



Workshop in Cologne

Symplectic Techniques in Topology and Dynamics

University of Cologne, 22-26 September 2014

Scientific Report for CAST

1) Summary

Hamiltonian dynamical systems are one of the classical inspirations for symplectic and contact geometry. The recent work of Albers, Frauenfelder, Hofer, van Koert and others on applications of contact topology to the restricted 3-body problem has generated renewed interest in the interaction between contact and symplectic geometry on the one hand, and celestial mechanics as a special source of dynamical systems on the other.

One of the highlights of celestial mechanics in the last decade was the discovery of new periodic solutions of the 3-body problem (in the case of equal masses) by Chenciner and Montgomery. This has led to further solutions of the n -body problem for other values of n , with all bodies moving on the same fixed curve --- so-called n -body choreographies. These generalise the classical Lagrange solutions to the 3-body problem, where in the case of equal masses the three bodies form an equilateral triangle and move along a single circle.

Last year, with partial CAST support, we organised a very successful summer school on Hamiltonian Systems and Celestial Mechanics, aimed at graduate students and post-docs, see

<http://www.mi.uni-koeln.de/summerschool2013/SummerSchool.html>

This year's workshop focused on similar themes, but it brought together established researchers in this field to report about current progress.

2) Description of the scientific content of and discussion at the event

The academic programme consisted of 17 lectures. The list of speakers and the titles of their talks is enclosed. A separate room for discussions was provided, and there was ample time for interaction between the speakers and the other participants.

3) Assessment of the results and impact of the event on the future direction of the field

The workshop provided an opportunity for the exchange of ideas between researchers coming from diverse backgrounds, ranging from mathematicians interested in the theoretical side of symplectic topology to analysts working on applications to celestial mechanics and space missions. Many of the participants expressed their thanks for our bringing together such a good mix of mathematicians, rather than the usual in-crowd one meets at more specialized conferences. The interests were close enough so that one could find a common language, yet diverse enough to stimulate new and interesting connections. Many new contacts were made at this workshop, and they may well lead to future collaboration or at least a cross-fertilization of ideas.

4) Annexes 4a) and 4b): Programme of the meeting and full list of speakers and participants

Annex 4a: Programme of the meeting

Time	Monday, 22 nd September 2014	Tuesday, 23 rd September 2014	Wednesday, 24 th September 2014	Thursday, 25 th September 2014	Friday, 26 th September 2014
08:00 – 08:30	REGISTRATION 2 nd floor, in front of the lecture hall				
08:30 - 09:00	WELCOME 2 nd floor, lecture hall				
09:00 - 10:00	TALK: CHENCINER 2 nd floor, lecture hall	TALK: CELLETTI 2 nd Floor, lecture hall	TALK: KNAUF 2 nd floor, lecture hall	TALK: SABATINI 2 nd floor, lecture hall	TALK: ABBONDANDOLO 2 nd floor, lecture hall
10:00 - 10:30	BREAK I 3 rd floor, room 314	BREAK I 3 rd floor, room 314	BREAK I 3 rd floor, room 314	BREAK I 3 rd floor, room 314	BREAK I 3 rd floor, room 314
10:30 - 11:30	TALK: MONTALDI 2 nd floor, lecture hall	TALK: VAN KOERT 2 nd floor, lecture hall	TALK: SIBURG 2 nd floor, lecture hall	TALK: BOWDEN 2 nd floor, lecture hall	TALK: BOURGEOIS 2 nd floor, lecture hall
11:30 - 14:00	LUNCH UniMensa	LUNCH UniMensa	LUNCH UniMensa	LUNCH UniMensa	LUNCH UniMensa
14:00 - 15:00	TALK: FRAUENFELDER 2 nd floor, lecture hall	TALK: ORTEGA 2 nd floor, lecture hall		TALK: TERRACINI 2 nd floor, lecture hall	TALK: TABACHNIKOV 2 nd floor, lecture hall
15:00 - 15:30	BREAK II 3 rd floor, room 314	Break II 3 rd floor, room 314		BREAK II 3 rd floor, room 314	BREAK II 3 rd floor, room 314
15:30 - 16:30	TALK: ALBERS 2 nd floor, lecture hall	TALK: OFFIN 2 nd floor, lecture hall		TALK: PINZARI 2 nd floor, lecture hall	
17:30 – 19:00 17:45 - 19:15			English Tour of the Cathedral German Tour of the Cathedral		
19:00	Wine & Cheese PARTY 3 rd floor, room 314			DINNER Brauerei Paffgen Friesenstraße 64-66	

Locations:

- Mathematical Institute, Weyertal 86-90, 50931
Lecture Hall (2nd Floor), Registration Desk (2nd Floor), Seminar Room (3rd Floor, Cohn-Vossen-Room 313), Refreshment Lounge (3rd Floor, Room 314)
- UniMensa, Zulpicher Straße 70, 50937 Köln

