Robert Berman

From Kähler-Einstein metrics to zeros of zeta functions

While the existence of a unique Kähler-Einstein metrics on a canonically polarized manifold X was established already in the seventies there are very few explicit formulas available (even in the case of complex curves!). In this talk I will give a non-technical introduction to a probabilistic approach to Kähler-Einstein metrics, which, in particular, yields canonical approximations of the Kähler-Einstein metric on X. The approximating metrics in question are expressed as explicit period integrals and the conjectural extension to the case of a Fano variety leads to some intriguing connections to zeros of zeta functions.

Sébastien Boucksom

Measures of finite energy in complex and non-Archimedean geometry

While measures of finite energy in the complex plane are classically studied within potential theory, their several complex variable analogues were only rather recently introduced, in relation to complex Monge-Ampère equations. The purpose of this talk is to review various aspects of this theory, and of its non-Archimedean version, of relevance to the study of K-stability.

Tristan Collins

SYZ mirror symmetry for del Pezzo surfaces and rational elliptic surfaces

I will describe a proof of a strong form of Strominger-Yau-Zaslow mirror symmetry for non-compact Calabi-Yau manifolds obtained from pairs (X, D) where X is a del Pezzo surface or a rational elliptic surface and D is an anti-canonical divisor. This is joint work with A. Jacob and Y.-S. Lin.

Dan Coman

Holomorphic sections of line bundles vanishing along subvarieties

Let X be a compact normal complex space of dimension n and L be a holomorphic line bundle on X. Given $\Sigma = (\Sigma_1, \ldots, \Sigma_\ell)$ an ℓ-tuple of distinct irreducible proper analytic subsets of X, and $\tau = (\tau_1, \ldots, \tau_\ell)$ an ℓ-tuple of positive real numbers, we consider the space $H^0_0(X, L^p)$ of global holomorphic sections of $L^p := L^{\otimes p}$ that vanish to order at least $\tau_j p$ along Σ_j, $1 \leq j \leq \ell$. We present necessary and sufficient conditions which ensure that $\dim H^0_0(X, L^p) \sim p^n$, analogous to Ji-Shiffman's criterion for

big line bundles. We discuss the convergence of the corresponding Fubini-Study currents and their potentials, and the distribution of normalized currents of integration along zero divisors of random holomorphic sections in $H_0^0(X, L^p)$ as $p \to \infty$. The results are joint with George Marinescu and Viêt-Anh Nguyên.

Tamás Darvas

The closure of test configurations and algebraic singularity types

Given a Kähler manifold X with an ample line bundle L, we consider the metric space of L^1 geodesic rays associated to the first Chern class of L. We characterize rays that can be approximated by ample test configurations. At the same time, we also characterize the closure of algebraic singularity types among all singularity types of quasi-plurisubharmonic functions, pointing out the very close relationship between these two seemingly unrelated problems. By Bonavero's holomorphic Morse inequalities, the arithmetic and non-pluripolar volumes of algebraic singularity types coincide. We show that in general the arithmetic volume dominates the non-pluripolar one, and equality holds exactly on the closure of algebraic singularity types. Joint work with Mingchen Xia.

Jean-Pierre Demailly

On the Monge-Ampère volume of holomorphic vector bundles

We discuss and study the properties of a new concept of Monge-Ampère volume for holomorphic vector bundles satisfying suitable positivity properties, such as dual Nakano positivity.

Eleonora Di Nezza

Pluripotential theory : how to get singular Kähler-Einstein metrics

In the last 50 years pluripotential theory has played a central role in order to solve geometric problems, such as the existence of special metrics (e.g. Kähler-Einstein, csck) on a compact Kähler manifold. In this talk I am going to present some recent developments in pluripotential theory. These new tools are so flexible that they allow to study "singular" settings : we will then be able to work with a singular variety and/or to search for singular metrics. The talk is based on a series of joint papers with Támas Darvas and Chinh Lu.

Sławomir Dinew

Geodesics in the space of convex and plurisubharmonic functions

Geodesics in the space of Kähler potentials arose as a tool for studying canonical metrics. As is well known construction of these boils down to solving a suitable homogeneous Monge-Ampere equation. In this talk I will discuss the analogous problem in bounded pseudoconvex domains in $\mathbb{C}^n$ and in convex domains in $\mathbb{R}^n$. This is a joint work with S. Abja.

Simone Diverio

Pointwise universal Gysin formulae and positivity of some characteristic forms

In the last few years there has been a renewed interest around an old conjecture by Griffiths characterizing which should be the positive characteristic forms for any given Griffiths positive holomorphic Hermitian vector bundle. According to this conjecture, they should be precisely the characteristic forms belonging to the positive cone spanned by the Schur forms. After recalling the various notions of positivity for holomorphic Hermitian vector bundles, and how they are (or should be) related, we shall explain a recent result obtained in collaboration with my PhD student F. Fagioli, which gives a partial confirmation of the above conjecture. Such a result is obtained as a consequence of a pointwise, differential-geometric Gysin formula for the pushforward of the curvature of the tautological line bundles over flag bundles.

Mattias Jonsson

Pluripotential theory over a trivially valued field

Pluripotential theory is an important part of complex analysis that has proven a powerful tool in complex geometry, including through work of A. Zeriahi and collaborators. To any smooth complex projective variety X one can associate a compact complex manifold, but also a second natural object, the analytification of X in the sense of Berkovich when the ground field of complex numbers is equipped with the trivial norm. It turns out that one can develop pluripotential theory on such a space in a way very similar to the complex analytic case. Moreover, this theory is useful when studying certain degenerations, appearing in K-stability and beyond. Joint work with S. Boucksom.

