Plan of Research

Takeshi Oota

I will study the matrix models which have connection with supersymmetric gauge theories and related topics. My immediate research agenda includes the following.

1. Multi-critical points of the unitary matrix models and Argyres-Douglas-type superconformal theories

Recently, it is shown that double scaling limits of the multi-critical unitary matrix model toward their multi-critical point is related to the four-dimensional supersymmetric theories of Argyres-Douglas type. I have determined the explicit form of the free energy and that of the Wilson loops in the large-N limit. My next goal is to elucidate the finite N correction of this model and the instanton effects.

2. Quiver matrix models and supercoformal fixed points

Recently, in the joint work with Itoyama and Yoshioka, the sequence of massive scaling limits of quiver matrix models of type A is studied and the parameter region with the maximal symmetry is determined. We would like to conduct a more detailed analysis of this model and to clarify how the algebraic structure of the matrix model corresponds to that of the gauge theory side. Furtheremore, we would like to extend the study of A-type to D- and E-types.

3. q-deformation of the matrix models and correspondence with the five-dimensional gauge theories

I would also like to consider whether it is possible to q-deform these unitary and quiver matrix models. The q-deformed models are expected to be related to five-dimensional gauge theories, therefore analyzing their properties will be an interesting research topic. These theories are also expected to be related to the q-deformed two-dimensional field theories, whose symmetry algebras form the q-Virasoro/q-W algebras.