Workshop on Interactions between Algebra and Dynamics in Symplectic Topology

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Technion - Israel Institute of Technology

ABSTRACTS

Displacing Lagrangian toric fibers by extended probes

Miguel Abreu
IST-Lisbon, Portugal

Abstract:

I will describe recent joint work with Matthew Strom Borman and Dusa McDuff, where we introduce a new way of displacing Lagrangian fibers in toric symplectic manifolds, a generalization of McDuff's original method of probes. Extended probes are formed by deflecting one probe by another auxiliary probe. We show how one can use them to displace all toric fibers in Hirzebruch surfaces except those already known to be nondisplaceable. We also discuss what extended probes can tell us about displaceability of toric fibers in certain weighted projective spaces, sectors and their resolutions, where there still remain many simple cases with continuous and even open sets of fibers whose displaceability status is unknown.

Periodic bounce orbits of prescribed energy

Peter Albers
University of Münster, Germany

Abstract:

This is joint work with Marco Mazzucchelli.

Periodic bounce orbits are generalizations of billiard trajectories in the presence of a potential. Using an approximation technique by Benci-Giannoni we prove existence of periodic bounce orbits of prescribed energy. At the end of the talk I will sketch very recent work in which we allow much more general Lagrangian systems including magnetic and Finsler billiards.

Lagrangian cobordisms and Fukaya categories

Paul Biran
ETH-Zurich, Switzerland

Abstract:

We will explain how to organize Lagrangian submanifolds and their cobordisms into a category and the relations of this category to the Donaldson and Fukaya categories. In particular we will discuss how Lagrangian cobordisms can be used to get geometric information on the (derived) Fukaya category and certain subcategories of it.

Based on joint work with Octav Cornea.

Lagrangian Topology and Homotopy Functors

Octav Cornea
University of Montreal, Canada

Abstract:

I will discuss the existence of some homotopy type functors that relate a category of Lagrangian cobordism to the Fukaya category.

The talk is based on joint work with Paul Biran (ETH).

On the topology of monotone Lagrangian submanifolds

Mihai Damian
University of Strasbourg, France

Abstract:

The method of Lagrangian surgery developed by Leonid Polterovich in the 90's yields many examples of Lagrangian submanifolds in $\mathbb{C}^n$. We show that many of these manifolds do not admit monotone Lagrangian embeddings. Therefore the condition of being monotone which is a condition of symplectic nature imposes topological restrictions on the Lagrangian.

Dihedral homology and the moon

Urs Frauenfelder
Seoul National University, Korea

Abstract:

To detect closed geodesics one often takes advantage of the O(2)-action on the free loop space obtained by rotating and flipping loops. On the free loop space of spheres there is a twisted O(2)-action where instead of just flipping loops one combines the flip with a reflection at the equator. The O(2)-equivariant homology for the twisted action is related to dihedral homology and was computed by G.Lodder. In this talk we explain how the twisted O(2) action appears in the restricted problem of three bodies.

Floer homology of arbitrary genus.

Kenji Fukaya
Kyoto University, Japan

Abstract:

In this talk I will explain a construction to define an invariant of Lagrangian submanifold using the moduli space of pseudo-holomorphic curve with arbitrary genus. This is defined as an element of certain generalization of Maurer-Cartan equation that is called BV-Master equation. It gives a series of elements of symmetric bar complex of cyclic barcomplex of de Rham complex. The first term of it gives a filtered A-infinity structure of FOOO.

Hyperbolic fixed points in Hamiltonian dynamics

Viktor Ginzburg
University of California, Santa Cruz, USA

Abstract:

In this talk, based on a joint project with Başak Gürel, we explore the effect of hyperbolic fixed points on the dynamics of Hamiltonian diffeomorphisms.

Periodic orbits of Hamiltonian systems hyperbolic and linear at infinity

Başak Gürel
Vanderbilt University, USA

Abstract:

In this talk we will discuss the question of existence of infinitely many periodic orbits for a certain class of Hamiltonian systems on the Euclidean space. Namely, we will prove that a compactly supported perturbation of a hyperbolic quadratic Hamiltonian has infinitely many periodic orbits, provided that it possesses more than one homologically essential one-periodic orbit.

Ellipsoid embeddings and packing stability

Richard Hind
Notre Dame University, USA

Abstract:

I will discuss symplectic embeddings of ellipsoids and the packing problem for symplectic manifolds. Packing stability is established for many manifolds, that is, a sufficiently large number of disjoint identical balls of total volume less than the volume of the manifold can always be embedded symplectically.

This is joint work with Olguta Buse and Emmanuel Opshtein.

Hamiltonian torus actions with two dimensional quotients

Yael Karshon
University of Toronto, Canada

Abstract:

We classify the Hamiltonian torus actions for which all the non-empty reduced spaces are two dimensional and the manifold is connected and compact, or, more generally, the momentum map is proper as a map to a convex set. In particular, we construct many interesting examples.

