Tagungsbericht 27/1997

Dynamische Systeme

13.07. bis 19.07.1997

Die Organisatoren der Tagung waren H. Hofer (Courant Institute N.Y.U.), J.C. Yoccoz (Université Paris-Sud) und E. Zehnder (ETH Zürich). Diskutiert wurden die neuesten Entwicklungen auf dem Gebiet der klassischen dynamischen Systeme, insbesondere der Hamiltonschen Systeme, und die Zusammenhänge mit partiellen Differentialgleichungen und symplektischer Geometrie.

Gefördert durch
DFG Deutsche Forschungsgemeinschaft

VORTRAGSAUSZÜGE

Sigurd Angenent: Floer's homology for an elliptic system of PDE's

Together with *Rob van der Vorst* we study solutions fo the following elliptic system of PDE's

$$(1)\qquad \begin{cases} -\Delta u = v^q & x \in \Omega \ (\Omega \text{ bounded domain, } \partial\Omega \text{ smooth}) \\ -\Delta v = u^p \end{cases}$$
$$u, v = 0 \quad \text{on } \partial\Omega$$

which are the Euler Lagrange equations of

$$f(u,v) = \int_\Omega \left(\nabla u \cdot \nabla v - \frac{|u|^{p+1}}{p+1} - \frac{|v|^{q+1}}{q+1} \right).$$

We found that Floer's method can indeed be applied, provided one uses the regular gradient flow on $H_0^1(\Omega) \times H_0^1(\Omega)$ (or $H^s \times H^{2-s}$, $0 < s < 2$) instead of the unregularized L^2 gradient flow. A consequence of the Floer construction is:

Theorem *The system has an unbounded sequence of solutions, if one assumes* $p, q > 1$ *and* $(p+1)^{-1} + (q+1)^{-1} > 1 - \frac{2}{n}$.

L. H. Eliasson: Extended solutions for the higher dimensional quasi-periodic Schrödinger equation

Let V be a real analytic function defined on the product torus $T^d \times T^d$ and let $\omega = (\omega_1, \omega_2) \in S^{2d} \subset \mathbb{R}^{2d}$. An eigenfunction $u(t_1, t_2)$ of the quasi-periodic Schrödinger equation

$$[-\Delta + V(\theta_1 + t_1\omega_1, \theta_2 + t_2\omega_2)]u(t) = Eu(t)$$

is a Floquet solution if it has the form

$$e^{i(t_1\xi_1 + t_2\xi_2)} U(\theta_1 + t_1\omega_1, \theta_2 + t_2\omega_2),$$

where $\xi = (\xi_1, \xi_2) \in \mathbb{R}^{2d}$ is called the quasi-momentum. The equation for $U(\theta)$ becomes

$$L_{\omega,\xi} U(\theta) := \left[\left(\partial_{\omega_1}^2 + \partial_{\omega_2}^2 \right) - 2i \left(\xi_1 \partial_{\omega_1} + \xi_2 \partial_{\omega_2} \right) + V(\theta) \right] U(\theta) = \tilde{E} U(\theta).$$

We described some arguments aiming at the proof of the following statement.

If $\sup_{|\mathrm{Im}\,\theta|<r} |V(\theta)| = \varepsilon$, is sufficiently small, then there is a set $B_V \subset S^{2d}$, with measure $(S^{2d} \backslash B_V) \longrightarrow 0$ as $\epsilon \longrightarrow 0$, such that for all $\omega \in B_V$ and for a.e. $\xi \in \mathbb{R}^{2d}$, the operator $L_{\omega,\xi}$ has a smooth eigenfunction $U(\theta)$. More precisely, for all $\omega \in B_V$ and for a.e. $\xi \in \mathbb{R}^{2d}$, the operator $L_{\omega,\xi}$ on $L^2(T^d \times T^d)$ has a pure point spectrum.

Jean-Marc Gambaudo: The asymptotic Hopf invariant

In this talk, we describe asymptotic properties of linking of orbits for volume preserving flows of the three-sphere. Classical invariants introduced by Arnold, Ruelle and Calabi are discussed. The following questions are analyzed:

1. Extension of these definitions to other invariant probability measures.
2. Extension to continuous flows.
3. Topological invariants.

The asymptotic linking properties of n-tuple of orbits for an area preserving diffeomorphism of the 2-disk are described by using a dynamical cocycle with values in the Artin braid group.

