

## Constructing the automorphism group of a finite $p$ -group

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Constructing the automorphism group of a finite group remains challenging. The critical hard case is that of a finite  $p$ -group  $P$  where much effort has been invested over the past 20 years in developing recursive algorithms which work down a central series for  $P$ . If we can locate characteristic structure in  $P$ , then we can often readily solve the problem.

The real challenge remains class 2  $p$ -groups of exponent  $p$ . Here we can readily reduce to the following concrete problem. Let  $G := \mathrm{GL}(d, \mathrm{GF}(p))$  act on the exterior square representation  $U$  of the natural module; given an explicit subspace  $W$  of  $U$  construct its stabiliser in  $G$ .

In this talk we will survey the problem and outline algorithmic approaches. In particular we will report on related work to uncover hidden characteristic structure and recent joint work with Brooksbank and Wilson on graded algebras. Both offer new hope of progress on this intractable problem.

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