Conference on Contact and Symplectic topology

June 14th – June 18th, 2010

Amphi Pasteur

Tuesday June 14th

8:30 – 9:30: Registration

9:30 – 10:30: E. Giroux: *Lefschetz fibrations on Stein* domains

11:00 – 12:00: M. Murphy: *An h-Principle for Stable Legendrian Knots in High Dimension*

14:00 – 15:00: Y. Eliashberg: *Flexible and rigid Weinstein manifolds*

15:30 – 16:30: S. Sandon: *On existence of translated points for contactomorphisms*

Wednesday June 15th

9:30 – 10:30: M. Abouzaid: *On Homological Mirror Symmetry for Toric varieties*

11:00 – 12:00: I. Smith: *Towards symplectic Teichmüller theory*

12:00-14:00: Welcome cocktail (Hall of the Amphi Pasteur)

14:00 – 15:00: R. Zarev: *Bordered Floer homology and the contact category*

15:30 – 16:30: S. Lisi: *Floer solutions in prequantization spaces*

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Thursday June 16th

9:30 – 10:30: M. Hutchings: *T.B.A.*

11:00 – 12:00: O. Plamenevskaya: *Rational open books and knot Floer homology*

14:00 – 15:00: E. Grigsby: *On Khovanov-Seidel quiver algebras and bordered Floer homology*

15:30 – 16:30: P. Rossi: *Topological recursion in Symplectic Field Theory*

19:30: Conference dinner (Brasserie Félix; see the information booklet)

Friday June 17th

9:30 – 10:30: Ç. Kutluhan: *Heegaard Floer meets Seiberg--Witten*

11:00 – 12:00: J. Etnyre: *Tightness in Contact Metric Manifolds.*

14:00 – 15:00: L. Ng: *Effective invariants of transverse knots*

15:30 – 16:30: Yi-Jen Lee: *T.B.A.*

Saturday June 18th

9:30 – 10:30: C. Manolescu: *A link surgery formula in Heegaard Floer homology*

11:00 – 12:00: S. Borman: *Symplectic reduction of quasi-morphisms and quasi-state*

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Mohammed Abouzaid: *On Homological Mirror Symmetry for Toric varieties*

I will explain a criterion involving Quantum cohomology, used to detect whether a collection of Lagrangians split-generate the Fukaya category of a symplectic manifold. We will then see that this criterion applies to toric manifolds, and shows that there is always a finite collection of fibres of the moment map which generate the Fukaya category in these examples. Time permitting, I will explain how to derive a proof of the Homological Mirror Symmetry conjecture in this case. This is joint work with Fukaya, Oh, Ohta, and Ono.

Strom Borman: *Symplectic reduction of quasi-morphisms and quasi-states*

The general construction of quasi-morphisms and quasi-states in symplectic topology via spectral invariants requires that the quantum homology ring (of some type) contains a field summand. However, since quantum homology is not functorial there is no general algebraic way to create new quasi-morphisms and quasi-states from known examples. In this talk I will explain how symplectic reduction provides a sort of geometric functoriality that allows quasi-morphisms and quasi-states to descend to reductions without further quantum homology. computations.

Yakov Eliashberg: *Flexible and rigid Weinstein manifolds*

In recent years there were a lot of progress in computing invariants of affine (Weinstein) symplectic manifolds. In particular, one of these invariants, the symplectic homology ring, proved to be a very efficient tool in distinguishing non-symplectomorphic Weinstein manifolds. However, when the symplectic homology vanishes this distinction is quite difficult. Though R. Harris constructed examples of non-symplectomorphic Weinstein manifolds with trivial symplectic homology, the result discussed in the talk indicates that in dimension >4 symplectic life beyond symplectic homology is very limited: a typical operation which kills symplectic homology transforms a Weinstein manifold in a pure topological object which abides a certain h-principle. A key ingredient is Max Murphy's h-principle for Legendrian knots of dimension >1 (see his talk at this conference). Parts of this work are joint with K. Cieliebak and F. Bourgeois - T. Ekholm.

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John Etnyre: *Tightness in Contact Metric Manifolds*

This talk will discuss the relations between Riemannian geometry and global properties of contact structures on 3–manifolds. In particular we prove an analog of the sphere theorem from Riemannian geometry in the setting of contact geometry. Specifically, if a given three dimensional contact manifold admits a complete compatible Riemannian metric of positive 4/9-pinched curvature then the underlying contact structure is tight; in particular, the contact structure pulled back to the universal cover is the standard contact structure on the 3-sphere. We also describe geometric conditions in dimension three for a contact structure to be universally tight in the nonpositive curvature setting. This is joint work with Rafal Komendarczyk and Patrick Massot.

Emmanuel Giroux: *Lefschetz fibrations on Stein domains*

We will discuss the existence and uniqueness of Lefschetz fibrations on Stein domains.

Eli Grigsby: *On Khovanov-Seidel quiver algebras and bordered Floer homology*

Ozsvath-Szabo's spectral sequence from Khovanov homology to Heegaard Floer homology has generated a number of interesting applications to questions in low-dimensional topology. Furthermore, viewing the connection through the lens of sutured manifold theory has enhanced our understanding of its algebraic structure. In particular, a generalization of Juhasz's surface decomposition theorem implies that the spectral sequence behaves ``as expected" under natural geometric operations like cutting and stacking.

