KASS 2009

December 2, 10.15

Genkai Zhang (Göteborg): Ramadanov conjecture and line bundles over compact Hermitian symmetric spaces.

November 4, 10.15

Mats Andersson (Göteborg): A fine resolution of the sheaf of holomorphic functions on an analytic space (joint with H Samuelsson).

Abstract. Let X be an analytic space. We introduce sheaves A_k of $(0,k)$-currents that are smooth on the regular part of X and have "mild" singularities at the singular set, and such that

$$0 \to \mathcal{O}_X \to A_0 \to A_1 \to \cdots$$

is exact, where the mappings are $\bar\partial$. In particular we get an extension of the Dolbeault isomorphism to the singular case.

October 15, 10.15 (joint KASS and AGAT)

Per Salberger (Göteborg): Volymer av linjeknippen med tillämpningar på diofantiska ekvationer.

October 14, 10.15

Dario Cordero-Erausquin (Paris): Interpolation and geometric inequalities.

Abstract: Some geometric inequalities related to convexity or plurisubharmonicity (such as Brunn-Minkowski or Prekopa's inequalities) can be seen "locally" as spectral inequalities. Here "locally" means that we look at the local convexity of certain functionals along an interpolation parameter. We shall study for instance the behavior of volume along complex interpolation. We shall also investigate real interpolations from the PDE point of view (degenerate Monge-Ampere equation) introduced by Rochberg and Semmes. Special emphasis will be put on the connection between convexity and spectral inequalities of Hormander (in the complex case) and Brascamp-Lieb (in the real case).

September 23, 10.15

Sandra di Rocco (Stockholm): Toric geometry and certain convex polytopes.

Abstract: Toric enbeddings are associated to convex lattice polytopes. A lot of the geometry of the embedded variety is detected via combinatorial invariants of the polytope and viceversa. The interplay between toric algebraic geometry and convex geometry will be recalled at the beginning of the talk. The aim of this seminar is to report on some (recent and less recent) results for non singular toric varieties, which translates to unexpected combinatorial properties of convex polytopes. More precisely (as long as timed permits) generation of jets, adjoint properties and dual properties of toric embeddings will be presented.

September 16, 10.15

Bo Berndtsson (Göteborg): Probability measures associated to geodesics in the space of Kähler metrics.

Abstract: An important idea in the recent theory of Kähler metrics is that the space of Kähler metrics on a given manifold (with fundamental form lying in a fixed cohomology class) is an infinite dimensional riemannian manifold, which can be approximated by finite dimensional symmetric spaces. A basic question is to make precise how this approximation works. I associate to geodesics in the respective spaces certain probability measures on R, and prove that the measures arising from the finite dimensional picture converge weakly to their counterparts in infinite dimension. That second order moments converge implies that geodesic distances converge, which was recently proved by Chen and Sun.

September 2, 10.15

Jean Ruppenthal (Wuppertal): L2-theory for the dbar-operator on compact complex spaces.

Abstract: Let X be a Hermitian compact complex space of pure dimension n. It is interesting to study the Dolbeault complex in the L2-sense on the regular part Reg(X) for several reasons (e.g. intersection cohomology; or birational invariance of the arithmetic genus). Since Reg(X) is not complete, it is essential to distinguish different closed extensions of the dbar-operator. In fact, the fundamental duality relation between the minimal and the maximal closed extension in combination with Hironaka's resolution of singularities and Takegoshi's

vanishing theorem open the door towards a general L2-dbar-theory on singular complex spaces. In this talk, we present such a theory for (0,q) and (n,q)-forms if X has isolated singularities, generalizing a former result of Pardon and Stern about normal projective surfaces.

August 26, 10.15

Frederic Faure (Grenoble): Semi-classical approach for hyperbolic dynamical systems. Ruelle resonances and Quantum chaos.

