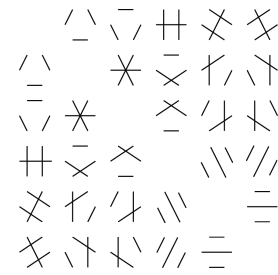# Mathematics Seminar

Rocky Mountain Algebraic Combinatorics Seminar

Optimality v. Symmetry

JM Landsberg

Texas A&M

Given a polynomial or tensor with symmetry, does an optimal expression for it also have symmetry? A classical example is Fischer's expression for the monomial $x_1 x_2 \ldots x_n$ as a sum of 2^{n-1} n-th powers of linear forms. (Ranestad and Schreyer showed his expression is optimal.) The monomial is invariant under permutations of the basis vectors, the permutation group on n elements. Fischer's expression also has symmetry, but under the permutation group on $n-1$ elements! I will discuss how to exploit such symmetry in two central problems in theoretical computer science: Valiant's algebraic analog of P v. NP and the problem of determining the number of arithmetic operations needed to multiply two nxn matrices. The first is a comparison of the permanent and determinant polynomials. The second became a question in 1969 when Strassen discovered the standard algorithm for multiplying matrices is not the optimal one, which, after much work, has led computer scientists to conjecture that as n grows, it becomes almost as easy to multiply nxn matrices as it is to add them!

The first project is joint work with N. Ressayre, the second is joint work with G. Ballard, L. Chiantini, C. Ikenmeyer, G. Ottaviani and N. Ryder.

Tensor products should be over Lie algebras

James B. Wilson

CSU

In 1938 Whitney cleaned up multilinear analysis and gave us tensors as universal products. He made one misstep – tensoring over rings. I will demonstrate the error, and prove that tensors over Lie algebras are in fact universal. Illustrating the power of the right perspective I will characterize simple rings, simple modules, Azumaya rings, simple Lie algebras, Octonions and other exceptional tensors completely by their Lie tensor product. Jointly with U. First and J. Maglione.

Weber 223
4–6 pm
Friday, October 14, 2016
(Refreshments in Weber 117, 3:30–4 pm)
Colorado State University

This is a joint Denver U / UC Boulder / UC Denver / U of Wyoming / CSU seminar that meets biweekly.
Anyone interested is welcome to join us at a local restaurant for dinner after the talks.