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**Frederick R. Cohen\*** (cohf@math.rochester.edu), Department of Mathematics, University of Rochester, Rochester, NY 14627, and **Jie Wu** (matwuj@nus.edu.sg). *On braid groups, free groups, and the loop space of the 2-sphere.*

Consider the single loop space of the 2-sphere, and Artin's pure braid group on  $n$  strands  $P_n$ . There is a simplicial group  $AP_*$  which in degree  $n-1$  is given by  $P_n$ . A second simplicial group is Milnor's free group construction  $F[K]$  generated by a pointed simplicial set  $K$ . For example, the geometric realization of  $F[S^1]$  is homotopy equivalent to the loop space of the 2-sphere where  $S^1$  denotes the simplicial circle.

**Theorem.** *The (simplicial) loop space of  $AP_*$  is isomorphic to  $F[\Delta[1]]$  where  $\Delta[1]$  is the simplicial one simplex. Thus  $AP_*$  is contractible.*

**Theorem.** *The smallest simplicial subgroup of  $AP_*$  containing a generator of  $P_2$  is isomorphic to  $F[S^1]$ . Thus the homotopy groups of  $F[S^1]$  are natural subquotients of the pure braid groups.*

Analogous theorems where a free group is replaced by a quotient of a free group by certain characteristic subgroups are given. An application is made to homotopy string links. Proofs arise from the structure of free Lie algebras as well as the "universal" Lie algebra which satisfies the infinitesimal braid relations of T. Kohno. (Received August 16, 2002)