Dissertation
Defense

R-equivalence and norm principles in algebraic groups

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Abstract: We start by exploring the theme of R-equivalence in algebraic groups. First introduced by Manin to study cubic surfaces, this notion proves to be a fundamental tool in the study of rationality of algebraic group varieties. A k-variety is said to be rational if its function field is purely transcendental over k. We exploit Merkurjev's fundamental computations of R-equivalence classes of adjoint classical groups and give a recursive construction to produce an infinite family of non-rational adjoint groups coming from quadratic forms.

In a different direction, we address Serre's injectivity question which asks whether a principal homogeneous space under a linear algebraic group admitting a zero cycle of degree one in fact has a rational point. We give a positive answer to this question for any smooth connected reductive k-group whose Dynkin diagram contains connected components only of type A_n, B_n or C_n by relating Serre's question to the norm principles previously proved by Barquero and Merkurjev.

The study of norm principles are interesting in their own right and we examine in detail the case of groups of type (non-trialitarian) D_n and get a scalar obstruction defined up to spinor norms whose vanishing will imply the norm principle for them. This in turn will also yield a positive answer to Serre's question for all connected reductive k-groups of classical type.

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