

MATHEMATISCHES FORSCHUNGSINSTITUT OBERWOLFACH

Report No. 34/2015

DOI: 10.4171/OWR/2015/34

Dynamische Systeme

Organised by
Hakan Eliasson, Paris
Helmut Hofer, Princeton
Jean-Christophe Yoccoz, Paris

19 July – 25 July 2015

ABSTRACT. This workshop continued the biannual series at Oberwolfach on Dynamical Systems that started as the “Moser-Zehnder meeting” in 1981. The main themes of the workshop are the new results and developments in the area of dynamical systems, in particular in Hamiltonian systems and symplectic geometry related to Hamiltonian dynamics.

Mathematics Subject Classification (2010): 37, 53D.

Introduction by the Organisers

The workshop was organized by H. Eliasson (Paris), H. Hofer (Princeton) and J.-C. Yoccoz (Paris). It was attended by more than 50 participants from 13 countries and displayed a good mixture of young, mid-career and senior people. The workshop covered a large area of dynamical systems centered around classical Hamiltonian dynamics: symplectic dynamics and geometry; billiards; Hamiltonian PDE’s; dynamics of vector fields and mappings on manifolds; Hamilton-Jacobi theory and weak KAM; celestial mechanics; circle diffeomorphisms; diffusion. Also other parts of dynamics were represented.

J. Fish presented a new result showing that Hamiltonian flows on compact hypersurfaces in 4-space are not minimal. This answers a question raised by M. Herman in his 1998 ICM address. The result constitutes a significant progress on a problem raised by Gottschalk in 1958 concerning the existence of a minimal flow on the three-sphere.

L. Polterovich reported on work finding robust obstructions to represent a Hamiltonian diffeomorphism as a k -th power using a Floer-theoretic version of

persistence modules and described applications to the geometry and dynamics of Hamiltonian diffeomorphisms.

D. Christofaro-Gardiner discussed an important relationship between the Reeb dynamics on a three-dimensional closed manifold equipped with a contact form and volume considerations coming from Seiberg-Witten theory. In particular there always have to be at least two periodic orbits.

N. Roettgen displayed examples of Reeb vector fields in higher dimensions, where the existence of trapped orbits does not implies the existence of periodic orbits unlike the three-dimensional case, where it was established by Eliashberg and Hofer. P. Albers talked about Hofer-Zehnder capacities and S. Hohloch about semi-toric integrable Hamiltonian systems.

D. Peralta-Salas presented, in a beautiful talk, new stationary solutions of the 3D Euler equation and studied their dynamics by KAM-theory. These solutions possess linearly stable periodic orbits surrounded by invariant tori (vortex tubes). M. Berti talked about quasi-periodic solutions for water wave equations, and Z. Zhao discussed ballistic motion in lattice Schrödinger equations. The talk of S. Kuksin focused on wave turbulence.

V. Baladi presented in a masterful manner the proof of exponential decay for Sinai billiards, the conclusion of a long search that has led to the creation of important tools in the functional-analytic approach to hyperbolic dynamics. G. Forni focused on non-rational polygonal billiards pointing out many important open questions. He presented a criterion for the ergodicity of such billiards related to the Cheeger constant of the phase space equipped with a renormalized metric.

A. Katok asked a natural and intriguing question about Lyapunov exponents of volume-preserving diffeomorphisms. P. Berger presented new results on the Newhouse phenomenon, and K. Kuperberg discussed the Seifert and the Modified Seifert conjecture.

M. Zavidovique presented a convergence result of viscosity solutions of Hamiltonian – Jacobi equations which lies at the basis of weak KAM-theory. Transposing to the context of optimal transport in compact metric spaces, he demonstrated how elementary arguments may lead to deep results.

M. Guardia, A.Knauf and Y. Long presented new results in celestial mechanics. V. Kaloshin displayed a new phenomenon of stochastic Arnold diffusion, and R. Krikorian discussed recent results on almost linearization of circle diffeomorphism.

