KAUS

Ungmennaráðstefna í tvinnfallagreiningu

Reykjavík, May 23-25 2025

Program

Thursday, May 22nd

16:30 - 16:55	Suprokash Hazra
17:00 - 17:25	Rahim Nkunzimana
17:30 - 17:55	Benjamin Marim de Moura
18:00	*Activities*

Friday

10:00 - 10:25	Gaofeng Huang
10:30 - 10:55	Fani Xerakia
11:00 - 11:25	Ai My Aleksandra Le
11:30 - 12:30	*Lunch*
12:30 - 12:55	Ludvig Svensson
13:00 - 13:25	Rolf Andreasson
13:30 - 13:55	Johannes Testorf
14:00 - 14:30	*Break*
14:30 - 14:55	Setareh Eskandari
15:00 - 15:25	Beno Učakar
15:30 - 15:55	Atte Pennanen

Organizers:

- Tryggvi Kalman Jónsson, Háskóli Íslands
- Mar Saiz Aparicio, Universitetet i Stavanger

Rahim Nkunzimana

Holomorphic matrices – an argument principle

Suppose f is a matrix of holomorphic functions in several variables. If f is surjective outside the origin, one can define the Buchsbaum-Rim multiplicity of f, generalising the order of vanishing of a single variable function. We show that we get a representation of the Buchsbaum-Rim multiplicity as a product of a smooth form and a residue current. This can be seen as an argument principle for holomorpic matrices, and it generalises a result of Andersson, where row matrices were considered, as well as a previous result of the speaker, where direct sums of row matrices were considered.

Ludvig Svensson

Critical inverse temperatures as solutions to discrete optimization problems

Consider a system of N point particles at positions $p_1, \dots, p_N$ on the 2-dimensional sphere $\mathbb{S}^2$ that interact according to the *Coulomb potential*

$$E = \sum_{1 \le i < j \le N} c_{i,j} \log \|p_i - p_j\|^2,$$

where $c_{i,j}$ is a symmetric matrix of real coupling constants, describing the strength (and sign) of interaction between particle i and particle j. In joint work together with Rolf Andreasson, we use tools from Complex and Algebraic geometry to study the *Gibbs measure* and associated *partition function* of this system in thermal equilibrium at inverse temperature β. We show that the critical inverse temperature(s), where the partition function diverges, are solution(s) to a certain discrete optimization problem.

Fani Xerakia

Automorphisms of the Worm Domain

The Diederich-Fornæss worm domain, constructed as the first smoothly bounded pseudoconvex domain without a Stein neighbourhood basis, is a key counterexample in Several Complex Variables. In this talk, we examine its automorphism group in both bounded and unbounded cases and demonstrate that its boundary is locally spherical everywhere except at the exceptional locus and the caps.

Gaofeng Huang

Large holomorphic automorphism groups

In this talk, we survey a few results in the study of large holomorphic automorphism groups. First we give an historical account of the so-called Andersen-Lempert theory, the core of which is an approximation of local biholomorphic injections by global holomorphic automorphisms, developed by Andersen-Lempert and Forstneric-Rosay in the 90s. Such an approximation is possible on Stein manifolds with the density property, a property describing the abundance of globally integrable holomorphic vector fields. It thus is fundamental to identify Stein manifolds with this property. A criterion by Kaliman and Kutzschebauch has substantially enlarged the classes of examples. We will also encounter two recent developments, one is a generalization of this criterion, and the other is a specification of this criterion to smooth affine SL_2-varieties.

Suprokash Hazra

Schlichtness of the envelope for truncated tube domains in higher complex dimension

We consider the notion of envelope of holomorphy of a domain in $\mathbb{C}^n$ and discuss the schlichtness of it by reviewing some known results. Next by addressing two motivating questions for research we introduce the notion of good barrier, augmenting function and compact fence. Then we discuss a generalization of a theorem by Jarnicki-Pflug in higher complex dimension for good domains. This includes the schlichtness of the envelope for truncated tube domains in higher complex dimension. Finally we state some open questions in this direction.

Beno Učakar

Carleman approximation without critical points

The classical Carleman approximation theorem states that any complex-valued continuous function on the real line can be approximated by an entire holomorphic function, such that their difference along the real line is bounded by a positive continuous error function. Closed sets in open Riemann surfaces that enjoy this property are called Carleman sets, and they were first characterised by A. Boivin in 1986. It turns out that under some additional assumptions, one can require that the approximating global function has no critical points. The plan for the talk is to present this result and provide a quick sketch of the proof.

