ABSTRACTS- PLENARY SPEAKERS

Dmitri Alekseevsky – *Cohomogeneity one Kähler and Kähler-Einstein manifolds*.
Abstract: We describe structure of cohomogeneity one G-manifolds M of a compact semisimple Lie group G wich admit an invariant Kähler structure in terms of painted Dynkin diagrams under some weak extra condition. An explicit description of such invariant Kähler and Kähler-Einstein structures is given. (This is a joint work with A. Loi and F. Zuddas)

Vestislav Apostolov – *From locally conformally Kähler to bi-Hermitian structures*.
Abstract: R. Goto has proved that one can deform any Kähler metric on a compact complex manifold endowed with a holomorphic Poisson structure into a family of (non-Kähler) generalized Kähler structures. On a compact complex surface, I will discuss a framework in which this result can be suitably extended to the non-Kähler case, and thus present new existence results for bi-Hermitian metrics on certain classes of compact complex surfaces with odd first Betti number. This is a joint work with Michael Bailey and Georges Dloussky.

Florin Belgun – *Special classes of non-Kähler metrics in low dimensions*
Abstract: One can usually endow a non-Kähler complex surface with a locally conformally Kähler (l.c.K.) metric, of which a special class consists of Vaisman manifolds, that generalize the natural metric on the standard Hopf manifold and are well understood today. In complex dimension 3 and higher, the classical Calabi-Eckmann complex manifolds can not admit l.c.K. metrics, but there is a special class of Hermitian metrics, that we call generalized Calabi-Eckmann metrics, that is adapted to this construction. We show that on compact complex 3-manifolds, this class of metrics have an uniformization property: they can be deformed to locally homogeneous ones belonging to one of 6 possible geometric types.

Vicente Cortés – *Homogeneous locally conformally Kähler manifolds* .
Abstract: We prove various classification results for homogeneous locally conformally symplectic manifolds. In particular, we show that a homogeneous locally conformally Kähler manifold of a reductive group is of Vaisman type if the normalizer of the isotropy group is compact. We also show that such a result does not hold in the case of non-compact normalizer and determine all left-invariant locally conformally Kähler structures on reductive Lie groups. (This is a joint work with D. Alekseevsky, K. Hasegawa and Y. Kamishima).

Jean Pierre Demailly – *Strong openness conjecture and generalized Nadel vanishing theorem*.
Abstract: This will be a survey talk covering recent results on the solution of the strong openness conjecture by Q.Guan-X.Zhou and Pham H.Hiep, and extensions of the Nadel vanishing theorem using techniques due to Ch.Mourougane, J.Cao and the lecturer. As a consequence, one gets optimal vanishing results of Nadel type for pseudoeffective line bundles over general compact Kähler manifolds.

Marisa Fernández – *On the formality of co-symplectic and Sasakian manifolds*.
Abstract: In this talk, we study the formality of the mapping torus of an orientation-preserving diffeomorphism of an oriented compact differentiable manifold. In particular, we give conditions under which a mapping torus, not necessarily symplectic, has a non-zero Massey product. We apply this to prove that there are non-formal compact co-symplectic manifolds of dimension m $(= 2n+1)$ and with first Betti number b if and only if $m = 3$ and $b \geq 2$, or $m \geq 5$ and $b \geq 1$. We show explicit examples for each one of these cases. On the other hand, answering questions raised by Boyer and Galicki, we prove that all higher Massey products on any simply connected Sasakian manifold vanish. Nevertheless, for every $n \geq 3$, we exhibit the first examples of simply connected compact Sasakian manifolds of dimension $2n+1$ which are non-formal because they have a non-zero triple Massey product. (this is a joint work with G. Bazzoni, I. Biswas, V. Muñoz and A. Tralle).

Akira Fujiki – *Donaldson-Friedman degeneration of anti-self-dual hermitian structures and Lee classes*.
Abstract: In the previous paper with M. Pontecorvo we have constructed on any hyperbolic Inoue surface S a degenerating family of anti-self-dual (bi)-hermitian structures with m-dimensional real and smooth parameters which is universal at each point of the parameter space, by using the twistor method of Donaldson and Friedman, where m is the second betti number of S. However, in this construction it is at all not clear how these m-dimensional parameters are related to the invariants of the corresponding (possible) anti-self-dual structures. I will talk about the following result which should be an important step toward

the complete understanding of the desired geometric interpretation of the parameters. We determine in general the behavior of the Lee classes associated to the anti-self-dual structures when the latter degenerate. This in particular shows that Lee class can be taken as a part of the coordinates of our parameter space.

