooth such that $\phi_*(D) = 0$.

The *contractibility problem* consists in finding necessary and sufficient conditions for pairs (S, D) to be contractible.

The contractibility problem is somehow trivial, unless S is rational, in which case it has its roots in the study of the *Cremona geometry* of the complex projective plane $\mathbb{P}^2$.

A result by Kumar-Murthy (1982) solves the problem if D is irreducible. In the reducible case, the only known general result so far was due to Iitaka (1983-88).

In this talk I will, focus on the reducible case, I will discuss some examples and open problems and I will mention two recent results, in collaboration with A. Calabri.

The first says that (S, D) is contractible if D is reduced and connected and $\kappa(S, D) = -\infty$ (which extends both Kumar-Murthy's and Iitaka's theorems).

The second, which relies on Miyanishi-Tsunoda's Theory of Peeling, says that (S, D) is contractible if $\kappa(S, D) = -\infty$, unless (S, D) is a logarithmic del Pezzo surface of rank 1 and one of the following occurs (1) (S, D) has shrinkable boundary, (2) if $(\tilde{S}, \tilde{D})$ is an

almost minimal model of (S, D), then a connected component of $\tilde{D}$ (and only one) is a *non–admissible fork*.

If time allows, I will discuss similar open questions in higher dimensions.

(11) **Elisabetta Colombo**: On Shimura subvarieties of A_g in the Prym locus

Abstract: The first goal of the talk is to illustrate a way to construct examples of Shimura curves of A_g generically contained in the Prym locus. For this we use 1-dimensional families of double étale covers of curves with a compatible action of a fixed group. We find several examples for $g < 13$. The second goal is to give a lower bound for the maximal dimension of a Shimura subvariety of A_g contained in the Prym locus. The motivation is to understand if and how one can extend to the Prym locus the Coleman-Oort conjecture on the nonexistence for high genus of Shimura curves in the Torelli locus not contained in the boundary. (Works in collaboration with A. Ghigi, P. Frediani and M. Penegini).

(12) **Alessio Corti**: Smoothing toric Fano 3-folds

Abstract: I will outline a program to classify smoothings of toric Fano varieties and report on some initial results for 3-folds. This is work with Paul Hacking and Andrea Petracci.

(13) **Tommaso De Fernex**: Geometry of arc spaces

Abstract: The work of Greenberg, Nash, Kolchin, and Denef-Loeser has set the basis for our understanding of the structure of arc spaces and their connections to singularities and birational geometry. Most of the focus in these studies is on the reduced structure of arc spaces and their underlying topological spaces, and little is known about their scheme structure. In joint work with Roi Docampo, we further investigate the structure of arc spaces. Our main result gives a description of the sheaves of Kahler differentials of the arc space. The approach leads to new results on arc spaces as well as simpler and more direct proofs of some of the theorems in the literature.

(14) **Olivier Debarre**: Periods of Debarre-Voisin varieties

Abstract: Beauville and Donagi showed that the primitive Hodge structure of a smooth complex cubic hypersurface of dimension four is isomorphic to that of its variety of lines, a smooth hyperkähler variety of dimension also four. This gives a way to study the period map for cubic fourfolds, a rational map from the projective GIT moduli space of semistable cubic fourfolds to the period domain. As shown by Hassett, this map is not defined at the very special (singular but semistable) point corresponding to the determinantal (or chordal) cubic, but it is well defined (generically) on the blow up of this point and the exceptional divisor maps onto a well understood divisor (called a Hassett-Looijenga-Shah, or HLS divisor) in the period domain.

In this talk, I would like to describe an analogous situation: with a general 3-form on a complex vector space of dimension 10, one can associate a smooth hyperkähler variety of dimension four (called a Debarre-Voisin variety). We exhibit several HLS divisors and identify the corresponding very special 3-forms.

This is work in progress in collaboration with Frédéric Han, Kieran O'Grady, and Claire Voisin.

(15) **Jean-Pierre Demailly**: Bergman bundles and invariance of plurigenera for polarized compact Kähler deformations

Abstract: The standard technique of using auxiliary ample line bundles cannot be applied to arbitrary compact Kähler manifolds. In the present talk, we will show that some sort of positively curved Hilbert bundle still exists in the general Kähler context. This new technique can be applied to the long standing question of invariance of plurigenera for polarized families of compact Kähler manifolds.

