The Book of Abstracts, Complex Analysis, Geometry, and Dynamics III.- Portorož 2024

June 7, 2024

TIMETABLE

	Monday	Tuesday	Wednesday	Thursday	Friday
9:00-10:00	**LARUSSON**	**BERNDTSSON**	**FAGELLA**	**ZERIAHI**	**GUPTA**
	Short break	Short break	Short break	Short break	Short break
10:10-11:10	**RU**	**NEMIROVSKI**	**RADU**	**VIVAS**	**BLOCKI**
	Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
11:30-12:30	**ALARCON**	**SHAFIKOV**	**VAROLIN**	**DRACH**	**LEMPERT**
	Lunch break	Lunch break		Lunch break	
15:00-16:00	**SUKHOV**	**ASTORG**	Free afternoon	**XIAO**	Free afternoon
	Coffee break	Coffee break		Coffee break	
16:20-17:20	**KUTZSCHEBAUCH**	**PARDO-SIMON**		**ZAITSEV**	
19:30				***Conference dinner***	

Algebraic directed immersions

Antonio Alarcón
Universidad de Granada

Let M be an affine Riemann surface and A be the punctured cone in $\mathbb{C}^n \setminus \{0\}$ on a smooth projective variety Y in $\mathbb{CP}^{n-1}$. We shall discuss a Runge approximation theorem for algebraic (regular) immersions $M \to \mathbb{C}^n$, directed by A, under the assumption that A is algebraically elliptic. This is based on recent joint work with Finnur Lárusson.

Horn maps of semi-parabolic Hénon maps

Matthieu Astorg
Université d'Orléans, Institut Denis Poisson

Bedford, Smillie and Ueda have introduced a notion of horn maps for polynomial diffeomorphisms of $\mathbb{C}^2$ with a semi parabolic fixed point, generalizing classical results from parabolic implosion in one complex variable. We prove that these horn maps satisfy a weak version of the Ahlfors island property. As a consequence, we obtain the density of repelling cycles in their Julia set, and we prove the existence of perturbations of the initial Hénon map for which the forward Julia set J^+ has Hausdorff dimension arbitrarily close to 4. Joint work with Fabrizio Bianchi.

Supercurrents and convex geometry

Bo Berndtsson
Chalmers University of Technology

The formalism of superforms and -currents is a way to use methods from Kahler geometry in real geometry. It has been applied to tropical geometry by Lagerberg, to mixed volumes by Larsson and to Riemannian geometry by myself. In this talk I will outline further applications, focusing on the theory of valuations on convex bodies.

L^2-estimates for $\bar{\partial}$-equation and ODEs

Zbigniew Błocki
Jagiellonian University

Hörmander's L^2-estimate for $\bar{\partial}$ and its generalizations can be used to construct holomorphic functions and prove various quantitative results in several complex variables. We will present some known and new $\bar{\partial}$-estimates and their relations with ODEs.

Length spectral rigidity of expanding circle maps

Kostya Drach
Universitat de Barcelona

For an expanding circle map of degree at least 2, the length spectrum is defined as the set of all Lyapunov exponents (multipliers) at periodic orbits. This set is analogous to the (unmarked) length spectrum of a negatively curved metric on a closed two-dimensional surface, which is defined as the set of lengths of all closed geodesics in the given metric. The extent to which this set uniquely defines the metric on the surface remains an open question. Motivated by this geometric problem, our talk will address a simpler, more dynamical question: To what extent is it true that two smooth expanding circle maps with the same length spectra are equal (up to a smooth change of coordinates)? I will explain both the geometric and dynamical setups. This is joint work with Vadim Kaloshin.

Wandering domains and sequences of Blaschke products: quasiconformal surgery and grand orbit relations

Núria Fagella
Universitat de Barcelona

In this talk, we present a surgery construction that replaces the interior dynamics in an orbit of wandering domains with the non-autonomous dynamics of a sequence of Blaschke products, as long as both are uniformly hyperbolic. As an application, we construct an entire function with a wandering domain for which discrete and indiscrete grand orbit relations coexist, in a way that is not possible for periodic Fatou components. Understanding grand orbit relations in the different types of Fatou components is a key step in the study of quasiconformal deformations of holomorphic maps. This is joint work with Vasiliki Evdoridou, Lukas Geyer and Leticia Pardo-Simon.

A characterization of rational convexity in Stein and projective manifolds

Purvi Gupta
Indian Institute of Science

We will discuss generalizations of rational convexity to Stein and projective manifolds. Motivated by results of Duval-Sibony, Nemirovski and Guedj, we will discuss a characterization of rationally convex sets in terms of extensions of Kähler forms. This is joint work with B. Boudreaux and R. Shafikov.

