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Frobenius modules and Galois groups in positive characteristic

It is an open question which finite groups occur as Galois groups over function fields over finite fields. So-called Frobenius modules have proved useful to study this question in the case of finite groups of Lie type. The method makes use of upper and lower bound criteria for the Galois group of a Frobenius module due to Matzat, and it deploys the structure of the underlying linear algebraic group. So far, all classical groups and the exceptional groups of small rank have been realized as Galois groups in this way. It is also possible to derive polynomials for the Galois extension which are in most cases of a particularly simple form.