Titles and Abstracts

Magnus Aspenberg

Perturbations of rational Misiurewicz maps

Abstract: Rational Misiurewicz maps are non-hyperbolic maps without parabolic periodic points and for which the critical set on the Julia set is non-recurrent. The talk will be focused on perturbation properties of such maps. We show that any rational Misiurewicz map (apart from flexible Lattes maps - these have to be treated differently) can be perturbed into a hyperbolic map. Moreover, if the Julia set if not the whole sphere, it is in fact a density point of hyperbolic maps.

Kari Astala

Random Conformal Welding

Abstract: There has been great advances in describing scaling limits of different lattice models of statistical physics, such as percolation or the ising model, by using methods of complex analysis, SLE (Stochastic/Schramm Loewner equation) in particular. In this talk, based on joint work with Peter Jones, Antti Kupiainen and Eero Saksman, I will consider an approach to producing random Jordan curves, based on the method of conformal welding. This approach provides a natural correspondence between (certain) Jordan curves in the complex plane and (suitable) homeomorphisms of the unit circle. Using this idea we construct random curves from random circle homeomorphisms, whose derivative is proportional to the exponential of the Gaussian free field, or more precisely, the restriction of the two dimensional free field to the circle.

Laurent Bartholdi

On Spiders, Rabbits and Thurston

Abstract: I will talk about (topological) branched coverings of the sphere; typical examples include rational maps, their continuous deformations; and all maps obtained from these by cutting and pasting. Of particular interest are the maps for which the critical points have finite orbits, because of the rigidity phenomena they exhibit.

A fundamental theorem by Thurston states when such a branched covering is isotopic to a rational map; and hints at an algorithm that either computes that map, or provides a proof that such a map does not exist.

I will explain how these ideas can be realised using group-theoretical language, and give an application to a problem involving quadratic polynomials.

The words in the title are justified as follows: the "Rabbit" is a polynomial of degree 2, whose critical point follows a cycle of length three, and whose Julia set looks like a rabbit. Thurston's algorithm involves imagining a "spider" sitting opposite the rabbit on the sphere, with three legs stretching to the orbit of the critical point. The spider knits the unfortunate rabbit with her legs, attempting to canonicalize it.

Araceli Bonifant

Topology of the period p curve for cubic polynomials

Abstract: The parameter space for monic centered cubic polynomial maps with a marked critical point of period p is a smooth algebraic curve whose genus increases rapidly with p. In this talk I will discuss the topology of this curve. This is joint work with Jan Kiwi and John Milnor.

Shaun Bullett

Moduli spaces of holomorphic correspondences

Abstract: Holomorphic correspondences generalise rational maps and Kleinian groups as dynamical systems on the Riemann sphere. In favourable circumstances a correspondence has a non-empty normality set, on which the space of grand orbits is a marked Riemann surface S. For a particular family of quasifuchsian examples we show how the moduli space of the correspondences sits as an intermediate covering between the moduli space of S and its universal cover, the Teichmueller space of S. This viewpoint allows us to parameterise the moduli space of our correspondences, to investigate its boundary, and to classify the critical relations that occur at isolated interior points.

Arnaud Cheritat

Two theorems of Herman

Abstract: We extend two theorems of Herman concerning Siegel disks. First we construct Siegel disks with non locally connected boundaries, for maps that are holomorphic beyond the boundary. Second (joint work with Pascale Roesch), we prove that under Herman's Diophantine condition, the boundary of Siegel disks of bicritical polynomials must contain a critical point.

Hiroyuki Inou

Discontinuous straightening maps

Abstract: Kiwi and the speaker gave a precise formulation of straightening maps for families of higher degree polynomials. I would like to explain that such a straightening map is always discontinuous if it is not "essentially" quadratic, as Douady-Hubbard's example of a cubic-like family suggested. I would also discuss straightening maps on escape locus.

