Title and Abstract for Dusa McDuff Workshop

1. Principle speaker: Dusa MacDuff, Columbia University, USA

Lecture 1: Introduction to Symplectic Topology
Abstract: An overview of symplectic geometry for nonexperts, givingsome perspective to the symplectic embedding question.

Lecture 2: Embeddings of 4-dimensionalellipsoids
Abstract: a discussion of the proof, showing how it is related tosymplectic blowing up, how we use toric models, and new results on the setof classes represented by exceptional curves in blow ups of thecomplex projective plane

Lecture 3: Beyond 4 dimensions
Abstract: We construct some interesting higher dimensional embeddings, discuss the stabilized embedding problem and mention some open questions.

2. Roger Casals, Massachusetts Institute of Technology, USA

Title: Symplectic topology and flat connections

Abstract: In this talk we will study the moduli space of flat connections on a surface using pseudoholomorphic curves. First, we will translate this differential geometry problem into a symplectic context and explain how the wrapped Fukaya category provides the intuition on how to solve it. Then we will use techniques from contact topology to do so. This involves new results in the study of Legendrian fronts and in addition we will recover the Fock-Goncharov cluster structures in the moduli space of flat connections and new counts of holomorphic disks for the Hitchinsystem.

3. Viktor L. Ginzburg, University of California, Santa Cruz, USA

Title: LagrangianPoincarRecurrenceandPseudo-rotations

Abstract: The Lagrangian Poincar recurrence conjecture, put forth bythespeaker and Viterbo around 2010, is a Hamiltonian version of the standard Poincar recurrence theorem. This conjecture asserts that the images of a Lagrangian submanifold under iterations of a compactly supported Hamiltoniandiffeomorphism intersect infinitelymanytimes. The conjecture isinteresting and non-obvious even for an individual map unless, of course, the map is periodic. In general, the conjecture is wide open. However, one class of maps, of independent interest, for which the conjecture is more accessible is that of pseudo-rotations. These are Hamiltonian diffeomorphisms with finite andminimal possible number of periodicorbits.

In this talk, based on a joint work with Basak Gurel, we discuss a proof of the conjecture for pseudo-rotations of complex projective spaces and a reasonably broad class of Lagrangian submanifolds. Wealsorelatethefrequencyofintersectionswith thehomologicalcapacityofthe Lagrangian.

4. Richard Hind, University of Notre Dame, USA

Title: Embedding and Packing Lagrangian Tori

Abstract: There has been much work recently on embedding and packing problems for symplectic manifolds, especially when the domain is an ellipsoid. I will describe joint work in progress with Ely Kerman and Emmanuel Opshtein considering the case when the domain is a Lagrangian torus. These kinds of questions still make sense provided we put constraints on the area class ofthetorus. In dimension 4 we can find optimalembeddingsbutsomebasic questions remain about maximalpackings.

5. Michael Hutchings, University of California, Berkeley, USA

Title: Symplectic embeddings into closed four-manifolds

Abstract: Embedded contact homology (ECH) gives obstructions to sym- plectically embedding one symplectic four-manifold with boundary into an- other, either via ECH capacities, or by the methods in the paper "Beyond ECH capacities". These obstructions are only computable for symplectic em- beddings into four-manifolds with nonempty boundary. To proceed further, using Seiberg-Witten theory, one can complete embedded contact homology (ECH) to a functor on the category whose objects are contact three-manifolds and whose morphisms are strong symplectic cobordisms between them. Us- ing this structure, we obtain computable and nontrivial obstructions to sym- plectic embeddings of symplectic four-manifolds with boundary into closed symplectic four-manifolds with $b^+ = 1$. In particular, all obstructions previ- ously obtained using ECH for symplectic embeddings into a ball also hold for symplectic embeddings into $\mathbb{C}P^2$ of the same volume. Likewise, all known ECH ob^{2}structions for symplectic embeddings into a polydisk $P(a,b)$ also hold for symplectic embeddings into $S^2(a) \times S^2(b)$.

6. Otto van Koert, Seoul National University, Korea

Title: The Three Body Problem and Symplectic Embeddings

Abstract: In this talk I will give an overview of the history of the three-body prob- lem, starting with very old questions and ending with symplectic embedding questions related to this problem. Along the way we will describe the numerous interactions with symplectic geometry, including periodic orbits and global surfaces of section. At the end I will go into work of Junyoung Lee which relates this topic to that of the workshop.

7. Yi-Jen Lee, Chinese University of Hong Kong, China

Title: Holomorphic curves and Seiberg-Witten-Floer invariants for cobordisms

8. Chris Wendl, Humboldt-Universita¨t zu Berlin, Germany

Title: Rigid Holomorphic Curves are Generically Super-rigid

Abstract: I will explain the main ideas of a proof that for generic compatible almost complex structures in symplectic manifolds of dimension at least 6, closed embedded J -holomorphic curves of index 0 are always "super-rigid," implying that their multiple covers are never limits of sequences of curves with distinct images. This condition is especially interesting in Calabi-Yau 3-folds, where it follows that the Gromov-Witten invariants can be "localized" and computed in terms of Euler classes of obstruction bundles for a finite set of disjoint embedded curves. By the same techniques, we can also show that unbranched covers of simple J -holomorphic curves are generically regular. These results are based on a decomposition of the space of branched covers into smooth strata on which certain twisted Cauchy-Riemann operators have kernel and cokernel of constant dimension.

9. Weiwei Wu, University of Georgia, USA

Title: Symplectomorphism Groups and Finite Symmetries in Symplectic 4-manifolds

Abstract: We survey some recent progress on symplectomorphism groups and their finite subgroups for certain symplectic four manifolds.

10. Boyu Zhang, Harvard University, USA

Title: Compactness Property of the Beasley-Witten Flow

Abstract: By studying the gradient flows of the Chern-Simons functional on a princi- pal SU(2)-bundle over a three-manifold, one can define the instanton Floer homology groups. Assuming the three-manifold is endowed with a contact structure, Beasley and Witten wrote down a deformed Chern-Simons functional, which reflects the topol-ogy of the contact structure. People have been using methods from theoretical physics to study this functional and obtained interesting results. Brendan McLellan asked if one could establish a rigorous Floer theory using this functional. The first step towards this direction is to establish the compactness property of the moduli space of its gradient flows. In this talk, we will discuss this compactness property.