Administrative information

Aims of the conference

This international conference will gather experts in Complex Hermitian Geometry for a week in Angers. It will be the closing conference of the ANR Project PARAPLUI and it will also be the occasion to celebrate Professor Paul Gauduchon's 80th birthday.

Dates and location

The conference will take place at Université d'Angers

Amphi Ardoise, on the fifth floor

Faculté de droit, d'économie, et de gestion

13 Allée François Mitterrand 49036 Angers

Monday May 19 until Friday May 23, 2025

Practical information

The coffee break will take place in room 506, on the fifth floor.
The cocktail will be held in Espace Coworking on the ground floor.
Lunch will be served in the Crous restaurant located next to the conference building.

The social dinner will take place on **Thursday, May 22, 19h30**, at the Restaurant **"La Ferme", 2 Place Freppel, Angers**.

Participants

1. Soufian Abja, A&M University Qatar, Qatar
2. Roberto Albesiano, University of Waterloo, Canada
3. Omar Alehyane, Chouaib Doukkali University, Maroc
4. Daniele Angella, Università di Firenze, Italy
5. Vestislav Apostolov, Université du Québec à Montréal, Canada
6. Giuseppe Barbaro, Aarhus University, Denmark
7. Houda Bellitir, Moulay Ismail University, Maroc
8. Florin Belgun, Inst. of Math. of the Romanian Academy, Romania
9. Olivier Biquard, Sorbonne Université, France
10. Sébastien Boucksom, Sorbonne Université, France
11. David Calderbank, University of Bath, England
12. Longteng Chen, Université Paris Saclay, France
13. Yenni Chabane Cherik, Université d'Angers, France
14. Guilherme Goncevalves Cerqueira, Université de Toulouse, France
15. Quang-Tuan Dang, ICTP, Trieste, Italy
16. Thibaut Delcroix, Université de Montpellier, France
17. Sławomir Dinew, Jagiellonian University, Poland
18. Eleonora Di Nezza, Sorbonne Université, France
19. Georges Dloussky, Aix-Marseille Université, France
20. Yanbo Fang, Aarhus University, Denmark
21. Yuetong Fang, Université d'Angers, France
22. Siarhei Finski, École Polytechnique, France
23. William Fremont, Université d'Angers, France
24. Paul Gauduchon, École Polytechnique, France
25. Keita Goto, The University of Tokyo, Japan
26. Vincent Guedj, Université de Toulouse, France
27. Henri Guenancia, Université de Bordeaux, France
28. Louis Ioos, Cergy Paris Université, France
29. Nicolina Istrati, Université d'Angers, France

30. Mattias Jonsson, University of Michigan, United States
31. Simon Jubert, Sorbonne Université, France
32. Abdelouaab Khelifati, Université de Toulouse, France
33. Claude LeBrun, Stonybrook University, United States
34. Eveline Legendre, Université Claude Bernard Lyon 1, France
35. Junbang Liu, Stony Brook University, United States
36. Hoang-Chinh Lu, Université d'Angers, France
37. Matthieu Madera, Université Côte d'Azur, France
38. Asia Mainenti, Università Di Torino, Italy
39. Laurent Meersseman, Université d'Angers, France
40. Andrei Moroianu, Université Paris-Saclay, France
41. Liviu Ornea, University of Bucharest, Romania
42. Chung-Ming Pan, Université du Québec à Montréal, Canada
43. Sönke Rollenske, Philipps-Universität Marburg, Germany
44. Giacomo Perri, Aarhus University, Denmark
45. Pietro Piccione, Sorbonne Université, France
46. Mihaela Pilca, University of Regensburg, Germany
47. Mousa Rasheed, Université d'Angers, France
48. Carlo Scarpa, Université Claude Bernard Lyon 1, France
49. Cristiano Spotti, Aarhus University, Denmark
50. James Stanfield, University of Muenster, Germany
51. Killian Sylvestre, Université de Nantes, France
52. Jeffrey D. Streets, University of California, United States
53. Nicoletta Tardini, Università di Parma, Italy
54. Itsuki Tazoe, The University of Tokyo, Japan
55. Junhao Tian, Stonybrook University, United States
56. Tat-Dat Tô, Sorbonne Université, France
57. Alejandro Tolcachier, Università degli studi dell'Insubria, Italy
58. Christina Tonnesen-Friedman, Union College, United States
59. Ahmed Zeriahi, Université de Toulouse, France

Abstracts

Daniele Angella

Some problems for Gauduchon metrics on complex non-Kähler manifolds

After the pioneering work of Professor Paul Gauduchon, we now possess strong tools to investigate the Hermitian geometry of complex non-Kähler manifolds, including Gauduchon metrics and Gauduchon connections.

