From Subfactors to Quantum Topology
In memory of Vaughan Jones

June 27th – July 1st, 2022 University of Geneva
(Uni Dufour - Auditorium U300 – Charles Rouillier)

Dror BAR-NATAN (University of Toronto)

Title: Cars, Interchanges, Traffic Counters, and a Pretty Darned Good Knot Invariant

Abstract: *Reporting on joint work with Roland van der Veen, I'll tell you some stories about ρ_1, an easy to define, strong, fast to compute, homomorphic, and well-connected knot invariant.ρ_1 was first studied by Rozansky and Overbay, it is dominated by the coloured Jones polynomial (but it isn't lesser!), it has far-reaching generalizations, and I wish I understood it.*
http://drorbn.net/j22

Dietmar BISCH (Vanderbilt University)

Title: Planar algebras, noncommutativity and hyperfinite subfactors

Abstract: *The hyperfinite II_1 factor contains a wealth of subfactors that give rise to many new and fascinating mathematical structures. Vaughan Jones discovered that the unitary tensor category generated by the standard representation of a subfactor has a planar structure and can be described as what he called a "planar algebra". It is a complete invariant for amenable subfactors by a deep result of Popa. However, generic subfactors are not amenable, and one typically does not know how to distinguish them. I will discuss a notion of asymptotic noncommutativity that can be used to distinguish subfactors with the same planar algebra invariant. I will construct "very noncommutative" examples from actions of suitable groups on the hyperfinite II_1 factor. Moreover, planar algebra techniques lead to new subfactors with Temperley-Lieb-Jones planar algebra.*

Christian BLANCHET (Université Paris Diderot)

Title: From Jones relation to representations of Mapping Class Groups

Abstract: *We will review fundamental contributions of Vaughan Jones in the genesis of Quantum Topology. Then we will focus on representations of Mapping Class Groups highlighting a contribution of Vaughan Jones in genus 2. We will finally discuss homological models producing new representations.*

Martin BRIDSON (University of Oxford)

Title: Knot my problem: looking for rigidity in group theory

Abstract: *I shall explain two type of rigidity results in group theory that rely on constructions involving knots. First I shall discuss how knots have figured in the search for groups that are profinitely rigid in the sense that they can be distinguished from other groups by means of their finite quotients. Second, I shall explain an extension of the Miller-Schupp embedding theorem: every finitely presented, torsion-free group G can be embedded in a finitely presented, torsion-free group G* that is asymmetric, i.e. Out(G*)=1.*

Alain CONNES (IHES)

TBA

David EVANS (Cardiff University)

Title: The search for the exotic in Subfactors and Conformal Field Theory

Abstract: *Groups can act as symmetries of physical systems and on their mathematical models as in conformal field theory. Vaughan's subfactor theory provides a framework for quantum symmetries beyond those arising from groups or their deformations as quantum groups or loop groups. The accepted position was that the Haagerup system, associated with the a subfactor at index* $(5 + \sqrt{(13)})/2$*, was exotic and surely could not be constructed from group like symmetries. I discuss work with Terry Gannon that this should be considered as misconception and the more general issue of constructing conformal field theories from subfactors and their associated modular tensor categories.*

Cameron GORDON (University of Texas at Austin)

Title: The ADE link conjecture

Abstract: *It is well known that the ADE graphs arise in many classification problems in mathematics. In 2019 Michel Boileau, Steve Boyer and I conjectured a modest addition to this list: the fibered links that induce the tight contact structure on* S^3 *and have a cyclic branched cover whose fundamental group is left-orderable. We will describe the conjecture, its background, and some recent results that establish it in many cases.*
This is joint work with Steve Boyer and Ying Hu.

Jean-Claude HAUSMANN (University of Geneva)

Title: The cell dispensibility problem for spaces and manifolds

Abstract: *We consider the following problem: when is a CW-space X homotopy equivalent to a CW-complex without j-cells for $k < j < r$? We show that this is equivalent to some cohomology condition together with the vanishing of an algebraic K-theory "cell-dispensability obstruction", analogous but not equal to the Wall finiteness obstruction. A similar theory holds for closed manifolds, replacing "cells" by "handles".*

Mikhail KHOVANOV (Columbia University)

Title: Facets of Temperley-Lieb algebra

Abstract: *Temperley-Lieb algebra plays a fundamental role in the theories of subfactors and quantum invariants, as discovered and developed by Vaughan Jones. The talk will touch upon several extensions of the Temperley-Lieb algebra and Jones' work, including its categorification together with the categorification of the Jones polynomial, and variations on the Temperley-Lieb algebra and category that control pairs of biadjoint functors.*

