Journées Normandes en Topologie (T-Days III)

21–23 October 2019, Caen

The conference will take place in the **Science 3 building, Campus 2, Université Caen Normandie**. Registration and Tuesday and Wednesday talks will be in **S3 247**, Monday talks in **S3 102**, and coffee breaks in the area in front of S3 247.

If you have any queries feel free to contact the organisers by mail:
paolo.bellingeri@unicaen.fr, lebed@unicaen.fr.

Program

Monday 21 October

14h - 14h30	Registration and welcome, S3 247	
14h30 - 15h20	Victoria Lebed	Yang–Baxter equation I
15h30 - 16h20	Adrien Brochier	Graphical calculus and virtual tangles
Coffee break		
16h50 - 17h40	Anne-Laure Thiel	Catalan numbers, Temperley–Lieb algebras and Soergel bimodules

Tuesday 22 October

09h00 - 9h50	Victoria Lebed	Yang–Baxter equation II
Coffee break		
10h20 - 11h10	Jean-Baptiste Meilhan	Characterization of the reduced peripheral system of links
11h20 - 12h10	Ramanujan Santharoubane	Quantum representations of mapping class groups
Lunch (at the university cafeteria)		
14h00 - 14h50	Paolo Bellingeri	Virtual braid groups and permutations
15h00 - 15h50	Celeste Damiani	Loop braid groups and a new lift of Artin's representation
Coffee break		
16h20 - 17h10	John Guaschi	(Almost)-crystallographic quotients of Artin braid groups and their finite subgroups
19h30	Conference dinner (Restaurant L'Aromate, 9 Rue Gemare)	

Wednesday 23 October

09h00 - 9h50	Victoria Lebed	Yang–Baxter equation III
Coffee break		
10h10 - 11h00	Alessia Cattabriga	Knot quandle decompositions
11h00 - 11h50	Markus Szymik	Symmetries and deformations: a classification of knots
Lunch (at the university cafeteria)		
14h00 - 14h50	Daniel Juan-Pineda	On the geometric dimension for classifying spaces for mapping class groups

Abstracts

Paolo Bellingeri (Caen): Virtual braid groups and permutations

Let VB_n be the virtual braid group on n strands, and S_n the symmetric group on n elements. We determine all possible homomorphisms between:

- VB_n and VB_m;
- VB_n and S_m;
- S_n and VB_m

when $n > 4$ and $n \geq m$. As corollaries we get several results on virtual braid groups, in particular we compute their outer group and we show that virtual braid groups are hopfian and co-hopfian. The approach is completely different from Artin and Lin ones for classical braids and permutations, and it is based on Basse–Serre theory of amalgamated products of groups.
This is a joint work with Luis Paris.

Adrien Brochier (Paris 7): Graphical calculus and virtual tangles

One of the most fundamental results tying braid and knot theory, and representation theory and category theory, is the Shum and Reshetikhin–Turaev theorem giving a presentation by generators and relations of the category of braids and that of framed oriented tangles. It states that those are the free braided monoidal category, and the free ribbon category respectively. In this talk we will explain a similar result about virtual knotted objects, which clarifies how those are related to the Yang–Baxter equation and quantum groups.

Alessia Cattabriga (Bologna): Knot quandle decompositions

After reviewing the definition of oriented tangle category and fundamental quandle, we will show that the fundamental quandle defines a functor from the oriented tangle category to a suitably defined quandle category. Then we will describe how, given a tangle decomposition of a link L, the fundamental quandle of L may be obtained from the fundamental quandles of tangles and, finally, we will apply this procedure to derive a presentation of the fundamental quandle of periodic links, composite knots and satellite knots.
This is a joint work with Eva Horvat (University of Ljubljana).

Celeste Damiani (Leeds): Loop braid groups and a new lift of Artin's representation

We associate to the 3-ball with an n-trivial link removed from its interior a 2-sorted structure $\mathscr{M}_n$. We describe an injection of the (extended) loop braid group LB_n^{ext} into the group of automorphisms of $\mathscr{M}_n$. Then, we show that it is both an extension of Artin's representation for braid groups and of Dahm's homomorphism for (extended) loop braid groups.
This is a joint work with J. Faria Martins and P. Martin.

John Guaschi (Caen): (Almost)-crystallographic quotients of Artin braid groups and their finite subgroups

We discuss some recent results regarding quotients of the Artin braid groups by elements of the lower central series of the corresponding pure braid group, and the embedding of finite groups in these quotients.
This is a joint work with D.L. Gonçalves and O. Ocampo.

