Plenary Speakers
Conférences plénières

DROR BAR-NATAN, University of Toronto
Meta-Groups, Meta-Bicrossed-Products, and the Alexander Polynomial

The a priori expectation of first year elementary school students who were just introduced to the natural numbers, if they would be ready to verbalize it, must be that soon, perhaps by second grade, they'd master the theory and know all there is to know about those numbers. But they would be wrong, for number theory remains a thriving subject, well-connected to practically anything there is out there in mathematics.

I was a bit more sophisticated when I first heard of knot theory. My first thought was that it was either trivial or intractable, and most definitely, I wasn't going to learn it is interesting. But it is, and I was wrong, for the reader of knot theory is often lead to the most interesting and beautiful structures in topology, geometry, quantum field theory, and algebra.

Today I will talk about just one minor example, mostly having to do with the link to algebra: A straightforward proposal for a group-theoretic invariant of knots fails if one really means groups, but works once generalized to meta-groups (to be defined). We will construct one complicated but elementary meta-group as a meta-bicrossed-product (to be defined), and explain how the resulting invariant is a not-yet-understood yet potentially significant generalization of the Alexander polynomial, while at the same time being a specialization of a somewhat-understood "universal finite type invariant of w-knots" and of an elusive "universal finite type invariant of v-knots".

Handout and related links at http://www.math.toronto.edu/ drorbn/Talks/Regina-1206/

LISA JEFFREY, University of Toronto
Equivariant K-theory of the based loop group of SU(2)

(Joint work with Megumi Harada and Paul Selick)

Let G be a compact Lie group. The loop group ΩG is the set of maps from S^1 to G. The based loop group (those loops which send the basepoint of S^1 to the identity element of G) is an infinite-dimensional analogue of a coadjoint orbit of a compact Lie group. It is equipped with a natural G action (pointwise conjugation) and a circle action (rotation of the loop); these two actions commute. Its cohomology, K-theory and equivariant cohomology (under the G action) have been studied since the work of Bott in the 1940's, but its equivariant K-theory has not been studied until recently. I describe our recent results, which compute the equivariant K-theory of the based loop group of $SU(2)$ (both as a module and as an algebra).

MARIUS JUNGE, Illinois-Urbana Champaign
From Bell inequalities to the Grothendieck program in Operator Algebras

Bell inequalities are of fundamental importance in quantum mechanics, and quantum information theory. In this talk we will show how Bell inequalities for two or three parties are related to classical topics in Banach space and Operator Algebra theory. In particular we will outline the connections between the work of Grothendieck, Tsirelson, Kirchberg and Connes in the context of Bell inequalities, and how the more recent theory of operator spaces and operator systems become relevant. Going from two parties to three parties, we can find arbitrary large violations, i.e. examples where quantum mechanics has the potential to substantially outperform classical systems.

(The talk is based on joint work with David Garcia-Perez, Carlos Palazuelos among others).

ULRIKE TILLMANN, Oxford University
Manifolds and Topological Field Theory

The notion of cobordism is a very powerful tool in the theory of manifolds. It also plays an important role in the axiomatic approach to quantum field theory. We will explain these concepts and show how recent developments shed light on both.

MARGARET WALSHAW, Massey University, New Zealand
Characteristics of effective teaching for diverse mathematics learners

Pressing pedagogical problems within mathematics classrooms call for greater accessibility to sound research evidence, and a greater responsiveness to the multiple cultural heritages brought to classroom settings. This presentation provides evidence of the sort of pedagogical arrangements that contribute to desirable outcomes for diverse students. It describes the ways in which effective teachers arrange for learning within their classrooms. In the presentation elements of practice are characterised taking into account the physical, social, and cultural community of practice in which the teaching is embedded. The discussion is grounded in the importance of shared responsibilities and mutual investment in students' well-being.