Yorkshire Durham Geometry Day 2023

📅 Wednesday 6 Dec 2023, 12:55 → 17:30 Europe/London

📍 L50 (Department of Psychology)

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Fernando Galaz-García (Durham University)

Description

Yorkshire Durham Geometry Days

The Yorkshire and Durham Geometry Days (YDGD) are jointly organised by the Universities of Durham, Leeds, and York and occur at a frequency of three meetings per year. Financial support is currently provided by the LMS Research Grant Number 32317.

This iteration will take place at Durham University on **6 December 2023.**

Speakers

- Mohammad Al-Attar (Durham)
- Karen Habermann (Warwick)
- Jordan Hofmann (UCL)
- Graeme Wilkin (York)
- Patrick Wood (Durham)

The talks will be in room L50 (Psychology), from 1 pm - 5:30 pm.

We will meet at 12:30 pm in the Mathematics and Computer Science building lobby and then go to the Psychology building (a short walk from the MCS building).

Organisers

John Bolton, Fernando Galaz-García, Martin Kerin & Wilhelm Klingenberg, Durham University.
Derek Harland & Gerasim Kokarev, University of Leeds.
Ian McIntosh & Chris Wood, University of York.

13:00 → 13:50   **Graeme Wilkin: Hitchin systems from curves in an ALE space**   🕐 50m   📍 L50

In this talk I will describe a number of different ways to view ALE hyperkähler four manifolds of type A. From one point of view we can construct a family of affine holomorphic curves which act as the spectral curves for a Hitchin system. In the case where the spectral curves are affine elliptic curves, compactifying each curve gives us a holomorphic symplectic partial compactification of our ALE space. When the spectral curves have higher genus we can replace each curve with its Jacobian and interpret the whole picture in terms of Higgs bundles and Nahm's equations, which gives us a very explicit description of the moduli space.

This is joint work with Rafe Mazzeo.

Speaker: Graeme Wilkin (University of York)

14:00 → 14:50   **Karen Habermann: Intrinsic sub-Laplacian for hypersurface in a contact sub-Riemannian manifold**   🕐 50m   📍 L50

We construct and study the intrinsic sub-Laplacian, defined outside the set of characteristic points, for a smooth hypersurface embedded in a contact sub-Riemannian manifold. We prove that, away from characteristic points, the intrinsic sub-Laplacian arises as the limit of Laplace-Beltrami operators built by means of Riemannian approximations to the sub-Riemannian structure using the Reeb vector field. We carefully analyse three families of model cases for this setting obtained by considering canonical hypersurfaces embedded in model spaces for contact sub-Riemannian manifolds. In these model cases, we show that the intrinsic sub-Laplacian is stochastically complete and in particular, that the stochastic process induced by the intrinsic sub-Laplacian almost surely does not hit characteristic points.

Speaker: Karen Habermann (University of Warwick)

15:00 → 15:30   **Tea Break** 🕐 30m   📍 L50

15:30 → 16:00   **Patrick Wood: Optimal Transport on sub-Riemannian Manifolds**   ⏱ 30m   📍 L50

The optimal transport problem on a metric space M involves finding a transport map (or plan) between two measures which minimises a given cost function. In this talk, we outline existence and uniqueness results by Brenier and McCann for optimal maps in the case where M is a Riemannian manifold. We also introduce sub-Riemannian manifolds, and results by Figalli and Rifford on optimal transport in this setting.

Speaker: Patrick Wood (Durham University)

16:00 → 16:30   **Mohammad Al-Attar: Stability and Equivariant Gromov-Hausdorff Convergence**   ⏱ 30m   📍 L50

In the 1990's, Perelman established a stability theorem with respect to the Gromov—Hausdorff topology, asserting that close enough compact Alexandrov spaces with the same dimension and curvature bound are homeomorphic. In this talk, we will present and discuss a new stability result with respect to the equivariant Gromov—Hausdorff topology, which asserts that two close enough compact Alexandrov spaces with the same dimension and curvature bound and different isometric actions acting on each space by compact Lie groups of the same dimension are the same up to a homeomorphism of the spaces and a Lie group isomorphism of the groups that is compatible with the homeomorphism. This result generalizes a stability theorem of Harvey for compact Alexandrov spaces with a fixed isometric action by a compact Lie group. Further, if time permits, we will discuss other new results in the realm of equivariant Gromov-Hausdorff convergence.

Speaker: Mohammad Al Attar (Durham University)

16:40 → 17:30   **Jordan Hofmann: Special Spinors and (3-)Contact Geometries**   ⏱ 50m   📍 L50

Special spinors play a key role in differential geometry, with beautiful (and often surprising) connections to many areas within the subject. The most famous examples are Riemannian Killing spinors, which are by now well understood to occur only in certain very special situations, and whose existence imposes strong geometric constraints on the underlying manifold. Various generalizations have been studied over the past several decades, but the problem of reliably producing examples of globally defined spinor fields in dimension >8 remains difficult. In this talk I will discuss the current state of the art as it relates to Einstein-Sasakian and 3-Sasakian manifolds. In particular, I will explain how 3-Sasakian structures may be explicitly recovered from Killing spinors, and discuss their invariance properties in the homogeneous setting.

Speaker: Jordan Hofmann (University College London)