

Interactions between continuous and discrete holomorphic dynamical systems.

2012-07-08

MEALS

*Breakfast (Buffet): 7:00–9:30 am, Sally Borden Building, Monday–Friday

*Lunch (Buffet): 11:30 am–1:30 pm, Sally Borden Building, Monday–Friday

*Dinner (Buffet): 5:30–7:30 pm, Sally Borden Building, Sunday–Thursday

Coffee Breaks: As per daily schedule, in the foyer of the TransCanada Pipeline Pavilion (TCPL)

***Please remember to scan your meal card at the host/hostess station in the dining room for each meal.**

MEETING ROOMS

All lectures will be held in the new lecture theater in the TransCanada Pipelines Pavilion (TCPL). LCD projector and blackboards are available for presentations.

SCHEDULE

The talks are not to exceed fifty minutes

Sunday

16:00 Check-in begins (Front Desk - Professional Development Centre - open 24 hours)
17:30–19:30 Buffet Dinner, Sally Borden Building
20:00 Informal gathering in 2nd floor lounge, Corbett Hall
Beverages and a small assortment of snacks are available on a cash honor system.

Monday

7:00–8:45 Breakfast
8:45–9:00 Introduction and Welcome by BIRS Station Manager, TCPL
9:00 Lecture, Sibony
Coffee Break, TCPL - to START no earlier than 10 am
Lecture, Pereira
11:30–13:00 Lunch
13:00 Lectures, Radu, Zhang
Coffee Break, TCPL - to END no later than 3:30 pm.
Lecture, Abate
17:30–19:30 Dinner

Tuesday

7:00–9:00 Breakfast
9:00 Lecture, Oguiso
Coffee Break, TCPL - to START no earlier than 10 am
Lecture, Lapan
11:30–13:00 Lunch
13:00 Lectures, Kaschner, Raissy
Coffee Break, TCPL - to END no later than 3:30 pm.
Lecture, Firsova, Uehara
17:30–19:30 Dinner

Wednesday**7:00–9:00**

Breakfast

9:00

Lecture, Ueda

Coffee Break, TCPL - to START no earlier than 10 am

Lecture, Bedford

11:30–13:30

Group Photo; meet in foyer of TCPL (photograph will be taken outdoors so a jacket might be required)

Lunch

Free Afternoon.

17:30–19:30

Dinner

Thursday**7:00–9:00**

Breakfast

9:00

Lecture, Dinh

Coffee Break, TCPL - to START no earlier than 10 am

Lecture, Boyd

11:30–13:00

Lunch

13:00

Lectures, Tanase, Roeder

Coffee Break, TCPL - to END no later than 3:30 pm.

Lecture, Bracci, Peters

17:30–19:30

Dinner

Friday**7:00–9:00**

Breakfast

9:00

Lecture, Lin

Lecture and Coffee, Lyubich

11:30–13:30

Lunch

Checkout by**12 noon.**

** 5-day workshop participants are welcome to use BIRS facilities (BIRS Coffee Lounge, TCPL and Reading Room) until 3 pm on Friday, although participants are still required to checkout of the guest rooms by 12 noon. **

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ABSTRACTS (in alphabetic order by speaker surname)

Speaker: **Abate, Marco** (Universita di Pisa)

Title: *Denjoy-Wolff theorems in not necessarily smooth convex domains*

Abstract: In this talk we shall describe a new simple proof of a Wolff-Denjoy theorem in not necessarily smooth strongly convex domains, extending to the non-smooth case the description of the dynamics of holomorphic self-maps known for smooth strongly convex domains. We shall also present some extensions to (not necessarily smooth) weakly convex domains. (Joint work with J. Raissy)

Speaker: **Bedford, Eric** (Indiana Univeristy)

Title: *Semi-parabolic implosion in complex dimension 2, Part 2*

Abstract: Let F_0 be a holomorphic automorphism of a complex manifold M of dimension 2. We suppose that F_0 has a fixed point O and that the differential of F has eigenvalues 1 and b with $0 < |b| < 1$. Further we suppose that F_0 is a member of a family of automorphisms $\{F_\epsilon\}$. We will investigate the phenomena of implosion, i.e., the discontinuity of the (filled-) Julia sets for this family. In dimension 1, the prototypical example of this is the so-called implosion behavior of the Julia sets $J(p_\epsilon)$ for the family $p_\epsilon(z) = z + z^2 + \epsilon^2$, for $\epsilon > 0$.

(Part 1) First we recall the properties of automorphisms F_0 with semi-parabolic fixed points. We define semi-attracting basin \mathcal{B} , asymptotic curve Σ , in-coming and out-going Fatou coordinates, and transition maps T_α . For the family of perturbed maps, we construct transit maps and almost Fatou coordinates. Then we prove their convergence to transition map.

(Part 2) We work with the Henon family as a concrete example. We recall the definitions and properties of the analogues of (filled-) Julia sets: K^\pm, J^\pm . We discuss the transition maps T_α as dynamical systems, and we define the associated Julia-Lavours sets $J(T_\alpha)$ and $K(T_\alpha)$. Our results on implosion relate the semi-continuity (both upper and lower) of the Julia sets of F_ϵ to the sets $J(T_\alpha)$ and $K(T_\alpha)$.

