

## Abstracts of 2009 LSU Math REU talks

- **Name:** Nik Aksamit  
*Title:* Finding Fibered Covers of Non-Fibered Two-Bridge Knot Complements  
**Abstract:** First we introduce a method for finding the knot group from tetrahedra pairs in the knot's complement and show an example with the Figure Eight knot. We then lay the foundation for what a non-fibered knot is and how to construct a cyclic cover over a knot complement. We ultimately work up to finding a great circle link complement that fibers over  $S^1$  and is a cover of the non-fibered,  $5_2$  two-bridge knot.
- **Name:** Nicole Bridgland  
*Title:* Cyclic Dessins  
**Abstract:** This talk will discuss properties of cyclic dessins, including how to recognize them.
- **Name:** Sam Calisch  
*Title:* Categorification of Krushkal's Fatgraph Polynomial  
**Abstract:** hovanov's seminal paper not only created a new way to think of the Jones polynomial but also provided a strictly stronger invariant of links. Since his paper appeared, there has been a flurry of categorification of invariants with similar state sum formulae, including the chromatic polynomial, the Tutte polynomial, and the Bollobas-Riordan polynomial. This paper continues the trend, providing an extension of Loeb and Moffatt's categorification of the Bollobas-Riordan polynomial to the four-variable Krushkal polynomial. We also show how both the duality and contraction-deletion properties of the polynomial can be lifted to the homological level.
- **Name:** Tim Champion  
*Title:* Dessins & Chord Diagrams  
**Abstract:**
- **Name:** Ezra Cohn  
*Title:* Handle-Slides on Single-Vertex Dessins  
**Abstract:** We consider single-vertex dessins, i.e., single-vertex graphs embedded on surfaces such that the edges hit the vertex in a specific cyclic order. It is possible to modify a single-vertex dessin by cycling through the half-edges on either side of a handle, thus altering the cyclic order. We call this move a handle-slide. We prove that handle-slides preserve the genus of the surface on which we embed the graph. This allows us to construct a graph representing handle-slides for each possible pair of number of edges and genus. We prove that this graph is connected. We then briefly present several directions for further study of the handle-slide graph and some limited results in these directions.
- **Name:** Michelle Delcourt  
*Title:* Dessins and Manturov bracket structures  
**Abstract:** In this talk we will explore the connections between knot the-

ory and combinatorics. Links are related to Grothendieck's dessins d'enfants. Cartographic one-vertex dessins can be represented by chord diagrams. The diagrams can be recorded as *words* using a finite alphabet (k-bracket parenthesis system). Many combinatorial objects are related to these Manturov bracket structures.

- **Name:** Ed Dewey

*Title:* A Quasitree Expansion of the Bollobás-Riordan Polynomial

**Abstract:** In 2002 Bollobás and Riordan introduced a polynomial invariant of ribbon graphs respecting the skein relations. In some unpublished work Champanerkar, Kofman and Stoltzfus expressed this polynomial as a sum over subgraphs with a single face, but this theorem only works for orientable ribbon graphs. In what follows I extend that work to non-orientable graphs.

- **Name:** Gregory Mezera

*Title:* Adams Operations on Chord Diagrams

**Abstract:** The Adams operations on the set of linear combinations of chord diagrams are described. A program for their computation is used to present some examples and find their eigenvectors. In addition, we will look at the Adams operations in the setting of one-vertex Dessins.

- **Name:** Richard A. Moy

*Title:* Non-congruence subgroups and modular forms on congruence subgroups

**Abstract:** We examine several examples of noncongruence sub-groups, the universal elliptic families over these subgroups, and associated weight 3 and 4 cusp forms on congruence subgroups.

- **Name:** Cyrus Peterpaul

*Title:* Automata and Growth Functions for the Trefoil and Figure-Eight Knot Groups

**Abstract:** In a recent paper, F. Chouraqui presents a novel algorithm for generating a confluent rewriting system on the Dehn presentation of any knot group. Using this algorithm, we generate rewriting systems for the trefoil and figure-eight knots. From these rewriting systems, we create finite state automata accepting normal forms under the rewrite rules as their languages, and use these to construct the growth function for both groups.

- **Name:** Claudia Raithel

*Title:* Dessins D'Enfants and Gassmann Triples

**Abstract:** Let  $\rho_i, \rho'_i \in S_n$  for  $i \in \{0, 1\}$ . We claim that if  $\rho_i$  is the composition of only  $t$ -cycles for some  $t \in \mathbb{N}$  and some  $i \in \{0, 1\}$  and there exists an isomorphism and local conjugation  $\phi : \langle \rho_0, \rho_1 \rangle \rightarrow \langle \rho'_0, \rho'_1 \rangle$  then  $D(\rho_0, \rho_1)$  and  $D(\rho'_0, \rho'_1)$  are isomorphic. We prove the case in which  $\rho_0$  and  $\rho_1$  are composed of two-cycles