Some questions on modular group algebras of finite p-groups

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Abstract: We address some questions relating the algebra structure of the group algebra kG of a finite p-group G with coefficients in the field k of p elements to the structure of the group G itself. A paradigmatic example of such questions is the modular isomorphism problem, which asks whether the isomorphism type of G can be read from kG, and to which we give positive answer provided that G belongs to some specific classes of p-groups. Another example is a question of Carlson and Kovacs about whether the group algebra of an indecomposable p-group (as a direct product of proper subgroups) must be indecomposable as a tensor product of proper subalgebras. We are able to show that, if such decomposition exists, none of these subalgebras can be commutative, and as a consequence we give positive answer to this question for p-groups that are at most 3-generated.