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Sharpening the Boundaries Between Flux Landscape and Swampland by Tadpole Charge

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We investigate the vacuum structure of four-dimensional effective theory arising from Type IIB flux compact-ifications on a mirror of the rigid Calabi-Yau threefold, corresponding to a T-dual of the DeWolfe-Giryavets-Kachru-Taylor model in Type IIA flux compactifications. By analyzing the vacuum structure of this interesting corner of string landscape, it turns out that there exist perturbatively unstable de Sitter (dS) vacua in addi-tion to supersymmetric and non-supersymmetric anti-de Sitter vacua. On the other hand, the stable dS vacua appearing in the low-energy effective action violate the tadpole cancellation condition, indicating a strong correlation between the existence of dS vacua and the flux-induced D3-brane charge (tadpole charge). We also find analytically that the tadpole charge constrained by the tadpole cancellation condition emerges in the scalar potential in a nontrivial way. Thus, the tadpole charge would restrict the existence of stable dS vacua, and this fact underlies the statement of the dS conjecture. Furthermore, our analytical and numerical results exhibit that distributions of $calO(1)$ parameters in expressions of several swampland conjectures peak at specific values.

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