Utilizing these tools, and in an attempt to move from the Kähler to the non-Kähler setting, several problems concerning Hermitian metrics with special curvature properties naturally arise. Among these, we mention the existence of Hermitian metrics with constant scalar curvature with respect to the Chern connection, as well as generalizations of the Kähler-Einstein condition to the non-Kähler case.

Growing interest has been devoted to geometric flows preserving Hermitianity. Among these, the Chern-Ricci flow is a parabolic evolution equation for Hermitian metrics that generalizes the Kähler-Ricci flow to the Hermitian setting.

Ultimately, it is expected that the behavior of solutions to the Chern-Ricci flow reflects the underlying complex structure of the manifold. In particular, understanding the behavior of the Chern-Ricci flow on non-Kähler compact complex surfaces is of special interest, especially on minimal class VII surfaces.

Regarding this, we study the convergence of the normalized Chern-Ricci flow on Inoue-Bombieri surfaces, starting at Gauduchon metrics.

In this talk, we present some joint works with Valentino Tosatti and Mauricio Corrêa, and acknowledge inspiring collaborations and discussions with Simone Calamai, Francesco Pediconi, Cristiano Spotti, Oluwagbenga Joshua Windare, and many others.

Auguri Professore!

Florin Belgun

Structure of curves in conformal manifolds

An immersed curve in a conformal manifold or a Möbius surface is naturally endowed with a projective structure, i.e. with an atlas whose transition functions are homographies. For a closed curve, such a projective class is a point in a certain non-Hausdorff space which is connected and locally one-dimensional. Not all these may however be realized by immersed curves in a given conformal manifold. Determining the full range of the projective classes that are realized by closed curves in a given manifold would lead to a conformal invariant

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Olivier Biquard

Gravitational instantons and Hermitian geometry

Gravitational instantons are finite energy Ricci flat complete 4-manifolds. They are completely understood in the Kähler setting, but remain mysterious in general, with old questions going back to the 90's. There is a renewed activity in the field at the moment, and I shall explain recent results using Hermitian geometry.

Sébastien Boucksom
The weighted Yau-Tian-Donaldson conjecture

I will present a recent joint work with Mattias Jonsson, in which we provide a solution to the Yau-Tian-Donaldson conjecture in the general context of weighted cscK metrics. More specifically, building on fundamental contributions by many people, we show that the existence of such metrics is equivalent to an appropriate notion of divisorial stability.

Thibaut Delcroix
What if: a principal fibration is not semisimple?

I will report on joint work with Simon Jubert on numerical invariants for weighted Kähler geometry, with applications to semisimple principal fibrations. The latter are fiber bundles with structure group a torus, satisfying a number of additional assumptions. Our results allow us to get information when some of these assumptions are relaxed. If time (or rather research advancement till the conference) permit, I will also report on related work in progress where different assumptions are relaxed.

Slawomir Dinew
Krylov type estimates for the Monge-Ampere equations

The regularity of the solutions of the complex Monge-Ampere equations is an interesting PDE problem with numerous geometric consequences. In this talk I will review what is known about the solutions when the right hand side of the equation is smooth but fails to be strictly positive. While the boundaryless case is fairly easy, the case of manifolds with boundary requires much subtler tools. We shall focus on the Krylov type estimates and in particular answer to what extent analytic tools can replace Krylov's probabilistic approach. This is a joint work with M. Sroka.

Eleonora Di Nezza
(Weighted) cscK metrics

A central theme in Kähler geometry is the search for canonical Kähler metrics, such as Kähler-Einstein metrics, constant scalar curvature Kähler (cscK for short) metrics, extremal metrics, Kähler-Ricci solutions, etc. The concept of weighted cscK, introduced by Lahdili in 2019, provides a unification of all the above geometric settings. In this talk I will give a panorama of what it is known about these metrics and I will present a criteria for ensuring their existence. This is a joint work with S. Jubert and A. Lahdili.