(16) **Alexandru Dimca**: On the jumping lines of bundles of logarithmic vector fields along plane curves

Abstract: For a reduced curve C in the complex projective plane, we study the set of jumping lines for the rank two vector bundle E_C, whose sections are the logarithmic vector fields along C. We point out the relations of these jumping lines with the Lefschetz type properties of the Jacobian module of C and with the Bourbaki ideal of the module of Jacobian syzygies of C. In particular, when the vector bundle E_C is not stable, a line is a jumping line if and only if it meets the 0-dimensional subscheme defined by this Bourbaki ideal. Classical general results by W. Barth and K. Hulek resurface and give new insight in the study of this special class of vector bundles.

(17) **Igor Dolgachev**: Automorphism groups of Enriques and Coble surfaces of Hessian type

Abstract: The Hessian quartic surface of a Sylvester non-degenerate cubic surface admits a natural involution such that the quotient surface is either an Enriques surface or a Coble rational surface. I will report on a joint work with Daniel Allcock where we compute the group of automorphisms of such surfaces. In particular, we find that in the case when the cubic surface has one node and 6 Eckardt points, the group is naturally isomorphic to the affine group of orthogonal transformations generated by reflections across the faces of a regular tetrahedron and its symmetry group. The latter group has many other incarnations, e.g. we prove that it is isomorphic to a lattice in the p-adoc group $\mathrm{SL}_2(\mathbb{Q}_3)$.

(18) **Paola Frediani**: On the geometry of some Shimura subvarieties contained in the Torelli locus

Abstract: Almost all the examples of Shimura subvarieties of A_g contained in the Torelli locus are given by families of Jacobians of Galois covers of the projective line or of elliptic curves. They satisfy a sufficient condition that I will explain. I will first show that this condition is also necessary in the case of double covers of elliptic curves (joint work with Paola Porru). In fact I will prove that the bielliptic locus is not totally geodesic for $g > 3$. With similar techniques I will show that the bihyperelliptic locus is not totally geodesic. Finally I will discuss the geometry of some examples of Galois covers of the projective line yielding Shimura curves. In particular, I will show several cases where the Jacobians of

these coverings are isogenous to a product of elliptic curves. This is joint work in progress with Elisabetta Colombo and Irene Spelta.

(19) **Baohua Fu**: On Fano complete intersections in rational homogeneous varieties

Abstract: Complete intersections inside rational homogeneous varieties provide interesting examples of Fano manifolds. We first classify these Fano complete intersections which are locally rigid. It turns out that most of them are hyperplane sections. We then classify general hyperplane sections which are quasi-homogeneous. This is a joint work with Chenyu Bai and Laurent Manivel.

(20) **Alessandro Ghigi**: On the compactification of the connected component of automorphism groups of Kaehler manifolds

Abstract: Around 1978 Akira Fujiki and David Lieberman independently introduced a natural compactification of the connected component of the identity in the automorphism group of a compact Kaehler manifold. In the talk I will recall the construction of this compactification using Barlet cycle space. Then I will describe some recent results obtained jointly with Leonardo Biliotti. The main result is the interpretation of boundary points in terms of non-dominant meromorphic maps of the manifold to itself.

(21) **Yoshinori Gongyo**: Nef anti-canonical divisors and rationally connected fibrations

Abstract: We study the Iitaka-Kodaira dimension of nef relative anti-canonical divisors. As a consequence, we prove that given a complex projective variety with klt singularities, if the anti-canonical divisor is nef, then the dimension of a general fibre of the maximal rationally connected fibration is at least the Iitaka-Kodaira dimension of the anti-canonical divisor. This is a joint work with Sho Ejiri.

(22) **Klaus Hulek**: Moduli Spaces of Cubic Threefolds - Geometry and Topology

Abstract:x Cubic threefolds were the first class of varieties who were shown to be unirational but not rational (Clemens,Griffiths). The key tool of the proof is the intermediate Jacobian, a principally polarized abelian variety of dimension 5. There is a second link to Hodge theory, namely via cubic fourfolds (Allcock, Carlson, Toledo) which leads to a 10-dimensional ball quotient model. Looking at cubic threefolds from these different points of view leads to various geometrically relevant compactifications of the moduli space of cubic threefolds. In this talk I will discuss the geometry and the topology of these spaces. This is joint work with S. Casalaina-Martin, S. Grushevsky and R. Laza.

(23) **Jun-Muk Hwang**: On Hirschowitz's conjecture on the formal principle

Abstract: We say that a compact complex submanifold of a complex manifold satisfies the formal principle if its formal neighborhood determines its germ of analytic neighborhoods. In 1981, Hirschowitz conjectured that an unobstructed submanifold satisfies the formal principle if its normal bundle is globally generated. I explain an approach to this conjecture by the equivalence method for geometric structures.

