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**ELLEN KIRKMAN**, Wake Forest University

*Degree bounds for Hopf actions on Artin-Schelter regular algebras*

In 1915 E. Noether proved that for a field  $\mathbb{k}$  of characteristic zero and a finite group  $G$  acting naturally on a polynomial ring  $\mathbb{k}[x_1, \dots, x_n]$ , the degrees of minimal generators of the subring of invariants are bounded above by the order of the group. In 2011, using Castelnuovo-Mumford regularity, P. Symonds proved that for a general field  $\mathbb{k}$ , an upper bound is  $n(|G| - 1)$  when  $n \geq 2$  and  $|G| > 1$ . Replacing  $\mathbb{k}[x_1, \dots, x_n]$  by an Artin-Schelter regular algebra  $A$  and  $G$  by a semisimple Hopf algebra  $H$ , we prove analogues of results of Noether, Fogarty, Fleischmann, Derksen, Sidman, Chardin and Symonds on bounds on the degrees of generators of the subring of invariants and on the degrees of syzygies of modules over the invariant subring. We further explore Castelnuovo-Mumford regularity and related weighted sums of homological and internal degrees in complexes of graded  $A$ -modules for noncommutative algebras. This is joint work with Robert Won and James J. Zhang.