COMPUTATIONS IN ALGEBRAIC GROUPS

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SERGEI HALLER

Abstract. This is a joint project with Arjeh M. Cohen, Scott H. Murray and D. E. Taylor. We design and implement algorithms for computation with groups of Lie type in the software package Magma. The goal is to perform computations with parametrised group elements.

The twisted groups of Lie type are implemented as fixed point subgroups of untwisted groups of Lie type. The possible twists for a given field extension and group type are classified by Galois cohomology. We report on current work to make Galois cohomology effective.

Let G be a simple linear algebraic group defined over the field k. One step in the process of computing the Galois cohomology of G is to extend 1-cocycles on a factor group A/B to 1-cocycles on A, where A is the group of algebraic automorphisms of G. We will discuss an algorithm to this effect.

Galois cohomology can also be used to compute all maximal tori of G. For finite k the tori are computed as subgroups $T_{\gamma w}$ of $G(K)_{\gamma w}$, where γ is the generator of $\mathrm{Gal}(K : k)$ and w is conjugation by an element normalising the split maximal torus T of $G(K)$. Using Lang's theorem the tori are conjugated from $G(K)_{\gamma w}$ back into the original group $G(k)$.

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Sergei.Haller@math.uni-giessen.de.