(24) **Akira Ishii**: Dimer models with group actions

Abstract: Dimer models are bipartite graphs on the real two-torus. From a dimer model, we can construct a convex lattice polygon, which associates a Gorenstein affine toric 3-fold. On the other hand, the dual of a dimer model is regarded as a quiver with relation. If a dimer model satisfies the "consistency condition", then the path algebra modulo the relations is a non-commutative crepant resolution of the toric variety. In a joint work with Alvaro Nolla and Kazushi Ueda we considered a dimer model with a finite group action, which produces a NCCR of the quotient of the toric variety. There were some small remaining problem which we think are now settled.

(25) **Atsushi Ito**: On Loewy filtrations and K-stability of Fano varieties with non-reductive automorphism groups

Abstract: It is known that the automorphism group of a K-polystable Fano manifold is reductive. Codogni and Dervan construct a canonical filtration of the section ring, called Loewy filtration, and conjecture that the Loewy filtration destabilizes any Fano varieties, or more generally any polarized variety, with non-reductive automorphism group. In this talk, I will explain some examples related to Loewy filtrations.

(26) **Toshiyuki Katsura**: Automorphism groups of Enriques surfaces with quasi-elliptic fibration in characteristic 2

Abstract: In this talk, I will explain the outline of the classification theory of Enriques surfaces with finite automorphism group in characteristic 2, and show how to calculate the automorphism groups of Enriques surfaces with quasi-elliptic fibration. This is a joint-work with S. Kondo and G. Martin.

(27) **Ludmil Katzarkov**: Spectral coverings and Categories

Abstract: In this talk we build a parallel between classical theory of Del Pezzo Fibrations and Sheaves of categories.

(28) **Yujiro Kawamata**: Non-commutative deformations of simple objects in a category of perverse coherent sheaves

Abstract: I define the category of perverse coherent sheaves by using the Bondal-Rickard equivalence arising from a tilting bundle for a projective morphism. This category is more algebraic than the usual category of coherent sheaves. I consider non-commutative deformations, the deformations whose parameter algebras are non-commutative. Since the objects interact each other in non-commutative deformations, it is natural to consider multi-pointed deformations of simple collections. The versal deformations are important in the deformation theory as usual. I will determine the versal deformations for some sets of simple objects in some categories of perverse coherent sheaves.

(29) **Keum Jong-Hae**: Algebraic surfaces with minimal Betti numbers

Abstract: Among algebraic curves the projective line is the unique curve with minimum genus $g = 0$. In dimension 2, there are infinitely many families of surfaces with minimum

invariants $p_g = q = 0$. The algebraic surfaces in the title are those with the Betti numbers of the complex projective plane, and are called Q-homology projective planes. If such an algebraic surface has only quotient singularities, then its minimal resolution is a smooth surface with $p_g = q = 0$. Fake projective planes and the complex projective plane are smooth examples of a Q-homology projective plane. There are many families of singular examples. I will begin with basic definitions and examples and then describe recent progress in the study of such surfaces, singular ones and fake projective planes. I will also discuss open questions.

(30) **Young-Hoon Kiem**: Cosection localization and quantum singularity theory

Abstract: Enumerative invariants since 1995 are defined as integrals of cohomology classes over a particular homology class, called the virtual fundamental class. When there is a torus action, the virtual fundamental class is localized to the fixed points and this turned out to be the most effective technique for computation of the virtual integrals so far. About 10 years ago, Jun Li and I discovered that when there is a cosection of the obstruction sheaf, the virtual fundamental class is localized to the zero locus of the cosection. This also turned out to be quite useful for computation of Gromov-Witten invariants and more. In this talk, I will discuss a generalization of the cosection localization to real classes which provides us with a purely topological theory of Fan-Jarvis-Ruan-Witten invariants (quantum singularity theory) as well as some GLSM invariants. Based on a joint work with Jun Li at arXiv:1806.00116.

(31) **Bruno Klingler**: On the Zariski-closure of the Hodge locus

Abstract: Given a variation of Hodge structures V on a smooth complex quasi-projective variety S, its Hodge locus is the set of points s in S where the Hodge structure V_s admits exceptional Hodge tensors. A famous result of Cattani, Deligne and Kaplan shows that this Hodge locus is a countable union of irreducible algebraic subvarieties of S, called the special subvarieties of (S, V). In this talk I will discuss the geometry of the Zariski closure of the union of the positive dimensional special subvarieties. This is joint work with Ania Otwinowska.

