

Mordell–Weil and the global gauge group of F-theory

The Mordell–Weil (MW) group of elliptic fibrations appears prominently in F-theory compactifications as the geometric origin of $\mathfrak{u}(1)$ gauge symmetries. In a more subtle way, the embedding of MW into the Néron–Severi group via the so-called Shioda map also determines the global structure of the gauge group. Generalizing a previously known result for the torsion part of MW, we show that F-theory compactifications with $\mathfrak{u}(1)$ symmetries generically exhibit non-trivial global gauge group structures. In particular, F-theory realizes the Standard Model gauge group $[SU(3) \times SU(2) \times U(1)]/\mathbb{Z}_6$ in a natural way. Furthermore, assuming the geometric incarnation of charge minimality in F-theory, we interpret our result as a novel condition that separates parts of the F-theory landscape from the ‘swampland’.