Ryushi Goto – *Deformations of generalized complex manifolds and locally conformally generalized Kähler structures*.
Abstract: In this talk, I discuss deformations of generalized complex surfaces and 3-folds and construct moduli spaces of generalized complex structures (G.C.S.) on several del Pezzo surfaces and 3-folds as G.I.T quotients. Complex projective 2-space is rigid as a complex manifold, however it admits deformations as generalized complex manifolds which are obtained by cubic curves. The deformation space of complex projective 3-space consists of six components. I also introduce locally conformally generalized Kähler structures (lc G.K.) and obtain the stability theorem and discuss relations with bihermitian structures.

Yoshinori Namikawa – *A characterization of nilpotent varieties of complex semisimple Lie algebras*.
Abstract: A complex normal variety X is called a symplectic variety if it admits a holomorphic symplectic 2-form w on the regular part of X and w extends to a holomorphic 2-form on a resolution Y of X. Compared with the compact case, there are a lot of examples of affine symplectic varieties. They are not only interesting objects in algebraic geometry, but also play important roles in geometric representation theory.
The aim of this talk is to characterize the nilpotent variety of a complex semisimple Lie algebra among affine symplectic varieties. The main result is that if (X, w) is an affine singular symplectic variety embedded in an affine space as a complete intersection of homogeneous polynomials and w is homogeneous, then (X, w) coincides with the nilpotent variety N of a complex semisimple Lie algebra together with the Kostant-Kirillov symplectic form.

Massimiliano Pontecorvo – *Index of Kato surfaces*.
Abstract: The rational curves of an intermediate Kato surface S are a basis of $H^2(S,\mathbb{Q})$. We present a way to express the rational coefficients of the first Chern class $c_1(S)$ and give some application in the case they are integral, or equivalently Index$(S) = 1$. Joint work with Prof. A. Fujiki.

Simon Salamon – *Configurations of points in the ?complex projective plane* .
Abstract: The nine flexes of a non-singular cubic curve $x^3+y^3+z^3 = cxyz$ have the remarkable property that any two have the same distance apart, when measured using the Fubini-Study metric. We shall classify configurations of equally-separated sets of points in $\mathbb{CP}^2$, so-called SIC-POVM's relevant to quantum information, using the moment mapping for the standard action of a maximal torus. They are in fact all isometric to sets in which each element has one homogeneous coordinate equal to zero (and not necessarily the flexes of a cubic), though the proof of this relies on a computation using multiplicities and Groebner bases.
This is joint work with Lane Hughston, and the talk is a sequel to one given in Turin in 2013 for the LM:
https://www.youtube.com/watch?v=LlBDl-DkOBk

Adriano Tomassini – *On The cohomology of complex manifolds* .
Abstract: Recently some authors have been studied cohomological properties of compact complex and almost-complex manifolds. In this talk we will report on some recent results on various kind of cohomological decompositions on compact complex non-Kähler manifolds, involving the de Rham, Bott-Chern and Aeppli cohomologies. We would like also to discuss the almost-complex case. The results have been obtained in joint papers with Angella, Fino, Hind, Medori and Zhang.

Misha Verbitsky – *Hypercomplex manifolds of quaternionic dimension 2 and HKT-structures* .
Abstract: HKT metric on a hypercomplex manifold is a natural analogue of Kähler metric on a complex manifold. We push this analogy further, proving a quaternionic analogue of Buchdahl-Lamari's theorem for complex surfaces. Buchdahl and Lamari have shown that a complex surface M admits a Kähler structure iff $b_1(M)$ is even. We show that a hypercomplex manifold M with Obata holonomy $SL(2,H)$ admits an HKT structure iff $H^{0,1}(M)$ is even. This is a joint work with Geo Grantcharov and Mehdi Lejmi.

ABSTRACTS- RESEARCH SPEAKERS

Amedeo Altavilla – *The real differential of a slice regular function.*
Abstract: In a recent work by G.Gentili, S.Salamon and C.Stoppato, the authors shows an interesting relation between the character of quaternionic functions of one quaternionic variable which are slice regular (definitions and fundamental properties will be stated) and the complex geometry of $\mathbb{R}^4$ minus a parabola. The set of functions considered in their work is restricted to a certain subclass in which the domain of definition has nonempty intersection with the real axis. In this talk I will show that at least the analytic setting of this theory is restored if the domain of definition of such functions does not intersects the real axis. Some examples will be given.