Aaron LAUDA (University of South California)

Title: Lattice models arising from non-semisimple TQFT

Abstract: *There is a rich interplay between two-dimensional topological phases in quantum mechanical systems and topological quantum field theory. This interaction is further enriched as topological structures inherent in TQFT lead to novel features, such as non-abelian braiding statistics for low energy excitations, when expressed in the corresponding quantum mechanical models. In this talk, we will review the relationship between Turaev-Viro TQFTs and Levin-Wen string net models for topological matter. We will explain new joint work with Geer, Patureau-Mirand, and Sussan extending this relationship to modified Turaev-Viro theories coming from non-semisimple TQFT. These new non-semisimple Levin-Wen models exhibit a novel feature of being pseudo-Hermitian, so that they have real spectrum, evolve via the Schrodinger equation, and have normalizable wavefunction, but are not given by Hermitian Hamiltonians.*

Lisa PICCIRILLO (MIT)

Title: 4-manifolds with boundary and fundamental group $\mathbb{Z}$

Abstract: *In this talk I will discuss a classification of topological 4-manifolds with boundary and fundamental group $\mathbb{Z}$, under some mild assumptions on the boundary. I will apply this classification classify surfaces in simply-connected 4-manifolds with 3-sphere boundary, where the fundamental group on the surface complement is $\mathbb{Z}$. I will also compare these homeomorphism classifications with the smooth setting, showing for example that every appropriate form can be realized as the equivariant intersection form of a pair of exotic smooth 4-manifolds with boundary and fundamental group $\mathbb{Z}$, and that every smooth 2-handlebody with 3-sphere boundary contains a pair of exotic surfaces. This is joint work with Anthony Conway and Mark Powell.*

Pavel SAFRONOV (University of Edinburgh)

Title: Skein modules for generic quantum parameters

Abstract: *Skein modules were defined by Przytycki and Turaev as a way to generalize the Jones polynomial and the Kauffman bracket to links in manifolds other than the 3-sphere. In this talk I will review some recent structural results, such as the fact that the skein module of a closed 3-manifold is finite-dimensional for generic quantum parameters. I will also describe a work in progress joint with Gunningham which relates skein modules for generic quantum parameters to the cohomology of a certain perverse sheaf on the character stack of the 3-manifold. This allows one to generalize skein modules to finite 3-dimensional Poincare complexes and compute them for those with a finite fundamental group.*

Paul WEDRICH (Universität Hamburg)

Title: On skein theory in dimension four

Abstract: *The Temperley-Lieb algebra describes the local behaviour of the Jones polynomial and gives rise to the Kauffman bracket skein modules of 3-manifolds. Going up by one dimension, Bar-Natan's dotted cobordisms describe the local behaviour of Khovanov homology and, likewise, give rise to skein modules of 4-manifolds. I will describe the construction of these skein modules and methods to compute them via a handle decomposition. Based on joint work with Morrison-Walker, Manolescu-Walker, and Hogancamp-Rose.*

Hans WENZL (University of California at San Diego)

Title: Braids, Dualities and more subfactors

Abstract: *The famous Schur-Weyl duality states that the commutant of the action of $Gl(V)$ on $V^{\otimes n}$ is generated by the obvious action of the symmetric group S_n on $V^{\otimes n}$. We will first give a survey of quantum groups $U_q\mathfrak{g}$ and representations V, where the commutant of the action of $U_q\mathfrak{g}$ on $V^{\otimes n}$ is (almost) generated by the braid group B_n. In the case of spin representations of $U_q\mathfrak{so}_N$, these braid representations are best described in the context of another q-deformation $U'_q\mathfrak{so}_n$ of $U\mathfrak{so}_n$. This q-deformation can be embedded into $U_q\mathfrak{sl}_n$ as a coideal subalgebra. It can also be used to construct more examples of subfactors which correspond to the embedding $SO(n) \subset SU(n)$ in the classical limit $q \to 1$.*

Helen WONG (Claremont McKenna College)

Title: Skein algebra of a punctured surface

Abstract: *In the case of a closed surface, there is a rich body of work describing how the Kauffman bracket skein algebra can be regarded as a quantization of Teichmuller space. In order to generalize to a surface with punctures, Roger and Yang defined a skein algebra with extra generators and relations that they conjectured to be a quantization of Penner's decorated Teichmuller space. In joint work with Han-Bom Moon, we resolve their conjecture by appealing to another algebra closely related to the decorated Teichmuller space, a cluster algebra for punctured surfaces first defined by Fomin, Shapiro, and Thurston.*