

# COLLOQUIUM

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Hyperdeterminants from  $E_8$

The logo for Mathematics and Statistics features a large orange circle in the center, containing the text "Mathematics and Statistics" in a bold, black, sans-serif font. This circle is set against a background of four blue squares arranged in a 2x2 grid, with the circle overlapping the center of the squares.

Mathematics  
and  
Statistics

Date: **Thursday** January 10, 2019

Time: **1:00** - 2:00 PM

Room: **ED 318**

**Abstract:** Projective duality can be used to study singularities. A matrix is singular precisely when its determinant vanishes, or equivalently, when it belongs to the projective dual to rank-one matrices, the Segre variety. A higher order tensor is singular when its hyperdeterminant vanishes, i.e. when it belongs to the dual of a higher order Segre product. Efficient expressions for hyperdeterminants are mostly unknown and they are difficult to compute. We describe a connection to the exceptional Lie algebra  $E_8$ . This gives an interpretation of certain hyperdeterminants (of formats  $2 \times 2 \times 2 \times 2$  and  $3 \times 3 \times 3$ ) and certain discriminants (of the Grassmannians  $Gr(3, 9)$  and  $Gr(4, 8)$ ) as sparse  $E_8$ -discriminants. We give expressions of these high degree invariants in terms of lower degree fundamental invariants, which allow evaluation, and may be useful for Quantum Information Theory as measures of entanglement. This is joint work with Frédéric Holweck.