Pekka Koskela

Generalized dimension estimate for the boundary of a simply connected domain

Abstract: The derivative of Riemann mapping function onto a simply connected domain of finite area is always in $L^2(B(0,1))$ with respect to the usual area. It is well-known that, if the derivative is L^2-integrable with respect to the measure $(1-|z|)^{-\epsilon}dA$, then the Hausdorff dimension of the boundary of the domain is bounded away from two, and that the bound tends to two when ϵ tends to zero. Consider the measure $\log^{\lambda}(1/(1-|z|))dA$. If $\lambda \leq 1$, it may happen that the boundary has positive area. When $\lambda > 1$, we prove that the generalized Hausdorff measure of the boundary is zero for the gauge function $h(t) = t^2 \log(1/t)$. This shows a "spectral gap" for these general scales. One can in fact replace the exponent one of the logarithm in the gauge function by an exponent strictly bigger than one, depending on λ.

Genadi Levin

Identities for forward and backward critical orbits

Abstract: We start by reviewing some results of a joint paper with M. Sodin and P. Yuditsky (1991). We derive from this a connection between Lyapunov exponents and the pressure at the critical points. This is a work in progress.

Daniel Meyer

Invariant Peano curves of expanding Thurston maps

Abstract: We consider postcritically finite rational maps, whose Julia set is the whole sphere. It is shown that every such map f has an iterate $F = f^n$, that is semi-conjugate to $z^d\colon S^1 \to S^1$, where $d = \deg F$. More precisely, for such an F there is Peano curve $\gamma\colon S^1 \to S2$ (onto), such that $F \circ \gamma(z) = gamma(z^d)$ (for all $z \in S1$). This was constructed by Milnor for a specific map before, it corresponds to a result by Cannon-Thurston for Kleinian groups.

Carsten Petersen

Polynomial-like semi-conjugates of the shift

Abstract: Let $f : U' \to U$ be a generealized polynomial-like mapping, i.e. f is proper, holomorphic of degree $d \geq 2$ with $U' \subset\subset U$ and with U and each component U'_i of U' isomorphic to $\mathbb{D}$. If the filled Julia set K_f of f is a Cantor set. Then there is a semi-conjugacy $\Pi : \Sigma_d \to J_f = K_f$ of the onesided shift σ on Σ_d to f such that Π is as injective as possible. That is, such that

$$\#\Pi^{-1}(z) = \lim_{n\to\infty} \deg(f^n, z).$$

Mary Rees

The parameter capture map

Abstract: The context of this talk is quadratic rational maps. In particular, we consider those for which one of the two critical points is of period three, and the second critical point is in the backward orbit of the first. If the second critical point is not itself periodic, then we say that the map is of type III. The (Wittner) captures are a proper class of type III. The capture construction is an analogue of mating. The Julia sets of capture maps are obtained in a simple manner from Julia sets of polynomial, by first identifying points on the Julia set of the polynomial in pairs using a lamination generated by a diagonal identifying points on the boundaries of two distinct Fatou components, and then opening up these connections in a different way – a construction which Timorin calls "gluing" and has considered in a more general context.

The polynomials that are relevant to us are the quadratic polynomials with a critical point of period three: the rabbit, anti-rabbit and aeroplane polynomials, and, in particular, the last of these. A type III quadratic rational map can be represented by a capture by the aeroplane polynomial in many different ways (or by none). The parameter capture map sends a capture representation to the rational map it represents. In this talk I shall discuss the fibres of the paramater capture map for the aeroplane polynomial.

Pascale Roesch

Cubic Newton Maps

Abstract: I will describe the parameter space of cubic Newton maps. It includes very recent works with Magnus Aspenberg.

Dierk Schleicher

Newton Maps as Dynamical Systems

Abstract: We describe the dynamics of Newton's method for complex polynomials from two points of view: as a root finder that is as efficient as possible, and as an interesting family of rational maps. We discuss how Newton's method can be turned into an efficient algorithm to find all roots of complex polynomials of a given degree, and we give a classification of all postcritically finite Newton maps.

Eva Uhre

Limits of hyperbolic components of polynomiallike quadratic rational maps

Abstract: