1024-20-80 **Russell D. Blyth*** (blythrd@slu.edu), Department of Mathematics & Computer Science, Saint Louis University, 220 N. Grand Blvd., St. Louis, MO 63103, and **Robert Fitzgerald Morse** (rfmorse@evansville.edu), Department of Electrical Eng. & Comp. Sci., University of Evansville, 1800 Lincoln Avenue, Evansville, IN 47722. *An algorithm for computing the nonabelian tensor squares of polycyclic groups.*

We develop the theory of computing the nonabelian tensor squares of polycyclic groups. The nonabelian tensor square $G \otimes G$ of any group G is isomorphic to a subgroup K of the commutator subgroup of a cover group $\nu(G)$. We develop a general commutator calculus in K that models computations in $G \otimes G$. We show that if G is polycyclic, then the cover group $\nu(G)$ is also polycyclic, and we give a finite presentation for $\nu(G)$ based on a presentation for G. We are then able to describe a finite generating set for K, and hence for $G \otimes G$, without needing a polycyclic presentation for $\nu(G)$. We apply our results in two ways. We develop an algorithm that can be implemented within a CAS (Computer Algebra System), such as GAP (Groups, Algorithms and Programming), to compute the nonabelian tensor square of any polycyclic group. We also use the commutator calculus and structural results for the cover group $\nu(G)$ to directly compute the nonabelian tensor squares for the free nilpotent groups of class 3 and finite rank. The computations for the free nilpotent groups of class 3 were guided by examining the structure of the nonabelian tensor squares of such groups of small rank that were found by computer calculation. (Received December 30, 2006)