Mikael Passare's day

September 14, 2012

Stockholms universitet

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MIKAEL PASSARE'S DAY

SEPTEMBER 14, 2012

RUM 14, BUILDING 5, KRÄFTRIKET
STOCKHOLM UNIVERSITY

Program

10:00–10:20 Christer Kiselman: *Mikael Passare 1959–2011*

10:20–10:50 Petter Johansson: *Amoebas and coamoebas on affine spaces*

10:55–11:25 Sergei Merkulov: *A line in the plane and the Grothendieck-Teichmüller group*

11:30–12:00 Henrik Shahgholian: *When are potentials optimally regular?*

Lunch

13:00–13:30 Christer Kiselman: *Questions inspired by Mikael Passare's mathematics*

13:35–14:05 Boris Shapiro: *New multiplier sequences and discriminant amoebae*

14:10–14:40 Richard Lärkäng: *Residue currents with prescribed annihilator ideals on singular varieties*

14:45–15:15 Håkan Hedenmalm: *The Gaussian free field and Hadamard's variational formula*

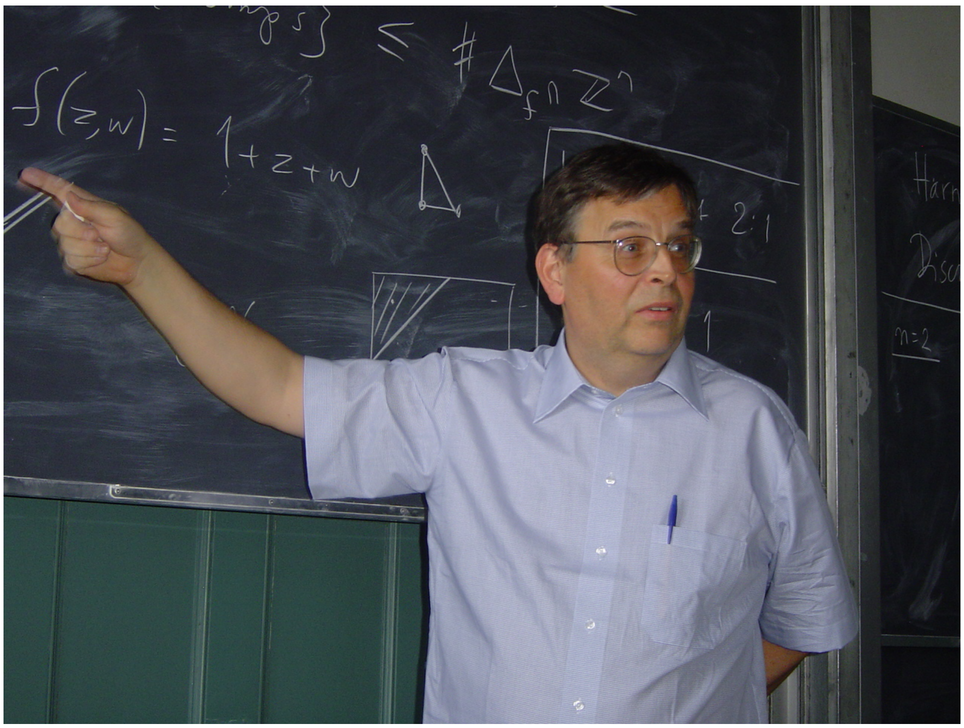
Coffee break

15:30–16:00 Jens Forsgård: *Lopsided Coamoebas*

16:05–16:35 Johan Andersson: *Voronin universality in several complex variables*

16:40–17:10 Rikard Bøgvad: *Piecewise pluriharmonic plurisubharmonic functions and limits of subvarieties.*

(Visit to Norra begravningsplatsen)



≤ # Δ_f ∩ Z^n
f(z,w) = 1+z+w
2:1
n=2

Abstracts

Voronin universality in several complex variables

Johan Andersson
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Birkhoff proved that there exists universal functions in one complex variable in the 1920s. By proving that the Riemann zeta-function is universal in the 1970s, Voronin gave the first such explicit example. While Birkhoff's result easily generalizes to several complex variables, universality for zeta-functions is harder. Our purpose of this talk is to give the first explicit example of such a function by showing that the Euler-Zagier multiple zeta function defined by

$$\zeta_n(s) = \sum_{1 \leq k_1 < k_2 < \cdots < k_n} k_1^{-s_1} \cdots k_n^{-s_n},$$

for $\mathrm{Re}(s_i) > 1$, and by analytic continuation elsewhere is universal in several complex variables. More precisely we prove that

Theorem. Let $n \geq 2$ and let $E \subset \mathbb{C}^n$ be a Runge domain so that if $s = (s_1, \ldots, s_n) \in E$ then $1/2 < \mathrm{Re}(s_j) < 1$, and let f be any holomorphic function on E. Then for any $\epsilon > 0$, and compact subset $K \subset E$ we have that

$$\liminf_{T \to \infty} \frac{1}{T^n} \operatorname{meas} \left\{ t \in [0,T]^n : \max_{s \in K} |\zeta_n(s + it) - f(s)| < \epsilon \right\} > 0.$$

Piecewise pluriharmonic plurisubharmonic functions and limits of subvarieties.