J. Bochi proved results on linear representations using dominated splitting for co-cycles. A. Gorodetski presented new results on sums of Cantor sets. M. Levi discussed high-frequency vibrations in mechanical models and S. Katok Fuchsian groups and coding of geodesics.

The meeting was held in an informal and stimulating atmosphere. The weather was excellent and many participants attended the traditional walk to St. Roman under the leading of Sergei Tabachnikov.

Acknowledgement: The MFO and the workshop organizers would like to thank the National Science Foundation for supporting the participation of junior researchers in the workshop by the grant DMS-1049268, “US Junior Oberwolfach Fellows”.

Workshop: Dynamische Systeme

Table of Contents

Joel W. Fish (joint with Helmut Hofer)	
<i>Feral pseudoholomorphic curves and minimal sets</i>	1941
Pierre Berger	
<i>Generic family with robustly infinitely many sinks</i>	1941
Daniel Peralta-Salas	
<i>Existence of knotted and linked invariant tori in the stationary Euler equations</i>	1942
Jairo Bochi (joint with Rafael Potrie, Andrés Sambarino)	
<i>Linear representations and dominated splittings</i>	1945
Viviane Baladi (joint with Mark Demers, Carlangelo Liverani)	
<i>Exponential decay of correlations for Sinai billiard flows</i>	1948
Leonid Polterovich (joint with Egor Shelukhin)	
<i>Hamiltonian diffeomorphisms and persistence modules</i>	1949
Giovanni Forni	
<i>On the ergodicity of billiards in non-rational polygons</i>	1950
Vadim Kaloshin (joint with Oriol Castejon, Marcel Guardia, Jianlu Zhang, Ke Zhang)	
<i>Stochastic Arnold diffusion of deterministic systems</i>	1953
Peter Albers (joint with Alexandru Oancea, Urs Frauenfelder)	
<i>Homology with twisted coefficients and vanishing of the Hofer-Zehnder capacity</i>	1953
Nena Röttgen (joint with Hansjörg Geiges, Kai Zehmisch)	
<i>Trapped Reeb orbits do not imply periodic ones</i>	1955
Anton Gorodetski	
<i>Sums of Cantor sets and convolutions of singular measures</i>	1957
Zhiyan Zhao	
<i>Ballistic motion in one-dimensional lattice Schrödinger equation</i>	1958
Massimiliano Berti (joint with Riccardo Montalto)	
<i>KAM for Water Waves</i>	1960
Sonja Hohloch (joint with Silvia Sabatini, Daniele Sepe, Margaret Symington)	
<i>From semi-toric systems to Hamiltonian \mathbb{S}^1-actions and back</i>	1964

Mark Levi	
<i>Geometry of high frequency vibrations</i>	1966
Marcel Guardia (joint with Pau Martin, Tere M. Seara, Lara Sabbagh)	
<i>Oscillatory orbits in the restricted planar three body problem</i>	1967
Daniel Cristofaro-Gardiner (joint with Michael Hutchings, Vinicius Ramos)	
<i>Volume in Seiberg-Witten theory and the existence of two Reeb orbits</i> ..	1968
Maxime Zavidovique (joint with Andrea Davini, Albert Fathi, Renato Iturriaga)	
<i>Convergence in the vanishing discount method for Hamilton–Jacobi equations</i>	1969
Svetlana Katok (joint with Ilie Ugarcovici)	
<i>Reduction theory for Fuchsian groups and coding of geodesics</i>	1972
Sergei B. Kuksin	
<i>Wave turbulence: the conjecture, approaches and rigorous results</i>	1975
Raphaël Krikorian	
<i>On the almost reducibility of circle diffeomorphisms</i>	1978
Yiming Long	
<i>Determining the linear stability of periodic orbits of the N-body problem via index theory</i>	1979
Andreas Knauf (joint with Jacques Féjoz, Richard Montgomery)	
<i>Train Correspondences for Celestial Bodies</i>	1981