Speaker: **Boyd, Suzanne** (University of Wisconsin, Milwaukee)

Title: *Julia sets of singularly perturbed rational maps of \mathbb{C} and polynomial skew products of \mathbb{C}^2 which contain Julia sets of quadratic polynomials.*

Abstract: In this talk, we will examine the dynamics of certain types of maps from each of the following two families, including computing some Iterated Monodromy Group representations. Family (1) consists of 'Singularly perturbed rational maps', which are rational maps of the 'Riemann sphere of the form $R(z) = z^n + c + a/(z^n)$. Family (2) is 'Polynomial skew products of \mathbb{C}^2 ', which are endomorphisms of the form $F(z, w) = (p(z), q(z, w))$, where p and q are both monic of degree $d \geq 2$.

For one class of polynomial skew product of \mathbb{C}^2 , we will exhibit a one-dimensional combinatorial model of the dynamics on the Julia set (closure of the set of repelling periodic points), which looks suspiciously similar to combinatorial models of singularly perturbed rational maps.

We will see how certain classes of maps from each family have dynamics which incorporates the dynamics of two hyperbolic quadratic polynomials, and in the case of the rational maps of family (1), display the intriguing effects of this in parameter space.

Speaker: **Bracci, Filippo** (Universita di Roma)

Title: *Parabolic basins of attractions of resonant germs*

Abstract: Resonances among eigenvalues of the linear part of a germ of a biholomorphism causes many interesting phenomena on the dynamics of the sequence of iterates of the map. In particular, resonances define a (formal) invariant foliation for the map, and the action on the space of leaves of such a foliation gives information on the dynamics of the map itself. In particular, if the resonances are infinite but finitely generated over the rationals, the speaker together with D. Zaitsev and J. Raissy constructed some invariants of the map which detect (sharply) the existence of basins of attraction of parabolic type. Similar phenomena seem to be true case of one eigenvalue equal to 1 and the others resonants as before. The aim of this talk is to discuss of these phenomena and some related open questions.

Speaker: **Dinh, Tien-Cuong** (Institut de Mathematique de Jussieu)

Title: *Density of currents and applications*

Abstract: We discuss a notion of density associated to positive closed currents on a compact Kaehler manifold. It generalizes both the intersection of currents and the notion of Lelong number. Applications in dynamics will be given. The talk is based on my work in collaboration with Nessim Sibony.

Speaker: **Firsova, Tanya** (Stony Brook University)

Title: *The Henon critical locus*

Abstract:

Speaker: **Kaschner, Scott** (Indiana Univeristy)

Title: *Non-analyticity of a stable manifold for the diamond hierarchical lattice (DHL) renormalization transformation.*

Abstract: In a recent preprint, Bleher, Lyubich, and Roeder give a rigorous description of the limiting distribution for the Lee-Yang zeros of the Ising model on the diamond hierarchical lattice. This distribution can be described in terms of the dynamics of an explicit rational map R in two variables, the renormalization transformation. Among other things, it was shown that the stable manifold of an invariant circle B , has C^∞ regularity. I will prove that the stable manifold of B is not real-analytic in a neighborhood of any point, using techniques from complex geometry and complex dynamics. I will then relate this to the Lee-Yang and Lee-Yang-Fisher zeros. I will conclude by giving examples of situations with similar assumptions in which the stable manifold is real-analytic.

Speaker: **Lapan, Sara** (University of Michigan)

Title: *Attracting domains of certain maps tangent to the identity*

Abstract: This talk will focus on recent results in discrete holomorphic local dynamics in two complex variables. In particular, a holomorphic fixed-point germ of the form $f = Id + (\text{higher order terms})$ whose only characteristic direction is non-degenerate, has a domain of attraction on which the map is conjugate to a translation: $(t, w) \mapsto (t + 1, w)$. In the case where f is a global automorphism, the corresponding domain of attraction is a Fatou-Bieberbach domain.

Speaker: **Lyubich, Mikhail** (Stony Brook University)

Title: *On the parameter space for the Henon family*

Abstract:

Speaker: **Oguiso, Keiji** (Osaka Univeristy)

Title: *Automorphism groups of Calabi-Yau manifolds of Picard number two*

Abstract: We prove that the automorphism group of an odd dimensional Calabi-Yau manifold of Picard number two is always a finite group. This makes a sharp contrast to the automorphism groups of $K3$ surfaces and hyperkähler manifolds and birational automorphism groups, as we shall see. We also clarify the relation between finiteness of the automorphism group (resp. birational automorphism group) and the rationality of the nef cone (resp. movable cone) for a hyperkähler manifold of Picard number two. We will also discuss a similar conjectural relation together with existence of rational curve, expected by the cone conjecture, for a Calabi-Yau threefold of Picard number two.

Speaker: **Pereira, Jorge Vitorio** (IMPA (Brazil))

Title: *Rational maps preserving webs*

Abstract: I will present a classification of rational maps of projective surfaces which preserve webs (i.e. multi-foliations).

