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Basic plan

Based on the results of research so far, one of the issues is that the moduli are unstable at the point where the cosmological constant is suppressed. From a phenomenological point of view, it is desirable for the cosmological constant to be small and for the moduli to be stabilized so that unobserved scalar fields do not appear. I will focus on investigating whether a point that satisfies both of those conditions exists. In previous research, I have restricted the moduli values ⊠⊠ to simplify the analysis, but in the future I will develop calculation programs to comprehensively investigate the moduli space.

Study in toroidal models

Using the analytical methods and results of previous research, analytical methods for 9-dimensional and 8-dimensional torus models can be established. In our previous research, the correspondences between supersymmetric and non-supersymmetric models in terms of enhanced gauge groups, moduli and massless spectra have been found. In the other research, a list of maximally enhanced gauge groups and the moduli that realize them for 9-dimensional and 8-dimensional supersymmetric models have been revealed. So, I expect that by using those data and the correspondence between supersymmetric and non-supersymmetric models, it will be possible to analyze the cosmological constant and potential of non-supersymmetric models. The strategy is as follows:

1. Identify all moduli that realize the maximally extended gauge groups.
2. For each moduli obtained in step 1, find the charge of all massless states.
3. Determine if the charge obtained in step 2 satisfies the condition for suppressing the cosmological constant.
4. Calculate the Hessian matrix and determine whether it is positive definite.

In fact, for 9-dimensional models, comprehensive analysis can be performed by hand without an analysis program. In the eighth dimension, there are a lot of moduli identified in step 1, so the analysis from step 2 is better to be carried out by creating a program.

Study in orbifold models

As a next step, I plan to construct a model that combines orbfold and the S-S mechanism to consider a more realistic scenario. It is known that orbifold compactification can be used to construct a string model similar to the minimal supersymmetric standard model. So, I hope that by combining such orbifold compactification with the S-S mechanism, it is possible to construct a model that has a more realistic massless spectrum and a small cosmological constant under non-supersymmetric conditions.