KASS 2010

December 15, 10.00

Gerard Freixas i Montplet (Paris): *Generalized holomorphic analytic torsion.*

Abstract: We present a formalism of hermitian structures on objects of the derived categor of coherent sheaves and we give an axiomatic characterization of the possible theories of analytic torsion classes, valid even for arbitrary projective morphisms (not only submersions as the constructions known so far). We briefly explain how to use the existence of such theories to describe the singularity of the Quillen metric for degenerating families of curves.

December 8, 10.00

Jan-Erik Björk (Stockholm): *Topics on residue currents.*

October 20, 10.00

Genkai Zhang (Göteborg): *Kähler-Einstein metrics on the space of complex icosahedra.*

October 13, 10.00

David Witt Nyström (Göteborg): *Analytic test configurations and geodesic rays.*

October 6, 10.00

Aron Lagerberg (Göteborg): *Super currents and tropical geometry.*

September 22, 10.00

Magnus Aspenberg (Jacobs University, Bremen): *Small divisors and binomial recursions.*

Abstract: In this talk I will present a recent result together with Rodrigo Perez, IUPUI, Indiana. The background of the problem goes back to a famous paper by C.L. Siegel in 1942 which briefly can be

stated as follows. Suppose $f : \mathbf{C} \to \mathbf{C}$ is analytic function and $f(z_0) = z_0, f'(z_0) = e^{2\pi i\theta}$ where θ is irrational. We say that θ is Diophantine if, roughly spoken, it is badly approximable by rational numbers, so that for each rational number p/q we have $|\theta p/q| \geq cq\mu$, where c, μ are positive parameters. Siegel showed that given f as above with θ Diophantine, then there is a conformal map (called the conjugating function or linearising map) ϕ mapping a neighbourhood of z_0 to a neighbourhood of 0 such that (1) $\phi \circ f(z) = \lambda\phi(z)$, where we have put $\lambda = e^{2\pi i\theta}$. In other words, f looks like a conformally distorted rigid rotation around z_0. The largest (simply connected) domain S where the conjugation (1) holds is nowadays called a Siegel disk. To show the existence of ϕ one has to prove that the formal power series satisfying (1) converges. The terms in the series for ϕ are defined recursively, and when θ is irrational, they may blow up due to so called "small divisors" in the recursion formula, thereby threatening the convergence of the series. Siegel surmounted this problem by first noting that each term is a sum of sub-terms, and then showing by an ingenious argument (given that θ is Diophantine) that this sum is majorised by the largest sub-term, which grows exponentially. However, the series for ϕ may still converge even if this largest sub-term grows super-exponentially. But for this to happen it is necessary to detect large cancellations between the sub-terms. The result which I present is focused on a simplified recursion formula from the setting above and is tailored for tackling such problems. The result also has a striking connection to the Catalan numbers.

September 8, 10.00

Mats Andersson (Göteborg): *Effective membership results for polynomial ideals on an algebraic subvariety of* $\mathbf{C}^N$*. (joint with E Wulcan)*
Abstract: Let X be an n-dimensional algebraic (not necessarily smooth) subvariety of $\mathbf{C}^N$. Given polynomials $F_1, \dots, F_m$, of degree at most d, with no common zeros on X, there are polynomials Q_j such that $F_1Q_1 + \cdots + F_mQ_m = 1$ on X. Jelonek proved 2005 that one can choose Q_j such that $\deg(F_jQ_j) \leq d^n degX$. This degree estimate is optimal in general. However, one can get sharper estimates by additional conditions on X and the polynomials at infinity. We will also discuss degree estimates of solutions to $F_1Q_1 + \cdots + F_mQ_m = \Phi$ when F_j have common zeros and the polynomial Φ a priori is assumed to belong to the ideal (F_j).

August 31, 10.00

Bo Berndtsson (Göteborg): *Extension of closed forms from hypersurfaces (Partly after Vincent Koziarz).*

June 21, 13.15

Rodrigo Parra (University of Michigan): *Equidistribution to the Green current.*

Abstract: In this talk I will breafly describe the problem of equidistribution in holomorphic dynamics on the complex projective space. More precisely, given a holomorphic map $f : \mathbb{P}^k \to \mathbb{P}^k$ of algebraic degree $d \geq 2$ then there exist a positive closed (1,1)-current T_f which is invariant (i.e. $f^*T_f = dT_f$) and supported on the Julia set of f. We will try to address the following question: If S is a positive closed (1,1)-current, when does the sequence $d^{-n}(f^n)^*S$ converges to T_f. This is always true if S is smooth and is always false if S is the current of integration of a totally invariant hypersurface. This question has been answered in dimensions $k = 1$ and 2 and I will describe some partial results recently obtained in higher dimensions.

