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Pointed Hopf algebras over finite simple groups of Lie type

The general question we are dealing with is the classification of finite-dimensional complex pointed Hopf algebras H over a finite simple group. We say that a finite group G *collapses* when every finite-dimensional pointed Hopf algebra H, with $G(H) \simeq G$ is isomorphic to $\Bbbk G$.

This problem was attacked by several authors obtaining, among others, the following results: If $G \simeq \mathbb{Z}/p$ is simple abelian, then the classification is known. In case G is non-abelian, the problem is far from being solved. If $G \simeq \mathbb{A}_m$, $m \geq 5$ is alternating, then G collapses. If G is a sporadic simple group, then G collapses, except for the groups $G = Fi_{22}$, B, M.

A remarkable fact is that the class of braided vector spaces corresponding to pointed Hopf algebras with non-abelian group can be identified as those constructed from racks and cocycles. In this sense, we say that a rack X collapses if the Nichols algebra associated to it is infinite-dimensional for all cocycles. Given a simple non-abelian group G, as a first step one has to determine all conjugacy classes in G that collapse.

If G is a finite simple group of Lie type, one may reduce the study to unipotent or semisimple conjugacy classes. In this talk, we present our study on unipotent conjugacy classes in Steinberg groups, based on the explicit presentation of our result on $\mathbf{PSL}_n(q)$.

This talk is based on a joint work with N. Andruskiewitsch and G. Carnovale.