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Understanding the tower weak gravity conjecture

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The weak gravity conjecture claims that a consistent quantum gravity theory must include states, called super-extremal states, whose gauge forces mediate interactions stronger than gravity. A stronger variant of this conjecture is the tower weak gravity conjecture (tWGC), which predicts an infinite tower of super-extremal states in every direction of the charge lattice of the theory under consideration. Albeit there are several non-trivial checks in favour of the tWGC in various string theory settings in the literature, we find a set of F-theory/M-theory constructions in which such an infinite tower of super-extremal states does not seem to be present. However, we argue that fulfilling the tWGC is not always necessary and elaborate on a set of criteria to explain under which circumstances the tWGC is required.

Summary

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