The Research Results

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My research objects are matrix models which formulate nonperturbatively superstrings. We calculate the amplitude for the individual diagrams which are distinguished topologically in analogous way to quantum field theory on perturbative string theories. On the matrix models we discretize the worldsheets and then we can treat simultaneously those. After all, it is considered that the matrix models describe nonperturbatively superstrings. By this procedure, the functions that represent the coordinates of string promote to matrices and the theory is described by matrices.

I have put USp matrix model which defines nonperturbatively type I superstrings to the center of research. Since superstring theories are defined only at ten dimensional spacetime, so are the matrix models. In conclusion, if we would like to obtain the models which describe realistic world, then the compactification of spacetime to four dimensions are required. But matrix models cannot yet tell us the information about the vacuum of strings at present. Thus we must introduce the conditions of compactification by hand. Especially, I considered orbifolding USp matrix model. In 2002, Aoki-Iso-Suyama proposed $\mathbb{C}^3/\mathbb{Z}_3$ orbifolding model for IIB matrix model which describes type IIB superstrings. I studied USp matrix models compactified by $\mathbb{C}^3/\mathbb{Z}_3$ orbifolding based on the above model.

In order to construct the USp matrix model, we must prepare the projectors which pick out USp(2k) Lie algebra from U(2k) Lie algebra that is used in IIB matrix model. This projector corresponds just to the operation taking away the orientation from each string and alters IIB matrix model to USp matrix model. Here we note that USp(2k) Lie algebra is embedded in U(2k) Lie algebra as two different representations, namely, symmetric one and antisymmetric one. As this fact there exist also two different projectors. In addition IIB matrix model has ten bosonic matrices and sixteen fermionic matrices. So it is nontrivial how to select appropriate projectors for respective matrices. We demand that thirty-two supercharges which IIB matrix model has are commutative with these projectors to resolve this problem.

I discussed how many supersymmetries USp matrix model can possess after $\mathbb{C}^3/\mathbb{Z}_3$ orbifolding. We seen that the obtained models were classified to ten different models according to how three integer parameters are assigned. In these ten classifications, four models have totally four supersymmetries and remaining six have eight supersymmetries. By detailed calculations the former has one model which possesses $4+0$ supersymmetries and four which possess $2+2$ supersymmetries and the latter has one which possesses $8+0$ supersymmetries and four which possess $4+4$ supersymmetries. Therefore I succeeded at enumerating totally fifty solutions.