Christer Oscar Kiselman

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Ahmed Zeriahi, a great mathematician and a faithful friend

I will go back thirty-eight years in time and tell you almost everything about our many meetings from that time and later, in Uppsala and Toulouse.

Eveline Legendre

K-stability and weighted K-stability for Sasaki manifolds and Kähler cones

We will see how to use weighted versions of the classical Kähler functionals to study Sasaki extremal metrics. As an application we improve to K-stability a result of Collins-Szekelyhidi on K-semistability of cscS manifolds. This is a joint work with V. Apostolov and D.J.M. Calderbank.

Shin-ichi Matsumura

Structure theorem for projective klt pairs with nef anti-canonical divisor

In this talk, I would like to discuss structures of projective klt pairs with nef anti-log canonical divisor. The result of Kollár-Miyaoka-Mori and Campana asserts that (weak) Fano varieties (i.e., projective klt varieties with nef and big anti-canonical divisor) are rationally connected (i.e., any two points can be connected by a rational curve). First, I will consider Hacon-McKernan's question generalizing this result in terms of Kodaira dimension. Then, I will discuss a structure theorem for maximal rationally connected fibrations (or Albanese maps) of projective klt pairs with nef anti-log canonical divisor after I review some recent progress on this topic, including the successive works by Cao, Höring, Păun, Zhang and the singular Beauville-Bogomolov decomposition by Druel, Greb, Guenancia, Höring, Kebekus, Peternell. This talk is based on joint works with Frédéric CAMPANA, Junyan CAO, and Juanyong WANG.

Joaquim Ortega-Cerdà

Optimal polynomial prediction

We will show that two classical extremal problems concerning polynomials are equivalent. One is the problem of finding the extremal growth of a polynomial which is bounded by one on a prefixed compact set and the other is a problem of optimal statistical designs. Both problems were studied more than half a century ago. The connection of both problems allows us to improve on some problem of Erdös. This is joint work with N. Levenberg and L. Bos.

Mihai Păun

Curvature formula for direct images of twisted relative canonical bundles

We will report on a recent work with J. Cao and H. Guenancia. Our main results can be seen as singular versions of Berndtsson's direct image formulas.

Christina Tønnesen-Friedman

Iterated S^3 Sasaki Joins

The Join Construction was developed in the context of Sasakian Geometry by Charles P. Boyer, Krzysztof Galicki, and Liviu Ornea. In this talk, which is based on joint work with Charles P. Boyer, I will discuss the idea of using this construction in a non-trivial iterative way to get new examples of Sasaki metrics with special curvature properties. We will discuss the theoretical aspect of the join, its iteration, and exhibit a few explicit examples.

Tat-Dat Tô

Convergence of the Kähler-Ricci flow on varieties of general type

We study the Kähler-Ricci flow on varieties of general type. We show that the normalized Kähler-Ricci flow exists at all times in the sense of viscosity, is continuous in an open Zariski set and converges to the singular Kähler-Einstein metric. This gives a partial answer to a question of Feldman-Ilmanen-Knopf on defining and constructing weak solutions of the Kähler-Ricci flow.

Valentino Tosatti

Estimates for collapsing families of complex Monge-Ampère equations

I will consider a family of complex Monge-Ampère equations with total volume that goes to zero, which arises naturally when studying the collapsing behavior of Calabi-Yau manifolds or the Kähler-Ricci flow on certain fiber spaces. After work of Eyssidieux-Guedj-Zeriahi and Demailly-Pali in 2007 who proved a uniform estimate for these equations, an outstanding problem was to obtain higher order estimates away from the singular fibers. I will report on recent joint work with H.-J. Hein where we obtain such estimates in the Calabi-Yau case, as a consequence of a full asymptotic expansion for the solution. I will also discuss recent results with S. Filip using complex dynamics to show that higher-order estimates fail in general for these equations when there is no fibration structure, but at least the uniform estimate continues to hold on some K3 surfaces.

David Witt-Nyström

Deforming Kähler manifolds to normal bundles

The deformation of a variety X to the normal cone of a subvariety Y is a classical construction in algebraic geometry. I am interested in the case when (X, ω) is a compact Kähler manifold and Y is a submanifold. The deformation space is fibered over $\mathbb{P}^1$ and all the fibers are isomorphic to X, except for the zero-fiber, which has the projective completion of the normal bundle of Y as one if its components. Thus a Kähler form on the total space which restricts to omega on say the 1-fiber corresponds to a deformation of (X, ω) to the normal bundle of Y, but where inevitably some of the volume of (X, ω) is lost to the other component of the zero-fiber. Unfortunately there is a cohomological lower bound on this volume loss. However, the result which I will try to explain, says that by modifying the deformation space one can make this lower bound arbitrarily small.

Elizabeth Wulcan

An extended Monge-Ampère operator

I will discuss a joint work in progress with Mats Andersson and David Witt Nyström, that extends previous work with Andersson and Błocki. We introduce a class of plurisubharmonic functions $\mathcal{G}$, for which there is a natural Monge-Ampère operator with nice local and global properties. The class $\mathcal{G}$ includes plurisubharmonic functions with analytic singularities and has certain convexity properties, and thus it has a quite rich structure.