Stefan Bechthtluft-Sachs –*Congruence Invariants for Holomorphic Maps and Rigidity*.
Abstract: Metric rigidity of holomorphic maps (as that of smooth maps between Riemannian mannifolds) generally requires some kind of non degenderacy assumptions. Thus holomorphic maps in complex projective spaces are congruent if they have the same first fundamental form. In Hermitian symmetric target spaces of higher rank however, the maps should be full in the sense that their osculating space exhausts the ambient tangent space. In Grassmannians this can be resolved by fixing the second fundamental form as well, but this overdetermines the map.

Jess Boling –*Homogeneous Solutions of Pluriclosed Flow on Closed Complex Surfaces*.
Abstract: Streets and Tian introduced a parabolic flow of pluriclosed metrics. We classify the long time behavior of homogeneous solutions of this flow on closed complex surfaces including minimal Hopf, Inoue, Kodaira, and non-Kähler, properly elliptic surfaces. We also construct expanding soliton solutions to the flow on the universal covers of these surfaces by taking blowdown limits of these homogeneous solutions. Abstract:

Giovanni Calvaruso – *A complete classification of four-dimensional paraKähler Lie algebras*.
Abstract: Let $\mathfrak{g}$ denote an arbitrary $2n$-dimensional Lie algebra. A symplectic structure on $\mathfrak{g}$ is a closed 2-form ω on $\mathfrak{g}$ of maximal rank, that is, such that $\omega^n \neq 0$. A paraKähler Lie algebra is an even-dimensional Lie algebra $\mathfrak{g}$, equipped with a pair (J, g), where J is a paracomplex structure and g a pseudo-Riemannian metric, such that the fundamental 2-form $\Omega(X, Y) = g(X, JY)$ is symplectic. We present a complete classification of left-invariant paraKähler structures on four-dimensional Lie algebras and a study of their geometry, emphasizing different behaviours with respect to their Kähler analogues.

Simon Chiossi – *Hermitian surfaces with small holonomy*.
Abstract: I'll discuss Hermitian surfaces (compact or not) with holonomy of dimension one. These are special Kähler-Hermitian 4-manifolds with invariant Ricci tensor, and many instances arise by deformations of Kähler surfaces of Calabi type. The classification remarkably ties in with the theory of Abelian vortices, affine spheres and Lagrangian immersions in projective space.

Yunhyung Cho – *Hard Lefschetz property for Simple Hamiltonian S^1-manifolds*.
Abstract is missing

Zdenek Dusek – *How many are torsion-less affine connections in general dimension*.
Abstract: We study the question how many real analytic torsion-free affine connections exist on a smooth manifold and how many of these connections have skew-symmetric Ricci tensor (joint work with O. Kowalski).

Yunhee Euh – *Orthogonal almost complex structures on the Riemannian products of even dimensional spheres*.
Abstract: In this talk, we shall describe the integrability of orthogonal almost complex structures on Riemannian products of even dimensional round spheres. As an application, we shall give a partial answer of the problem proposed by E. Calabi [Ca]. Let $M = V^2 \times S^4$, where V^2 is an orientable closed surface and S^4 is the 4-dimensional round sphere. Does the orthogonal almost complex integrable?
References: [Ca] E. Calabi, Construction and properties of some 6-dimensional almost complex manifold, Trans. Amer. Math. Soc. 87 (1958), 407–438.

Marco Freibert –*On the boundary behaviour of the hypo and Hitchin flow on Lie groups*.
Abstract: The hypo/Hitchin flow starts with a certain type of G-structure on a five-, six- or seven-dimensional manifold M and constructs from this initial data a Riemannian metric g on $M \times I$ with holonomy in $SU(3)$, G_2 or $Spin(7)$, respectively, which is incomplete if the open interval I is not the entire real line.
However, if the flow degenerates nicely at the boundary of I, one may extend $(M \times I, g)$ to a complete manifold containing $(M \times I, g)$ as an open, dense subset as it happens for the Hitchin flow on $S^3 \times S^3$ for certain left-invariant initial values. In contrast, Conti showed that the hypo flow on five-dimensional nilpotent Lie groups yields Riemannian manifolds which cannot be extended at any point of ∂I.

