"Groupoid Lift of Universal Invariants"
Jørgen Ellegaard Andersen (CTQM)

Abstract: We will first recall the universal invariant of links in surface cylinders due to Andersen, Mattes and Reshetikhin. Following this, we will construct an invariant of 3-manifolds obtained by surgery on links in surface cylinders, which is universal among homology cylinders. This invariant depends only on the choice of a fatgraph marking of the surface in question or equivalently the choice of an ideal triangulation of the surface. The Ptolemy groupoid of the surface naturally acts on our universal invariant and we use this action to give a TQFT reconstruction of the LMO invariant of integral homology spheres given by a Heegaard splitting.
The new work presented in this talk is joint work with Bene, Meilhan and Penner.

"The Penultimate Alexander Invariant"
Dror Bar-Natan (University of Toronto)

Abstract: Following joint work with Jana Archibald I will describe a clean and elegant extention *pA* of the multi-variable Alexander polynomial (MVA) to the planar algebra of tangles, which is well-behaved under arbitrary planar compositions. (Actually, it's more: I really mean virtual tangles, and arbitrary circuit algebra compositions). We have at least two reasons to be happy:

1. *pA* can be implemented in less than one page of computer code. After that, the proofs of many identities satisfied by the MVA, whose current proofs span many journal pages, become completely mechanical.
2. We find at least one new identity satisfied by the MVA, which may lead to a very simple characterization of the MVA.
3. In the case of Khovanov homology, the extension to tangles leads to significant computational and other advantages. The presence of an MVA for virtual tangles with good composition properties sets the bar for our hopes for a (or the) categorification of the MVA.

Why "penultimate"? Because there is in the works an "ultimate" Alexander invariant which is even better (though likely less elegant). But we won't talk about it here.

Links: A handout and some programs will likely be linked later on at:
http://www.math.toronto.edu/~drorbn/Talks/Sandbjerg-0810

"On a Simplification of Combinatorial Link Floer Homology"
Anna Beliakova (CTQM)

Abstract: Link Floer homology is a new powerful invariant of links discovered independently by Ozsvath-Szabo and Rasmussen. This invariant detects the knot genus, its fiberedness and provides obstructions for the slice genus of knots.
In 2006 Manolescu, Ozsvath, Sarkar, Szabo and D. Thurston (MOSST) gave a combinatorial construction of link Floer homology. The MOSST construction uses rectangular link diagrams, where the counting of holomorphic discs is reduced to applying the Riemann mapping theorem. Unfortunately, the MOSST complex is quite big. Already in the simplest case of the trefoil, it has 120 generators, while the knot Floer homology has rank 3.
In my talk, after a gentle introduction to link Floer homology, I will explain how the MOSST complex can be simplified. For example, for all knots with less than 6 crossings, my combinatorial complex has the same rank as its homology.

"Unified SO(3)-Quantum Invariant for Rational Homology 3-Spheres"
Irmgard Bühler (University of Zurich)

Abstract: In 2001, K. Habiro constructed for an integer homology 3-sphere M a unified invariant I_M(q) which, if evaluated at any root of unity, gives the SU(2) Witten-Reshetikhin-Turaev invariant of M at that root.
In this talk, we extend Habiro's construction to rational homology 3-spheres. More precisely, given a rational homology 3-sphere M with |H_1(M;Z)|=b, we construct a unified invariant I_M(q), which dominates the SO(3) WRT invariants of M at all roots of unity.

"Using Algebraic Morse Theory to Compute Link Floer Homology"
Jean-Marie Droz (University of Zurich)

Abstract: We describe the computer implementation of a method of A. Beliakova for computing link Floer homology.

"Classical and Quantum Dilogarithm"
Vladimir Fock (Moscow State University)

Abstract: We shall present the definition and discuss the main properties of the quantum dilogarithm function. The main aim is to explain two dual interpretations for it: one an operator in a Hilbert space defining the action of the generalised mapping class group on a cluster variety, and another one as a gluing function for a prequantisation line bundle over a dual variety.

"Hitchin's Connection with Metaplectic Correction (Part 2)"
Niels Leth Gammelgaard (CTQM)

Abstract: Hitchin's connection was originally constructed to identify the quantum spaces for different choices of Kahler structures in quantized Chern-Simons theory, arising from geometric quantization of the moduli space of flat connections.
Later it was generalized to geometric quantization of compact symplectic manifolds by Andersen, who also gave an explicit formula.
This talk will present a recent generalization to geometric quantization with metaplectic correction on symplectic manifolds.
First, we will review the original construction. Then we discuss metaplectic structures and the problems of extending the original ideas to the metaplectic setting. This will lead us to constructing a so-called "reference connection", from which the Hitchin connection is built. Finally, we present the Hitchin connection in this generalized setting and show that it agrees with the original connection, in cases where they both exist.

"Hitchin's Connection with Metaplectic Correction (Part 1)"
Magnus Roed Lauridsen (CTQM)

Abstract: Hitchin's connection was originally constructed to identify the quantum spaces for different choices of Kahler structures in quantized Chern-Simons theory, arising from geometric quantization of the moduli space of flat connections.
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"Topological Invariants Related to Quantum Groups at Roots of 1"
Nicolai Reshetikhin (Berkeley and CTQM)

Abstract: There are several versions of quantum groups at roots of unity. One has divided powers, the other has a big center. Some generators have intermediate versions with divided powers. All these quantum groups have different braiding. In this talk, I will give a survey of all these constructions for sl_2 and will discuss the corresponding invariants of links and 3-manifolds.

"Gauged Vortices and Localisation"
Nuno Miguel Romão (CTQM)

Abstract: The vortex equations describe field configurations in a U(1) gauge theory on a surface S. Their moduli spaces support natural Kaehler structures, defined in terms of integrals of fields over S. In this talk, I will review localisation techniques that provide a purely local description of these structures, and how this can be used to compute quantities such as partition functions or symplectic volumes of moduli spaces. Time permitting, I will also report on current work (with J. Baptista) extending some of these results to the generalised vortex equations associated to the so-called hamiltonian Gromov-Witten invariants.

"Characterizing Generic Global Rigidity"
Dylan Thurston (Columbia University, NY)

Abstract: A d-dimensional framework is a graph and a map from its vertices to E^d. Such a framework is globally rigid if it is the only framework in E^d with the same graph and edge lengths, up to rigid motions.
For which underlying graphs is a generic framework globally rigid? We answer this question by proving a conjecture by Connelly, that his sufficient condition is also necessary. The condition comes from considering the geometry of the length-squared mapping l; essentially, the graph is generically locally rigid iff the rank of l is maximal, and it is generically globally rigid iff the rank of the Gauss map on the image of l is maximal. (This is an equivalent reformulation of Connelly's version of the condition, which was in terms of the size of the kernel of a generic stress matrix.) We also show that this condition is efficiently checkable with a randomized algorithm.
This is joint work with Steven Gortler and Alex Healy.

"Khovanov-Rozansky Homology for Embedded Graphs"
Emmanuel Wagner (CTQM)

Abstract: We generalize Khovanov-Rozansky link homology to the case of embedded graphs in the three-space.