Holomorphic Factorization of vector bundle automorphisms

Frank Kutzschebauch
University of Bern

A classical result from any Linear Algebra course states that the group $\mathrm{SL}_m(\mathbb{C})$ is generated by elementary matrices $\mathrm{Id}+\alpha E_{ij}$, $i \neq j$, i.e., matrices with ones on the diagonal and at most one nonzero element outside the diagonal. The same question for matrices in $\mathrm{SL}_m(R)$, where R is a commutative unital ring is a very complicated and much studied question.

If for example R is the ring of complex valued functions (continuous or holomorphic) from a space X, then given a map $f : X \to \mathrm{SL}_m(\mathbb{C})$ one has to find a factorization into a product of upper and lower diagonal unipotent matrices

$$f(x) = \begin{pmatrix} 1 & 0 \\ G_1(x) & 0 \end{pmatrix} \begin{pmatrix} 1 & G_2(x) \\ 0 & 1 \end{pmatrix} \cdots \begin{pmatrix} 1 & G_N(x) \\ 0 & 1 \end{pmatrix},$$

where the G_i's are maps $G_i : X \to \mathbb{C}^{m(m-1)/2}$. A necessary condition for this factorization to exist is that the map f is homotopic to a constant map (or *null-homotopic*).

For continuous complex valued functions on a finite dimensional topological space X, the problem was studied for a long time and it was finally solved by Vaserstein. In 2012 Ivarsson and the speaker settled its holomorphic analogue. This is also called Gromov's Vaserstein problem as it was suggested by Gromov in 1989. The first generalization to the case of (special) vector bundle automorphisms was done in the topological case by Hultgren and Wold.

We will present the holomorphic counterpart of Hultgren and Wold's result, but only for holomorphic vector bundles of rank 2. Our main result is the following: let X be a Stein space and $E \to X$ be a holomorphic vector bundle of rank 2 over X. Then a special holomorphic automorphism can be written as a (finite) product of unipotent holomorphic automorphisms if and only if it is null-homotopic. This is a joint work with George Ionita.

Generic dynamics on Oka-Stein manifolds and Stein manifolds with the density property

Finnur Lárusson
University of Adelaide

I will describe joint work with Leandro Arosio on the dynamics of generic endomorphisms of Oka-Stein manifolds and generic automorphisms of Stein manifolds with the density property.

A variational problem in Kähler geometry

László Lempert
Purdue University

Consider the following problem: Given a convex body in some real Euclidean space, among all ellipsoids inscribed in it find/characterize the one with greatest volume. This problem was posed and solved in a 1948 paper by Fritz John. A rather straightforward complex variant can be viewed as a question concerning hermitian metrics on line bundles over complex projective space. The talk will be about a certain generalization of this latter problem from projective spaces to general compact Kähler manifolds.

Geometric topology of complex domains

Stefan Nemirovski
Ruhr-Universität Bochum & Steklov Mathematical Institute

In the past several decades, considerable progress has been achieved in understanding the topological, differential, and symplectic properties of various types of pseudoconvex domains but a number of natural questions have remained unanswered. I will give a survey of the subject focusing on open problems and possible research directions.

On the dynamics of complex Hénon maps

Remus Radu
Institute of Mathematics of the Romanian Academy

The theory of holomorphic dynamics in 2D is substantially different than in 1D and contains new and thrilling phenomena not present in the one-dimensional world. In this talk we discuss the dynamics of complex Hénon maps and show how to use foliation theory, the Milnor number of a singularity, Hartog's extension theorem to unveil intricate geometric structures associated with Hénon maps from the complex horseshoe region and beyond. Based on joint work with T. Firsova and R. Tanase.

The Ru-Vojta inequality and its applications

Min Ru
University of Houston

The joint work with Paul Vojta has found many applications, especially in the study of the G.C.D. problem and related topics by Julie Tzu-Yueh Wang and her collaborators. In this talk, I will give a brief introduction to the Nevanlinna theory and describe the so-called the "Ru-Vojta inequality". I then will discuss its applications. Finally I will present the most recent joint work with Julie Tzu-Yueh Wang regarding the defect relation for holomorphic maps into $\mathbb{P}^n(\mathbb{C})$ intersecting the divisor with $n+1$ irreducible components.

Singular Holomorphic Foliations and Levi-flat Hypersurfaces

Rasul Shafikov
University of Western Ontario

In this talk I will give a general overview of singular holomorphic foliations. I will discuss their connection with Levi-flat hypersurfaces, (singular) holomorphic webs, first integrals, and local hulls.

