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**James B. Wilson\*** (jwilson7@uoregon.edu), Department of Mathematics, University of Oregon, Eugene, OR 97403. *Decomposing  $p$ -groups via Jordan algebras.*

Central products of  $p$ -groups are studied using Jordan and  $*$ -algebras. There are at least  $p^{2n^3/27+Cn^2}$  centrally indecomposable  $p$ -groups of order  $p^n$ , which corresponds to the Higman-Sims bounds on the total number of groups of order  $p^n$ . Also a Krull-Schmidt type theorem is proved: any two fully refined central decompositions of a  $p$ -group of class 2 and exponent  $p$  have the same number of subgroups, and these subgroups have the same multi-sets of orders and center orders. However, unlike for direct product decompositions, there are families of  $p$ -groups in which the fully refined central decompositions have unbounded numbers of orbits under the actions of the automorphism groups.

The methods translate into a probabilistic polynomial time algorithm for decomposing an arbitrary  $p$ -group as a central product, and another for decomposing an arbitrary  $p$ -group into a direct product. (Received September 17, 2007)