Michel Herman: Existence of invariant tori with no torsion conditions

Various theorems where announced: Let $F : \mathbb{T}^1 \times [-\delta, \delta] \hookrightarrow \mathbb{T}^1 \times \mathbb{R}$ a C^∞ embedding that leaves invariant $\mathbb{T}^1 \times \{0\}$, and $F : \mathbb{T}^1 \times [0, \delta] \hookrightarrow \mathbb{T}^1 \times \mathbb{R}_+$, such that the rotation number $\rho\left(F_{|\mathbb{T}^1 \times \{0\}}\right) = \alpha$, satisfies a diophantine condition and F has the intersection property, then we have:

Theorem 1 *For all $\varepsilon > 0$ the map F leaves invariant in $\mathbb{T}^1 \times [0, \pm\varepsilon]$ a Cantor set, of positive measure, of invariant diopantine C^∞ circles.*

Corollary 1 *Let $F : (\mathbb{C}, 0) \to (\mathbb{C}, 0)$ be a C^∞ germ of an area preserving diffeomorphism satisfying $F(0) = 0$, and $DF(0) = \begin{pmatrix} \cos 2\pi\alpha & -\sin 2\pi\alpha \\ \sin 2\pi\alpha & -\cos 2\pi\alpha \end{pmatrix}$ where α satisfies a diophantine condition, then F is Lyapunoff stable near 0.*

This generalizes a theorem of J. Moser.

Corollary 2 (of the proof) *Let $F : \mathbb{T}^1 \times [-1,1] \to \mathbb{T}^1 \times [-1,1]$ be a C^∞ diffeomorphism, homotopic to the identity, and $\rho(F|_{T^1\times\{-1\}}) = \alpha$ that satisfies a diophantine condition, there exists $k_0(\alpha)$, $\varepsilon_0(\alpha) > 0$ such that if $\|F - R_\alpha\|_{C^{k_0}} < \varepsilon_0$, where $R_\alpha(\theta, r) = (\theta + \alpha, r)$, and F has no periodic points, and the intersection property holds,, then F is C^∞ conjugated to R_α.*

This generalizes, in part, a theorem of A. Denjoy (a circle C^2–diffeomorphism with no periodic points is topologically conjugated to a rotation) and the local congugacy results of V.I. Arnold and J. Moser.

In the lecture we discussed the **persistence of invariant circles of a fixed diophantine rotation** α for perturbations of general completely integrable C^∞–mappings $(\theta, r) \to (\theta + \ell(r), r)$ of $\mathbb{T}^1 \times [-1,1]$ and the **existence of Lagrangian invariant tori of fixed diophantine rotation vector** α for Hamiltonian perturbations of $H_0(r)$ on $\mathbb{T}^n \times \mathbb{D}^n$ with coordinates $\theta = (\theta_1, \ldots, \theta_n)$, $\Gamma = (\Gamma_1, \ldots, \Gamma_n)$ with a degree hypothesis on $\frac{\partial H_0}{\partial r} = \ell(r)$, $\ell(r_0) = \alpha \in \mathrm{Int}\,(\ell(\mathbb{D}^n))$, $\|r_0\| < 1$. By examples we showed that Theorem 1 and Corollary 1 unfortunately do not generalize to higher dimensions for symplectic diffeomorphisms or Hamilton flows. We presented a generalization of a theorem of H. Rüssmann and of V.I. Arnold as well as the following result: On $T^*\mathbb{R}^q = \mathbb{R}^q \times \mathbb{R}^q$, $(x, y) = z$, let H_λ be a C^∞ Hamiltonian depending C^∞ on a parameter $\lambda \in [-\frac{1}{2}, \frac{1}{2}]$,

$$H_\lambda(z) = \pi \sum_1^q a_j(\lambda)(x_j^2 + y_j^2) + O(z^\infty).$$

We suppose that $\lambda \to (a_1(\lambda), \ldots, a_q(\lambda))$ is **$\mathbb{R}$-analytic and its image is not contained in a hyperplane** of $\mathbb{R}^q$ passing through 0.

Gefördert durch DFG Deutsche Forschungsgemeinschaft

Theorem *For Lebesgue almost every* λ *the Hamiltonian* H_λ *leaves invariant a set of positive measure of Lagrangian tori of* $T^*\mathbb{R}^q$.

All the results avoid making any hypothesis about higher order terms (that could be C^∞ tangent to 0); what is very convenient in Celestial Mechanics.
In an evening talk we presented some of the proofs.