(32) **Shigeyuki Kondo**: Classification of Enriques surfaces in characteristic 2 covered by the supersingular K3 surface with Artin invariant 1

Abstract: In this talk I will discuss Enriques surfaces whose canonical double covers are mutually isomorphic. I consider the most special but rich case, that is: the canonical cover is birational to the supersingular K3 surface with Artin invariant 1 in characteristic 2. I will give a classification of such Enriques surfaces into three types.

(33) **Sándor Kovács**: Liftable local cohomology and deformations

Abstract: This is a report on joint work with János Kollár. We introduce a lifting property for local cohomology, which leads to a unified treatment of the dualizing complex for flat morphisms with semi-log-canonical, Du Bois or F-pure fibers. As a consequence we obtain that, in all 3 cases, the cohomology sheaves of the relative dualizing complex are

flat and commute with base change. We also derive several consequences for deformations of semi-log-canonical, Du Bois and F-pure singularities.

(34) **Radu Laza**: Cubics with an Eckardt point

Abstract: I will discuss a surprisingly rich picture associated to a cubic hypersurface with an Eckardt point (i.e. a cubic with a hyperplane section isomorphic to the cone over a lower dimensional cubic). I will discuss potential connections to hyper-Kaehler manifolds and rationality questions.

This is joint work with G. Pearlstein and Z. Zhang.

(35) **Kyoung-Seog Lee**: Cox rings and derived categories of minimal surfaces of general type with $p_g = 0$

Abstract : Recently, there have been lots of new developments in the theory of minimal surfaces of general type with $p_g = 0$. In this talk, I will discuss Cox rings and derived categories of minimal surfaces of general type with $p_g = 0$. Part of this talk is based on joint works with JongHae Keum, Hyun Kyu Kim, Yun-Hwan Kim and Timofey Shabalin.

(36) **Yongnam Lee**: Relative S_2-condition and applications to $\mathbb{Q}$-Gorenstein morphisms

Abstract: Let Y, T be locally Noetherian schemes and F be a coherent $\mathcal{O}_Y$-module. Let $f : Y \to T$ be a flat morphism locally of finite type. In this talk, we give some criteria on the relative S_2-condition for F over T. In particular, we consider the case when F lies in an exact sequence

$$0 \to F \to E_1 \to E_2 \to G \to 0$$

of coherent $\mathcal{O}_Y$-modules satisfying suitable conditions. Then we show that the relative S_2-condition for F over T is equivalent to the flatness of G over T. We also show that if $\mathcal{O}_Y$ satisfies the relative S_2-condition then a reflexive sheaf F on Y admits such an exact sequence locally on Y when F is locally free in codimension one on each fiber. We apply them to the relative canonical sheaf ω_Y/T of an S_2-morphism $Y \to T$ and find some applications to $\mathbb{Q}$-Gorenstein morphisms. This is a joint work with Noboru Nakayama.

(37) **Wenfei Liu**: Simple-connectedness of Fano log pairs with semi-log-canonical singularities

Abstract: Fano manifolds are (complex) projective manifolds whose canonical class is anti-ample. It is now well-known that every Fano manifold is simply connected. In birational geometry, the notion of Fano manifolds is generalized to that of Fano log pairs, which allows singularities coming up naturally in the minimal model program. Correspondingly, the simple-connectedness of Fano pairs with log canonical singularities were proven by work of several authors.

In this talk, I will report on a further generalization in this direction, saying that any union of slc strata of a Fano log pair with semi-log-canonical singularities is simply connected. In particular, Fano log pairs with semi-log canonical singularities are simply connected. This is joint work with Osamu Fujino.

(38) **Angelo Lopez**: Extremal cycles and diagonals in symmetric products of curves

Abstract: The d-fold symmetric product C_d of a smooth curve C is a variety with very interesting geometry. There are, for example, several open questions on the cones of ample divisors, connected to classical conjectures, such as Nagata's. In the talk I will report on some recent work on the cones of nef and pseudoeffective n-cycles on C_d, by highlighting the fundamental role played by the diagonals. This is in collaboration with F. Bastianelli, A. Kouvidakis and F. Viviani.

(39) **Michael Lönne**: On homological stability of mapping class groups with twisted coefficients

Abstract: In this talk I review shortly homological stability for mapping class groups with trivial coefficients under the maps studied by Harer, Ivanov and others. Next I introduce actions on groupoid homomorphisms compatible with these maps. Reporting on work in progress with Fabrizio Catanese and Fabio Perroni, I will give homological stability results for the corresponding twisted coefficients (which are not polynomial). Also the relation to spaces of Galois coverings will be explained.

(40) **Frédéric Mangolte**: Algebraic models of the line in the real affine plane.

