

# Research Plan

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One of the issues I should address is that the moduli is unstable in the points where the cosmological constant is suppressed. From a phenomenological point of view, it is desirable that the cosmological constant be small and the moduli be stabilized so that unobserved scalar fields do not appear. As for research plans, I will focus on investigating whether those two conditions can be compatible or not.

- **Study in toroidal models**

In [3] of the publication list, we analyzed the cosmological constant and the stability of the moduli in nine-dimensional models. In that work, in order to simplify the analysis, we imposed appropriate restrictions on the moduli under consideration. In future studies, to achieve a more comprehensive and rigorous analysis, we will remove such restrictions and instead utilize computer-base analysis. As of December 2025, the analysis in nine dimensions has been completed, and computations in eight dimensions are currently in progress. Compared to the nine-dimensional case, the computational cost in eight dimensions increases drastically, and obtaining the full set of results requires a considerable amount of time. In view of extending the analysis to even lower-dimensional models in the future, it is therefore necessary to improve the existing programs at this stage so as to enhance computational efficiency.

- **Study in orbifold models**

In our previous studies, we have focused on simple non-supersymmetric models based on toroidal compactification. In order to construct more realistic models, we aim to explore various possibilities by adopting, for example, orbifold compactifications. Specifically, we consider that one of the following two types of compactification would be an appropriate next step:

- Orbifold compactifications corresponding to limits of Calabi – Yau manifolds, based on  $\mathbb{Z}_2$  or  $\mathbb{Z}_3$  symmetries
- Asymmetric orbifold compactifications employing the  $\mathbb{Z}_2$  symmetry used in the construction of CHL models.

By combining these orbifold compactifications with Scherk – Schwarz compactification, we plan to construct non-supersymmetric models and analyze the cosmological constant and the structure of the moduli space.