Svetlana Katok: Conjugacy problem and coding of closed geodesics on the modular surface

Closed geodesics on the modular surface, associated to conjugacy classes of hyperbolic elements in $SL(2,\mathbb{Z})$, can be coded in two different ways. The arithmetic code, given by "$-$" continued fractions, comes from the Gauss reduction theory, and in this context is the period of "$-$" continued fraction expansion of the attracting fixed point of the corresponding Möbius transformation. The arithmetic code is a finite sequence of integers ≥ 2, defined up to a cyclic permutation, and is a complete system of $SL(2,\mathbb{Z})$–invariants (just as the period of an ordinary continued fraction expansion is a complete system of $GL(2,\mathbb{Z})$-invariants, a standard fact in number theory). The geometric code, with respect to the standard fundamental region for $SL(2,\mathbb{Z})$, is obtained by a construction universal for all finitely generated Fuchsian groups of the first kind. Is is also a finite sequence of integers defined up to a cyclic permutation, but it may contain both positive and negative integers. The following theorem is the main results of the talk. It gives a description of all closed geodesics for which the two codes coincide.

Theorem *Let* $A \in SL(2,\mathbb{Z})$ *be a hyperbolic matrix with arithmetic code* $(n_1,\dots,n_m)$. *Then its geometric code coincides with its arithmetic code if and only if* $\frac{1}{n_i}+\frac{1}{n_{i+1}} \leq \frac{1}{2}$ *for all* $i \pmod m$, *i.e. the arithmetic code does not contain 2 and the following pairs:* $\{3,3\},\{3,4\},\{4,3\},\{3,5\}$, *and* $\{5,3\}$.

Any closed geodesic satisfying the theorem above is characterized by the following regular behavior: in the standard fundamental region it consists of m "coils" with i-th coil closely "imitating" the behavior of the closed geodesic with the code (n_i), except for $n_i = 3$; particularly, all its segments in the fundamental region are clockwise oriented.

Andreas Knauf: Classical and quantum motion in periodic potentials

This is a report on joint work with J. Asch, and with F. Benatti and T. Hudetz. We consider the motion of a classical and a quantum particle in a periodic potential. The distribution of asymptotic velocities is studied in its energy dependence and compared with the distribution of the gradient of the quantal band functions. One result implies in the integrable as well as in the ergodic case convergence in the semi-classical limit $\hbar \searrow 0$. However, concerning the dynamical entropy, no such continuity holds. In fact, the Connes-Narnhofer-Thirring entropy of the quantal electron gas may be **lowered** by the same mechanism that **enlarges** the Kolmogorov-Sinai entropy of its classical counterpart.

Gerhard Knieper: Distribution of closed orbits and the uniqueness of the measure of maximal entropy for manifolds on nonpositive curvature

This lecture provided a summary on new results on the dynamics and geometry of nonpositively curved manifolds. Those results generalize the work of Bowen and Margulis in the case of strictly negative curvature. For each manifold of nonpositive curvature M and $v \in SM$ denote by $\text{rank}_v = \dim$ of parallel Jacobi fields along the geodesic c_v. Then $\text{rank}\, M = \min\limits_{V \in SM} \text{rank}_v$ measures the amount of "flateness". Using this invariant the main results are the following:

Theorem A *Let M be a compact non flat nonpositively curved manifold. Then*

$$\text{vol}\, S(p,r) \approx e^{hr} \cdot r^{\frac{\text{rank}\, M - 1}{2}}$$

where h is the topological entropy of the geodesic flow and $\text{vol}\, S(p,r)$ is the volume of the geodesic sphere of radius r in the universal covering.

Now, let M be a $\text{rank}\, 1$ in field and denote by $\text{reg} = \{r \in SM \mid \text{rank}_v = 1\}$ the regular set and by $\text{sing} = SM \backslash \text{reg}\, V$ the singular set. Denote by

$$P(H) = \# \,\{\textit{free homotopy classes of closed geodesics of period} \le t\},$$

$$\begin{aligned} P_{\text{reg}}(t) &= \# \quad \{\textit{free homotopy classes of regular closed geodesic of period} \le t\} \\ P_{\text{sing}}(t) &= \# \quad \{\textit{free homotopy classes of singular closed geodesic of period} \le t\}. \end{aligned}$$

Theorem B *There exists* $a > 1$ *such that*

$$\frac{1}{at}e^{ht} \leq P_{\text{reg}}(t) \leq P(t) \leq ae^{ht}$$

Theorem C *There exists* $\varepsilon > 0$ *such that*

$$\frac{P_{\text{sing}}(t)}{P_{\text{reg}}(t)} \leq e^{-\epsilon t} \quad \textit{for } t \geq t_0.$$

Theorem C is a consequence of the following result, which answers a conjecture of A. Katok.

