Geometry, Physics, and Representation Theory
Northeastern University

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Wednesday, March 4, 1:30-4 pm (two talks), Lake Hall 509

Introduction to Soergel bimodules and Rouquier complexes (baby talk, 1.30-2.30pm)

Abstract. Soergel bimodules are certain kinds of bimodules over polynomial rings. Collectively, they form a categorification of the Hecke algebra (attached to a Coxeter group). Rouquier complexes are complexes of Soergel bimodules which form a categorification of the braid group. We give a gentle introduction to these constructions.

Diagonalization in categorical representation theory (joint w/ Matt Hogancamp) (adult talk, 3-4pm)

Abstract. The representation theory of the Hecke algebra in type A can be understood by examining the Young-Jucys-Murphy (YJM) operators, which form a large commutative subalgebra. One proves that these operators are (simultaneously) diagonalizable, and classifies their spectrum via standard tableaux. Alternatively, one can use full twists of parabolic subgroups to replace YJM operators, with the same results.

Given a categorical representation of the Hecke algebra, one obtains a categorical representation of the braid group, and thus categorical versions of the YJM operators and the full twists. We describe what it means for these operators to be "categorically diagonalizable," and conjecture that the full twist of any Coxeter group is categorically diagonalizable. (On the other hand, the categorical YJM operators are not diagonalizable.)

Given a diagonalizable operator F whose spectrum is known, linear algebra tells one how to construct operators which project to the eigenspaces of F. This construction lifts for categorically diagonalizable functors. For example, projection to eigenspaces of YJM operators gives any representation a canonical decomposition whose summands are isotypic. Upstairs, any categorical representation has a canonical and explicit filtration whose subquotients are isotypic categorifications.