ECSTATIC - Abstracts

Marco Golla - Twisting (Heegaard Floer) correction terms

Correction terms in Heegaard Floer homology are rational numbers associated to rational homology spheres, introduced by Ozsváth and Szabó (inspired by the work of Frøyshov in Seiberg-Witten theory). These invariants have been used to study the topology of 4-manifolds whose boundary is a rational homology sphere. We use twisted coefficients to generalise this construction to arbitrary 3-manifolds, and give some applications. This is joint work with Stefan Behrens.

Rachael Boyd - Homological stability

Many interesting sequences of groups satisfy the phenomenon known as "homological stability". Examples include the symmetric groups, braid groups, and mapping class groups of surfaces. I will provide an introduction to this topic and explain the proof for symmetric groups in some detail. I will finish by giving an overview of current research.

Hatice Çoban - CR structures on 3-dimensional contact manifolds

In this talk, we start with an introduction to Cauchy-Riemann (CR) structures and give the relation between contact manifolds and CR manifolds in dimension 3.

Andrew Ranicki - The role of the number 8 in topology

On New Year's Day 2015 I started a modest website with a grand title 'Eight in algebra, topology and mathematical physics' `http://www.maths.ed.ac.uk/~aar/eight.htm`. The website is a collection of sources concerning the number 8 - starting with Sesame Street! The mathematical links are to papers on various occurrences of quadratic forms and manifolds with signature 8 - the E_8 form being the key example. The talk will try to explain the topological significance of these occurrences in algebraic and geometric surgery theory, from a historical point of view.

Note: coincidentally, 8 is also the subject of a current exhibition at University College London 'Eights in the Octagon: Medieval and Renaissance perspectives' `https://www.ucl.ac.uk/museums/visit/highlights/octagon` which I am happy to recommend.

Robert Kropholler - Free-by-Cyclic Groups

I will prove that all free of rank 2 by cyclic groups act on CAT(0) square complexes.

Gemma Halliwell - Families of Berge Knots

Dehn surgery is the process of gluing a solid torus to the exterior of a knot. A lens space is a 3-manifold obtained from identifying two solid tori via a homeomorphism of their boundaries, which can be thought of as a surgery on the unknot. Nontrivial knots with lens space surgeries exist, and it is conjectured that every such knot is a Berge knot (this is known as the Berge Conjecture). In this talk I will describe the process of Dehn surgery and discuss whether a family of knot exteriors with lens space fillings, described by Martelli and Petronio, are Berge knots.

Duncan McCoy - Surgeries on torus knots

Given a knot K in S^3 then for each rational number p/q one can produce a 3-manifold $S^3_{p/q}(K)$, called p/q-surgery on K. We say that p/q is a characterising slope for K if there is no other knot in S^3 with the same p/q-surgery. In 2012, Ni and Zhang showed that for the $T_{m,n}$ torus knot with $m, n > 0$, there is a lower bound, beyond which any p/q is a characterising slope for $T_{m,n}$. Their lower bound is quadratic in mn. I will talk about the proof of this result and about how this lower bound can be improved to one which is linear in mn.

Carlo Collari - Contact invariants from Khovanov-type homologies

In 2006, Olga Plamenevskaya defined a transverse braid invariant from Khovanov homology. More precisely, Plamenevskaya associated to a braid B an homology class $\psi(B)$ in the Khovanov homology of its (Alexander) closure. Some years later, Lenhard Ng, Robert Lipshitz, and Sucharit Sarkar, in the same spirit, defined two transverse braid invariants $\psi^{\pm}(B)$, which take value in a twisted version of Lee homology, and another family of invariants $\psi^{\pm}_{p,q}(B)$, which take value in the homology of the graded object associated to the natural filtration in Lee homology. In this seminar I wish to talk about another transverse braid invariant, which generalizes all the above-mentioned invariants, and discuss some of its properties.