Theorem D *There exists a unique measure* μ *of maximal entropy for the geodesic flow (i.e.* $h_\mu(\phi) = h$ *and* μ *is uniquely determined by this equation). Furthermore* $\mu(\text{sing}) = 0$.

Sergei B. Kuksin: Turbulence in forced/damped Hamiltonian PDEs

For solutions of nonlinear PDEs of the form

$$\langle n/e \text{ Hamiltonian e.q.}\rangle + \langle \delta - \text{small linear damping}\rangle + \langle \text{ order one forcing}\rangle$$

we study their space-scale R_x and prove that $\delta^C \leq R_x \leq \delta^c$, where C and c are positive constants. Some relations with the Kolmogorov theory of turbulence are given.

Krystyna Kuperberg: Periodic points from periodic prime ends

Under certain conditions, periodic prime ends associated with the complementary domains of a continuum invariant under an orientation preserving homeomorphism of the plane imply periodic points. In particular, the following is true:

Theorem *Suppose that a continuum X separates the plane into finitely many domains $U_1, \ldots, \ldots, U_n, n \geq 2$, and X is invariant under an orientation preserving plane homeomorphism F. If*

1. *F has a prime end in U_1 of least period q,*
2. *for $1 \leq i \leq n-1$, if U_i is invariant under F^q, then F^q has a fixed prime end in U_i, and*
3. *U_n is invariant under F,*
   then F has a periodic point in X of least period q.

(This is a joint work with M. Barge.)

Patrice Le Calvez: Local dynamics around a fixed point for a homeomorphism of the plane

We prove the following theorems:

1. **Theorem 1** *If $\phi : S^2 \to S^2$ is a homeomorphism with $\Omega(\varphi) = S^2$ and $\#\,\mathrm{Fix}\,\phi \geq 3$, then $\#\mathrm{Per}\,\phi = \infty$.*

   This generalizes a result of M. Handel and a result of J. Franks.

2. **Theorem 2** *If $F : T^2 \to T^2$ is a homeomorphism which preserves the measure and the center of mass (for a lift of $\phi : \mathbb{R}^2 \to \mathbb{R}^2$), then $\#PerF = +\infty$.*

   The idea is to use local properties of a C^0–germ $\phi : (W, 0) \to (W, 0)$. We classify the germs in 2 classes and in each class we compute the sequence

$(i(\phi^n, 0))_{n\geq 0}$. One of the main tools is the following theorem (proved with J.C. Yoccoz).

3. **Theorem 3** *If* $\phi : (W, 0) > (W', 0)$ *has no periodic orbits (other than* 0*) and if there exists a domain* U *satisfying* $0 \in U \subset \overline{U} \subset W$ *and* $\bigcap_{k\in\mathbb{Z}} \phi^{-k}(\overline{U}) \bigcap \partial U = \emptyset$, *then there exists* $q \geq 1$ *and* $r \leq 0$ *such that*

$$i(\phi^k, 0) = 1 \quad \text{if } k \notin q\mathbb{Z}$$

$$i(\phi^k, 0) = r \quad \text{if } k \in q\mathbb{Z}\,.$$

Michael Lyubich: Almost every real quadratic map is either regular or stochastic

We prove that for Lebesque almost every $c \in [-2, 1/4)$, the quadratic map P_c has either an attracting cycle, or an absolutely continuous invariant measure.

John Mather: Variational construction of orbits in a time periodic Lagrangian system in two degrees of freedom

Let $\langle\,,\rangle$ be a C^r–Riemannian metric on $\mathbb{T}^2$, $r \geq 2$. Let $T : T\mathbb{T}^2 \to \mathbb{R}$ be the associated kinetic energy, $T(\xi) = \frac{1}{2}\langle\xi, \xi\rangle$. Let $U : \mathbb{T}^2 \times \mathbb{T} \to \mathbb{R}$ be C^r. Let $L(\xi, t) = T(\xi) - U(\pi\xi, t)$. We study trajectories of the Euler–Lagrange flow on $T\mathbb{T}^2 \times \mathbb{T}$ associated to the Lagrangian L. Sufficient conditions for the existence of orbits whose energy goes to $+\infty$ as time goes to $+\infty$ are:

- (H_1) there exists an indivisible $h_0 \in H_1(\mathbb{T}^2, \mathbb{Z})$ which contains a unique shortest geodesic Γ,
- (H_2) there is only one positively directed Morse "class A" geodesic Λ homoclinic to Γ, and
- (H_3) a certain "Melnikov integral" is non-constant. These are also sufficient conditions for the construction of orbits connecting and visiting certain "Aubry-Mather" sets.