Thursday June 10, 15.15

Johannes Lundqvist (Stockholm): *The Ronkin function and hyperplane amoebas in 3 dimensions.*

Abstract: Let f be a polynomial in several variables. The Ronkin function of f, N_f, is closely connected to the amoeba of f and is well studied in the case of two variables by Mikael Passare and Hans Rullgård. For example, the real Monge-Ampère measure of N_f gives rise to a nice inequality that bounds the area of the amoeba in terms of the area of the Newton polytope. In this talk we consider the case when f is an affine linear polynomial in three variables. We are then able to express the second order derivatives of the Ronkin function, and hence the real Monge-Ampère measure, in terms of complete elliptic integrals or hypergeometric functions.

Wednesday June 2, 10:00

Elizabeth Wulcan (Göteborg): *Non-proper intersection theory and positive currents.*

Abstract: I will discuss an ongoing project with M. Andersson, H. Samuelsson, and A. Yger, which aims to present a current approach to non-proper intersection theory.

Our main result (so far) is a generalization of the classical King's Formula: given a coherent ideal sheaf J on an analytic space we construct a positive current whose Lelong numbers are precisely the Segre numbers of J.

Thursday April 22, 10.00

Alan Sola (KTH): *Anisotropic Hastings-Levitov clusters and harmonic measure.*

Abstract: In 1998, Hastings and Levitov introduced a conformal mapping approach to certain random growth phenomena arising in physics. In fact, they defined a family of Laplacian growth models indexed by a parameter $\alpha \in [0, 2]$, where the $\alpha = 2$ instance can be thought of as an off-lattice version of the famous Diffusion-limited aggregation of Witten and Sander. While it is relatively easy to produce pictures of the evolving $HL(\alpha)$ clusters, a precise mathematical description is still lacking, at least when $\alpha \neq 0$.

In recent work with Johansson Viklund (KTH) and Turner (Lancaster) we have studied an anisotropic version of the $\alpha = 0$ case of the $HL(\alpha)$ model. We obtain a description of the boundary flow that describes the evolution of harmonic measure on the boundary of the growing clusters in terms of an ordinary differential equation, and we characterize the fluctuations around this deterministic limit in terms of certain SDEs.

Wednesday, April 21, 10:00

Alan Sola (KTH): *The Loewner equation and random processes in the plane.*

Abstract: Loewner's differential equation, one of the most important tools in geometric function theory, provides a description of the evolution of simply connected subsets of the complex plane in terms of positive measures supported on the boundary of a reference domain. The equation was originally introduced in connection with coefficient problems for conformal mappings. In recent years, random Loewner evolutions have been used to analyze scaling limits of certain planar stochastic processes and have led to breakthroughs in this field. In my talk, I plan to give an informal overview of some of these results, and the Loewner theory in general.

Wednesday, April 14, 10:00

Bo Berndtsson (Göteborg): *Hodge bundles and the Gauss-Manin connection.*

Wednesday, April 7, 10.15

Robert Berman (Göteborg): *Kähler-Ricci flows and their quantization (continuation).*

Wednesday, March 24, 10.15

Robert Berman (Göteborg): *Relative Kähler-Ricci flows and their quantization.*

Abstract: Let X be a complex manifold whose canonical line bundle is ample. To this data Donaldson recently introduced an iteration on the space of all Hermitian matrices of a fixed rank N. This latter space can be thought of as the quantization of the space of all metrics on the canonical line bundle of X. In fact, only certain values of N are allowed, namely those which appear as plurigenera of X. In this talk I will explain that, in the large N limit, Donaldson's iteration converges to the Kähler-Ricci flow on the space of all metrics on X. This confirms a conjecture of Donaldson. I will also relate this latter result to relative versions of the Kähler-Ricci flow on fibrations. with applications to the construction of canonical metrics on the universal space of the moduli space of X. There is also a similar story when the canonical line bundle of X is anti-ample, which is related to a result of Perelman for the large time convergence of the Kähler-Ricci flow.

Friday, March 19, 15.15

Erlend F. Wold (Oslo): *Poletsky disks and the currents og Duval and Sibony.*

Abstract: It is well known that analytic structure cannot account for the maximum principle in SCV. Duval and Sibony have shown that currents account for it, and Poletsky has shown that analyticity "almost" accounts for it. Noone seems to have pointed out that Poletsky's result implies the result of Duval and Sibony, and we will explain the (simple) reason.

Friday, March 19, 10.15

Gerard Freixas i Montplet (Paris): *Deligne-Riemann-Roch type isometries for pointed stable curves II.*

Thursday, March 18, 10.00

Jan-Erik Björk (Stockholm): *On the mathematics by Arne Beurling.*

Wednesday, March 17, 10.15 (joint KASS and AGAT)

Gerard Freixas i Monplet (Paris): *Deligne-Riemann-Roch type isometries for pointed stable curves I.*

Wednesday, March 3, 10.15

Robert Berman (Göteborg): *Kähler-Einstein metrics and Ricci flows I.*

Abstract: I will start by giving an introduction to Einstein metrics and Hamilton's Ricci flow in the setting of complex geomtry, or more precisely on Kähler manifolds. In particular I will explain the major brake through of Perelman for Fano manifolds. Finally, I will briefly dicscuss some new results (http://arxiv.org/abs/1002.3717) on relative Kähler-Ricci flows and their quantization that will be further explained in a subsequent talk.