Abstract: We study the following real version of the famous Abhyankar-Moh Theorem: Which real rational map from the affine line to the affine plane, whose real part is a non-singular real closed embedding of $\mathbb{R}$ into $\mathbb{R}^2$, is equivalent, up to a birational diffeomorphism of the plane, to the linear one? We give some criterion in relation with the classification of Fake Real Planes previously obtained in a series of papers. See Real frontiers of fake planes, Eur. J. Math. 2 (2016), and Fake real planes: exotic affine algebraic models of $\mathbb{R}^2$, Selecta Math. 23 (2017). (Joint Work with Adrien Dubouloz.)

(41) **Massimiliano Mella**: Projective geometry and tensor identifiability

Abstract: A tensor rank-1 decomposition of a tensor T, lying in a given tensor space is an additive decomposition with rank one tensors. In many instances, for both pure and applied mathematics, it is interesting to understand when such a decomposition is unique, in a suitable sense. This problem translates very efficiently into geometric statements and can be attached via old and new techniques in projective geometry. In the talk I will survey on old and new result on the topic giving evidences towards the standard conjectures in this area.

(42) **Ngaiming Mok**: Curvature, Uniformization and Zariski Closures on Quotients of Bounded Symmetric Domains

Abstract: The asymptotic curvature behaviour of invariant metrics on bounded domains has been an important tool in several complex variables especially in characterization theorems. A first instance of such a result is the work of B. Wong (1977) showing that a strictly pseudoconvex domain in the Euclidean space is biholomorphic to the complex unit ball $\mathbb{B}^n$ whenever it admits a noncompact group of automorphisms, a result which was obtained by exploiting the asymptotic curvature behaviour of the Bergman metric and by the method of rescaling. Here by rescaling we mean the method of composing

with a divergent sequence of automorphisms and extracting a convergent subsequence. We will illustrate the method of rescaling by studying special classes of algebraic subsets of bounded symmetric domains in their Harish-Chandra realizations and illustrate how the method leads to solutions of problems on these domains concerning uniformization and functional transcendence theory, including (a) a solution of the characterization of totally geodesic subsets of $X_\Gamma = \Omega/\Gamma$, as the unique bi-algebraic subvarieties without making use of monodromy results of André-Deligne, and (b) a differential-geometric proof of the hyperbolic Ax-Lindemann Theorem for the rank-1 case, viz., the total geodesy of Zariski closures of images of algebraic subsets $Z \subset \Omega$ under the uniformization map $\pi_\Gamma : \mathbb{B}^n \to \mathbb{B}^n/\Gamma$ for torsion-free lattices $\Gamma \subset \mathrm{Aut}(\mathbb{B}^n)$. These solutions are obtained by studying the asymptotic behaviour of curvature forms and second fundamental forms and by the method of rescaling. By the analytic nature of our approach, these results are proven without restricting to arithmetic lattices.

(43) **Masaaki Murakami**: Surfaces with $c_1^2 = 9$ and $\chi = 5$ whose canonical classes are divisible by 3

Abstract: Study of surfaces with $p_g = 4$ has a long history, even from classical Italian school. In this talk, I shall explain my recent study on surfaces with $c^2 = 9$ and $\chi = 5$ whose canonical classes are divisible by 3 in the singular cohomology group with integral coefficients, where c_1^2 and χ denote the first Chern number and the Euler characteristic of the structure sheaf, respectively. The main results are: any such surface S is essentially a $(6, 10)$–complete intersection in the weighted projective space $\mathbb{P}(1, 2, 2, 3, 5)$; its canonical map $\Phi_{|K|} : S - - \to \mathbb{P}^3$ is either a birational map onto a singular sextic (general case) or a generically two–to–one mapping onto a cubic surface (special case); the coarse moduli space $\mathcal{M}$ of such surfaces is a unirational variety of dimension 34. As a byproduct, we can rule out a certain case (Case (ii), Proposition 1.7) mentioned in Ciliberto, C., Francia, P., Mendes Lopes, M., Remarks on the bicanonical map for surfaces of general type, Math. Z. 224 (1997), 137–166.

(44) **Yusuke Nakamura**: A vanishing theorem of Witt-vector cohomology of Ambro-Fujino type

Abstract: I will explain that the dual complex of a log Fano pair is simply connected. As a corollary, we can get a vanishing theorem of Witt-vector cohomology for log canonical Fano threefolds. This is an analogy of the Ambro-Fujino vanishing theorem in characteristic zero.

(45) **Juan Carlos Naranjo**: Hyperelliptic Jacobians and Isogenies

Abstract: We will report on a joint work with G.P. Pirola (arXiv:1705.10154).

