

Generalized associahedra via representation theory

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Abstract

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Let Q be a Dynkin quiver with n vertices and consider the corresponding cluster algebra \mathcal{A} . Each cluster variable has an associated vector in \mathbb{Z}^n , its g -vector. The g -vectors are the rays of the g -vector fan, the maximal-dimensional cones of which correspond to clusters. This fan is proper, in the sense that the union of its cones is all of \mathbb{Z}^n . There has been considerable research on the problem of showing that this fan can be realized as the outer normal fan of a polytope, called a generalized associahedron. Recently, a new construction of the associahedron associated to a particular orientation of the type \mathbb{A}_n quiver was given in the physics literature by Arkani-Hamed, Bai, and Yan. We present how to extend the ABHY construction to arbitrary (simply-laced) Dynkin quivers. We further show that this same construction can be used to realize the Newton polytopes of the F -polynomials of this cluster algebra. The F -polynomials are certain polynomials in n variables which are a reparameterization of the cluster variables; in particular, the cluster variables can be recovered from them.