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**Gary Gordon** (gordong@lafayette.edu), PA , and **Andrija Perunicic**. *Combinatorial  
symmetry of the 24-cell via matroids.*

The Coxeter group  $F_4$  is the symmetry group of the 24-cell, a regular 4-dimensional solid. Let  $S$  be the set of all vectors normal to all the hyperplanes of symmetry of the 24-cell, and let  $M(S)$  be the associated matroid over the rational numbers. (The set  $S$  is the *root system*  $F_4$ .) We compare the geometric symmetry of the 24-cell with the combinatorial symmetry of the associated matroid by computing the automorphism group of  $M(S)$ . This automorphism group includes all of the geometric symmetries in addition to a *non-geometric* action, which nevertheless has a geometric interpretation. We give the structure of this group and compare it to  $F_4$ .

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