Antonio De Capua - Hyperbolic volume of links, via pants graph and train tracks

A result of Jeffrey Brock states that, given a hyperbolic 3-manifold which is a mapping torus over a surface S, its volume can be expressed in terms of the distance induced by the monodromy map in the pants graph of S. This is an abstract graph whose vertices are pants decompositions of S, and edges correspond to some 'elementary alterations' of those. We use this theorem to estimate the volume of hyperbolic complements of closed braids in the solid torus, in terms of braid properties. More specifically, Brock's theorem motivates investigation about distances in the pants graph: the core piece of our volume estimate is a generalization of a result of Masur, Mosher and Schleimer that train track splitting sequences induce quasi-geodesics in the marking graph.

Liam Watson - Loop calculus, L-spaces, and left-orders

There is a conjectural relationship between L-spaces and non-left-orderable groups which, at present, has left-orderability making (often surprising) predictions about Heegaard Floer theory. This talk will focus on the case of three-manifolds with torus boundary by studying a variant of Heegaard Floer homology that is adapted to cut-and-paste techniques called bordered Floer homology. I'll explain some joint work with Jonathan Hanselman developing a calculus for studying these invariants, and explain what this calculus tells us about certain toroidal L-spaces.

Antonio Alfieri - Taut Foliations and L-Spaces

One of the problems of Heegaard-Floer theory concern the topological classification of L-spaces. There is a conjecture (mainly based on a theorem proved by Ozsváth and Szabó) whose answer would give a complete description of L-spaces in terms of foliation theory. I will survey basic aspects of this conjecture.

Kyle Larson - Embedding 3-manifolds via surgery on surfaces

I will discuss some new constructions of embeddings of 3-manifolds into certain 4-manifolds (including the 4-sphere), by seeing Dehn surgery on a knot as a cross-section of surgery on a surface.

Claudius Zibrowius - On a polynomial Alexander invariant for tangles (and its categorification)

Link Floer homology categorifies the multivariable Alexander polynomial, a classical invariant for knots and links. Motivated by constructions in Khovanov homology, one can ask if it is possible to define this invariant 'locally', i.e. to generalise it to tangles. In the first part of this talk, we generalise the Kauffman state formula for the classical multivariate Alexander polynomial of knots and links to tangles and thereby obtain a finite set of polynomial tangle invariants. This invariant enjoys many properties of the classical multivariate Alexander polynomial, in particular invariance under Conway mutation. In the second part of the talk, we take a first step towards a categorification by showing that the polynomial invariants can be obtained as the graded Euler characteristics of the sutured Floer homologies of suitable 3-manifolds with boundary.

Thomas Wasserman - Spin Topological Quantum Field Theories and Anyons

Spin topological quantum field theories are representations of a category of bordisms with spin structures in an appropriate symmetric monoidal (n-)category. I will explain how to build such theories and indicate the various connections they have to physics, in particular to anyonic theories, and other areas of maths such as conformal nets.

Cristina Ana-Maria Anghel - Multivariable link invariants and Renormalized quantum dimension

We intend to describe a family of multivariable link invariants introduced by N. Geer and B. Patureau. The algebraic input will be a category of representations associated to a super Lie algebra of type one. The key point will be to define a 'renormalized quantum dimension' of a module and use it instead of the usual quantum dimension in a Reshetikhin-Turaev type construction. We will explain this idea and the definition of the multivariable link invariants.

Matthew Burfitt - Free loop cohomology of complete flag manifolds

We will discusses the calculation of the cohomology of the free loops space of complete flag manifolds. To demonstrate this we will focus on the case of the complete flag of the special unitary group, as our primary example.

Mark Bell - Finding paths in graphs of triangulations

There are many different ways of triangulating a surface using n edges. As some triangulations are more similar than others, we get a natural topology on the space of triangulations which can be seen as an infinite graph; where two triangulations are connected if and only if they share $n-1$ edges. We will look at some techniques for efficiently finding paths through this graph. This is closely related to several problems in the mapping class groups of surfaces.