

## A Complex Geometry Day

Friday May 15, 2015

Centro di Ricerca Matematica "Ennio de Giorgi", Pisa

<b>time</b>	<b>Friday 15<sup>th</sup></b>
<b>09:20–10:10</b>	P. Tortella
<b>10:10–11:00</b>	R. Lena
<b>11:00–11:20</b>	<i>coffee break</i>
<b>11:20–12:10</b>	A. Cattaneo
<b>12:10–13:00</b>	G. Sarfatti
<b>13:00–14:20</b>	<i>lunch break</i>
<b>14:20–15:10</b>	E. Di Nezza
<b>15:10–16:00</b>	D. Petrecca
<b>16:00–16:20</b>	<i>coffee break</i>
<b>16:20–17:10</b>	G. Bazzoni
<b>17:10–18:00</b>	C. Spotti

*Room:* Sala Conferenze, Collegio Puteano, Centro di Ricerca Matematica "Ennio de Giorgi"

**Giovanni Bazzoni** – *A zoo of symplectic, complex and non Kähler manifolds*

(joint work with M. Fernández and V. Muñoz).

The goal of this talk is to give an overview of the existing examples of manifolds which are symplectic and complex but carry no Kähler metric. I will also construct an example of a simply connected manifold which admits both symplectic and complex structures, but no Kähler structure. Such a manifold has dimension 6, the lowest in which such a phenomenon can occur.

*References*

[BFM] G. Bazzoni, M. Fernández and V. Muñoz, *A 6-dimensional simply connected complex and symplectic manifold with no Kähler metric*, <http://arxiv.org/abs/1410.6045>, *preprint*.

**Andrea Cattaneo** – *Dolbeault–Massey products and formality of the Dolbeault complex*.

The study of the properties of the Dolbeault cohomology of a complex variety has recently addressed to the problem of formality. From an abstract point of view, the Dolbeault algebra is an example of differential bigraded algebra, and it is known that for such objects the presence of non-vanishing Massey products is an obstruction to formality. The advantage of working in the abstract setting is that we can use the minimal model of the Dolbeault complex, which is equivalent to the latter from the cohomological point of view, but which make it easier to detect whether there are non-vanishing Massey products.

The aim of the talk is to show a condition on the Dolbeault complex of a complex variety which ensures the presence of a non-vanishing Dolbeault–Massey product in cohomology. As an application, we will use it in the case of nilmanifolds and solvmanifolds of low dimension, in particular to show the stability of the presence of Dolbeault–Massey products under deformations of the complex structure.

**Eleonora Di Nezza** – *Generalized Monge–Ampère capacities*.

In this talk I will introduce new pluripotential tools: generalized Monge–Ampère capacities. And I will show that these are the key ingredient when dealing with singular solutions of degenerate Monge–Ampère equations.

I will then generalize both Yau’s and Kolodziej’s uniform  $C^0$ -estimates in the non-compact case using such generalized capacities.

This is a joint work with Hoang-Chinh Lu (Chalmers University of Technology).

**Riccardo Lena** – *Special metrics on resolutions of orbifolds*.

Given a complex orbifold with a special metrics we study sufficient conditions for the existence of special metrics on a resolution of singularities.

**David Petrecca** – *Different geometries on the space of Kaehler and Sasakian metrics*.

On a closed Kaehler manifold, the space of all Kaehler metrics in a fixed cohomology class has a natural structure of infinite dimensional manifold. On it, several (weak) Riemannian metrics can be assigned and the most studied ones are called  $L^2$ , Calabi and Gradient (or Dirichlet) metric. I will recall known results about their different geometries and write down and compare the relative geodesic equations as PDEs on the manifold. Finally I will discuss my contribution, joint with S. Calamai and K. Zheng, about the geodesic equation of the gradient metric and of the Ebin metric restricted to the (similarly defined) space of Sasakian metrics.

**Giulia Sarfatti** – *Quaternionic toric manifolds*.

In this seminar I will introduce a possible counterpart to classical toric manifolds in the quaternionic setting.

This definition is inspired by the Delzant procedure that, in the complex setting, allows to construct symplectic toric manifolds starting by a special class of polytopes.

Besides their own interest, we will see that some of the examples obtained by means of this procedure can be interpreted as quaternionic manifolds which are differentiable in the sense of quaternionic slice regularity.

This is a work in progress in collaboration with G. Gentili e A. Gori.

**Cristiano Spotti** – *Degenerations of Kahler-Einstein manifolds*.

The way a family of Kahler-Einstein manifolds can degenerate is deeply

linked to underlying algebro-geometric properties. In the talk I will survey recent (and older) results in this area with the goal of giving a non-technical overview/introduction. Along the way, I will mention some results on the “positive curved” KE Fano case obtained in collaboration with Y. Odaka, S. Sun and C. Yao.

**Pietro Tortella** – *Representations of Atiyah algebroids and logarithmic connections.*

We study representations of the Atiyah algebroid of a line bundle, and establish some relation with flat logarithmic connections. Thus we are able to formulate in a natural way established properties of logarithmic connections. As an application, we give a “functorial” definition of the residue of a logarithmic connection, and show that Deligne’s Riemann-Hilbert correspondence between representations of the fundamental group and flat meromorphic bundles follows directly from the second theorem of Lie for Lie algebroids/groupoids.

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