16th Seminar on Conformal Field Theory

January 19, 2024

The 16th Seminar on Conformal Field Theory will take place at the Technical University of Darmstadt at January 19, 2024 in Room S214|24.

Britta Späth (University of Wuppertal)

On the McKay Conjecture

John McKay's Conjecture (from 1971) predicts that, for any finite group G and prime ℓ, the number of complex irreducible representations of G with a degree not divisible by ℓ is controlled by the normaliser of a Sylow ℓ-subgroup of G. In the talk I will report on the final proof of this conjecture. By work of Isaacs, Malle and Navarro this conjecture was reduced to a statement on finite quasi-simple groups and their representation theory. After a series of results by various authors it is sufficient to verify a statement on quasisimple groups. The last step is a joint work with Marc Cabanes, where we analyse the representation theory of a new subgroup of Spin groups.

Ida Zadeh (Johannes Gutenberg University Mainz)

Mathieu Moonshine and $T^4/\mathbb{Z}_3$ sigma-models

The phenomenon of Mathieu moonshine is a peculiar connection between the elliptic genus of the K3 surface and the Mathieu group M_{24}. More specifically, dimensions of representations of the Mathieu group M_{24} appear in the decomposition of the elliptic genus of K3 into the characters of the small N=4 superconformal algebra. This suggests that there should exist a conformal field theory, e.g. a non-linear sigma-model on K3, whose automorphism group is M_{24}. It has, however, been shown that no such K3 sigma model exists!

There have been various approaches towards understanding this puzzle. Symmetry surfing is an approach proposed by Taormina and Wendland which proposes combining geometrical symmetries from different points in the moduli space of K3 sigma-models to pin down the action of M_{24}. Focussing on Kummer surfaces, namely the $T^4/\mathbb{Z}_2$ locus, the symmetry surfing describes the action of a maximal subgroup of M_{24}. This suggests considering other orbifold

loci ($T^4/\mathbb{Z}_N$) to enhance the symmetry group to M_{24}. In this talk I will report progress on $T^4/\mathbb{Z}_3$ K3 surfaces, their group of geometric symmetries and its connection to M_{24}. The talk is based on work in progress, joint with Kasia Budzik, Anne Taormina, Mara Ungureanu and Katrin Wendland.

David Reutter (University of Hamburg)

A braided tensor 2-category from link homology

An early highlight of quantum topology was the observation of Reshetikhin and Turaev that the Jones polynomial - and many other knot and link invariants - arise from, and may be expressed in terms of braided tensor categories of representations of certain quantum groups (although not yet using that language).

Not much later, Khovanov discovered his link homology which refines and "categorifies" the Jones polynomial, in that it assigns graded chain complexes to links from which the earlier link polynomials may be recovered. It was therefore widely expected that Khovanov homology and its variants are themselves expressible in terms of certain braided tensor 2-categories which "categorify" the familiar braided tensor categories. However, a major roadblock in realizing this dream is the problem of coherence: Link homology theories live in the world of homological algebra, and constructing a braided tensor structure in principle requires an infinite amount of higher and higher homological coherence data.

In this talk, I will sketch a proposed solution to this problem, joint with Leon Liu, Aaron Mazel-Gee, Catharina Stroppel and Paul Wedrich, and explain how we use the language of infinity-categories to build a braided tensor 2-category (more precisely, an E_2-monoidal $(\infty, 2)$-category) which categorifies the Hecke braided tensor category underlying the HOMFLYPT link polynomial.