In this talk, I will describe joint work with Denis Auroux and Stephan Wehrli aimed at understanding how the connection between Khovanov and Heegaard-Floer homology behaves under gluing. More precisely, we will see how to recover (a portion of) the sutured version of Khovanov homology using bimodules over quiver algebras originally defined by Khovanov-Seidel. Along the way, we will discuss an explicit algebraic relationship between these Khovanov-Seidel bimodules and certain bimodules appearing in the bordered Floer package of Lipshitz-Ozsvath-Thurston.

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Michael Hutchings: *T.B.A.*

Çağatay Kutluhan: *Heegaard Floer meets Seiberg-Witten*

Heegaard Floer homology and Seiberg--Witten Floer homology are two invariants of 3-manifolds defined via exploiting the ideas of Andreas Floer. Although the former is defined via symplectic geometry and the latter via gauge theory, these two invariants exhibit very similar properties. The aim of this talk is to explain the construction, joint with Yi-Jen Lee and Clifford H. Taubes, of an isomorphism between these two Floer homologies.

Yi-Jen Lee: *T.B.A.*

Samuel Lisi: *Floer solutions in prequantization spaces*

We show that Floer solutions in the symplectization of a prequantization space can be described explicitly in terms of holomorphic curves together with some additional data. We will explain how this fits in to a larger project of describing symplectic homology/Floer homology for affine/projective algebraic varieties. This is joint work with Luis Diogo and part of a larger project with Borman, Eliashberg and Polterovich.

Ciprian Manolescu: *A link surgery formula in Heegaard Floer homology*

I will discuss a formula that expresses the Heegaard Floer homology of surgery on a link in terms of some data associated to the link. This is joint work with Peter Ozsvath, and generalizes the knot surgery formula of Ozsvath and Szabo. I will explain in some detail the example of (2,2) surgery on the Hopf link.

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Max Murphy: *An h-Principle for Stable Legendrian Knots in High Dimensions*

In contact manifolds of dimension greater than three, a stable Legendrian knot is one which has been stabilized in a neighborhood of a cusp. Such stabilizations were first defined by Eliashberg, and Ekholm/Etnyre/Sullivan showed that stable knots have trivial Legendrian contact homology. We show that an h-principle holds for such knots, and therefore they are classified by their formal (algebraic topological) invariants. The proof is similar to the classification of overtwisted contact manifolds, which we briefly sketch.

Lenny Ng: *Effective invariants of transverse knots*

I'll discuss the current status of invariants of transverse knots in standard contact R3. These include transverse homology, which is a relatively new invariant derived from symplectic field theory, as well as an older invariant derived from knot Floer homology. I'll compare the nature and effectiveness of these invariants. This talk incorporates joint work with T. Ekholm, J. Etnyre, and M. Sullivan, and preliminary work with D. Thurston.

Olga Plamenevskaya: *Rational open books and knot Floer homology*

Suppose that (Y, K) is an open book decomposition of a contact manifold (Y, ξ) with non-vanishing Ozsvath-Szabo contact invariant. We prove that manifolds obtained by certain Dehn surgeries on the knot K carry tight contact structures. Our main tool is the examination of knot Floer homology of the knots induced by K in surgered manifolds. Since Dehn surgeries on the binding typically produce "rational" open books (in the sense of Baker-Etnyre-Van Horn-Morris), we also discuss the Ozsvath-Szabo contact invariants in the context of rational open books. (Joint with M.Hedden.)

Paolo Rossi: *Topological Recursion in Symplectic Field Theory*

Symplectic Field Theory attaches to a closed contact manifold (or more in general a stable Hamiltonian structure) an infinite dimensional Poisson algebra with a sequence of commuting elements that can be extended, using gravitational descendants, to be infinite. In order to study the

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properties of such highly symmetric Hamiltonian system, in a joint program with Oliver Fabert, we are trying to enlarge the set of equations satisfied by such topological Hamiltonians by studying the geometric structure of the involved moduli spaces. While for the full rational SFT we were already able to prove string, dilaton, and divisor equations, full Topological Recursion Relations (a much more powerful set of equations for the SFT potential) seem to find a more natural setting in the still-to-be-developed non-S1-equivariant version of the theory. In the meantime, in a recent paper, we were able to prove TRRs for non-equivariant cylindrical contact homology, where they take a particularly suggestive form.

Sheila Sandon: *On existence of translated points for contactomorphisms*

A point p in a contact manifold is called a translated point for a contactomorphism φ with respect to a fixed contact form if p and φ(p) belong to the same Reeb orbit and if the contact form is preserved at p. In my talk I will discuss the problem of existence of translated points, and its relation with the Arnold conjecture, the chord conjecture and the problem of leafwise coisotropic intersections. If I have the time I will also explain how to use generating functions techniques to study this problem for contactomorphisms of the euclidean space, the sphere and the projective space.

Ivan Smith: *Towards symplectic Teichmüller theory*

Rumen Zarev: *Bordered Floer homology and the contact category*

Bordered Heegaard Floer homology is a verison of Heegaard Floer homology for 3-manifolds with boundary, developed by Lipshitz, Ozsvath, and Thurston. A key component of the theory is a DG-algebra associated to a parametrized surface F. On the other hand, there is a contact category associated to F (as developed by Honda). The objects are given by dividing sets on F. The morphisms are given by the free Z/2-vector spaces generated by isotopy classes of tight contact structures on Fx[0,1], with given dividing sets along the convex boundary. I will discuss how the homology of the bordered algebra associated to F can be naturally identified with a full subcategory of the contact category of F.