Constructing entire functions with wandering domains

Leticia Pardo-Simón
Universitat de Barcelona

Let f be a transcendental entire function, i.e., a non-polynomial, holomorphic self-map of the complex plane. Transcendental dynamics studies the behaviour of a point z under repeated iteration of the function f. In particular, points might belong to wandering domains — open 'maximal' regions of stability whose iterated images are pairwise disjoint. In this talk, I will discuss how recent techniques based on approximation theory enable us to construct a broad array of examples: from wandering domains that remain within a bounded part of the plane for 'almost all iterates' to those that converge to infinity 'as fast as possible'. This is based on joint work with A. Glücksam, V. Evdoridou and D. Sixsmith.

On the Kobayashi metric on Riemannian manifolds

Alexandre Sukhov
Université de Lille

We discuss some properties of the Kobayashi metric (such as the hyperbolicity, the boundary behavior) of the Kobayashi metric on Riemannian manifolds. This is a joint work with H.Gaussier.

A new Poincaré type rigidity phenomenon with applications

Ming Xiao
University of California at San Diego

In this talk, we discuss a new Poincaré type phenomenon. More precisely, we will present an optimal rigidity theorem for local CR mappings between circle bundles that are defined in a canonical way over (possibly reducible) bounded symmetric domains. We prove such a local CR map, if nonconstant, must extend to a rational biholomorphism between the corresponding disk bundles. The result includes as a special case the classical Poincaré–Tanaka–Alexander theorem. We then present some applications of the theorem.

Deformation of Bergman Spaces

Dror Varolin
Stony Brook University

Let X and B be complex manifolds, let $p : X \to B$ be a holomorphic submersion of fiber dimension n, and let $E \to X$ be a holomorphic vector bundle with smooth Hermitian metric h. To the family $(E, h) \to X \xrightarrow{p} B$ of holomorphic Hermitian vector bundles parametrized by B we can associate a family of Bergman spaces $\mathscr{H} \to B$ whose fiber over $t \in B$ is

$$\mathscr{H}_t := \left\{ f \in H^0(X_t, \mathcal{O}(K_{X_t} \otimes E)) \ ; \ i^{n^2} \int_{X_t} \langle h, f \wedge \bar{f} \rangle < +\infty \right\}.$$

The family of Bergman spaces $\mathscr{H} \to B$ has a natural fiberwise Hermitian inner product, and also a natural notion of 'complex structure'. With respect to this structure, $\mathscr{H} \to B$ is sometimes but not always a holomorphic vector bundle. Nevertheless, under favorable conditions one can define a notion of the curvature of $\mathscr{H} \to B$, which of course agrees with the curvature of the Chern connection when $\mathscr{H} \to B$ is a holomorphic vector bundle. We present some theorems about this curvature, as well as some open questions.

Local dynamics of reduced saddle-node biholomorphisms

Liz Vivas
Ohio State University

We study the dynamics on a full neighborhood of the origin for a biholomorphism F in $\mathbb{C}^2$ that is of the reduced saddle-node type. For these type of diffeomorphisms we will show that there exist connected domains with the origin in their boundary which are either stable for F or for its inverse, and that outside these domains every point is either fixed or has a finite orbit. This is a work in progress in collaboration with Lorena Lopez-Hernanz and Rudy Rosas.

Global regularity in the $\bar{\partial}$-Neumann problem and finite type conditions.

Dmitri Zaitsev
Trinity College Dublin

The celebrated work of Catlin on the global regularity of the $\bar{\partial}$-Neumann operator for pseudoconvex domains of finite type links local algebraic- and analytic geometric invariants through potential theory with estimates for $\bar{\partial}$-equation. Yet despite their importance, there seems to be a lack of understanding of Catlin's techniques, resulting in a notable absence of an alternative proof, exposition or simplification.

The goal of my talk will be to present an alternative approach based on the new notion of a "tower multi-type". The finiteness of the tower multi-type is an intrinsic geometric condition that is more general than the finiteness of the regular type, which in turn is more general than the finite type. Under that condition, we obtain a generalized stratification of the boundary into countably many level sets of the tower multi-type, each covered locally by CR submanifolds of the boundary, along which the Levi form is positive definite. The existence of such stratification implies Catlin's potential-theoretic "Property (P)", which, in turn, is known to imply global regularity via compactness estimate. Notable applications of global regularity include Condition R by Bell and Ligocka and its applications to boundary smoothness of proper holomorphic maps generalizing a celebrated theorem by Fefferman.

Diameter estimates of Kähler metrics

Ahmed Zeriahi
Institut de Mathématiques de Toulouse (IMT)

We establish upper bounds on the diameter of Kähler manifolds endowed with Kähler metrics whose volume form satisfies an Orlicz integrability condition. Our results partially extend previous estimates due to Fu-Guo-Song and Guo-Phong-Song-Sturm. In particular, they do not involve any constraint on the vanishing of the volume form.