P. Rabinowitz

We discuss some recent joint work with Sergey Bolotin on the existence of heteroclinic solutions on $\mathbb{T}^n$ for a Hamiltonian system of multiple pendulum type which possesses a reflectoral symmetry. We also discuss the related problem of the existence of heteroclinic minimal geodesics on $\mathbb{T}^n$, where the potential is not present.

Matthias Schwarz: Symplectic fixed points and quantum cohomology

The conjectured estimate on the number of fixed points of a Hamiltonian symplectomorphism ϕ on a closed symplectic manifold (M, ω)

$$\sharp \operatorname{Fix} \phi \geq \inf\{\#\mathrm{Crit} f \,|\, f \in C^\infty(M, \mathbb{R})\}$$

is still far from proven. In this talk we try to extend the known cup-length estimate by Hofer and Floer

$$\sharp \operatorname{Fix} \phi \geq \text{cup-lenght}(M) \quad \text{in case that } \omega_{\pi_2|m} = 0$$

to the more general class of weakly monotone symplectic manifolds. Whereas typically the presence of J-holomorphic spheres is a technical obstruction to known variational methods, we positively exploit their existence in order to prove the existence of more symplectic fixed points. Namely, one can replace the classical cup-lenght of M by a "quantum" cup-length based on the knowledge of the ring structure of the quantum cohomology ring of (M, ω). This estimate extends all previously known estimates for (degenerate) symplectic fixed points.

Karl Friedrich Siburg: A new proof of Birkhoff's Invariant Circle Theorem for monotone twist maps

We present a new proof of Birkhoff's Theorem: Any embedded, homotopically nontrivial circle which is invariant under a monotone twist map φ on the cylinder $S^1 \times \mathbb{R}$ must be a Lipschitz-graph over S^1. The traditional proofs go back to Birkhoff himself and are of topological nature. Ours, on the contrary, uses dynamical consideration; the key observation is the following. If the invariant circle is folded over S^1 then each application of φ pushes more area into these folds. Since φ is measure-preserving, this finally implies that the invariant circle has a point of self-intersection – which contradicts its embeddedness.

Carles Simó: Area preserving maps with reversal of orientation

First some motivation is presented, related to the limit behaviour of some "universal" family of planar dissipative diffeomorphisms and also to $3D$ diffeomorphisms. The paradigm of the maps studied is $(x, y) \xrightarrow{T} (x + w + \alpha(y + \sin x), -(y + \sin x))$. It plays a role similar to the one of the standard map in the orientation preserving case. The symmetries allow to reduce ω to $[0, \pi]$ and $\alpha \geq 0$. Taking T^2, we recover preservation of orientation, but the map T^2 is non twist, but extremely degenerate. Several results are presented:

1. The limit cases $\omega = 0$, $\omega = \pi/2$ are first studied. For α small the limit Hamiltonian flows are described and the non existence of invariant rotational curves.

2. An excursion is made to the splitting of separatries in these limit cases. They are exponentially small and numerical evidence is given that the correction factor (splitting $= \alpha^r \exp(-\frac{c}{a})\cdot$ correction factor) is a formal power series in a parameter, h, related to α, which is not convergent but Borel summable with radius of convergence $2c$.

3. For the non limit cases and α small the existence of rotational invariant curves is proved. It requires a kind of "averaging" to remove the non twist character. For α big there is evidence of the existence of non Birkhoff invariant curves.

4. The breakdown of invariant curves is analyzed. It is produced in a much more wild way then in the orientation preserving case. Several conjectures are stated.

5. Consequently on the dynamics for small dissipative perturbations of the previous situation are described. In particular there are topological obstructions to the existence of parameters for which a "..." homoclinic tangency occurs.

