The major index of a permutation
\( w = w_1 \cdots w_n \) is the sum of all
\( i \) such that
\( w_i > w_{i+1} \). MacMahon investigated enumerative properties of these statistics a century ago. Since then, they have found use in many other representation-theoretic, algebraic, and probabilistic contexts through work of Green, Klyachko, Lusztig, Stanley, Diaconis, and many others. In this talk, we will discuss two such connections. The first is related to Lie modules and answers a question of Sundaram concerning global conjugacy classes. The second is related to the type A coinvariant algebra and describes asymptotic distributions of major index statistics on standard tableaux. This latter work is joint with Sara Billey and Matjaž Konvalinka.

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