Siarhei Finski

Kobayashi-Hitchin correspondence for polarized fibrations

A Hermitian metric on a holomorphic vector bundle is said to be Hermite-Einstein if its mean curvature is proportional to the identity operator. The Kobayashi-Hitchin correspondence (or the Donaldson-Uhlenbeck-Yau theorem) asserts that a holomorphic vector bundle admits a Hermite-Einstein metric if and only if it satisfies the algebraic condition of slope polystability.

In this talk, I will describe a recent extension of the Kobayashi-Hitchin correspondence to general fibrations beyond holomorphic vector bundles. Specifically, for a polarized family of complex projective manifolds, we examine the so-called Wess-Zumino-Witten (WZW) equation, which specializes to the Hermite-Einstein equation, when the polarized fibration is associated with a projectivization of a holomorphic vector bundle. We establish that the existence of approximate solutions to this equation is equivalent to the asymptotic semistability of the direct image sheaves associated with high tensor powers of the polarizing line bundle. We also discuss a relation between this result and the conjecture of Demailly concerning the optimality of Holomorphic Morse Inequalities.

Henri Guenancia

Kähler-Einstein metrics of negative curvature

I will report on recent joint work with U. Hamenstädt where we show the existence in any complex dimension greater than or equal to two of compact Kähler-Einstein manifolds of negative curvature which are not uniformized by the unit ball.

Claude LeBrun

Einstein Metrics, 4-Manifolds, and Gravitational Instantons

Recall that a Riemannian metric is said to be Einstein if it has constant Ricci curvature. Certain peculiar features of 4-dimensional geometry make dimension four into a "Goldilocks zone" for Einstein metrics, with just the right amount of local flexibility managing to coexist with strong global rigidity results. This talk will first describe some aspects of the interplay between Einstein metrics and smooth topology on closed 4-manifolds that admit symplectic structures. We will see how ideas from Kaehler and conformal geometry allow us to construct Einstein metrics on many such manifolds, while a complimentary tool-box shows that these existence results are optimal in certain specific contexts. However, we will also see that the study of the moduli of such metrics naturally assigns a key role to a class of complete Ricci-flat 4-manifolds known as gravitational instantons. The talk will thus conclude with a discussion of recent results concerning this complete, non-compact setting.

Asia Mainenti

Hodge-Riemann balanced structures on non-Kähler manifolds

A Hodge-Riemann balanced structure on a complex manifold is the datum of a balanced metric whose $(n-1)$-th power can be decomposed into the wedge product of two differential forms, satisfying the classical Hodge-Riemann bilinear relations. Such structures were introduced by X. Chen and R. Wentworth, to generalize the nonabelian Hodge correspondence to non-Kähler Hermitian metrics. However, there are no known examples of Hodge-Riemann balanced structures on non-Kähler manifolds. The aim of this talk is to address this lack of examples, highlighting the relation with p-Kähler structures and discuss some obstruction results in the class of solvmanifolds. Lastly, we will present the first example of such a structure on a non-Kähler, non-compact complex manifold obtained as the product of the Iwasawa manifold by $\mathbb{C}$. This is joint work with A. Fino.

Chung-Ming Pan

Gauduchon metrics and Hermite-Einstein metrics on non-Kähler varieties

Gauduchon metrics are very useful generalizations of Kähler metrics in non-Kähler geometry, as Gauduchon proved that these special metrics always exist on compact complex manifolds. One of their important applications is defining the notion of stability for vector bundles/sheaves on non-Kähler manifolds. It also leads to studying the existence of Hermite-Einstein metrics and the classification of non-Kähler surfaces. In this talk, I will first introduce a singular version of Gauduchon's theorem and its application to the Hermite-Einstein problem for stable reflexive sheaves on non-Kähler normal varieties. Then, I will explain one of the main technical points that lies in obtaining uniform Sobolev inequalities for perturbed hermitian metrics on a resolution of singularities.

Mihaela Pilca

Weyl connections with special holonomy on compact Kähler manifolds

In this talk, which is based on joint work with Andrei Moroianu, I will give a geometric description of the compact Kähler manifolds carrying a Weyl connection with special holonomy. We will see that when the Weyl connection is exact, we either have an ambikähler structure, if the dimension is 4, or the manifold is obtained by the so-called Calabi Ansatz, as S2-bundles over polarized Hodge manifolds, if the dimension is at least 6. On the other hand, in the case of Weyl connections with reducible holonomy, i.e. when the tangent bundle decomposes as the orthogonal direct sum of two parallel distributions, then one of these distributions needs to be of rank 1 and the compact Kähler manifold is locally isometric to a Riemannian product of a Kähler manifold and a two-torus carrying a geodesic foliation.

