On forms of G-graded simple algebras

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Let G be finite group and D a finite dimensional G-graded division algebra e-central over k (k consists of the central e-homogeneous elements of D). Restricting scalars to the algebraic closure $F = \bar{k}$, we obtain a finite dimensional G-graded simple algebra. In this lecture we consider the problem in the opposite direction, namely if A is a finite dimensional G-graded simple algebra over F (with $char(F) = 0$), then we ask under which conditions it admits a G-graded division algebra form (in the sense of descent theory)? (i.e. nonzero homogeneous elements are invertible). More restrictive, we ask under which conditions A admits a division algebra G-graded form? (i.e. nonzero elements are invertible). We provide a complete answer for the first question and only a partial one for the second. The main tools come from PI-theory. These allow us to construct the corresponding generic objects. Joint works with (1) Haile and Karasik, (2) Karasik.