Christmas M³ Geometry Workshop 19-20 December 2024, ICMAT, Madrid

Thursday, 19 December 2024

10:00 - 11:00 Guillermo Gallego 11:00 - 11:30 **Coffee break** 11:30 - 12:30 Jaime Mendizabal **Lunch** 14:00 - 15:00 Mateo Galdeano 15:00 - 15:30 Coffee break 15:30 - 16:30 Guillermo Barajas

Friday, 20 December 2024

10:00 - 11:00 Izar Alonso 11:00 - 11:30 **Coffee break** 11:30 - 12:30 Juan Muñoz-Echaniz **Lunch**

TITLES AND ABSTRACTS

Guillermo Gallego (Berlin)

Title: Langlands duality for generalized Hitchin systems

Abstract: A generalized Hitchin system is a type of fibration over a projective manifold, constructed from the natural map from a quotient stack to the associated GIT quotient. For example, the usual Hitchin system over a curve is naturally obtained from the adjoint action of a reductive group on its Lie algebra. A celebrated property of the Hitchin system is that its generic fibres are abelian varieties. Moreover, the Hitchin system associated to a group has equal base and dual generic fibres to the ones of its Langlands group. In this talk we give a general framework for obtaining similar results in the context of generalized Hitchin systems. In particular, our framework yields a duality theorem for the multiplicative Hitchin system. This answers to one of the "multiplicative Langlands conjectures" posed by Elliott and Pestun. Our duality theorem is related to the Langlands duality of affine Lie algebras and to the S-duality of 5d super Yang-Mills theory twisted on a circle. This talk is based on joint work (in preparation) with Benedict Morrissey.

Jaime Mendizabal (London) Title: Asymptotics of monopoles

Abstract: Monopoles are solutions to the Bogomolny equations which satisfy certain asymptotic conditions. In this talk, we discuss some of the possible asymptotic properties which we can impose (and, perhaps, expect) and some of their consequences.

In particular, we will discuss framings, moduli spaces, and the relationship with rational maps.

Mateo Galdeano (Hamburg)

Title: Strings with torsion and SW-algebras

Abstract: Given a special holonomy manifold, via string theory we can obtain an associated superconformal algebra of symmetries (SW-algebra). This is a fascinating correspondence between geometry and conformal field theory that has spectacular consequences in mathematics: for instance, mirror symmetry was originally discovered through this SW-algebra. Although the correspondence is well understood for torsion-free G-structures, very little is known for more general G-structures. In this talk I will present the first steps to

identify these conformal algebras. We will do so through a study of the classical sigma model. This is based on joint work with Xenia de la Ossa and Enrico Marchetto, soon to appear on arXiv.

Guillermo Barajas (Odense)

Title: An equivariant Verlinde formula for the moduli space of Higgs bundles of rank 2 and degree 1

Abstract: Let X be a compact Riemann surface and consider the moduli space M of vector bundles of rank 2 and degree 1. There is a universal vector bundle over M x X, and hence one can construct a determinant line bundle L over M. The Verlinde formula lets us calculate the dimension of the space of global sections of L. If one further takes an automorphism f of X of prime order, there is an action of f on M lifting to an action on L, and one may consider the trace of the action of f on the space of sections of L. One may further replace M with the moduli space of Higgs bundles with rank 2 and degree 1, and introduce the C*-action to obtain an C*-equivariant version of this trace, called the Hitchin equivariant index. In this talk we report on work in progress about the calculation of this index.

Izar Alonso (Rutgers)

Titulo: G_2-instantons on non-compact cohomogeneity one manifolds

Abstract: G_2-instantons are a special kind of connections on a Riemannian 7-manifold, analogues of antiself-dual connections in 4 dimensions. I will start this talk by introducing G_2-instantons and their significance, and then describe new families of $SU(2)^2$ -invariant G_2-instantons in cohomogeneity one manifolds with a coclosed G_2-structure.

Juan Muñoz-Echaniz (Stony Brook)

Title: The monodromy of isolated singularities and Seiberg--Witten theory

Abstract: Associated to a complex hypersurface with an isolated singularity there is an associated diffeomorphism of its Milnor fiber, given by the monodromy of the Milnor fibration. The induced automorphism of the (co)homology of the Milnor fiber has been extensively studied. However, little is known about the monodromy as an element of the smooth mapping class group of the Milnor fiber. A well-studied class of singularities are the ADE singularities, which are a particular family of 2-dimensional weighted-homogeneous hypersurface singularities (e.g. $x^2 + y^2 + z^{n+1} = 0$ is the A_n singularity). A classical result of Brieskorn (the Simultaneous Resolution Theorem) shows that the monodromy diffeomorphism of an ADE singularity has finite order in the smooth mapping class group (i.e. after iterating the monodromy diffeomorphism a finite number of times it becomes smoothly isotopic to the identity). The main result that I will discuss provides a converse of this: the ADE singularities are the only 2-dimensional weighted-homogeneous hypersurface singularities with this property. The proof involves techniques from Seiberg-Witten gauge theory and Floer homology. Based on recent joint work with Hokuto Konno, Jianfeng Lin and Anubhav Mukherjee (arXiv: 2409.11961 and 2411.12202).