The Interplay Between Skew Braces and Hopf-Galois Theory

University of Leeds (Belgium)

15th May, 2025

Schedule

(09:30-10:30) **Paul Truman**: *Biskew braces and abelian maps*

(10:30-11:00) Coffee break

(11:00-12.00) **Vincent Caudrelier**: *Set-theoretical Yang-Baxter and reflection equations and soliton interactions*

(12:00-14:00) Lunch

(14:00-14:30) **George Altmann**: *A Higher Peripheral System for Welded Knots*

(14:30-15:00) **Jack Romo**: *TBA*

(15:30-16:00) Coffee break

(16:00-16:30) **Benjamin Morris**: *A Diagram Category for Non-orientable Surfaces*

(16:30-17:00) **Eric Rowell**: *Subobjects and Quotient Objects of Yang-Baxter Matrices*

Abstracts

Biskew braces and abelian maps

Paul Truman

University of Keele (UK)

We give a brief survey of the theory of biskew braces from the perspective of regular subgroups of permutation groups. We also show how group endomorphisms with abelian image can be used to produce example of biskew braces.

Set-theoretical Yang-Baxter and reflection equations and soliton interactions

Vincent Caudrelier

University of Leeds (UK)

In this overview talk, I will discuss how the analysis of soliton interactions in various integrable models of physical interest naturally gives rise to (parametric) Yang-Baxter maps or set-theoretic solutions of the Yang-Baxter equation. There is an underlying mechanism, common to the different models, that produces these solutions: a refactorisation problem for certain elements of a loop group. In turn, this is rooted in a nonlinear version of the Fourier transform which explains why all these maps are inherently parametric. I will also explain how a very natural problem physically, the presence of a spatial boundary, led to the introduction of the set-theoretical reflection equation and of classes of solutions for it, known as (parametric) reflection maps. An important ingredient in the construction involves an involution. Finally, I will try to venture into connections with some algebraic structures that have emerged as central facets of the Yang-Baxter and reflection equations, as well as more geometric aspects related to symplectic and Poisson properties of Yang-Baxter and reflection maps (time allowing).

A Higher Peripheral System for Welded Knots

15 May
14:00
14:30

George Altmann

University of Leeds (UK)

The fundamental group of the complement of a knot is a classical and powerful invariant in knot theory. For welded knots, this knot group can be defined combinatorially via a Wirtinger-type presentation, closely related to a lift of Artin's representation to loop braid groups. Building on this structure, we define a natural enhancement of the knot group W(D) by equipping it with a Z[W(D)]-module, arising from the topology of the associated loop braid representation. This yields a new invariant of welded links that is strictly stronger than the knot group alone. Analogous to the classical setting where the knot group is enriched to a peripheral system, a complete invariant of classical knots, we introduce a higher peripheral system stemming from our new invariant. We will present this construction and compare it to the classical peripheral system, highlighting its potential for distinguishing welded links.

TBA

15 May
14:30
15:00

Jack Romo

University of Leeds (UK)

TBA

A Diagram Category for Non-orientable Surfaces

15 May
16:00
16:30

Benjamin Morris

University of Leeds (UK)

The Temperley-Lieb (TL) category was introduced in lattice statistical mechanics and has since found applications in several areas including integrable systems, low dimensional topology, and representation theory. Famously, it has a diagrammatic realisation whereby morphisms are represented by (linear combinations of) embedded curves in a square considered up to isotopy and a finitising local relation. In this talk, I will present the construction of a skeletal diagram category which extends the TL category by including diagrams of embedded curves on non-orientable bounded surfaces. Such diagrams utilise handle decompositions for surfaces and are considered up to a handle-slide equivalence. A full set of monoidal generators is given which include the TL generators, a family of orientable genus one diagrams, which are the components of a braiding, and a and family of non-orientable diagrams, which are the components of a certain natural transformation. I will present some results and conjectures regarding finitising quotients of this category, motivated by representation theory.

Subobjects and Quotient Objects of Yang-Baxter Matrices

Eric Rowell

Texas A&M University (USA)

I will say a little about the words in the title, part of ongoing joint work with Martin and Torzewska.