Research Achivement

My research interest is non-supersymmetric string theories. I considered what kind of top-down approaches are possible under the assumption that supersymmetry is broken at very high energy scale. In particular, I focused on the question of whether it is posssible to realize very small cosmological constant without supersymmetry, and if so, whether the moduli can be stabilized under such conditions. Below, I will summarize what I did in our research:

- **Cosmological constant and moduli stability**

  It is known that in string models in which supersymmetry is broken by the Schark-Schwarz mechanism, the cosmological constant can be exponentially suppressed if the Bose-Fermi degeneracy is realized only in the massless level[1]. In a series of our studies[2, 3, 4], I investigated whether such a special condition is realizable or not in the heterotic models, and found some points in the moduli space that satisfy the condition. I also analyzed the stability of the moduli and clarified that the points with suppression of the cosmological constant correspond to saddle points of the potential.

- **T-duality of non-supersymmetric strings**

  It is known that the gauge symmetry is enhanced at special points where the cosmological constant is suppressed, and such points correspond to fixed points under T-duality transformations. In [5], I investigated the structure of T-duality in models whose supersymmetry is broken by the Schark-Schwarz mechanism, and found that T-duality transformations in non-supersymmetric models are restricted to congruent subgroups of the T-duality group of supersymmetric ones.

- **Non-supersymmetric string model with reduced rank**

  The models studied so far are constructed by starting from a maximally supersymmetric model in which the rank of a gauge group is $16 + 2d$ and breaking the supersymmetry by the Schark-Schwarz mechanism. On the other hand, it is known that a maximally supersymmetric model with reduced rank can be constructed by compactifying with an asymmetric orbifold. In [6], I constructed non-supersymmetric models whose rank is reduced to $8 + 2d$ by starting from so-called CHL string model which has maximal supersymmetry and reduced rank, and showed that the gauge symmetry can be enhanced to non-simply-laced group. I also studied the cosmological constant and the moduli stability in such models.