Gregor Światek: Polymodal box mappings

Box mappings were introduced in the study of unimodal maps and, by extension, complex polynomials. It is possible to show a unified construction, based on the concept of nice sets, that covers all known applications of the technique. A crucial property of unimodal box mappings is decay of geometry. In the bi–modal case, decay of geometry persists in some examples in which both critical points have the same ω–limit set, but fails in general.

Carlos Tamm: Sums of Cantor sets and geometric properties of Markov, Lagrange and other related spectra

Let

$$K(\alpha) := \lim_{\substack{p,q\to\infty \\ p,q\in\mathbb{Z}}} \sup (q|q\alpha - p|)^{-1} .$$

The Lagrange spectrum L is the image of $K\colon \mathbb{R}\setminus\mathbb{Q} \to \mathbb{R}$. The Markov spectrum M is the set

$$\left\{ \left(\inf_{\substack{x,y\in\mathbb{Z} \\ (x,y)\neq(0,0)}} |f(x,y)| \right)^{-1} \middle| f(x,y) = ax^2 + bxy + cy^2;\ a,b,c\in\mathbb{R};\ b^2 - yac = 1 \right\} .$$

We prove that given $\beta \in [0,1]$ there exists $t(\beta)\in\mathbb{R}$ such that $HD(L\cap(-\infty,t(\beta))) = HD(M\cap(-\infty,t(\beta))) = \beta$. The main tool is a metrical study of sums of Cantor sets based in a work with Yoccoz. We discuss extensions of these results to the related dynamical Markov and Lagrange spectra, $L(f,\wedge) := \{\limsup_{n\to\infty} f(C^n(x)), x\in\wedge\}$, $M(f,\wedge) := \{\sup f(C^n(x)), x\in\wedge\}$, where $\wedge$ is a horseshoe for $C : M^2 \to M^2$ and $f : M^2 \to \mathbb{R}$ is a differentiable function.

Marcelo Viana: Statistical properties of attractors

We report on an ongoing joint project with C. Bonatti (Dijon) and J.F. Alves (IMPA and Porto).

A diffeomorphism is **partially hyperbolic** if there exists a continuous splitting $TM = E^{nn}\oplus E^c\oplus E^{ss}$, invariant under Df, such that $Df|E^{nn}$ is uniformly expanding , $Df|E^{ss}$ is uniformly contracting, and they both dominate $Df|E^c$. We also require that $\dim E^c > 0$, and either $\dim E^{nn} > 0$ or $\dim E^{ss} > 0$ (or both).

An f-invariant probability μ is an **SRB measure** if $\frac{1}{n}\sum_{j=0}^{n-1}\delta_{f^j(z)} \to \mu$ in the weak sense for a set $B(\mu)$ of points $z \in M$ with positive Lebesgue measure.

Theorem 1 *Suppose* $\limsup_{n\to+\infty} \frac{1}{n}\log\|Df^n|E_x^c\| < 0$ *for a positive Lebesgue measure subset of any disk contained in a strong–unstable leaf. Then f has finitely many SRB measures, and their basics cover Lebegue almost all of M.*

Theorem 2 *Suppose* $\limsup_{n\to+\infty} \frac{1}{n}\log\|Df^n|E_x^c\| < 0$ *for a positive Lebesgue measure subset of some disk contained in a strong–unstable leaf, and suppose all strong–unstable leaves are dense. Then f has a unique SRB measure μ, and $B(\mu)$ is a full Lebesgue measure subset in M.*

Theorem 3 *Suppose* $\liminf_{n\to+\infty} \frac{1}{n}\log\|(Df^{-n}|E_x^c)^{-1}\| < 0$ *on a positive Lebesgue measure subset of some centre–unstable leaf, and suppose* $\dim E^c = 1$. *Then f has some SRB measure.*

Some cases where $\dim E^c > 1$ can also be treated in the setting of this last theorem, and we expect to weaken the hypothesis $\dim E^c = 1$ considerably. The present version of Theorem 3 leads to a result in 1–dimensional dynamics: any C^2 map of the circle or the interval whose critical points are all nondegenerate, and which has positive Lyapunov exponent at a positive Lebesgue measure set of points has some SRB measure.

Kris Wysocki: Unknotted periodic orbits for Reeb flows on S^3

A Reeb vector field on S^3 admits a periodic orbit. We show that every Reeb vector field on S^3 possesses a periodic orbit with special properties. Namely, we show that there exist orbits which are unknotted and have self–linking number -1. If in addition all periodic orbits of X are non–degenerate, then there always exists an unknotted periodic orbit with Conley–Zehnder index $\in \{2,3\}$. The proofs are based on the theory of pseudo–holomorphic curves in $\mathbb{R} \times S^3$. This is a joint work with H. Hofer and E. Zehnder.

