VI Workshop on Symplectic Geometry, Contact Geometry and Interactions

ICMAT, Madrid February 2-4, 2012
Programme

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GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN

List of speakers:

Juan-Carlos Álvarez-Paiva (Lille)

Rémi Cretois (Lyon)

Jacqueline Espina (Lyon)

Jonathan Evans (Zurich)

Hélène Eynard-Bontemps (Paris)

Penka Georgieva (Princeton)

Clément Hyvrier (Uppsala)

Yael Karshon (Toronto)

Samuel Lisi (Brussels)

Ignasi Mundet i Riera (Barcelona)

Schedule:

The conference will start at 3pm on Thursday and will finish on Saturday before lunch. We kindly ask you to come to the registration desk at 2:15 to take your Welcome package and get your lunch ticket for Friday.

Time	Thursday	Friday	Saturday
09:30-10:30		Alvarez-Paiva	Georgieva
10:30-11:00		Coffee Break	Coffee Break
11:00-12:00		Eynard-Bontemps	Cretois
12:10-13:10		Lisi	Mundet
Registration (2:15-3p.m)		LUNCH	
15:00- 16:00	Karshon	Evans	
16:00- 16:30	Coffee Break		
16:30- 17:30	Hyvrier	Espina	

Programme:

Juan Carlos Álvarez-Paiva (Lille) Contact perturbation theory and a question of Viterbo

Abstract: Over ten years ago Claude Viterbo asked whether the ball in R^{2n} has the largest symplectic capacity among all convex bodies of a given volume. In this talk we shall give various partial (affirmative) answers to this question by adapting the perturbative techniques of celestial mechanics to study the dynamics of Reeb flows.

Rémi Cretois (Lyon) Real automorphisms of a vector bundle and Cauchy-Riemann operators

Abstract: We consider a complex vector bundle N equipped with a real structure c_N over a real curve (\Sigma_g,c_\Sigma) of genus g. The set of all Cauchy-Riemann operators on (N,c_N) is a contractible space. The determinant bundle over this space is a real line bundle whose fiber at given operator is its determinant. We will try to describe the action of the automorphism group of (N,c_N) on the orientations of the determinant bundle and show some consequences on the first Stiefel-Whitney class of the moduli spaces of real pseudo-holomorphic curves in a real symplectic manifold.

Jacqueline Espina (Lyon) The mean Euler characteristic of contact structures

Abstract: The mean Euler characteristic (MEC) of a contact manifold is an invariant that arises in contact homology. True to its name, the mean Euler characteristic is the average alternating sum of the ranks of cylindrical or linearized contact homology. This is a powerful enough invariant to distinguish inequivalent contact structures within the same homotopy class. We will give an expression of the MEC in terms of local properties (the Conley-Zehnder and mean indices) of closed Reeb orbits for a broad class of contact manifolds, the the so-called asymptotically nite contact manifolds. This class is essentially closed under subcritical contact surgery and we will see that the MEC changes under such surgery in a very simple way. Furthermore, we will give an

expression for he mean Euler characteristic in the Morse-Bott case and calculate the MEC for some examples.

Jonathan Evans (Zurich) Quantum cohomology of twistor spaces

Abstract: Monotone symplectic (aka symplectic Fano) manifolds are pretty rare in the universe of all symplectic manifolds, in much the same way that Fano varieties or Ricci-positive manifolds are rare. Positivity usually has strong implications for the underlying topology and one wonders if the same is true here. However, the twistor space of a hyperbolic 2n-manifold M (n bigger than or equal to 3) was observed to be a monotone symplectic manifold by Fine and Panov in 2009 and these examples counter many of one's expectations of what a symplectic Fano manifold ought to look like. We explore the symplectic topology of these spaces (for the simplest case n=3) further by computing their quantum cohomology ring and the self-Floer cohomology of certain natural (equally unexpected) monotone Lagrangian submanifolds (Reznikov Lagrangians) associated to totally geodesic n-dimensional submanifolds of M. We will see evidence that there might be (yet more unusual) Lagrangians hiding in these spaces that we haven't yet observed.

