Plan of research

I will research integrable systems in field theories and statistical mechanics from a point of view of mathematical physics. For example, I will continue to research the following topics.

(1) Baxter Q-operators and related topics

Baxter Q-operators and their functional relations were introduced by Baxter in the early 1970's when he solved the 8-vertex model. Because of their importance in integrable systems, they have been studied from various point of view. In relation to Baxter Q-operators, I will research on R- and L-operators and their (q- and/or elliptic-) hypergeometric- and/or Gamma-function expressions, contractions and asymptotic representations of quantum (super) algebras, solutions of the tetrahedron equation, q-Onsager algebras and K-operators (solutions of the reflection equation), etc.

(2) Yang-Baxter maps

Based on techniques in quantum integrable systems, such as the universal R-matrix, we would like to establish a systematic theory on Yang-Baxter maps. Quantum analogues of Yang-Baxter maps are defined by the adjoint action of the universal R-matrix. I proposed quasi-determinant expressions of them for $U_q(gl(n))$. Conventional Yang-Baxter maps are given as quasi-classical limit of our quantum Yang-Baxter maps. I would like to generalize these to other algebras, such as $U_q(gl(m|n))$. We will also investigate relation to 3 dimensional integrable models, which are given as solutions of the tetrahedron equation.

(3) Integrability in AdS/CFT correspondence and higher dimensional integrable systems

Beisert's S-matrix is an important fundamental matrix in the study of integrability in AdS/CFT correspondence. We have reconstructed his S-matrix based on the Shastry-Shiroishi-Wadati formalism for the one-dimensional Hubbard model. The tetrahedral-Zamolodchikov algebra, which is related to 3 dimensional integrable models, plays a key role for this. We would like to investigate integrable systems in AdS/CFT (and generalization of the Hubbard model) in the context of higher dimensional solvable models.