

Plan of Research

Takeshi Oota

We have introduced the so-called β -deformed matrix models of Selberg type in the year 2010. These model have remarkable property that they are exactly calculable models at any finite size N of the matrix. In the calculation, properties of the Jack symmetric polynomials play important roles. Recently, we are studying the β -deformed matrix models of Selberg type and related models. We will continue the study of these models.

Last year, we have studied correspondence among a “ q -lifted” five-dimensional gauge theory, a two-dimensional conformal field theory (CFT) with the q -deformed Virasoro/W-symmetries and a 0-dimensional “matrix model” defined by using the q -integrals. For the q -lifted gauge theory, the 5-th direction is compactified on a circle S^1 whose radius is proportional to $\log q$. In the $q \rightarrow 1$ limit, the ordinary 4d gauge/ 2d CFT/0d matrix model correspondence is obtained. We have demonstrated that in the r -th root of unity limit of q , the correspondence between the gauge theories on the ALE space of type A_{r-1} and the CFT with the two-dimensional supersymmetry or its generalization is successfully generated. We will study this root of unity limit in more detail.

Also, it has been suggested that the Cherednik algebra (the double affine Hecke algebra) plays important roles in these gauge/CFT correspondence. Hence, we plan to study the connection between the Cherednik algebra and the matrix model of the Selberg type. Also, it seems it interesting to investigate the root of unity limit of a parameter of the (non-degenerate) Cherednik algebra.

For an unsolved problem of the choice of expansion basis, it is recently suggested that the generalized Jack polynomials is a good expansion basis. We will investigate properties of the generalized Jack polynomials or their q -deformation. It is well-known that the Jack polynomials have deep connection with the Dunkl operators and the affine Hecke algebra. It is an interesting problem how the corresponding Hecke algebra is modified.

Furthermore, one of future theme of our study is the extension to the gauge theories on general ALE spaces or to quiver gauge theories. It is proposed an construction of associated “Yangian” for the quiver gauge theories. In the Schur-Weyl duality, the Yangian is connected with a Hecke algebra. Hence, an extension to these direction will deepen our understanding of the gauge/CFT/matrix model correspondence.