Speaker: **Radu, Remus** (Cornell Univeristy)

Title: *Topological models for semi-parabolic Henon maps*

Abstract: We will look at the parameter space P_λ of complex Henon maps which have a fixed point with one eigenvalue a root of unity, λ . We would like to understand semi-parabolic Henon maps that are small perturbations (inside the parabola P_λ) of a quadratic polynomial $p(x)$ that has a parabolic fixed point of multiplier λ . We get an open disk of parameters for which J is connected and J^+ can be understood as an inductive limit of $J_p \times D$ under an appropriate solenoidal map. This is joint work with John Hubbard and Raluca Tanase.

Speaker: **Raissy, Jasmine** (Univeristy of Milano Bicocca)

Title: *Backward iteration in strongly convex domains*

Abstract: We study backward orbits for holomorphic self-maps of bounded strongly convex \mathcal{C}^2 domains in \mathbb{C}^n . We prove that a backward orbit with bounded Kobayashi step for a hyperbolic, parabolic or strongly elliptic holomorphic self-map of a bounded strongly convex \mathcal{C}^2 domain in \mathbb{C}^n necessarily converges to a repelling or parabolic boundary fixed point, generalizing previous results obtained by Bracci and Poggi-Corradini in the unit disk and by Ostapyuk in the unit ball of \mathbb{C}^n . We also prove the existence of backward orbits with bounded Kobayashi step, showing that given an isolated repelling boundary point for a strongly elliptic, hyperbolic or parabolic, self-map then there always exists a backward orbit with bounded Kobayashi step converging to it. (Joint work with M. Abate).

Speaker: **Roeder, Roland** (IUPUI)

Title: *Postcritically finite rational mappings of $\overline{\mathcal{M}}_{0,5}$ arising from Thurston's Theorem*

Abstract: We study a family of maps $F_d : X \dashrightarrow X$ which arise as *moduli space maps* in the context of Thurston's topological characterization of rational maps. The space X is isomorphic to $\overline{\mathcal{M}}_{0,5}$, which in turn is isomorphic to \mathbb{P}^2 blown up at four generic points. The maps F_d are rational and postcritically finite; each one has a nonempty indeterminacy set. Each map F_d is constructed from a simple combinatorial procedure coming from Thurston's theorem. Using this, we can readily analyze the dynamical behavior; in particular, algebraic stability, dynamical degrees, and maximal invariant cohomology class, etc.

This is joint work with Sarah Koch

Speaker: **Tanase, Raluca** (Cornell Univeristy)

Title: *Describing the boundary of the escaping set for complex Henon maps*

Abstract: Consider the set U^+ of points that escape in forward time under the complex Henon map $H(x, y) = (p(x) - ay, x)$, where p is a quadratic polynomial. This set can be presented as a quotient of $(C - \bar{D}) \times C$ by a discrete group G of automorphisms isomorphic to $Z[1/2]/Z$. We will show how to extend the group action to $S^1 \times C$ in certain cases, in order to represent the boundary J^+ of U^+ as a quotient of $S^1 \times C/G$. We will analyze this extension for Henon maps that are small perturbations of hyperbolic polynomials with connected Julia sets.

Speaker: **Sibony, Nessim** (Universite Paris-Sud-Bat 425)

Title: *Holomorphic Dynamics and Nevanlinna's Theory*

Abstract: I will discuss some analogies between results in holomorphic dynamics i.e foliations by Riemann Surfaces and discrete holomorphic dynamics and the second main theorem in Nevanlinna's theory. Equidistribution results for holomorphic endomorphisms in \mathbb{P}^k appear as refined version of the second main theorem in Nevanlinna's theory. Ergodicity results for foliations by Riemann Surfaces appear as precise version of value distribution theory for maps from the unit disc into a compact manifold. This is joint work with T.C Dinh.

Speaker: **Ueda, Tetsuo** (Kyoto Univeristy)

Title: *Semi-parabolic implosion in complex dimension 2, Part 1*

Abstract: Let F_0 be a holomorphic automorphism of a complex manifold M of dimension 2. We suppose that F_0 has a fixed point O and that the differential of F has eigenvalues 1 and b with $0 < |b| < 1$. Further we suppose that F_0 is a member of a family of automorphisms $\{F_\epsilon\}$. We will investigate the phenomena of implosion, i.e., the discontinuity of the (filled-) Julia sets for this family. In dimension 1, the prototypical example of this is the so-called implosion behavior of the Julia sets $J(p_\epsilon)$ for the family $p_\epsilon(z) = z + z^2 + \epsilon^2$, for $\epsilon > 0$.

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Speaker: **Zhang, De-Qi** (National University of Singapore)

Title: *Pseudo-Automorphisms of positive entropy on the blowups of products of projective spaces*

Abstract: We use a concise method to construct pseudo-automorphisms f_n of the first dynamical degree $d_1(f_n) > 1$ on the blowups of the projective n -space for all $n > 1$ and more generally on the blowups of products of projective spaces. These f_n , for $n = 3$, have positive entropy. In particular, we realise as $d_1(f_n)$ for some f_n , the smallest Salem numbers of degrees 10, 8 and 6, respectively. This is a joint work with F. Perroni.