Rikard Bøgvad
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I will describe some situations related to GKZ systems where subvarieties related to polynomial solutions converge to a set that may be described in terms of an associated plurisubharmonic function, that is piecewise pluriharmonic.

Lopsided Coamoebas

Jens Forsgård
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The coamoeba of an algebraic hypersurface $V(f) \subset (\mathbb{C}*)^n$ is defined as its image under the componentswise argument mapping. One of the main problems regarding coamoebas is to describe the structure of its set of connected complement components, given either a fixed point configuration $A = \mathrm{supp}\,(f)$ or a fixed Newton polytope $\Delta_f = \mathrm{Conv}\,(A)$. The progress so far consists of an upper bound given by the weighted volume $n!\mathrm{Vol}\,(\Delta_f)$. In this talk we will introduce the lopsided coamoeba. This is a simpler object then the coamoeba, and in general it has fewer complement components. We will show that there is a relation between its complement components and a certain translated lattice inside the zonotope of a Gale transform of A. In some cases this allows us to construct coamoebas with the maximal number of complement components. Focusing on the exceptional cases, we find some interesting examples of coamoebas.

The Gaussian free field and Hadamard's variational formula

Håkan Hedenmalm
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The Gaussian free field (GFF) can be viewed as a collection of Gaussian random variables indexed by elements of the Sobolev space W_0^1 on the given domain, subject to a formula for the correlations. In a sense which can be made precise, it is a Gaussian random "element" of the Sobolev space (with Dirichlet inner product). A much simpler random field is the white noise field, which does contain long-range correlations. We show how to build the GFF using infinitesimal Gaussian independent increments (like in Brownian motion) where each increment is harmonic on a subdomain along a given foliation.

This reports on joint work with P.J. Nieminen.

Amoebas and coamoebas on affine spaces

Petter Johansson
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During his last years, Mikael got some ideas on amoebas of complex lines and complex affine spaces of dimension "n/2", and he assigned me the task to write them down and transfer them to the coamoeba case. I will present these ideas and some related general work on affine spaces.

Mikael Passare 1959–2011

Christer Kiselman
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Mikael's significance goes much beyond his own research. Many persons have testified to his positive view of life, his humor, and to his genuine interest in people he met. He was an unusually stimulating partner in discussions; listening, inspiring, and supportive, in professional situations as well as private ones.

Questions inspired by Mikael Passare's mathematics

Christer Kiselman
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Mikael Passare (1959–2011) was a brilliant mathematician. His PhD thesis from 1984 was a breakthrough in the theory of residues in several complex variables. Later he switched to the theory of amoebas and coamoebas. In discussions with him during the last thirty years many questions have emerged—not all of them were resolved at the time of his premature death. The purpose of my talk is to save from oblivion some of the mathematical ideas of Mikael Passare.

Residue currents with prescribed annihilator ideals on singular varieties.

Richard Lärkäng
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The duality theorem for Coleff-Herrera products states that the annihilator of the Coleff-Herrera product of a complete intersection f on a complex manifold equals the ideal generated by f. This was proven by Mikael Passare in his doctoral thesis, and independently proven by Dickenstein and Sessa.

Given an arbitrary ideal J on a complex manifold, Andersson and Wulcan constructed a current R^J such that its annihilator equals J, generalizing the duality theorem. I will describe how one can construct such a current also on a singular variety, mainly by focusing on special cases.

A line in the plane and the Grothendieck-Teichmüller group

Sergei Merkulov
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The Grothendieck-Teichmüller group (GT) appears in many different parts of mathematics: in the theory of moduli spaces of algebraic curves, in number theory, in the theory of motives, in the theory of deformation quantization etc. Using recent breakthrough theorems by Thomas Willwacher, we argue that GT controls the deformation theory of a line in the complex plane when one understands these geometric structures via their associated operads of (compactified) configuration spaces. Applications to Poisson geometry and Batalin-Vilkovisky formalism are discussed.

When are potentials optimally regular?

Henrik Shahgholian
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It is well-known that the Newtonian potential of a given (smooth) density f over a domain D, has "almost" bounded second derivatives. In general a logarithmic term appears. In this talk I shall discuss conditions that makes the second derivatives of potentials bounded. This can be applied to problems in free boundaries and the classical quadrature domain theory to show the optimal regularity of solutions.

This is a work in collaboration with John Andersson (Warwick), and Erik Lindgren (Trondheim).

New multiplier sequences and discriminant amoebae

Boris Shapiro
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In their classic 1914 paper, Pólya and Schur introduced and characterized two types of linear operators acting diagonally on the monomial basis of R[x], sending real-rooted polynomials (resp. polynomials with all nonzero roots of the same sign) to real-rooted polynomials. Motivated by fundamental properties of amoebae and discriminants discovered by Gelfand, Kapranov, and Zelevinsky, we introduce two new natural classes of polynomials and describe diagonal operators preserving these new classes. A pleasant circumstance in our description is that these classes have a simple explicit description, one of them coinciding with the class of log-concave sequences.

This is joint work with M. Passare and M. Rojas.