Howie Weiss:

We explicitly construct smooth metrics arbitrarily close to the round metric on S^n, $n \geq 3$ whose geodesic flow has an ϵ–dense orbit. Iterating this local construction we obtain a metric close to the round metric which has an orbit whose closure has almost full measure.

Zhihong Jeff Xia: Topological entropy and stability

It has long been conjectured (Newhouse, Palis, Takens, ...) that the topological entropy of a diffeomorphism of a compact manifold changes only through homoclinic bifurcations. We prove this for compact surfaces. More precisely, we show that for a diffeomorphism on compact surface, either the entropy is locally constant or it can be approximated (in C^1) by a map with homoclinic tangencies.

Tagungsteilnehmer

Casim Abbas
Mathematik Department
ETH Zürich
ETH-Zentrum
Rämistr. 101

CH-8092 Zürich

Michel Andenmatten
Courant Institute of Math. Sciences
New York University
251, Mercer Street

New York , NY 10012-1110
USA

Prof.Dr. Sigurd B. Angenent
Department of Mathematics
University of Wisconsin-Madison
480 Lincoln Drive

Madison WI, 53706-1388
USA

Prof.Dr. Victor Bangert
Mathematisches Institut
Universität Freiburg
Eckerstr. 1

79104 Freiburg

Prof.Dr. Misha L. Bialy
Tel Aviv University, Dept. of Maths
Raymond and Beverly Sackler
Faculty of Exact Sciences
Ramat-Aviv

Tel Aviv 69978
ISRAEL

Prof.Dr. Alain Chenciner
U. F. R. de Mathematiques
Case 7012
Universite de Paris VII
2, Place Jussieu

F-75251 Paris Cedex 05

Dr. Jochen Denzler
Zentrum Mathematik
TU München
Arcisstr. 21

80333 München

Prof.Dr. Hakan Eliasson
Dept. of Mathematics
Royal Institute of Technology
Lindstedtsvägen 25

S-100 44 Stockholm

Prof.Dr. Giovanni Forni
Department of Mathematics
Princeton University
Fine Hall-Washington Road

Princeton , NJ 08544-1000
USA

Prof.Dr. John Franks
Dept. of Mathematics
Lunt Hall
Northwestern University
2033 Sheridan Road

Evanston , IL 60208-2730
USA

Dr. Jean-Marc Gambaudo
Institut non lineare de Nice
1361 Route des Lucioles

F-06560 Valbonne

Prof.Dr. Hansjoerg Geiges
Mathematik Department
ETH Zürich
ETH-Zentrum
Rämistr. 101

CH-8092 Zürich

Prof.Dr. Victor L. Ginzburg
Department of Mathematics
VC Santa Cruz

Santa Cruz , CA 95064
USA

Dr. Boris Hasselblatt
Forschungsinst. für Mathematik
Eidgen. Techn. Hochschule Zürich
ETH Zentrum

CH-8092 Zürich

Prof.Dr. Michael R. Herman
UFR de Mathematiques, URA 748
Universite Denis Diderot - Paris 7
Case 7012
2, place Jussieu

F-75251 Paris Cedex 05

Prof.Dr. Helmut W. Hofer
Courant Institute of
Mathematical Sciences
New York University
251, Mercer Street

New York , NY 10012-1110
USA

Prof.Dr. Thomas Kappeler
Mathematisches Institut
Universität Zürich
Winterthurerstr. 190

CH-8057 Zürich

Prof.Dr. Anatole B. Katok
Department of Mathematics
Pennsylvania State University
303 McAllister Building

University Park , PA 16802
USA

Prof.Dr. Svetlana Katok
Department of Mathematics
Pennsylvania State University
218 McAllister Building

University Park , PA 16802
USA

Dr. Andreas Knauf
Fachbereich Mathematik
Technische Universität Berlin
Straße des 17. Juni 136

