

RESEARCH PLANS

HIDEYA WATANABE

My research goal is to generalize important results in the theory of quantum groups to the q quantum groups setting based on an idea “The q quantum groups are generalizations of the quantum groups” (q program) proposed by Bao-Wang. In particular, I aim to describe module structures over q quantum groups combinatorially, and apply it to the representation theory of related algebras, and to integrable systems.

(1) **Combinatorial structures in representation theory of the q quantum group of type AI.**

I will analyze combinatorial structures obtained in the notion of based modules in representation theory of the q quantum group of type AI in a purely combinatorial way. Furthermore, by reinterpreting results to be obtained there in terms of representation theory of the q quantum group, I will make both sides ample. Especially, I study the branching rule from the special linear Lie algebra to the special orthogonal Lie algebra, which is a classical problem in representation theory, via new combinatorics.

The notion of based modules makes sense in representation theory of the q quantum group of general type. I expect that the finite-dimensional irreducible classical weight modules over the q quantum group of type AIII admit based module structures.

(2) **Applications to the quantum Brauer algebra and the Hecke algebra of type B.**

It is known that the q quantum groups of type AI and AIII are closely related to the quantum Brauer algebra and the Hecke algebra of type B, respectively (Schur duality). Using this fact and the theory of based modules in representation theory of q quantum groups, I will study the cellular structures of the quantum Brauer algebra and the Hecke algebra of type B. This is also important for applications to modular representation theory of these algebras.

(3) **Representation theory of affine q quantum groups and integrable systems.**

It is known that certain representations of affine q quantum groups play important roles in integrable systems. I will study representation theory of affine q quantum groups which lies behind this fact. Especially, I aim to generalize the theory of R -matrices, affinizations, crystal bases, and so on in representation theory of the affine quantum groups to the affine q quantum groups setting.