We mainly consider abelian varieties isogenous to hyperelliptic Jacobians. In the first part of the talk we will prove that a very general hyperelliptic Jacobian of genus $g \geq 4$ is not isogenous to a non-hyperelliptic Jacobian. As a consequence we will obtain that the Intermediate Jacobian of a very general cubic threefold is not isogenous to a Jacobian.

Another corollary is that the Jacobian of a very general d-gonal curve of genus $g \geq 4$ is not isogenous to a different Jacobian.

In the second part we will consider a closed subvariety $\mathcal{Y} \subset \mathcal{A}_g$ of the moduli space of principally polarized varieties of dimension $g \geq 3$. We will show that if a very general element of $\mathcal{Y}$ is dominated by the Jacobian of a curve C and $\dim \mathcal{Y} \geq 2g$, then C is not hyperelliptic. In particular, if the general element in $\mathcal{Y}$ is simple, its Kummer variety does not contain rational curves. Finally, if time permits, we will show that a closed subvariety $\mathcal{Y} \subset \mathcal{M}_g$ of dimension $2g-1$ such that the Jacobian of a very general element of $\mathcal{Y}$ is dominated by a hyperelliptic Jacobian is contained either in the hyperelliptic or in the trigonal locus.

(46) **Frank Neumann**: Hochschild cohomology of dg-categories, spectral sequences and coherent sheaves

Abstract: The Hochschild cohomology of a differential graded algebra, or a differential graded category, admits a natural map to the graded center of its homology category: the characteristic homomorphism. We interpret it as an edge homomorphism in a spectral sequence. This gives a conceptual explanation of the failure of the characteristic homomorphism to be injective or surjective, in general. To illustrate this, we discuss coherent sheaves over algebraic curves, as well as examples related to free loop spaces. Joint work with M. Szymik (Trondheim).

(47) **Keiji Oguiso**: Minimum positive entropy of complex Enriques surface automorphisms

Abstract: We determine the minimum positive entropy of complex Enriques surface automorphisms. This together with McMullen's work completes the determination of the minimum positive entropy of complex surface automorphisms in each class of Enriques-Kodaira classification of complex surfaces. As in McMullen's work, we finally reduce the problem to computer algebra.

In this talk, after recalling known results and differences from Enriques case, I would like to explain how one can reduce this problem to finite computational problems which can be done by computer. This is a joint work with Professor Xun Yu.

(48) **Shinnosuke Okawa**: On the definition of noncommutative del Pezzo surfaces

Abstract: Noncommutative projective planes and noncommutative quadrics are defined as abelian categories associated to the so-called 3-dimensional AS-regular quadratic (resp. cubic) Z-algebras. Moreover there is a bijective correspondence between such algebras and certain geometric data consisting of a genus one curve and a collection of line bundles on it. I will talk on a work in progress with Tarig Abdelgadir and Kazushi Ueda which aims to generalize this story to obtain solid definition and classification of noncommutative del Pezzo surfaces of all other types as well.

(49) **Matteo Penegini**: On Zariski multiplets of branch curves

Abstract: In this talk, I consider Zariski multiplets of plane singular curves obtained as branched curves of ramified covering of the plane by surfaces isogenous to a higher product with group $(\mathbb{Z}/2\mathbb{Z})^k$. This is a joint work in progress with Michael Loenne.

(50) **Fabio Perroni**: On the homology stability for moduli spaces of curves with symmetry, the case of closed surfaces

Abstract: I will report on a joint work with Fabrizio Catanese and Michael Lönne, where we investigate the stability of the homology of moduli spaces of (smooth) curves C with a given group of symmetry G. Over the field of rational numbers, the homology of these moduli spaces are interpreted as equivariant homology $H_*(Map_{g',d}, HV(G;g',d)/G)$ of the mapping class group $Map_{g',d}$ acting on $HV(G;g',d)/G$, where $HV(G;g',d)$ is the set of Hurwitz vectors corresponding to coverings $C \to C/G$, g' is the genus of C/G, d is the number of branch points of the covering $C \to C/G$, and G acts on $HV(G;g',d)$ via conjugation. Homology stability means that $H_p(Map_{g',d}, HV(G;g',d)/G)$ does not depend on g', for g' sufficiently large with respect to p. To address this problem we follow two steps. The first step consists in proving that homology stability holds true for the mapping class group of surfaces with one boundary component, $Map^1_{g',d}$, acting on $HV(G;g',d)/G$. In the second step we study the map $k\colon H_*(Map^1_{g',d}, HV(G;g',d)/G) \to H_*(Map_{g',d}, HV(G;g',d)/G)$, which is induced by the morphism of groups $Map^1_{g',d} \to Map_{g',d}$ obtained by glueing a disk along the boundary component. While the first step is almost completed, in the second one more work remains to be done to prove that k is an isomorphism in a certain range.