In this talk, I present joint work with Florin Belgun, Vicente Cortés and Oliver Goertsches which extends Conti's negative result to the Hitchin flow and certain types of split-solvable Lie groups. Moreover, I show that the Hitchin flow

with maximally symmetric initial values on the Lorentz group yield Riemannian manifolds with holonomy G_2 which can be extended at precisely one boundary point.

Rebecca Glover – *Generalized twistor spaces for hyperkähler manifolds*.
Abstract: Generalized complex geometry is a simultaneous generalization of symplectic and complex geometry. In this talk, we will discuss generalized complex structures on hyperkahler manifolds. We will describe the generalized twistor space of a hyperkahler manifold M: a $\mathbb{CP}^1 \times \mathbb{CP}^1$ fibration over M constructed by considering a family of generalized complex structures on M. We will show that this space is itself a generalized complex manifold and detail its properties. If time, we will explain how to modify this construction for quaternionic Kahler and hypercomplex manifolds.

Hiroaki Ishida – *Complex manifolds with maximal torus actions*.
Abstract: We say that an effective action of a compact torus G on a connected manifold M is maximal if there is a point x such that $\dim G + \dim G_x = \dim M$. In this talk, We give a one-to-one correspondence between the family of compact connected complex manifolds with maximal torus actions and the family of certain combinatorial objects, like toric geometry.

Wlodzimierz Jelonek – *Kähler surfaces with quasi-constant holomorphic curvature*.
Abstract: We describe a class of Kahler surfaces with quasi-constant holomorphic curvature.

Hisashi Kasuya – *Hodge theory on solvmanifolds*.
Abstract: It is known that almost all solvmanifolds are non-Kahler. By studying the Hodge theoretical properties of solvmanifolds, we try to find interests in Hodge theory on non-Kahler manifolds.

Eveline Legendre – *Labelled convex quadrilaterals and toric Kähler-Levi structures on the CR structure of $S^3 \times S^3$*.
Abstract: I will explain a correspondence between labelled convex quadrilaterals and the set of T^4 invariant connection 1-forms on $S^3 \times S^3$ whose differential define a positive definite 2-form on the natural CR structure of $S^3 \times S^3$. These structures define transversal Kähler structures with a Hamiltonian 2-form, which are canonical metrics Kähler metrics on the compact toric orbifolds obtained as the quotient in the rational cases. Using the negative complex CR structure, we get all the toric cscK metrics on compact symplectic toric orbifolds having a quadrilateral as moment polytope.

Thomas Madsen – *The geometry of SO(3)-structures on 6-manifolds*.
Abstract: This talk discusses the geometry associated with Riemannian six-manifolds endowed with an infinitesimal action of the Lie group SO(3) by which each tangent space splits into two irreducible three-dimensional summands. Unravelling the theory leads, amongst others, to a generalization of the nearly-KÂŁhler metric on S3xS3; these particular SO(3)-structures are characterized by the condition of invariant (intrinsic) torsion. They come with an associated$SU(3)$-structure which is (usually) not Calabi-Yau but may be "half-flat". In that case, we can use Hitchin's evolution equations so as to obtain metrics with holonomy G_2. I shall conclude by discussing a systematic way of solving the evolution equations in this setting. The talk is based on joint work, in progress, with Diego Conti.

Shin-ichi Matsumura – *An injectivity theorem with multiplier ideal sheaves of singular metrics with transcendental singularities*.
Abstract: The injectivity theorem is a generalization of the cohomology vanishing theorem (such as, the Kodaira vanishing theorem) in complex (algebraic) geometry. In this talk, I would like to give an injectivity theorem with multiplier ideal sheaves of singular metrics. This result is a generalization of various injectivity and vanishing theorems. If time permits, I give applications.

Homare Tadano – *Gap theorems for compact gradient Sasaki-Ricci solitons*.
Abstract: The Sasaki geometry is an odd dimensional counterpart of the Kähler geometry and plays an important role in theoretical physics. In this talk, we give some necessary and sufficient conditions for compact gradient Sasaki-Ricci solitons to be Sasaki-Einstein. Our result may be considered as a Sasaki geometry version of recent works by H. Li and M. Fernandez-Lopez-E. Garcia-Rio.