Cristiano Spotti

On some multiscale aspects of canonical Kähler metrics near singularities.

In this talk I discuss how canonical Kähler metrics (e.g., Kähler-Einstein) behave geometrically near (the formation of) certain singularities, with emphasis on relations with Algebraic Geometry. In particular, I will review some examples (e.g., AC bubbling, lc cusps, etc.) and discuss some conjectural pictures.

Jeffrey D. Streets

Generalized Ricci Flow and the Hull-Strominger System

The Hull-Strominger system was introduced in 1986 in physics as a geometric model for string backgrounds, and was proposed by Yau as a tool for geometrizing Reid's fantasy. In this talk I will describe a geometric flow approach to solving for this system arising from the theory of generalized Ricci flow/pluriclosed flow. A key result is to give a natural interpretation of this flow in terms of the geometry of a holomorphic string algebroid. As a consequence of this we obtain a natural extension of Yau's C^3 estimate for the complex Monge-Ampère equation, and global existence/convergence results for the flow. Joint work with M. Garcia-Fernandez and R. Gonzalez Molina.

Nicoletta Tardini

Pluriclosed manifolds with parallel Bismut torsion

Several special non-Kähler Hermitian metrics can be introduced on complex manifolds. Among them, pluriclosed metrics deserve particular attention. They can be defined on a complex manifold by saying that the torsion of the Bismut connection associated to the metric is closed. These metrics always exist on compact complex surfaces but the situation in higher dimensions is very different. We will discuss several properties concerning these metrics also in relation with the torsion of the Bismut connection being parallel. This is joint work with G. Barbaro and F. Pediconi.

Christina Tonnesen-Friedman

Some Constant Scalar Curvature Sasaki Metrics

In this talk we will consider Sasaki manifolds M whose regular quotient is of the form $N = \mathbb{P}(E_0 \oplus E_\infty) \to \Sigma$, where E_0 and E_∞ are both projectively flat hermitian holomorphic vector bundles over a compact Riemann surface Σ of any genus. Such cases arise for example for certain Yamazaki fiber joins over Σ. While N usually does not admit a Kähler metric with constant scalar curvature (CSC), we will see that there always exists a ray of CSC Sasaki metrics somewhere in the Sasaki cone of M.

This talk is based on collaborations with and results by C. P. Boyer, V. Apostolov, D.M.J. Calderbank, P. Gauduchon, H. Huang, E. Legendre, and G. Maschler.

Program

Monday, May 19, 2025

- 09h00 – 09h30: Welcome
- 09h30 – 10h30: Mihaela Pilca
- 10h30 – 11h00: Coffee break
- 11h00 – 12h00: Olivier Biquard
- 12h00 – 14h00: Lunch
- 14h00 – 15h00: Chung-Ming Pan
- 15h00 – 15h30: Coffee break
- 15h30 – 16h30: Jeff Streets
- 16h50 – 17h10: Liviu Ornea
- 17h30 – 19h00: Cocktail

Tuesday, May 20, 2025

- 09h30 – 10h30: Eleonora Di Nezza
- 10h30 – 11h00: Coffee break
- 11h00 – 12h00: Sławomir Dinew
- 12h00 – 14h00: Lunch
- 14h00 – 15h00: Henri Guenancia
- 15h00 – 15h30: Coffee break
- 15h30 – 16h30: Cristiano Spotti
- 16h45 – 17h45: Florin Belgun

Wednesday, May 21, 2025

- 09h30 – 10h30: Sébastien Boucksom
- 10h30 – 11h00: Coffee break
- 11h00 – 12h00: Asia Mainenti
- 12h00 – 14h00: Lunch
- 15h30 –17h30: Château d'Angers

Thursday, May 22, 2025

- 09h30 – 10h30: Christina Tonnesen-Friedman
- 10h30 – 11h00: Coffee break
- 11h00 – 12h00: Siarhei Finski
- 12h00 – 14h00: Lunch
- 14h00 – 15h00: Claude LeBrun
- 15h00 – 15h30: Coffee break
- 15h30 – 16h30: Daniele Angella
- 19h30 : Social Dinner

Friday, May 23, 2025

- 09h30 – 10h30: Nicoletta Tardini
- 10h30 – 11h00: Coffee break
- 11h00 – 12h00: Thibaut Delcroix
- 12h00 – 14h00: Lunch