EFT Strings and Quantum Obstructions to 4d N=1 Limits

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Abstract

We probe infinite-distance limits in the complex-structure moduli space of F-theory compactified on elliptically fibered Calabi–Yau fourfolds using EFT strings. For broad classes of limits in which the fourfold undergoes a semistable degeneration, we determine the worldsheet theory of the candidate EFT string by counting zero modes of the associated supersymmetric quantum mechanics in M-theory and uplifting to F-theory. Whenever the resulting central charges are incompatible with the behavior predicted by the Emergent String Conjecture at the level of the classical N=1 effective theory, we conclude that the supergravity approximation is not under perturbative control in α. These results demonstrate that EFT string probes can diagnose the breakdown of the classical moduli space geometry and, in this sense, we use Swampland constraints to extract qualitative information about quantum corrections in 4d N=1 string compactifications.

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