

Smooth curves having a large automorphism p -group in characteristic $p > 0$

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Abstract:

Let k be an algebraically closed field of characteristic $p > 0$ and C a connected nonsingular projective curve over k with genus $g > 1$. We define a big action as a pair (C, G) where G is a p -subgroup of the k -automorphism group of C such that $|G| > (2p/p-1)g$. Then $C \rightarrow C/G$ is an étale cover of the affine line $\text{Spec } k[X]$ totally ramified at infinity. The second ramification group G_2 of G at infinity plays a major role in the study of such actions.

We first display examples of these actions related to the construction of curves with many rational points using ray class field theory for global function fields. This produces big actions with G_2 abelian of arbitrary large exponent.

Then we focus on the case where G_2 is p -elementary abelian. We obtain a structure theorem involving additive polynomials of $k[X]$ for the functions parametrizing the Artin-Schreier cover $C \rightarrow C/G_2$. Note that this theorem generalizes the p -cyclic case described by Lehr and Matignon.

We also deduce from this theorem an algorithmic method which gives the parametrization of universal families in some special cases. We finally discuss the corresponding deformation space.