Abstract: Hyperbolic dynamical systems display strong chaotic behaviour. We will explain how some spectral properties of hyperbolic diffeomorphisms can be obtained by semi-classical analysis. In particular the Ruelle resonances which are eigenvalues of the Ruelle transfer operator acting in suitable anisotropic Sobolev spaces and which govern the decay of dynamical correlations, can be treated as the quantum resonances of open quantum systems in the Helffer-Sjöstrand phase-space theory. This work has been done with Nicolas Roy and Johannes Sjöstrand (arXiv:0802.1780) and proposes a semi-classical approach after the recent works of M. Blank, S. Gouëzel, G. Keller, C. Liverani and V. Baladi and M. Tsujii. We will also discuss some connections with quantum chaos via geometric quantization of Kahler manifolds.

May 27, 10.15

Lisa Nilsson (Stockholm): Discriminantal coamoebas in dimenson 2.

Abstract: This talk is based on a joint work with M. Passare, in which we study the general structure and properties of two dimensional coamoebas. I will describe how such a coamoeba can in fact be interpreted as the union of two mirror images of a polygonal curve simply obtained from the matrix B in the Horn-Kapranov parametrization. I will provide an area formula for the coamoeba and prove that the coamoeba is intimately connected to a certain zonotope. In fact considering the coamoeba and the zonotope as chains projected on the torus $(\mathbb{R}/2\pi\mathbb{Z})^2$, the summed chain obtained as a union of the coamoeba and the zonotope is a 2-cycle, and as such, is an integer multiple of the torus itself.

May 20, 10.15

Håkan Samuelsson (Göteborg): A residue approach to non-proper intersection theory.

Abstract: The classical proper intersection theory can be elegantly formulated in terms of the calculus of integration currents. For instance, if Z and W are analytic cycles intersecting properly and $[Z]$ and $[W]$ the corresponding integration currents, then the intersection cycle $Z \cdot W$ is described by the current equation $[Z \cdot W] = [Z] \wedge [W]$. In the non-proper case, there is not a unique intersection pairing but quite recently, Tworzewski developed a geometric algorithm to obtain a "minimal" intersection pairing that in some sense is canonical. This algorithm has an algebraic counterpart that gives Tworzewski's intersection index as ageneralized Hilbert-Samuel multiplicity. I will discuss an analytic approach to Tworzewski's intersection theory based on the calculus of residue currents. We will see that this approach gives the generalized Hilbert-Samuel multiplicity as the Lelong number of a natural global current. This is joint work with Mats Andersson, Elizabeth Wulcan, and Alain Yger.

May 6, 10.15

Dov Aharonov (Haifa): Conditions for univalence of analytic functions related to the Schwarzian derivative.

Abstract: Using a simple but useful observation we are able to derive some significant generalizations of well known sufficient conditions for univalence of an analytic function in terms of the Schwrarzian derivative.These classical conditions were found mainly by Nehari.

April 22, 10.15

Bo Berndtsson (Göteborg): Monotonicity of the entropy of sums of random variables (after Arstein, Ball, Barthe and Naor).

Abstract: Rather recently Arstein, Ball Barthe and Naor solved an old problem of Shannon by proving the following

Theorem: Let X_j be a sequence of identically distributed independent real random variables with finite variance, and let

$$Y_n = (X_1 + X_2 + ...X_n)/n^{1/2}.$$

Then the entropy of Y_n is monotonically increasing. I will present a slight simplification of their argument.

April 1, 10.15

Richard Lärkäng (Göteborg): Residue currents associated with weakly holomorphic functions.

Abstract: Residue currents like the Coleff-Herrera product and Bochner-Martinelli type residue currents are certain currents associated with a set of holomorphic functions, or more generally an ideal of holomorphic functions on a complex manifold or an analytic space. I will discuss how to define analogous currents related to weakly holomorphic functions, and how the theory generalizes from holomorphic functions to the case of weakly holomorphic functions.

March 25, 10.15

Robert Berman (Göteborg): A variational approach to complex Monge-Ampère equations and Kähler-Einstein metrics.

