Midwest Dynamical Systems Conference

October 26 – 28, 2012
University of Notre Dame

TALK TITLES AND ABSTRACTS
(revised 10-18-12)

All talks held in 127 Hayes-Healy Hall

Guillaume Dreyer (University of Notre Dame) ***"Thurston's length function(s) of Anosov representations"***

Let S be a connected, closed, oriented surface of negative Euler characteristic. We consider the PSL(n,R)-character variety of S, or more precisely the preferred connected component Hit(n,S) of this variety. It contains a copy of the Teichmuller space of S, and is thus regarded as the higher rank Teichmuller space for the case of PSL(n,R).

To study the elements in Hit(n,S), F. Labourie introduced the notion of Anosov representation. An interesting feature of Anosov representations is that they enjoy similar properties as Teichmuller representations: They are discrete and injective, and have a geometric meaning. The purpose of this talk is to extend to Anosov representations Thurston's length function, which is a fundamental tool in the study of 2 and 3-dimensional hyperbolic manifolds. We will then discuss various geometric and dynamical applications of this(ese) length(s), in particular to the study of Hitchin representations.

Romain Dujardin (École Polytechnique, France) ***"Homoclinic tangencies in the complex Hénon family"***

We explore the stability/bifurcation dichotomy for families of polynomial automorphisms of $C^{\wedge 2}$. Our results are reminiscent both of the classical bifurcation theory of rational mappings of the Riemann sphere (due to Mané-Sad-Sullivan and Lyubich) and of the Palis conjectures on the global dynamical structure of the space of diffeomorphisms. This is joint work with Misha Lyubich.

Alex Eskin (University of Chicago) ***"TBA"***

Abstract TBA

Ilya Gekhtman (University of Chicago) ***"Patterson-Sullivan Theory for Subgroups of Mapping Class Groups and Orbit Counting in Teichmuller Space"***

We develop an analogue of Patterson-Sullivan theory for convex-cocompact subgroups of mapping class groups acting on the sphere of projective measured foliations, and use it to compute exact multiplicative asymptotics for orbit growth of such groups in Teichmueller space and growth of conjugacy classes of Pseudo-Anosovs of such groups with bounded dilatation. I may also indicate some partial results in that direction for more general non-elementary subgroups of mapping class groups.

Federico Rodriguez Hertz **(Penn State University)** ***"TBA"***
Abstract TBA

Vadim Kaimanovich **(University of Ottawa, Canada)** ***"TBA"***
Abstract TBA

Sarah Koch **(Harvard University)** ***"Eigenvalues of the Thurston Pullback Map"***
Given a critically finite rational map, one can define a holomorphic endomorphism of a Teichmueller space associated to it; this endomorphism is called the Thurston pullback map. With the exception of one class of examples, this endomorphism has a unique fixed point, and the eigenvalues of the derivative at this fixed point are all *algebraic*. What do these eigenvalues mean? What algebraic numbers arise this way? We establish some facts about these eigenvalues if the rational map is a quadratic polynomial (for example, we prove in this case that there are no "small eigenvalues"), but the situation is still mysterious.

Jan-Li Lin **(University of Notre Dame)** ***"Dynamical and arithmetic degrees for rational maps."***
Let f be a rational mapping on a complex projective manifold X. The complexity of (f,X) as a dynamical system is measured by the dynamical degrees. I will define the dynamical degrees and show how to compute them in certain cases. Recently, for maps defined over the algebraic numbers, Silverman defined numerical invariants such as the arithmetic degree and canonical height. Arithmetic degree measures the local arithmetic complexity of an orbit.

Silverman also proposed several deep conjectures about dynamical degrees, arithmetic degrees, and canonical height. I will also introduce the arithmetic degree and canonical height, and present various results and conjectures along this direction.

Rafael de la Llave **(Georgia Tech)** ***"Geometric and Topological Methods in Arnold Diffusion."***
We consider Hamiltonian systems close to integrable and study the problem of whether there are orbits which experience large chances in action.

We identify several geometric (normally hyperbolic manifolds) and topological tools (correctly aligned windows) that lead to large effects. We also present finite calculations that allow to verify the mechanisms in concrete problems and estimate the time.

Joint work with M. Gidea, A. Delshams, T. M.-Seara

Andres Sambarino **(Université Paris 11 - Orsay)** ***"An extension of the Weil-Petersson metric on the Hitchin component(s)"***
A Hitchin component is a conneceted component of the space of representations of the fundamental group of a closed hyperbolic surface to PSL(n,R), that naturally contains the Teichmuller space (called the Fuchsian locus) of the surface.

The purpose of the talk is to explain a recent work in colaboration with M. Bridgeman, D. Canary and F. Labourie where a (mapping class group invariant-) Riemannian metric on the Hitchin components is constructed. This metric extends the Weil-Petersson metric on the Fuchsian locus.

Sergei Tabachnikov (Penn State University) ***"Tire tracks geometry, hatchet planimeter, Menzin's conjecture, and complete integrability"***
This talk concerns a simple model of bicycle motion: a bicycle is a segment of fixed length that can move in the plane so that the velocity of the rear end is always aligned with the segment. The trajectory of the front wheel and the initial position of the bicycle uniquely determine its motion and its terminal position; the monodromy map sending the initial position to the terminal one arises. This circle mapping is a Moebius transformation, a remarkable fact that has various geometrical and dynamical consequences. Moebius transformations belong to one of the three types: elliptic, parabolic and hyperbolic. I shall outline a proof of a 100 years old conjecture: if the front wheel track is an oval with area at least Pi then the respective monodromy is hyperbolic. I shall also discuss the related Backlund-Darboux transformation on curves, in the continuous and discrete settings, its complete integrability, and its unexpected relation with the binormal (smoke ring, filament) equation, a much studied completely integrable PDE.

Amie Wilkinson (University of Chicago) ***"The general case"***
In the early 1930's, the Ergodic theorems of von Neumann and Birkhoff put Boltzmann's Ergodic Hypothesis in mathematical terms, and the natural question was born: is ergodicity the "general case" among conservative dynamical systems? Oxtoby and Ulam tackled this question early on and showed that the answer to this question is "yes" for continuous dynamical systems. The work of Kolmogorov Arnol'd and Moser beginning in the 1950's showed that the answer to this question is "no" for C^infty dynamical systems. I will discuss recent work with Artur Avila and Sylvain Crovisier that addresses what happens for C^1 dynamical systems.

Poster session presenters and titles

Brett Bozyk, Bruce Peckham (University of Minnesota - Duluth) ***"Nonholomorphic Singular Continuations: A Case with Radial Symmetry"***

Min Huang (University of Chicago) ***"Solving Painlevé Connection Problems Using a Dynamical Systems Approach"***

Linh Huynh (Texas Woman's University) ***"Influences of Extracellular Potassium Concentration on Neuron Dynamics"***

Scott Kaschner (Indiana University Purdue University Indianapolis) ***"Superstable Manifolds of Invariant Circles"***

Paul Reschke (University of Illinois - Chicago) ***"Salem Numbers and Complex Surface Automorphism"***

Kelly Yancey **(University of Illinois – Urbana/Champaign)** ***"Rigidity in Topological Dynamics"***

William Yessen **(University of California - Irvine)** ***"Trace Map Dynamics and Applications in Spectral Theory"***