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Hopf objects between the permutahedra and associahedra

We study the multiplihedra, a relatively new family M of polytopes nestled between the permutahedra P and the associahedra A. The latter families were given interesting Hopf algebra structures by Malvenuto–Reutenauer and Loday–Ronco, respectively. In the work of Aguiar–Sottile, these Hopf structures were largely explained based on geometric properties of P and A (for example, a description of their primitive elements was given in terms of the 1-skeletons of the polytopes). In this talk, we define a structure on M making it a module over P and Hopf module over A. We also use its 1-skeleton to exhibit the fundamental theorem of Hopf modules, giving an explicit basis of coinvariants in M. Time permitting, we indicate a whole zoo of other Hopf objects, yet to be studied, surrounding P, M, and A.

This is joint work with F. Sottile and S. Forcey.