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Pyramids in 3-space and Crystallographic Groups in 4-space.

The monodromy group $M(\mathcal{P})$ for a polyhedron $\mathcal{P}$ (or indeed for any convex, even abstract, $d$-polytope $\mathcal{P}$) is a combinatorial invariant of $\mathcal{P}$. This group somehow encodes the essential structural features of the polytope. Intuitively, $M(\mathcal{P})$ describes how an abstract set $\mathcal{F}$ of flags can be assembled to produce $\mathcal{P}$.

Recently (Discrete Mathematics, in press) we have completely described $M(\mathcal{P})$ when $\mathcal{P}$ is an ordinary pyramid over an $n$-gonal base. Though $\mathcal{P}$ itself is very familiar, $M(\mathcal{P})$ has some interesting features.

Here we focus on the extreme cases $n = 2$ and $\infty$. In the first instance, when $\mathcal{P}$ is the rather modest pyramid over the digon, $M(\mathcal{P})$ is, surprisingly, isomorphic to the symmetry group of a 4-cube. And, at the other extreme, when $n = \infty$, $M(\mathcal{P})$ acts, in a natural way, as a crystallographic group in real 4-space.

But why dimension 4? Well, look at a pyramid and count flag orbits under the action of the automorphism group of the base. (Received January 10, 2014)