Name:Jun'ichi Shiraishi
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Current research topics
I study the Macdonald symmetric polynomials $P_\lambda(x; q, t)$ from the point of view of representation theory of certain variants of quantum groups. Note that a variety of symmetric polynomials can be obtained as special limits from the Macdonald symmetric polynomials. For example, the Schur polynomials (the case $q = t$) and the Hall-Littlewood polynomials ($q = 0$) are important objects both in representation theory of groups and quantum integrable systems.

Let q and t be a pair of parameters in Macdonald polynomials. Introduce another parameter p (called elliptic nome) to fix an elliptic curve. We can construct a certain commutative algebra on the curve (Feigin-Odesskii algebra). When the curve degenerates ($p = 0$), the Feigin-Odesskii algebra becomes isomorphic to the commutative ring of the symmetric polynomials. More precisely, we have a good filtration (Gordon filtration) which allows us to find a one dimensional subspace spanned by $P_\lambda(x; q, t)$ characterized as an intersection of two Gordon filters. Can we find an elliptic (or p)analogue of $P_\lambda(x; q, t)$?

The Macdonald polynomials appear (at least) in three different ways when we study the so-called Ding-Iohara algebra, and quantum deformed W-algebras. These correspondence appears when we look at the singular vectors of the deformed W-algebras, Hopf algebra structure of the Ding-Iohara algebra, the Gordon filtration in the Feigin-Odesskii algebra.
Request for students
Students will be requested to learn about the quantum groups and the symmetric polynomials.

Christian Kassel, Quantum Groups, Springer GTM 155

I.G. Macdonald, Symmetric Functions and Hall Polynomials, Oxford