Name	Abstract title
Alberto Abbondandolo	"Periodic orbits of exact magnetic flows on surfaces"
Peter Albers	"The (un-)magnetic Polterovich Torus in T^*S^2 "
Frédéric Bourgeois	" S^1 -equivariant symplectic homology and linearized contact homology"
Jonathan Bowden	"Symplectic four-manifolds with circle actions"
Alessandra Celletti	"From symplectic to conformally symplectic KAM theory with applications to Celestial Mechanics"
Alain Chenciner	"Angular momentum and Horn's problem"
Urs Frauenfelder	"contacting the moon"
Andreas Knauf	"New Techniques for the N-Body Problem"
Otto van Koert	"From contact geometry to global surfaces of section"
James Montaldi & Gattin	"Classification of symmetries of planar choreographies"
Daniel Offin	"Maslov index and some questions of dynamic stability"
Rafael Ortega	"A fixed point theorem for area-preserving maps"
Gabiella Pinzari	"A full symplectic reduction for the planetary problem which preserves the symmetry by reflections, with an application "
Silvia Sabatini	"Hamiltonian actions of tori and semi-toric systems on 4-dim compact symplectic manifolds"
Karl Friedrich Siburg	"Shortest billiard trajectories in hyperbolic polygons"
Sergei Tabachnikov	"Frieze patterns and discretization of a Virasoro orbit"
Susanna Terracini	"Parabolic trajectories in the N-body problem"

Annex 4b: Full list of speakers and participants

Workshop „Symplectic Techniques in Topology and Dynamics“, 22nd – 26th September 2014, Cologne

List of participants:

	Name	University/Affiliation
1.	Luca Asselle	University of Bochum, Germany
2.	Alberto Abbondandolo	University of Bochum Germany
3.	Peter Albers	University of Münster, Germany
4.	Kilian Barth	University of Cologne, Germany
5.	Amelie Bönninger	University of Cologne, Germany
6.	Frédéric Bourgeois	University Paris-Sud, France
7.	Jonathan Bowden	University of Augsburg, Germany
8.	Marcel Braukhoff	University of Cologne, Germany
9.	Simone Buttler	University of Cologne, Germany
10.	Alessandra Celletti	University of Rome "Tor Vergata", Italy
11.	Alain Chenciner	IMCCE Paris & University of Paris 7, France
12.	Alexandru Doicu	University of Augsburg, Germany
13.	Sebastian Durst	University of Cologne, Germany
14.	Christian Evers	University of Cologne, Germany
15.	Urs Frauenfelder	Seoul National University, Korea
16.	Hansjörg Geiges	University of Cologne, Germany
17.	Doris Hein	University of Freiburg, Germany
18.	Kathrin Helmsauer	University of Augsburg, Germany
19.	Riccardo D. Jadanza	Politechnical University of Turin, Italy
20.	Dominic Jänichen	University of Cologne, Germany
21.	Jungsoo Kang	University of Münster, Germany
22.	Elena Kantonistova	Moscow State University, Russia
23.	Marc Kegel	University of Cologne, Germany
24.	Michael Khanevsky	University of Chicago, USA
25.	Seongchan Kim	University of Augsburg, Germany
26.	Mirko Klukas	University of Cologne, Germany
27.	Andreas Knauf	University of Erlangen-Nürnberg, Germany
28.	Vladimir Krajnak	University of Groningen, The Netherlands
29.	Markus Kunze	University of Cologne, Germany
30.	Anna Lindner	University of Cologne, Germany
31.	Martin Wen-Yu Lo	Caltech, California, USA
32.	Abdella Mansur	Royal Military College of Canada, Ontario, Canada
33.	Stefano Marò	University of Pisa, Italy
34.	James Montaldi	University of Manchester, United Kingdom
35.	Daniel Offin	Queen's University Kingston, Canada
36.	Rafael Ortega	University of Granada, Spain

37.	Federica Pasquotto	VU University of Amsterdam, The Netherlands
38.	Alessandro Portaluri	University of Turin, Italy
39.	Gabriella Pinzari	University di Napoli "Federico II", Italy
40.	Sven Prüfer	University of Augsburg, Germany
41.	Aaron Saalman	University of Cologne, Germany
42.	Silvia Sabatini	IST Lissabon, Portugal
43.	Karl Friedrich Siburg	Technical University Dortmund, Germany
44.	Richard Siefring	Max-Planck-Institute Leipzig, Germany
45.	Marcin Styborski	Gdansk University of Technology, Gdansk, Poland
46.	Christian Summerer	University of Cologne, Germany
47.	Sergei Tabachnikov	Pennsylvania State University, USA
48.	Susanna Terracini	University of Turin, Italy
49.	Antonio Urena	University of Granada, Spain
50.	Otto van Koert	Seoul National University, Korea
51.	Jian Wang	Max-Planck-Institute Leipzig, Germany
52.	Jagna Wisniewska	VU University of Amsterdam, The Netherlands
53.	Lei Zhao	University of Groningen, The Netherlands