Hélène Eynard-Bontemps (Paris) Homotopy of codimension one foliations on 3-manifolds

We are interested in the topology of the space of smooth codimension one foliations on a given closed 3-manifold.
In 1969, J. Wood proved that any smooth plane field on a closed 3-manifold can be deformed into a plane field tangent to a foliation. This fundamental result was then reproved and generalized by W. Thurston.
It is natural then to wonder whether two foliations whose tangent plane fields are homotopic can be connected by a path of foliations, or, in other words, if there is actually a bijection between the (pathwise) connected components of the space of foliations on a given manifold and that of the space of plane fields.

In this talk, we will show that the answer is essentially yes. To that end, we will first present Thurston's construction, along with later works by A. Larcanché, who answered the above question in the case of two sufficiently close taut foliations.

Penka Georgieva (Princeton) Orientability and Open Gromov-Witten Invariants

Abstract: I will first discuss the orientability of the moduli spaces of J-holomorphic maps with Lagrangian boundary conditions. It is known that these spaces are not always orientable and I will explain what the obstruction depends on. Then, in the presence of an anti-symplectic involution on the target, I will give a construction of open Gromov-Witten disk invariants. This is a generalization to higher dimensions of the works of Cho and Solomon, and is related to the invariants defined by Welschinger.

Clément Hyvrier (Uppsala) On symplectic uniruling of Hamiltonian fibrations.

Abstract: A symplectic manifold is said to be symplectically uniruled if there is a non vanishing genus zero Gromov-Witten invariant with one point constraint. It is known that symplectic uniruledness of a closed Hamiltonian fibration over a symplectic base is induced from symplectic uniruledness of its fiber. We will show, under some assumptions, that the same applies when we require the base to be symplectically uniruled instead. As a consequence such fibrations verify the Weinstein conjecture for separating hypersurfaces, due to work of Lu (following previous results of Hofer-Viterbo and Li-Tian).

Yael Karshon (Toronto) Counting toric actions

Abstract: In how many different ways can a two-torus act on a given simply connected symplectic four-manifold? If the second Betti number is one or two, the answer has been known for a while. For a higher Betti number, our (``soft'') proof that there are only finitely many inequivalent torus actions did not enable us to count these actions.
I will report on more recent work, in which we reduce this counting question to combinatorics by expressing the manifold as a symplectic
blowup in a way that is compatible with all the torus actions simultaneously. For this we use the theory of pseudoholomorphic curves. This work is joint with Liat Kessler and Martin Pinsonnault.

Samuel Lisi (Brussels) Fillings of spinal open books

Abstract: A spinal open book on a contact manifold is a generalization of a supporting open book. Open books arise naturally as the boundary of a Lefschetz fibration over a disk. Similarly, spinal open books arise as the boundary of a Lefschetz fibration over a more general surface
with boundary. I will describe how the existence of a spinal open book with a certain planarity condition allows us to classify strong
fillings. Applications include classifications of fillings of circle bundles with S^1 invariant contact structures. This is joint work
with Jeremy Van Horn-Morris and Chris Wendl.

Ignasi Mundet i Riera (Barcelona) Loops of homeomorphims of adjoint orbits

Abstract: Let G be a compact Lie group and let ${\mathcal O}\subset{\mathfrak g}$ be an adjoint orbit of G. Our aim is to talk about the proof that the morphism $G\to\text{Homeo}({\mathcal O})$ given by the adjoint action induces a monomorphism of fundamental groups. This extends a problem considered about 30 years ago by Weinstein, who asked the analogous question when the homeomorphisms group is replaced by the group of Hamiltonian symplectomorphisms (Weinstein's question was answered partially by Viñas and in a complete way by McDuff and Tolman). This is joint work with David Martínez-Torres.