1096-12-1659 **Chris Castillo*** (castillo@math.udel.edu) and **Robert S. Coulter** (coulter@math.udel.edu). *Representing groups by permutation polynomials.*

Cayley's Theorem guarantees that any group can be represented as a permutation group. In particular, when we take the set being permuted to be a finite field $\mathbb{F}_q$, we can use the Lagrange Interpolation Formula to construct a polynomial which represents a given permutation. Such polynomials, whose induced function defines a bijection of $\mathbb{F}_q$, are called permutation polynomials. A central problem in the theory of finite fields is to discover new classes of permutation polynomials.

In this talk, we introduce a new technique for constructing groups of permutation polynomials using group actions. As an application of this method, we construct a new class of permutation polynomials over the field $\mathbb{F}_{p^2}$ for any odd prime p using the regular action of the cyclic group of order p^2 on itself. The construction method guarantees that the set of permutation polynomials so obtained naturally forms a cyclic group, where the group operation is composition of polynomials in $\mathbb{F}_{p^2}[X]$ reduced modulo $X^{p^2} - X$. Moreover, every non-identity permutation polynomial generated by this method is fixed-point free. (Received September 16, 2013)