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Bruhat Orders and Combinatorics on Reductive Monoids

Originating from the early '80s, the theory of reductive monoids is a combinatorial, fledgling branch of algebraic geometry within the theory of spherical embeddings. It brings together algebraic groups, the torus embeddings and semigroups. One can (naïvely) describe a reductive monoid M as the Zariski closure of the image of a representation $\sigma\colon G \to \mathrm{End}(V)$ of a reductive group in the $\mathrm{End}(V)$.

With this description, many pleasant features of the group G lift up to M, however the catch is the set of idempotents which, of course, lacks from the group structure. In this talk we shall concentrate on the generalized Bruhat ordering on M. In the case of $n \times n$ matrices, we shall give a purely combinatorial characterization of the Bruhat ordering (in the group case, it is originally due to V. Deodhar). We shall also give combinatorial formulas for the dimensions of the $B \times B$ orbits in M. If time permits, we shall describe an analogue of the Hasse–Weil zeta function for M and give a recipe to compute it.

This is a joint work with Prof. Renner.