

BPS Lie algebras, from mathematics, for physicists

Ten years ago, Kontsevich and Soibelman provided a mathematical construction, utilising quiver representations, vanishing cycles, and Hall algebras, of the algebra of BPS states associated to certain 4d $N=2$ supersymmetric gauge theories. The starting data for the construction is a quiver with potential. In the context of quantum groups, these algebras should be analogues/generalisations of (half of) Yangians associated to semisimple Lie algebras: for very special choices of quivers with potentials this is exactly what their construction produces. In particular, although the algebra is very “large”, it is controlled in a precise way by something “small” a graded-finite-dimensional subspace that is endowed with a Lie bracket via the commutator in the ambient algebra.

In this talk I will explain how to define a similar BPS Lie algebra controlling the algebra of BPS states for general quivers with potential, using perverse filtrations, as well as explaining some links with nonabelian Hodge theory. This is meant as a guide to the mathematical construction of the BPS Lie algebra, for physicists.

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