

Yorkshire Durham Geometry Day

University of York, Wednesday April 24th 2024

Location. Mathematics Department, Dusa McDuff Room (G/N/135, first floor).

Programme.

11.30 Arrivals and coffee (Topos, ground floor)

12.00 Katie Gittins (Durham) *Upper bounds for Steklov eigenvalues, ratios and gaps.*

13.00 Lunch.

14.15 Markus Upmeyer (Aberdeen) *Towards Gromov-Witten invariants in exceptional geometry.*

15.15 Short break

15.20 Linden Disney-Hogg (Leeds) *Symmetries of Riemann Surfaces and the Construction of Monopoles.*

16.20 Tea break.

17.00 Katrin Leschke (Leicester) *Smooth a discrete tori via Darboux transforms.*

There will be a dinner in a restaurant in York in the evening, probably starting at 18.45.

Abstracts.

Katie Gittens (Durham). *Upper bounds for Steklov eigenvalues, ratios and gaps.*

The interplay between the eigenvalues of the Steklov problem and the geometry of the underlying object is a key theme within Spectral Geometry.

In the last decade, substantial progress has been made in obtaining geometric upper bounds for the Steklov eigenvalues in various geometric settings. The Steklov spectral ratios and gaps have also received attention in recent years and they too offer fascinating insights into this interplay.

In this talk we will first give an overview of some geometric bounds for Steklov eigenvalues. We will then present recent results regarding upper bounds for the Steklov ratios and gaps on balls with revolution-type metrics.

The latter is based on joint work with Jade Brisson (Université de Neuchâtel) and Bruno Colbois (Université de Neuchâtel).

Markus Upmeyer (Aberdeen). *Towards Gromov-Witten invariants in exceptional geometry.*

There is a well-known theory of J-holomorphic curves in symplectic geometry which leads, for example, to the construction of powerful Gromov-Witten invariants. One conjectures that parts of this story carry over to manifolds of exceptional holonomy.

Most of my talk will introduce background on G2-geometry and their calibrated submanifolds, which here play the role of J-holomorphic curves. I will then survey some recent progress in the area, including my own results on orientations (joint with D. Joyce).

Linden Disney-Hogg (Leeds). *Symmetries of Riemann Surfaces and the Construction of Monopoles.*

The study of magnetic monopoles in gauge theory and the connection with algebraic geometry celebrates its 50th anniversary in 2024, and in 1982 Hitchin provided the criteria for certain algebraic curves to correspond to monopole solutions. These constraints are hard to solve, being transcendental in nature, and in the ensuing 40 years only a limited number of spectral curves have been discovered, typically requiring large symmetry groups. I will describe how a combination of the representation theory of Nahm's equations, computer algebra software, and Riemann surface theory allows us to construct the first new explicit monopole spectral curves in 25 years.

Katrin Leschke (Leicester). *Smooth a discrete tori via Darboux transforms.*

In classical differential geometry, geometric transformations have been used to create new curves and surfaces from simple ones: the aim is to solve the underlying defining compatibility equations of curve or surface classes by finding solutions to a simpler system of differential equations arising from the transforms. Classically, the main concern was a local theory. In modern theory, global questions have led to a renewed interest in classical transformations. For example, in the case of a torus, the investigation of closing conditions for Darboux transforms naturally leads to the notion of the spectral curve of the torus.

In this talk we discuss closing conditions for smooth and discrete polarised curves, isothermic surfaces and CMC surfaces. In particular, we obtain new explicit periodic discrete polarised curves, new discrete isothermic tori and new explicit smooth CMC cylinder.

Yorkshire Durham Geometry Days are financially supported by a London Mathematical Society Scheme 3 Grant.

Local organizers:

York – Ian McIntosh, Graeme Wilkin & Chris Wood.

Durham – John Bolton, Fernando Galaz-Garcia & Wilhelm Klingenberg.

Leeds – Derek Harland & Gerasim Kokarev.

Ian McIntosh – 06/03/2024.