Abstract: The complex Monge-Ampère operator is the natural generalization of the Laplace operator on a Riemann surface to higher dimensional complex manifolds. In his famous resolution of the Calabi conjecture, in the seventies, Yau showed the existence of solutions to the inhomogenous Monge-Ampère equation given smooth and non-degenerate data. In this talk I will present a variational approach to this problem which has the virtue of working for very singular data. It can be seen as a complex analog of Alexendrov's classical approach to the Minkowski problem on the n-sphere. I will also comment on some applications to Kähler-Einsten geometry. This is joint work with S.Boucksom (Paris), V.Guedj (Marseille) and A.Zeriahi (Toulouse).

March 4, 10.15

Bo Berndtsson (Göteborg): Centrala gränsvärdessatsen och kanoniska knippen.

February 11, 10.15

Aron Lagerberg (Göteborg): An analyticity theorem for a generalized Lelong number.

Abstract: Lelong numbers, introduced by Pierre Lelong in the 50's, provide us with a way of measuring singularities of plurisubharmonic functions. I will discuss a generalization of Lelong numbers, introduced by Berndtsson, and prove that they satisfy an analyticity property. More precisely, we prove that, for $c > 0$, the upper level set

$$\{x \in \Omega : \nu_{x,\psi}(f) \geq c\}$$

defines an analytic set in Ω,where $\nu_{x,\psi}(f)$ denotes Berndtsson's generalized Lelong number of f, with respect to a sufficiently nice function ψ, at the point x. For $\psi = (n-1)\log|z|$, this number is just the classical

Lelong number, and we obtain the classical semi-continuity theorem as proved by Siu in 1974.

February 4, 10.15

Chin-Yu Hsiao (Göteborg): On the lower order terms of the asymptotic expansion of Berman-Sjöstrand.

Abstract: We compute the first two coefficients of the asymptotic expansion of Berman-Sjöstrand in a simple case. We hope that this talk can serve as an introduction to certain microlocal techniques with applications of complex geometry.

January 28, 10.15

Jacob Sznajdman (Göteborg): A non-reduced Briancon-Skoda theorem for analytic schemes.

Abstract: I will present a generalization of the Briancon-Skoda theorem, that was earlier known for quite general reduced rings, and in particular for the local ring of an analytic space. The theorem relates powers of ideals to Noetherian differential operators and the integral closure of ideals.

January 21, 10.15

Mikael Passare (Stockholm): Coamoebas and Mellin transforms of rational functions.

Abstract: The coamoeba of a complex polynomial f is defined to be the image of the hypersurface defined by f under the mapping Arg that sends each coordinate z_k to its argument $\arg z_k$. We shall discuss the connection between coamoebas and the multidimensional Mellin transforms of rational functions. It turns out that there is some amusing combinatorics involved here.

January 14, 10:15

Robert Berman (Göteborg): Convergence towards equilibrium for determinantal random point processes on complex manifolds.

Abstract: Determinantal random point processes were introduced in the seventies as a statistical model of a quantum gas of fermions (e.g. electrons). I will explain how the setting of an Hermitian line bundle L over a complex manifold X naturally leads to such a random point process on X, which is critical in the sense that it has a

natural many particle limit. This complex geometric frame work generalizes the usual random matrix ensembles, as well as multivariate orthogonal polynomial ensembles and, physically, the fermion gas in a strong magnetic field. The main result says that random particle configurations converge exponentially to the pluripotential equilibrium measure on the manifold X, defined by L (i.e. a large deviation principle holds). The corresponding rate (-entropy) functional turns out to coincide with a well-known non-linear energy functional in Kähler-Einstein geometry. In the one-dimensional case this functional is precisely the weighted logarithmic energy (as first shown by Ben Arous-Guinnet and Ben Arous-Zeitouni in this case).

January 7, 10.15

Elizabeth Wulcan (Ann Arbor): *Sparse effective Nullstellensätze via residue currents.*

Abstract: Residue currents are generalizations of one complex variable residues and can be thought of as currents representing ideals of holomorphic functions or polynomials.

I will discuss how residue currents on toric varieties can be used to obtain certain effective versions of Hilbert's Nullstellensatz; this is work in progress.