Daniel Juan-Pineda (UNAM Mexico): On the geometric dimension for classifying spaces for mapping class groups

We explore the notion of geometric dimension for different families of subgroups in a group. We give a bound for the case of the family of virtually cyclic subgroups of the mapping class groups.

Victoria Lebed (Caen): Yang–Baxter equation (mini-course)

Solutions to the Yang–Baxter equation (YBE) of different types can be used to cook up a braid group representation, a knot invariant, an exactly solvable lattice model, a rewriting system, or a non-commutative space. This diversity of applications suggests that the family of YBE solutions is very large, and their classification must be a hard problem—which is indeed the case. In this mini-course we will present what is currently known about how this family is organised.
On Monday we will describe important solution families and give an overview of applications. On Tuesday we will talk about the cohomology of YBE solutions, and relate it to solution deformation. In addition, applications to knot theory and to Hochschild homology computation will be given. On Wednesday two important solution invariants will be introduced: the structure group and the structure rack. We will discuss what they remember about a solution. We will also see that the structure group construction yields groups with interesting algebraic and geometric properties (Garside, Bieberbach etc.).

Jean-Baptiste Meilhan (Grenoble): Characterization of the reduced peripheral system of links

The reduced peripheral system was introduced by Milnor in the fifties for the study of links up to link-homotopy, i.e. up to isotopies and crossing changes within each link component. However, for four or more components, this invariant does not yield a complete link-homotopy invariant.
In this talk, I will explain two characterizations of links having the same reduced peripheral system: a diagrammatical one, in terms of link diagrams, seen as welded diagrams up to self-virtualization, and a topological one, in terms of ribbon solid tori in 4-space up to ribbon link-homotopy.
This is a joint work with Benjamin Audoux.

Ramanujan Santharoubane (Paris 11): Quantum representations of mapping class groups

Surface mapping class groups act on finite dimensional complex vector spaces arising from Witten–Reshetikhin–Turaev TQFT's. For a given mapping class group, these actions are indexed by an integer called the level. One of their main features is that the action of a single Dehn twist is always of finite order although the action of the whole mapping class group is non-trivial. In 2005, Andersen, Masbaum and Ueno conjectured that a pseudo-Anosov homeomorphism should act with infinite order for all but finitely many levels. In some sense, this conjecture says that the Nielsen–Thurston classification of surface homeomorphisms is nicely packaged in TQFT. This is still an open problem but I will present the different known approaches and results in this direction.

Markus Szymik (Trondheim):

Quandles (and more generally racks) are fundamental algebraic structures. While applications in knot theory are rich, their conceptual study is still in its infancy. In this talk I will survey new results and directions of thought that arose from a categorical and homotopical approach to the subject.
Part of this is joint work with Tyler Lawson (University of Minnesota).

Anne-Laure Thiel (Caen): Catalan numbers, Temperley–Lieb algebras and Soergel bimodules

I will first introduce the Temperly–Lieb algebra, which is a diagram algebra originating from statistical mechanics and playing a remarkable role in knot theory. I will then present an overview of the category of Soergel bimodules and of its importance in representation theory. Finally, I will sketch the construction of a similar category associated to cyclic groups, show how Catalan numbers appear in this context and explain how the Temperley–Lieb algebra can describe certain morphism spaces in this category.
This is joint work with Thomas Gobet.

Participants

1. Marc Bataille (Rouen)
2. Paolo Bellingeri (Caen)
3. Adrien Brochier (Paris Diderot)
4. Alessia Cattabriga (Bologna)
5. Christophe Cordero (Marne la Vallée)
6. Celeste Damiani (Leeds)
7. Jacques Darné (Dijon)
8. Jean Fromentin (Calais)
9. Guillaume Gandolfi (Caen)
10. Eddy Godelle (Caen)
11. Giovanna Guaiana (Rouen)
12. John Guaschi (Caen)
13. Eva Horvat (Ljubljana)
14. Daniel Juan-Pineda (UNAM Mexico)
15. Victoria Lebed (Caen)
16. Bernard Leclerc (Caen)
17. Gilbert Levitt (Caen)
18. Jean-Gabriel Luque (Rouen)
19. Stavroula Makri (Caen)
20. Jean-Baptiste Meilhan (Grenoble)
21. Arnaud Mortier (Caen)
22. Florin Nichita (Bucharest)
23. Guillaume Pagel (Calais)
24. Pablo G Pagotto (Grenoble)
25. Jérôme Poineau (Caen)
26. Philippe Satge (Caen)
27. Ramanujan Santharoubane (Orsay)
28. Mireille Soergel (Dijon)
29. Arthur Soulié (Cambridge)
30. Markus Szymik (Trondheim)
31. Anne-Laure Thiel (Caen)
32. Fiona Torzewska (Leeds)