(51) **Thomas Peternell**: The Decomposition Theorem for singular Ricci-flat Varieties

Abstract: Given a projective manifold with trivial canonical bundle, a famous theorem, due to Beauville-Bogomolov-Kobayashi-Michelson, states, that - possibly after finite étale cover - X decomposes into a product of an abelian variety, Calabi-Yau manifolds and irreducible symplectic manifolds. In my talk I will discuss recent work with A. Höring, where we generalized this theorem to the case of minimal models with vanishing Kodaira dimension, i.e., to varieties with canonical singularities and trivial canonical class.

(52) **Roberto Pignatelli**: Rigid but not infinitesimally rigid compact complex manifolds

Abstract: We give an infinite series of rigid compact complex manifolds for each dimension $d \geq 2$ which are not infinitesimally rigid. In other words, all small deformations of their complex structure is trivial, but the first cohomology group of their tangent spaces is positive dimensional. This gives a complete answer to a problem stated by Morrow and Kodaira in the famous book "Complex manifolds". This is a joint work with I. Bauer.

I will explain our basic constructions, minimal resolution of the singularities of the quotient of a product of two curves with nodes; by a classical result of Burns and Wahl, the nodes ensures the surface to be not infinitesimally rigid. Then I will explain our criterion for rigidity, that applies to our surfaces answering Morrow-Kodaira's question.

(53) **Gian Pietro Pirola**: The number of odd ramification maps on a general curve

Abstract: Let C be a general complex curve of genus $g > 2$ and $d = 2g + 1$. It has been proved by Magaard and Völklein that there is a finite number $N(g)$ of maps from C to the projective line having only odd (and then necessarily 3:1) ramific ation points. These numbers $N(g)$, that we call the alternate Catalan numbers, are the degrees of dominant maps from Hurwitz spaces of maps to the moduli space of curves. In collaboration with Farkas, Moschetti and Naranjo we give the following:

`Theorem`: Denote by $\sigma_{0,5}$ and $\sigma_{1,4}$ the Schubert cycles in the Grassmannian of lines in the projective space of dimension $2g + 1$, then $N(g) = 16^g(\sigma_{0,5} + \sigma_{1,4})^g$.

A generating function for the alternate Catalan numbers is also available. The method of the proof involves degeneration (in the Eisenbud-Harris style) to a curve with g-elliptic tails and some de Rham theory.

(54) **Yuri Prokhorov**: Tetragonal conic bundles

Abstract: This is joint work in progress with V. Shokurov. I outline an approach to the rationality problem of three-dimensional conic bundles based on the Sarkisov program and Mori theory.

(55) **Xavier Rolleau**: Construction of Nikulin configurations on some Kummer surfaces

Joint work with Alessandra Sarti. A Nikulin configuration on a K3 surface is a set C of 16 smooth disjoint rational curves. By the results of Nikulin, any K3 surface X containing a Nikulin configuration is a Kummer surface, which means that there exists an abelian surface A such that X is the minimal resolution of the quotient A/[-1] and the exceptional curves of the resolution X→A[-1] are the 16 curves of the Nikulin configuration C (this is denoted X=Km(A)). In this talk, starting with a Kummer configuration C on some polarised Kummer surface X, we will explicitly construct another Kummer configuration C on X such that if A and A' denotes the associated Abelian surfaces, although one has: Km(A)=X=Km(A'), the Abelian surfaces A and A' are not isomorphic (unless X is a Jacobian Kummer surface). If we have enough time we will derive some applications on the construction surfaces of general type, like the Schoen surfaces.

(56) **Matthias Schütt**: Lines on surfaces in $\mathbb{P}^3$ - from quartics to quintics

Abstract: How many lines may a surface in $\mathbb{P}^3$ contain? Starting from the classical answer for smooth cubic surfaces, we review whats known for quartics, with emphasis on the so-called lines of the second kind. Then we turn to higher degree and introduce suitable functions which give control over the valency of a given line. As an application, we derive a new upper bound for the maximum number of lines on a smooth quintic in $\mathbb{P}^3$. (Joint work with S. Rams)

(57) **Lidia Stoppino**: Irregular varieties on the Clifford-Severi lines

Abstract: Let X be an n-dimensional complex variety with a morphism a: $X \to A$ to an abelian variety finite onto its image and such that the induced homomorphism on the Pic^0's is injective (for example take $a = alb_X$ and X a variety of maximal Albanese dimension). Let L be a line bundle on X and let $h^0_a(L) = \min h^0(L + a^*P), P \in Pic^0(A)$

be its continuous rank with respect to a. The following "Clifford-Severi" inequalities have been proved by Barja (starting from Pardinis proof of the Severi inequality for surfaces):

1) $vol(L) \geq n! h^0_a(L)$;

2) $vol(L) \geq 2n! h^0_a(L)$ if $K_X - L$ is pseudoeffective.