Rolf Andreasson

Multipole phenomena for the two-component plasma

I will describe a work in progress together with Ludvig Svensson. We study the two component plasma in two dimensions, a well-studied model in mathematical physics describing positive and negatively charged particles in two dimensions with logarithmic interaction. In particular we are interested in the conjectural occurence of dipoles and multipoles at low temperature, that is, neutral clusters of particles. To do this we use classical methods of complex analysis and algebraic geometry such as the Bernstein-Atiyah-Gelfand analytic continuation of complex powers and the Fulton-MacPherson compactification of configuration spaces.

Setareh Eskandari

Hankel forms and operators induced by measures

This talk explores the boundedness of bilinear Hankel forms and Hankel operators within weighted Bergman spaces, where the weights satisfy an upper-doubling condition. We will also discuss the connection of these operators to Hankel measures. Our goal is to characterize p-Hankel measures for $p \leq 2$, using duality and factorization techniques from weighted Bergman spaces, along with recent results on two-weight fractional derivatives.

Atte Pennanen

Carleson measures for Bergman-Zygmund spaces induced by doubling weights

In this talk, we consider generalized weighted Bergman-Zygmund spaces induced by doubling weights and generalized Lebesgue-Zygmund spaces induced by positive Borel measures. We begin by showing some basic properties of a certain class of inducing functions and of doubling weights. Then, we give a characterization for when the identity operator from the weighted Bergman-Zygmund spaces to the Lebesgue-Zygmund spaces is bounded or compact. The talk is based on joint work with H. R. Cho, H. Koo, Y. J. Lee, J. Rättyä and F. Wu.

Johannes Testorf

Ohsawa Takegoshi and geodesics in the space of Kähler metrics

I will discuss an Ohsawa takegoshi L^2 extension result which associates an estimate to a $\mathbb{C}^*$ degeneration of a Kähler manifold. In particular, I will focus on the estimates when the metrics along this degeneration are associated to geodesic rays in the space of Kähler metrics. The main example here will be the deformation to the tangent bundle. This is joint work with Yan He and Xu Wang.

Benjamin Marim de Moura

On the boundary of the Milnor fiber

We present results describing the degeneration process of the boundary of the Milnor fiber of a holomorphic function f into the link of the analytic set defined by the critical values of f. These results address both the case where f has an isolated singularity at the origin and the case where the origin is a non-isolated singular point.

Ai My Aleksandra Le

Fast Bellman algorithm for real Monge-Ampere equation

In this talk I will introduce a new numerical algorithm solving the Dirichlet problem for real Monge-Ampere equation. The algorithm is based on Bellman's principle which enables to solve our fully non-linear elliptic Monge-Ampere equation by approximating it with a sequence of linear elliptic differential equations. Further, I will discuss the strengths and weaknesses of the method whilst demonstrating its performance on many examples of various degrees of degeneracy as well as compare its efficiency with two other numerical methods, which emerges to be 3-10 times faster for smooth, convex examples and 20-100 times (or even more) faster for mildly degenerate examples.

Participants

Ai My Aleksandra Le - *Lund University*
Álfheiður Edda Sigurðardóttir - *IMFM*
Atte Pennanen - *University of Eastern Finland*
Benjamin Marim de Moura - *Mittuniversitetet*
Beno Učakar - *IMFM*
Bergur Snorrason - *Háskóli Íslands*
Breki Pálsson - *Háskóli Íslands*
Eggert Karl Hafsteinsson - *Menntaskólinn í Reykjavík*
Fani Xerakia - *University of Vienna*
Gaofeng Huang - *University of Bern*
João Fontinha - *University of Lisbon*
Johannes Testorf - *NTNU*
Ludvig Svensson - *Chalmers and Gothenburg University*
Mar Saiz Aparicio - *Universitetet i Stavanger*
Mårten Nilsson - *Stockholm University*
Michał Kudra - *Jagiellonian University*
Olof Rubin - *Lund University*
Rahim Nkunzimana - *Chalmers and Gothenburg University*
Rolf Andreasson - *Gothenburg University*
Setareh Eskandari - *Umeå University*
Suprokash Hazra - *Mittuniversitetet*
Tryggvi Kalman Jónsson - *Háskóli Íslands*
Wills Ton Minh Nguyen - *IMFM*

KAUS - Complex Analysis without Seniors			
	Year	Location	Organizers
1	2005	Umeå	Umeå University
2	2006	Göteborg	Chalmers University of Technology/ University of Gothenburg
3	2007	Sundsvall	Mid Sweden University
4	2007	Stockholm	Stockholm University
5	2009	Reykjavík	University of Iceland
6	2010	Umeå	Umeå University
7	2010	Göteborg	Chalmers University of Technology/ University of Gothenburg
8	2024	Östanskär	Mid Sweden University/Umeå University
9	2025	Reykjavík	University of Iceland