

# WORKSHOP IN ALGEBRAIC GEOMETRY

## SCHEDULE

### December 19, 2018

14:00–14:50 E. Brakkee

15:00–15:50 A. Ricolfi

Break

16:30–17:20 J. Hicks

### December 20, 2018

9:30–10:20 L. Cesarano

10:30–11:20 P. Borówka

Break

12:00–12:50 M. Mauri

## TITLES AND ABSTRACTS

### **Hyperelliptic curves on (1,4) polarised abelian surfaces**

*Paweł Borówka*

The talk will start by recalling the fact that a smooth hyperelliptic curve can be embedded into an abelian surface if the genus of the curve is at most 5.

Using similar methods to these used to define (1,3) theta divisors, we will prove that there exists a unique hyperelliptic curve (up to translation) on a general (1,4) polarised abelian surface.

Then aim of the talk will be to study the geometry of such curves. Contrary to (1,3) case, such curves are invariant under the subgroup of translations isomorphic to the Klein group.

The main result is the fact that being a Klein covering of a genus 2 curve non-isotropic with respect to the Weil pairing is not only necessary but also sufficient condition.

The construction is explicit, i.e the Jacobian of a genus 2 curve is a principally polarised surface that is given as a quotient of a (1,4) polarised surface and the quotient map restricted to a copy of genus

5 curve is the Klein covering. The talk is based on a joint work with Angela Ortega.

### **Two polarized K3 surfaces associated to the same cubic fourfold**

*Emma Brakkee*

For infinitely many  $d$ , Hassett showed that special cubic fourfolds of discriminant  $d$  are related to polarized K3 surfaces of degree  $d$  via their Hodge structures. For half of the  $d$ , a generic special cubic has not one but two different associated K3 surfaces. This induces an involution on the moduli space of polarized K3 surfaces of degree  $d$ . We give a geometric description of this involution. As an application, we obtain examples of Hilbert schemes of two points on K3 surfaces that are derived equivalent but not birational.

### **On the canonical map of smooth, ample divisors in abelian varieties.**

*Luca Cesarano*

In this talk, we present some results and open questions concerning the behavior of the canonical map of a general smooth ample divisor in the polarization of a general non-principally polarized complex abelian variety. The case of abelian threefold is the first geometrically meaningful case, in which new examples of canonically embedded irregular surfaces in low dimensional complex projective spaces arise.

### **Tropical Lagrangian Submanifolds from Lagrangian Cobordisms**

*Jeff Hicks*

Mirror symmetry conjectures that there is a relation between the symplectic geometry of a Calabi-Yau manifold  $X$ , and the complex geometry of a mirror Calabi-Yau manifold  $Y$ . These spaces are expected to have dual torus fibrations over a common affine base  $Q$ . One proposed mechanism for this duality comes from comparing symplectic geometry on  $X$  and complex geometry on  $Y$  to the affine geometry on  $Q$ .

The recent work of Matessi and Mikhalkin provides a method to lift tropical varieties on  $Q$  to Lagrangian submanifolds on  $X$ , filling

in one of the steps of this comparison. We will construct a version of these tropical Lagrangian submanifolds using a Lagrangian surgery cobordism. If time permits, we will discuss how these Lagrangian submanifolds are homologically mirror to hypersurfaces in toric varieties.

### **The essential skeletons of pairs and the geometric $P=W$ conjecture**

*Mirko Mauri*

The geometric  $P=W$  conjecture is a conjectural description of the asymptotic behavior of the celebrated non-abelian Hodge correspondence. In particular, it is expected that the dual boundary complex of the compactification of character varieties has the homotopy type of a sphere. In a joint work with Enrica Mazzon and Matthew Stevenson, we manage to compute the first non-trivial examples of dual complexes in the compact case. This requires to develop a new theory of essential skeletons over a trivially-valued field. As a byproduct, inspired by these constructions, we show that certain character varieties appear in degenerations of compact hyper-Kähler manifolds. In this talk we will explain how these new non-archimedean techniques can shed new light into classical algebraic geometry problems.

### **A higher rank local DT/PT correspondence**

*Andrea Ricolfi*

Donaldson-Thomas invariants are virtual counts of stable objects in the derived category of a Calabi-Yau 3-fold  $X$ . Toda proved the DT/PT correspondence in arbitrary rank, linking DT invariants to PT invariants via wall-crossing in a suitable heart in  $D(X)$ . We will show a local version of Toda's correspondence, centered at a fixed slope-stable sheaf of a given rank. This generalises the (rank one) local DT/PT correspondence centered at a Cohen-Macaulay curve embedded in  $X$ . Our wall-crossing formula is the virtual analogue of a recent Euler characteristic calculation for Quot schemes on 3-folds proved by Gholampour-Kool. Joint work with Sjoerd Beentjes.