Clay Mathematics Institute

Symplectic Topology
September 29 - October 3, 2014

Abstracts of Talks

Mohammed Abouzaid (Columbia University)
Title: The family Floer functor is faithful

Abstract: In the absence of singularities, I will explain how to construct a functor from the Fukaya category of a symplectic manifold equipped with a Lagrangian torus fibration to the category of coherent sheaves of the mirror, and how to prove that this functor is faithful.

Denis Auroux (University of California, Berkeley)
Title: A plethora of Lagrangian tori

Abstract: We will discuss some recent constructions of "exotic" Lagrangian tori in simple symplectic manifolds such as CP^2 (work of Renato Vianna) and R^6 that are not Hamiltonian isotopic to previously known examples, inspired by wall-crossing phenomena and mirror symmetry.

Paul Biran (ETH Zürich)
Title: Lagrangian cobordisms and Lefschetz fibrations

Abstract: We will explain how Lagrangian cobordisms in the total space of a Lefschetz fibration can be used to study the Fukaya category of the fiber of that fibration. Based on joint work in progress with Octav Cornea.

Vincent Colin (University of Nantes)
Title: Higher-dimensional Heegaard Floer homology

Tobias Ekholm (University of Uppsala)
Title: Knot contact homology, Chern-Simons theory, and topological strings

Kenji Fukaya (Simons Center for Geometry and Physics)
Title: Borderline case(s) in applying virtual technique to pseudo-holomorphic curves

Abstract: In this talk I will explain certain case(s) where virtual technique becomes the most delicate to apply to the moduli space of pseudo-holomorphic curves. Especially I will explain one of (or both of) the following two cases.

1) The case of pseudo-holomorphic map from bordered Riemann surface of arbitrary genus and arbitrary number of boundary components.
2) The case when there exists an action of compact group of symplectic diffeomorphism on the target spaces.

Helmut Hofer (Institute for Advanced Study)
Title: Construction of Moduli Spaces in Symplectic Geometry

Michael Hutchings (University of California, Berkeley)
Title: Beyond ECH capacities

Mark McLean (Stony Brook University)
Title: The Lefschetz hyperplane theorem is mostly wrong.

Abstract: ......symplectically speaking that is. We show that for any symplectic manifold of dimension $2n>4$, there exists a symplectic hypersurface Poincare dual to some multiple of the symplectic form whose $(n-2)$th Betti number is as large as we like. The idea here is to find an appropriate Liouville domain inside each of these symplectic manifolds and use Donaldson's asymptotically holomorphic techniques to find a symplectic hypersurface not intersecting this Liouville domain. We also show using ideas from McDuff, Lalonde and Garside's Oxford thesis that every symplectic hypersurface inside a Hirzebruch surface or the projective plane Poincare dual to the symplectic form is Hamiltonian isotopic to an algebraic one. Using the earlier techniques we can show that any 4 dimensional Liouville domain symplectically embedded in a Hirzebruch surface or the projective plane becomes affine Stein after attaching some Weinstein handles.

Emmy Murphy (Massachusetts Institute of Technology
Title: Existence of overtwisted contact structures on high dimensional manifolds

Abstract: The Lutz-Martinet theorem states that any 2-plane field on a 3-manifold is homotopic to a contact structure. This construction lead to Eliashberg's definition of overtwisted contact manifolds, and in this context the existence theorem of Lutz-Martinet can be extended to a uniqueness result: any two overtwisted contact structures which are homotopic as plane fields are in fact isotopic. We discuss a recent extension of these results to contact manifolds of all dimensions. We will focus on showing that any almost contact structure is homotopic to a contact structure, and seeing how this leads to a new definition of overtwistedness in high dimensions. As time allows we will discuss a proof that a homotopy class of almost contact structures is realized by a unique isotopy class of overtwisted contact structure. This project is joint work with Borman and Eliashberg.

Tim Perutz (University of Texas at Austin)
Title: The open-closed string map and homological mirror symmetry

Abstract: I will report on joint work with Nick Sheridan in which we prove the following result. Suppose that one has Calabi-Yau manifolds X and Y, which one has proved to be a mirror pair in the following weak sense: some full subcategory A of the Fukaya category of X is equivalent to some generating full subcategory B of the derived category of Y. Then the open-closed string map, from Hochschild homology of the Fukaya category to quantum cohomology of X, is an isomorphism respecting the natural inner products. Moreover, certain Gromov-Witten invariants of X are to equal period integrals of Y.

Leonid Polterovich (Tel Aviv University)
Title: Autonomous flows and Hofer's geometry

Abstract: We discuss geometric aspects of one parameter subgroups of Hamiltonian diffeomorphisms. Work in progress with Egor Shelukhin.

Paul Seidel (Massachusetts Institute of Technology)
Title: Lefschetz pencils and noncommutative geometry

Abstract: Lagrangian Floer cohomology associates a rich algebraic structure to a Lefschetz pencil. I will describe this structure in terms of noncommutative geometry, and explain conjectural relationships to other types of Fukaya categories.

Nick Sheridan (Princeton University)
Title: The Fukaya category of a Fano hypersurface in projective space