10623 Berlin

Dr. Gerhard Knieper
Fakultät für Mathematik
Ruhr-Universität Bochum

44780 Bochum

Markus Kriener
Mathematik Department
ETH Zürich
ETH-Zentrum
Rämistr. 101

CH-8092 Zürich

Prof.Dr. Sergei B. Kuksin
Djalilya St. 23 56, kv 267

115 580 Moscow
RUSSIA

Prof.Dr. Krystyna Kuperberg
Dept. of Mathematics
Auburn University
Parker Hall

Auburn , AL 36849-5310
USA

Prof.Dr. Patrice Le Calvez
Departement de Mathematiques
Universite Paris 13
Inst. Galilee
Avenue Jean-Baptiste Clement

F-93430 Villetaneuse

Daniel Lenz
Myliusstr. 43

60323 Frankfurt

Torsten Linnemann
Department für Mathematik
Raum HGE 18.4
ETH-Zürich
Rämistr. 101

CH-8092 Zürich

Prof.Dr. Michael Lyubich
Institute of Mathematical Science
SUNY at Stony Brook

Stony Brook , NY 11794-3660
USA

Prof.Dr. John N. Mather
Department of Mathematics
Princeton University
Fine Hall
Washington Road

Princeton , NJ 08544-1000
USA

Prof.Dr. Jürgen Moser
Mathematik Department
ETH Zürich
ETH-Zentrum
Rämistr. 101

CH-8092 Zürich

Prof.Dr. Georgi Popov
Universite de Nantes
Departement de Mathematiques
2, rue de la Houssiniere

F-44072 Nantes Cedex 03

Prof.Dr. Jürgen Pöschel
Mathematisches Institut A
Universität Stuttgart
Pfaffenwaldring 57

70569 Stuttgart

Prof.Dr. Paul H. Rabinowitz
Department of Mathematics
University of Wisconsin-Madison
480 Lincoln Drive

Madison WI, 53706-1388
USA

Dr. David Sauzin
Astronomie et Systemes Dynamiques
Bureau des longitudes
3, rue Mazarine

F-75006 Paris

Martin Schmoll
BiBoS Forschungszentrum Bielefeld-Bochum-Stochastik
ZiF Universität Bielefeld
Wellenberg 1

33615 Bielefeld

Matthias Schwarz
Department of Mathematics
Stanford University

Stanford , CA 94305-2125
USA

Prof.Dr. Gregor Swiatek
Department of Mathematics
Pennsylvania State University
218 McAllister Building

University Park , PA 16802
USA

Prof.Dr. Eric Sere
CEREMADE
Universite Paris-Dauphine
Place de Marechal Lattre
de Tassigny

F-75775 Paris Cedex 6

Prof.Dr. Carlos Gustavo Tamm
Instituto de Matematica Pura e
Aplicada - IMPA
Jardin Botanico
Estrada Dona Castorina, 110

22460 320 Rio de Janeiro , RJ
BRAZIL

Dr. Karl-Friedrich Siburg
Mathematisches Institut
Universität Freiburg
Eckerstr. 1

79104 Freiburg

Dr. David Theret
15, rue D. Casanova

F-75001 Paris

Prof.Dr. Jean-Claude Sikorav
Universite Paul Sabatier
U.F.R. M.I.G.
118, route de Narbonne

F-31062 Toulouse Cedex

Prof.Dr. Marcelo Viana
Instituto de Matematica Pura e
Aplicada - IMPA
Jardin Botanico
Estrada Dona Castorina, 110

22460 320 Rio de Janeiro , RJ
BRAZIL

Prof.Dr. Carles Simo
Departament de Matematica Aplicada
i Analisi
Universitat de Barcelona
Gran Via 585

E-08007 Barcelona

Prof.Dr. Clarence Eugene Wayne
Department of Mathematics
Pennsylvania State University
218 McAllister Building

University Park , PA 16802
USA

Prof.Dr. Zhihong Xia
Dept. of Mathematics
Lunt Hall
Northwestern University
2033 Sheridan Road

Evanston , IL 60208-2730
USA

Dr. Howie Weiss
Department of Mathematics
Pennsylvania State University
McAllister Building

University Park , PA 16802
USA

Prof.Dr. Jean-Christophe Yoccoz
Mathematiques
Universite de Paris Sud (Paris XI)
Centre d'Orsay, Batiment 425

F-91405 Orsay Cedex

Krzysztof Wysocki
Department of Mathematics
The University of Melbourne

Parkville , VIC 3052
AUSTRALIA

Prof.Dr. Eduard Zehnder
Mathematik Department
ETH Zürich
ETH-Zentrum
Rämistr. 101

CH-8092 Zürich