Both inequalities are sharp. The classification of the triples (X, a, L) reaching the equalities (i.e. on the Clifford-Severi lines) has proven to be very hard, mainly due to the fact that Barjas arguments involve a limit. Using new techniques introduced together with Barja and Pardini, as well as new inequalities deriving from them, it is possible to produce a classification of these triples in any dimension. The cornerstones of our new methods are: the "eventual map" naturally associated to L, factorizing a, and a continuous real extension of the continuous rank. In this talk I will explain the proof of the classification, discuss examples and formulate some open problems.

(58) **Gang Tian**: On uniform K-stability of pairs

Abstract: I will discuss K-stability of pairs first studied by S. Paul. I will show that stable pairs are uniformly K-stable. I will also give an application to the study of CM-stability.

(59) **Gerard Van der Geer**: Modular Forms of Genus 2 and 3 and invariant theory

Abstract: Siegel modular forms live on the moduli of abelian varieties and Teichmueller modular forms on the moduli of curves. We show how invariant theory can be used to efficiently describe such modular forms for genus 2 and 3. This is joint work with Fabien Clery and Carel Faber.

(60) **Alessandro Verra**: Coble cubics, genus 10 Fano threefolds and the theta map

Abstract: The talk deals with the relations between two different moduli spaces. From one side the branch divisor B is considered for the theta map of the moduli of semistable rank r vector bundles with trivial determinant on a genus 2 curve C. Special attention is payed to the case $r = 3$. Here B is the sextic dual to the Coble cubic, the unique cubic hypersurface singular along the embedding of the Jacobian JC by its 3-theta linear system. From the other side the moduli space of Fano threefolds X of genus 10 is considered. Since the intermediate Jacobian of X is JC, for a given genus 2 curve C, the assignment $X \to C$ defines a rational map $f : F \dashrightarrow M$, M being the moduli space of genus 2 curves. Relying on the properties of theta map, and of its ramification divisor, a description of the map f and of its fibres is outlined. The main result is that the fibre of f is naturally birational to the Coble cubic defined by JC. This is a joint work in progress with Daniele Faenzi.

(61) **Claire Voisin**: Segre classes of tautological bundles on Hilbert schemes of surfaces and the Lehn conjecture

Abstract: We establish geometric vanishings in certain ranges for the top Segre classes of tautological bundles of punctual Hilbert schemes of K3 surfaces (which had been first obtained by Marian-Oprea-Pandharipande by different methods) and also K3 surfaces blown-up at one point. We show how all the Segre numbers for any surface and any polarization

are formally determined by these vanishings and we reduce the Lehn conjecture to showing that Lehns function also has these vanishing properties. Marian-Oprea-Pandharipande in turn used the present results to complete recently the proof of Lehns conjecture.

(62) **Umberto Zannier**: Some specialization theorems for families of abelian varieties

Abstract: Consider an algebraic family $\pi : A \to S$ of abelian varieties, defined over $\overline{\mathbb{Q}}$. We shall be concerned with properties of the generic fiber of A which are preserved by taking some (or 'many') suitable special fibers. For instance, 'simplicity' is such a property, and also the endomorphism ring structure. This was considered by various authors, whose results shall be surveyed on. We shall then focus on more recent instances. One example concerns families of Pell's equations in polynomials: this can be related to hyperelliptic Jacobian-families. Another issue which we shall discuss, raised by Katz and Oort, concerns the existence of abelian varieties over $\overline{\mathbb{Q}}$ not isogenous to a Jacobian.

(63) **Francesco Zucconi**: Adjoint quadrics and Torelli-type theorems

Abstract: TBA

(64) **Daniele Zuddas**: The smooth presentation of non-smoothable 4-manifolds

Abstract: Smooth compact 4-manifolds can be presented by handle decompositions, and triangulations. However, non-smoothable 4-manifolds have no such decompositions. Nevertheless, we will describe a way to understand non-smoothable topological 4-manifolds by using smooth objects. This leads to a presentation of all topological 4-manifolds by means of a finite amount of combinatorial data. This is a joint work with Michael Hartley Freedman.