

Research Plan

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I will continue to inquire into research that has been done so far more deeply. In particular, I want to study the quantum theory of superstrings. The principal aim is to find out the informations for the nonperturbative nature of superstrings by using matrix model. In particular, the emergence of four dimensional spacetime and unified treatment of elementary particles are the central target. The content is indicated as follows.

Matrix Model

- Compactification

Now my primal interest is to generate four-dimensional spacetime in matrix model. Since the matrix models are usually defined in ten-dimensional spacetime, we must compactify the spacetime to four dimensions. Then, we must demand the conditions for compactifications from outside. So far, I have considered about the matrix models compactified by $\mathbb{C}^3/\mathbb{Z}_3$ -orbifolding. In similar way, I continue to study the other orbifolded models. On the other hand, I will study spontaneous breaking of ten-dimensional Lorentz symmetry for the matrix models without compactifying spacetime by hand.

- Effects of orientifolding

USp matrix model was proposed as the constructive definition of T^6/\mathbb{Z}_2 compactified type I superstring theory. Because the interaction between two spacetime points is different depending on the direction in this model, the compactification of this model may also have the feature. In addition, it is suggested that there is a four dimensional object in the the USp matrix model from the research of the Berry phase. By studying the compactification of this model, I will search for the possibility of emergence of four dimensional spacetime.

- Calculation of partition function

I want to estimate exactly the partition function of the USp matrix model. In order to perform this calculation, I use the prescription of Moore-Nekrasov-Shatashvili. In this procedure, matrix models promote to CohFT (Cohomological Field Theory) and the calculation of partition function becomes more easy. Indeed, I calculated the partition function of four-dimensional reduced matrix model as its prescription as mentioned in “Research Result”. I want to apply the methods thought out in these simpler models to the USp matrix model.

Additionally, I will positively work on the discussions other than the above mentioned subjects.