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Counting rational points of orbital varieties over finite fields

Let $\mathfrak{g}$ be a semisimple Lie algebra and let $\mathfrak{u}$ be a $\mathfrak{b}$-stable ideal of $\mathfrak{n}$, where $\mathfrak{b} = \mathfrak{h} \oplus \mathfrak{n}$ is a Borel subalgebra of $\mathfrak{g}$. An orbital variety of $\mathfrak{g}$ is the intersection of a nilpotent orbit of $\mathfrak{g}$ with $\mathfrak{u}$. When $\mathfrak{g}$ is of type A, we obtain explicit formulas for the number of $\mathbb{F}_q$-points of an orbital variety, in terms of well-known families of symmetric functions. In the special case where $\mathfrak{u}$ is the nilradical of a parabolic subalgebra, our result specializes to a theorem of Karp and Thomas that provides a formula in terms of coefficients of Macdonald polynomials. We also discuss some applications, e.g., a generalization (with new proof) of the Kirillov-Melnikov-Ekhad-Zeilberger formula for the number of elements of $\mathfrak{n}$ with a given matrix rank. This talk is based on joint work with M. Bardestani, K. Karai, and S. Ram.