This is joint work with Susan Tolman.

Distortion in groups of homeomorphisms

Jarek Kedra
University of Aberdeen, UK

Abstract:

I will introduce the notion of distortion in groups and discuss examples. I will investigate the distortion in groups of homeomorphisms of closed manifolds with positive first Betti number. I will provide easy to check conditions implying that a homeomorphism of such a manifold is undistorted. This gives restrictions on actions of, for example, certain lattices in semisimple Lie groups.

This is a joint work with Światosław Gal.

On the injectivity radius in Hofer's geometry

François Lalonde
Université de Montréal, Canada

Abstract:

I will discuss the conjecture stating that the ball of radius ρ in the Hofer metric is relatively contractible inside the full group of Hamiltonian diffeomorphisms when ρ is small enough.

Joint work with Yasha Savelyev.

Algebraic construction of S^1-equivariant Floer homology

Alexandru Oancea
University of Strasbourg, France

Abstract:

I will explain two equivalent definitions of S^1-equivariant Floer homology. One is more geometric and goes along the original lines of Viterbo using the coarse Borel construction, the other one is more algebraic and goes along lines of Seidel, using the fact that the Borel construction is naturally a fibered space. The second definition allows for a shorter functorial proof of the isomorphism between S^1-equivariant symplectic homology and linearized contact homology using rational coefficients. Applications on the contact homology side include a rigorous definition that solves some transversality issues, a subcritical surgery long exact sequence, and the computation of linearized contact homology for unit cosphere bundles.

The talk is based on joint work with F. Bourgeois.

Hamilton-Jacobi equation and continuous Hamiltonian dynamics

Yong-Geun Oh
University of Wisconsin at Madison, USA

Abstract:

In this talk, we will explain how a natural continuous solution to Hamilton-Jacobi equation (HJE) can be constructed by the Floer homology theory in the framework of continuous Hamiltonian dynamics. We will relate its initial value problem and boundary value problem to various constructions arising from Floer homology theory.

Non-displaceable Lagrangian tori

Kaoru Ono
RIMS, Kyoto University, Japan

Abstract:

Based on a joint work with Fukaya, Oh and Ohta, I will discuss a relation between two criteria for displaceability for Lagrangian submanifolds. One is the non-vanishing of Lagrangian Floer cohomology and the other is (super)-heavyness in the sense of Entov-Polterovich. I will also give some examples, which illustrate the relation.

Hyperkähler Floer theory, the Fueter equation, and divergence free frames

Dietmar Salamon
ETH Zürich, Switzerland

Abstract:

A divergence free frame on a closed three manifold is called regular if every solution of the linear Fueter equation is constant and is called singular otherwise. Singular divergence free frames form an analogue of the Maslov cycle. Regular divergence free frames satisfy an analogue of the Arnold conjecture for flat hyperkähler target manifolds. The Seiberg–Witten equations can be viewed as gauged versions of the Fueter equation, and so can the Donaldson–Thomas equations on certain seven dimensional product manifolds.

Filling 4-tori with a symplectic ball

Felix Schlenk
Université de Neuchâtel, Switzerland

Abstract:

In recent work with Dusa McDuff and Janko Latschev we have shown that any 4-torus with a linear symplectic form can be fully filled by one symplectic ball. I will explain an explicit and elementary construction of such a full embedding for the standard torus $\mathbb{R}^4/\mathbb{Z}^4$. For most other symplectic 4-tori our construction of a full filling is not elementary, but uses tools from algebraic geometry. I will address a few of them.

Microlocal category

Dmitry Tamarkin
Northwestern University, USA

Abstract:

I will review a microlocal approach to associating a dg category to a compact symplectic manifold.

Submanifolds and the Hofer norm

Michael Usher
University of Georgia, USA

Abstract:

Hofer's norm on the Hamiltonian diffeomorphism group of a symplectic manifold induces a natural pseudometric on the orbit of any submanifold under the action of the group. It is trivial to see that the pseudometric vanishes identically when the submanifold is a point, whereas Chekanov showed that for a compact Lagrangian submanifold of a tame symplectic manifold the pseudometric is nondegenerate. I will discuss the situation for more general submanifolds, showing on the one hand that the pseudometric continues to be nondegenerate for many classes of coisotropic submanifolds, and on the other that it vanishes identically for generically-embedded submanifolds having codimension at least two.

Open Gromov-Witten invariants in dimensions four and six

Jean-Yves Welschinger
CNRS/Université Lyon 1, France

Abstract:

Given a closed orientable Lagrangian submanifold of a closed symplectic manifold of dimension four or six, I will explain how it is sometimes possible to extract Gromov-Witten invariants from the count of pseudo-holomorphic discs with boundary on this Lagrangian submanifold.