Wall-crossing in N=4 super Yang-Mills and quantum toroidal algebra

Yegor Zenkevich

Line operators in 4d N=2 gauge theories can be expressed in terms of line operators in the low-energy effective abelian theory living at a generic point on the vacuum moduli space. These "abelianized" expressions determine framed BPS invariants which undergo nontrivial wall-crossing transitions between different chambers in the vacuum moduli space. I argue that for N=4 U(M) gauge theories the algebra of line operators given by spherical double affine Hecke algebra can be naturally understood as a certain quotient of the quantum toroidal algebra of type gl(1). Different abelianizations coincide with the tensor product of M vector representations of the quantum toroidal algebra with the action given by different coproducts. Wall-crossing transformations are identified with Drinfeld twists transforming coproducts into each other. S-duality of the N=4 theory is built into the construction as an automorphism group of the quantum toroidal algebra acting transitively on the space of coproducts. This description is uniform in M and fits into the interpretation of the quantum toroidal algebra as the universal algebra of (p,q) strings in Type IIB string theory.